


# Integrating smart contracts with Islamic economic law: A Sharia design framework for digital finance governance

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## ABSTRACT

### Introduction

Smart contracts have become an important innovation in blockchain-based digital transactions because they enable automated, transparent, immutable, and self-executing agreements. In Islamic economic law, however, contracts are not merely technical instruments but also ethical and legal commitments that must fulfill the principles of consent, clarity, justice, lawful subject matter, and freedom from prohibited elements such as usury, excessive uncertainty, and gambling. This creates an important scholarly issue concerning whether smart contracts can be integrated with sharia contract principles in the digital age.

### Objectives

This study analyzes the compatibility of smart contracts with Islamic economic law and examines their legal and regulatory position in Indonesia. It also formulates an Islamic Smart Contract Framework as a conceptual model for integrating blockchain technology with sharia contract validation, digital sharia supervision, and legally accountable execution.

### Method

This study uses a normative-judicial approach based on secondary legal and scholarly materials. The analysis examines Indonesian regulations on electronic contracts, personal data protection, Islamic banking, and financial technology, along with fatwas issued by the National Sharia Council of the Indonesian Ulema Council. Academic literature on blockchain, smart contracts, Islamic contract theory, sharia fintech, and comparative practices in Malaysia, Bahrain, and the United Arab Emirates is also reviewed. The data are analyzed descriptively, normatively, comparatively, and conceptually.

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## Results

The findings show that smart contracts can support Islamic economic transactions when they function as technical instruments for executing valid sharia contracts. They can strengthen transparency, legal certainty, transaction efficiency, auditability, and trust. However, smart contracts cannot independently ensure contractual intent, consent, legal capacity, fairness, public benefit, or compliance with the higher objectives of sharia. Their implementation therefore requires sharia contract validation, fatwa-based supervision, digital sharia audits, hybrid dispute resolution, and clear regulatory standards.

## Implications

This study provides a conceptual basis for regulators, sharia authorities, Islamic financial institutions, and fintech developers to design smart contracts that are technologically reliable, legally recognized, and sharia-compliant.

## Originality/Novelty

This study contributes by proposing the Islamic Smart Contract Framework as a sharia-by-design model that integrates contract validation, programmable code structure, algorithmic sharia auditing, and blockchain-based execution.

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## INTRODUCTION

Smart contracts have become one of the most significant legal-technological innovations in blockchain-based digital transactions. They are commonly understood as computer programs stored on distributed ledgers that automatically execute contractual terms once predefined conditions are satisfied, thereby enabling self-executing and self-enforcing transactions with reduced dependence on intermediaries (Atiyah et al., 2024; Guadamuz, 2019; Hewa et al., 2021; Low & Mik, 2020; Nzuva, 2024; Wilson et al., 2024). Their automation, transparency, immutability, and auditability have encouraged scholarly interest across law, finance, information systems, and governance studies. Recent literature emphasizes that smart contracts can accelerate performance, reduce transaction costs, strengthen evidentiary reliability, and improve trust in digital markets (Bassan & Rabitti, 2024; Taherdoost, 2023; Zhu et al., 2024).

The rapid expansion of blockchain-based contracting is especially relevant to Islamic finance, where digital transformation has intensified the need for secure, transparent, and compliant financial instruments. Studies on digital Islamic finance suggest that blockchain and smart contracts can improve accountability, reduce information asymmetry, and support more efficient sharia-compliant transactions (Chong, 2021; Mufidah et al., 2025). However, Islamic economic law does not treat

contracts merely as technical instruments for exchange. Contracts are also ethical and normative commitments grounded in justice, consent, clarity, lawful subject matter, and the avoidance of *riba*, *gharar*, and *maysir* (A. A. Ahmad et al., 2024; Al Rahahleh et al., 2019; Takidah & Kassim, 2022).

The central problem is that the technical architecture of smart contracts does not automatically guarantee conformity with Islamic contract theory. Although code can execute obligations efficiently, it may not fully express contractual intention, informed consent, legal capacity, moral purpose, or *maqasid al-shariah*. Islamic law requires valid *ijab-qabul*, *ridha*, *ahliyya*, and lawful contractual objects, while automated systems often depend on encoded triggers, external data inputs, and irreversible execution (Mohamed Shaarani et al., 2023; Wahid et al., 2023). This creates a normative tension between algorithmic certainty and the ethical-legal substance of sharia contracts, particularly when contractual terms are opaque, incomplete, or difficult for parties and sharia boards to interpret.

A broader solution proposed in recent scholarship is to move beyond purely technical implementation and develop hybrid governance models that combine on-chain automation with off-chain legal and sharia oversight. Such models preserve the efficiency of smart contracts while allowing human verification of consent, capacity, sharia compliance, and dispute resolution (Chattopadhyay, 2020; Onufreiciuc & Stănescu, 2021; Takidah & Kassim, 2022). This approach is also necessary because immutability, while beneficial for transparency and non-repudiation, can create rigidity when contractual errors occur, when external conditions change, or when a transaction requires rescission, renegotiation, *khiyar*, or *iqalah* under Islamic law (Abidin, 2023; Zulkepli, 2025).

Previous studies have identified several specific mechanisms for reconciling smart contracts with Islamic legal principles. First, encoded terms should be mapped explicitly to recognized Islamic contract structures, such as *murabahah*, *ijara*, *musharakah*, or *mudarabah*, so that automated execution reflects a valid sharia contract rather than a merely technical transaction (Abu-Husin et al., 2025; Kasmon et al., 2025; Muhammad & Lanaula, 2019; Unal & Aysan, 2022). Second, digital consent must be supported by auditable evidence, including informed consent, digital signatures, time-stamped approvals, and multi-layer confirmations (Hidayat & Ahmad, 2023; Mohamed Shaarani et al., 2023). Third, contract logic should be designed to prevent *riba*-like outcomes, excessive uncertainty, speculative gains, and unjust enrichment (Al Rahahleh et al., 2019; Kiliç & Türkan, 2023).

Other scholars emphasize the importance of sharia governance and regulatory supervision from the earliest stages of smart contract design. Fatwas, sharia supervisory boards, and regulatory standards are considered essential to bridge the gap between code-based execution and Islamic jurisprudence (Andriansyah, 2023; Armaini & Said, 2023; Muhammad & Lanaula, 2019). Comparative experiences from Malaysia, Bahrain, and the United Arab Emirates show that regulatory sandboxes, centralized sharia governance, AAOIFI-aligned standards, and specialized dispute-resolution mechanisms can support innovation while maintaining religious and legal

legitimacy (Ab Razak et al., 2020; Al Hammadi et al., 2024; Ulfi, 2022). These models provide useful references for Indonesia's emerging sharia fintech ecosystem.

Despite this growing body of literature, significant gaps remain. Existing studies have discussed smart contract efficiency, legal enforceability, blockchain transparency, and general sharia compliance, but few have formulated an integrated framework for algorithmic sharia auditing, digital sharia supervision, and regulatory standardization. Most available approaches still rely on human-centered or post-transaction review rather than machine-checkable sharia parameters embedded throughout the smart contract lifecycle (Gulyamov, 2024; Rizqiani & Yulianto, 2020; Tlemsani et al., 2020). There is also no widely accepted model for translating fatwas, maqasid principles, and prohibitions of *riba*, *gharar*, and *maysir* into auditable digital rules that regulators, developers, and sharia boards can jointly verify.

This study aims to analyze the integration of smart contracts with Islamic economic law and to formulate a conceptual model for sharia-compliant implementation in Indonesia. Its novelty lies in proposing the Islamic Smart Contract Framework as a sharia-by-design approach that integrates contract validation, code structure, algorithmic sharia auditing, and blockchain-based execution. The study is limited to a normative-judicial analysis of Indonesian positive law, DSN-MUI fatwas, Islamic contract theory, and comparative international practices. It argues that smart contracts can support Islamic economic transactions only when automation is embedded within a structured framework of sharia validation, legal recognition, regulatory supervision, and accountable dispute-resolution mechanisms.

## LITERATURE REVIEW

### Smart Contracts in Blockchain-Based Transactions

Recent scholarship generally conceptualizes smart contracts as code-based protocols stored and executed on blockchain networks. They operate by automatically performing, verifying, or enforcing contractual terms when predefined conditions are fulfilled, thereby reducing dependence on trusted intermediaries (Hewa et al., 2021; Khan et al., 2021; Msawil et al., 2022; Tolmach et al., 2020). Unlike ordinary digital agreements, smart contracts do not merely record contractual obligations; they operationalize them through programmable logic and distributed consensus. This feature makes them important in legal, financial, and technological studies because they transform contractual performance from a human-centered process into an automated and auditable sequence of actions.

The main value of smart contracts lies in automation, self-execution, immutability, transparency, and auditability. Automation enables predetermined actions to occur once agreed conditions are met, while immutability strengthens integrity and non-repudiation because recorded data and executed states cannot easily be changed unilaterally (Hewa et al., 2021; Khan et al., 2021; Msawil et al., 2022). At the same time, literature also notes that these features create new legal and technical challenges. Self-execution does not necessarily guarantee legal enforceability, because contract

law still requires evidence of agreement, capacity, intention, lawful object, and appropriate remedies when disputes occur (Alamsyah et al., 2024; Kasatkina, 2021; Tolmach et al., 2020).

A major debate concerns the tension between immutability and adaptability. Immutability strengthens trust in on-chain records, but it may create rigidity when contractual errors, security vulnerabilities, regulatory changes, or changed circumstances require correction (Alamsyah et al., 2024; Onufreiciuc & Stănescu, 2021; Zulkepli, 2025). To address this issue, scholars propose upgradeable proxy architectures, modular contract design, formal verification, and off-chain governance mechanisms (Ivanov et al., 2023a, 2023b; Tolmach et al., 2020). These mechanisms indicate that effective smart contract implementation requires not only technological reliability but also governance structures that connect automated execution with legal interpretation and institutional accountability.

### Smart Contracts and Islamic Contract Theory

Islamic contract theory provides a normative framework for assessing whether smart contracts can be accepted in sharia-compliant transactions. Classical fiqh requires the fulfillment of essential contractual elements, including *ijab-qabul*, *ridha*, *ahliyya*, lawful subject matter, and the absence of prohibited elements. Recent studies argue that smart contracts may be compatible with Islamic contract theory if encoded terms clearly represent offer and acceptance, demonstrate genuine consent, involve legally competent parties, and concern lawful objects (A. A. Ahmad, 2020; Nouman et al., 2021). Thus, technology may function as an execution instrument, but it cannot replace the substantive requirements of a valid Islamic contract.

The question of *ijab-qabul* and *ridha* is particularly important. Smart contracts execute commands through code, yet Islamic law requires mutual consent that is conscious, informed, and free from coercion. Scholars therefore argue that on-chain assent should be supported by explicit digital approval, transparent contract terms, off-chain attestations, and sharia board verification when necessary (Kasdi, 2019; Nouman et al., 2021; Tumanggor, 2024). Some studies allow flexibility in the form of contractual expression, provided that the substance of offer, acceptance, and consent is fulfilled. However, they also emphasize that hidden, opaque, or technically incomprehensible code may weaken genuine consent and create uncertainty.

*Ahliyya* and lawful subject matter also remain central in automated transactions. Blockchain systems, especially public networks, may allow anonymity or pseudonymity, making it difficult to verify legal capacity, age, identity, or authority. Islamic law requires parties to possess legal competence before entering binding transactions (Ayub, 2012; Damanik, 2024; Wahab, 2021); therefore, smart contracts need reliable identity verification and trusted off-chain attestations (Azevedo et al., 2023; Saha et al., 2023). The object of the contract must also be lawful, clear, and deliverable. In Islamic finance, this means that automated transactions must not facilitate *riba*, *gharar*, *maysir*, unlawful commodities, or speculative arrangements inconsistent with sharia principles.



### **Maqasid al-Shariah, Maslahah, and Ethical Evaluation**

Beyond formal validity, Islamic legal scholarship evaluates contracts through maqasid al-shariah and maslahah. These concepts assess whether a transaction protects religion, life, intellect, lineage, and wealth while promoting justice, welfare, and the prevention of harm. Studies on Islamic fintech argue that smart contracts may serve maqasid objectives when they enhance transparency, reduce fraud, improve access to finance, and strengthen the protection of wealth (A. A. Ahmad, 2020; Hidayat & Ahmad, 2023; Ishak, 2023; Jaafar & Brightman, 2022). Therefore, smart contracts should not be judged only by technical efficiency but also by their ethical and social outcomes.

Maslahah provides a basis for accepting technological innovation when it advances public welfare without violating explicit sharia prohibitions. In this sense, smart contracts may be valuable for Islamic finance if they improve accountability, reduce transaction costs, and make contractual performance more predictable. However, maslahah cannot be used as a general justification for every form of digital automation. Scholars caution that maqasid-based reasoning must remain disciplined, evidence-based, and supported by sharia governance, fatwa validation, and appropriate risk assessment (A. A. Ahmad, 2020; Hidayat & Ahmad, 2023; Jaafar & Brightman, 2022). Otherwise, technological benefits may obscure hidden ethical and legal risks.

The maqasid perspective also highlights the limits of fully automated contracting. While code can enforce predefined obligations, it cannot independently evaluate intention, fairness, hardship, exploitation, or changing social circumstances. This limitation is especially relevant when immutable execution conflicts with justice, khiyar, iqalah, dispute settlement, or consumer protection. For that reason, literature increasingly supports governance-by-design, in which maqasid, maslahah, disclosure, risk-sharing, lawful asset-backing, and dispute mechanisms are incorporated into the smart contract lifecycle (Kasdi, 2019; Nouman et al., 2021).

### **Sharia Risks in Smart Contract Implementation**

The implementation of smart contracts in Islamic finance raises doctrinal risks related to riba, gharar, and maysir. Riba may arise when automated payment structures create guaranteed interest-like returns without genuine asset-backing or risk-sharing. Scholars therefore recommend structuring smart contracts around permissible sale, lease, partnership, service-fee, or profit-and-loss-sharing models rather than fixed-return mechanisms that imitate interest (Attoyibah et al., 2022; Ferdiansyah et al., 2019). Tokenized liquidity, dynamic pricing, and automated yield mechanisms also require careful review to ensure that their economic substance does not reproduce prohibited financial outcomes (Z. Ahmad et al., 2023; Laksono & Sumidartini, 2023).

Gharar and maysir represent further challenges. Gharar can emerge when contract objects, prices, triggers, data sources, or performance conditions are unclear, while maysir may arise from speculative payoff structures resembling gambling or zero-sum risk transfer. Smart contracts can reduce uncertainty by making rules explicit, yet they may also create new uncertainty when their code is opaque or dependent on unreliable

external data (Ferdiansyah et al., 2019; Laksono & Sumidartini, 2023; Wahid et al., 2023). For this reason, sharia-compliant design must ensure clear deliverables, transparent logic, lawful asset-backing, and avoidance of purely speculative automated outcomes (Anwer & Habib, 2019; Attoyibah et al., 2022).

Technical risks also affect sharia compliance. Coding errors, vulnerabilities, oracle dependency, and algorithmic opacity can lead to outcomes that violate both legal expectations and Islamic norms. Since smart contracts depend on software, bugs may cause unintended transfers or non-compliant execution, while manipulated or inaccurate oracle data may trigger invalid performance (Alamsyah et al., 2024; Khan et al., 2021; Tolmach et al., 2020). Algorithmic opacity also makes it difficult for sharia boards, courts, regulators, and users to understand contractual logic. Consequently, formal verification, trusted oracles, interpretable code, audit trails, and human oversight are required to safeguard compliance (Ivanov et al., 2023a, 2023b; Nouman et al., 2021).

### **Sharia Governance, Fatwa Validation, and Digital Audit**

The literature consistently emphasizes that sharia governance remains indispensable in smart contract implementation. Sharia supervisory boards, fatwas, and recognized standards provide interpretive authority to ensure that encoded terms correspond to valid Islamic contract structures and avoid prohibited elements (Jaafar & Brightman, 2022; Kasdi, 2019; Nouman et al., 2021; Ramadhan, 2022). These institutions are especially important because smart contracts are not self-legitimizing from a sharia perspective. Their technical correctness must be complemented by religious, legal, and ethical validation that assesses both form and substance.

Several studies propose digital sharia audits as a necessary development beyond conventional periodic review. A digital sharia audit would examine contract templates, encoded logic, data inputs, execution records, and compliance outputs in a systematic and technology-enabled manner (Gulyamov, 2024; Muhammad & Lanaula, 2019; Rizqiani & Yulianto, 2020; Tlemsani et al., 2020). Such audits could produce evidence trails linking on-chain activity to fatwa-based validation and supervisory approval. This approach would allow regulators, sharia boards, and users to verify whether a smart contract remains compliant not only before deployment but also during execution.

Algorithmic sharia auditing represents a more advanced model. It involves translating sharia rules, fatwas, and standards into machine-readable predicates that can test smart contract logic before deployment and at runtime. Proposed methods include rule engines, formal verification, ontologies, model checking, and cryptographically anchored audit trails (Gulyamov, 2024; Rizqiani & Yulianto, 2020; Tlemsani et al., 2020). However, this field remains underdeveloped because Islamic legal reasoning contains interpretive nuance that is difficult to reduce entirely to code. Therefore, algorithmic auditing should support, not replace, qualified sharia scholars and institutional supervision.

### **Regulatory Sandboxes and Hybrid Dispute Resolution**

Regulatory sandboxes are widely discussed as instruments for testing sharia-compliant smart contracts in controlled environments. They allow fintech developers, regulators, and sharia boards to evaluate innovation before market-wide adoption. Comparative literature highlights Malaysia, the United Arab Emirates, and Bahrain as relevant examples because they combine fintech experimentation with sharia governance, supervisory oversight, and regulatory learning (Ab Razak et al., 2020; Al Hammadi et al., 2024; Al-Azizah, 2017; Vorobiova et al., 2023). Such models can help jurisdictions design safe pathways for Islamic digital finance while protecting consumers and maintaining market integrity.

Hybrid dispute resolution is another important governance mechanism. Pure on-chain execution may be insufficient when disputes arise from ambiguous terms, faulty oracle data, coding errors, changed circumstances, or contested sharia interpretation. Scholars therefore propose arbitration, off-chain review, and Judge-as-a-Service mechanisms that can interpret smart contract outcomes within civil and Islamic legal frameworks (Jaafar & Brightman, 2022; Kasdi, 2019; Mohamed Shaarani et al., 2023; Takidah & Kassim, 2022). These mechanisms preserve the efficiency of automation while ensuring that parties retain access to lawful redress, fairness, and maqasid-oriented remedies.

For Indonesia, literature suggests a combined architecture involving national sharia governance, regulatory sandboxes, digital audit standards, and cross-border dispute mechanisms. Such a system should recognize blockchain records, standardize sharia screening, provide certification for digital contracts, and coordinate among DSN-MUI, OJK, Bank Indonesia, technology developers, and Islamic financial institutions. International models offer valuable guidance, but domestic adaptation is necessary because Indonesia has its own legal system, fatwa institutions, fintech regulations, and Islamic economic priorities. Therefore, smart contract governance must be both globally informed and nationally grounded.

### **Research Gap and the Significance of the Study**

Although the literature has examined smart contract automation, legal enforceability, Islamic contract compatibility, and sharia governance, important gaps remain. Existing studies have not sufficiently developed operational models for algorithmic sharia auditing, machine-readable fatwa standards, digital contract certification, and integrated regulatory supervision (Gulyamov, 2024; Keramat & Kahf, 2022; Muhammad & Lanaula, 2019; Muryanto, 2023; Ramadhan, 2022; Wani & Dar, 2022; Yulitasari et al., 2024). Most discussions still rely on general calls for oversight rather than concrete frameworks that connect sharia validation, code structure, audit logic, execution, certification, and dispute resolution within one coherent system.

The significance of this study lies in its effort to formulate an Islamic Smart Contract Framework that responds to those gaps. The framework is intended to integrate sharia contract validation, programmable contract architecture, algorithmic sharia auditing, blockchain-based execution, and hybrid governance. By doing so, the study

contributes to Islamic economic law, fintech regulation, and digital sharia governance. It also provides a conceptual foundation for policymakers, DSN-MUI, OJK, Bank Indonesia, sharia fintech developers, and Islamic financial institutions seeking to implement smart contracts without reducing sharia compliance to mere technical automation. This makes the study both theoretically relevant and practically urgent.

## **METHOD**

### **Research Design and Approach**

This study employs a normative-juridical research design to examine the integration of smart contracts with the principles of Islamic economic law. This approach is appropriate because the study does not seek to measure technological performance empirically, but rather to analyze whether smart contracts can be normatively situated within existing legal, regulatory, and sharia frameworks. The central concern of the research is the legal validity, doctrinal compatibility, and regulatory feasibility of smart contracts when used in sharia-compliant digital transactions. Therefore, the study treats smart contracts not merely as technological instruments, but as legal phenomena that must be assessed through positive law, *fiqh al-muamalat*, and contemporary regulatory discourse.

The normative-juridical approach is also used to identify the extent to which smart contracts can satisfy the essential requirements of Islamic contracts, including *ijab-qabul*, consent, legal capacity, lawful subject matter, clarity of contractual terms, and freedom from *riba*, *gharar*, and *maysir*. In this context, legal analysis is combined with conceptual reasoning drawn from Islamic economic law. The study assumes that technological innovation may be accepted in Islamic finance when it does not contradict established sharia principles and when it contributes to justice, transparency, legal certainty, and public benefit. Accordingly, the research is designed to move from general legal analysis toward the formulation of a specific conceptual framework for sharia-compliant smart contracts.

### **Sources of Legal and Scholarly Materials**

The data used in this study consist entirely of secondary materials. These materials are classified into primary legal materials, secondary legal materials, and tertiary supporting materials. Primary legal materials include Indonesian laws and regulations related to electronic contracts, digital transactions, financial technology, Islamic banking, personal data protection, and sharia-compliant financial services. These include the Electronic Information and Transactions Law, the Personal Data Protection Law, the Sharia Banking Law, and relevant regulations issued by the Financial Services Authority and Bank Indonesia. These materials are used to determine whether smart contracts can be recognized as electronic contracts and whether their implementation has a sufficient legal basis in Indonesia.

The study also examines DSN-MUI fatwas related to Islamic contracts, online transactions, sharia fintech, information technology-based financing services, *murabahah*, transparency, and dispute resolution. These fatwas are important

because they provide authoritative sharia guidance for digital and financial transactions in the Indonesian Islamic economic system. In addition, secondary legal materials include academic books, peer-reviewed journal articles, legal commentaries, research reports, and scholarly works on blockchain, smart contracts, Islamic contract theory, digital Islamic finance, and sharia governance. Tertiary materials, such as legal dictionaries, encyclopedias, and institutional documents, are used only to clarify technical and legal terminology where necessary.

### **Data Collection Technique**

Data were collected through library research and document analysis. Library research was conducted by identifying and reviewing academic literature on smart contracts, blockchain-based transactions, Islamic economic law, sharia fintech, and digital regulation. The literature was selected based on its relevance to the research questions, its contribution to the discussion of contract validity and sharia compliance, and its ability to explain the legal and technological characteristics of smart contracts. Particular attention was given to recent studies that address automation, self-execution, immutability, algorithmic governance, digital consent, and the enforceability of blockchain-based contracts.

Document analysis was conducted by examining statutory texts, regulatory provisions, DSN-MUI fatwas, and comparative regulatory materials. This process was intended to identify legal norms governing electronic contracts and to compare them with the principles of Islamic contract law. International literature and regulatory discussions from jurisdictions such as Malaysia, Bahrain, and the United Arab Emirates were also reviewed to obtain comparative insights. These jurisdictions were selected because they have relatively developed Islamic finance ecosystems and have introduced regulatory or institutional mechanisms relevant to fintech innovation, sharia governance, and digital financial supervision.

### **Analytical Framework**

The data were analyzed using descriptive, analytical, comparative, and conceptual methods. The descriptive method was used to explain the basic characteristics of smart contracts, including automation, self-execution, immutability, transparency, and blockchain-based verification. This stage was necessary to establish a clear understanding of the technological object being assessed. The analytical method was then applied to examine whether those characteristics are compatible with Islamic contract principles and Indonesian positive law. This included analyzing the relationship between code-based execution and the legal requirements of agreement, capacity, lawful object, valid cause, consent, and contractual clarity.

The comparative method was used to examine how smart contracts and sharia-compliant digital finance are addressed in other jurisdictions. Comparative analysis was not intended to transplant foreign models directly into Indonesia, but to identify regulatory lessons that may inform Indonesian policy development. The conceptual method was then used to synthesize legal, sharia, and technological findings into a

proposed model of integration. Through this synthesis, the study formulates the Islamic Smart Contract Framework as a conceptual design that links sharia contract validation, contract code structure, algorithmic sharia audit, and blockchain-based execution.

### **Stages of Analysis**

The analysis was conducted in several sequential stages. First, the study identified the main legal and technological concepts related to smart contracts, including electronic contracts, digital signatures, blockchain records, automated execution, and digital consent. Second, these concepts were compared with the essential elements of Islamic contracts, particularly *ijab-qabul*, *ridha*, *ahliyya*, lawful subject matter, *maqasid al-shariah*, and the prohibition of *riba*, *gharar*, and *maysir*. This stage aimed to determine whether smart contracts could be treated as valid instruments for executing sharia contracts rather than as independent sources of legal validity.

Third, the study assessed the compatibility of smart contracts with Indonesian positive law by examining relevant statutory and regulatory frameworks. This stage focused on whether existing laws provide a sufficient basis for recognizing smart contracts as electronic contracts and whether additional rules are needed for sharia-compliant implementation. Fourth, the study reviewed comparative international practices to identify possible models of sharia governance, regulatory sandboxes, digital audit, and dispute resolution. Fifth, the findings were synthesized into a conceptual framework that may guide regulators, sharia authorities, and fintech developers in designing and supervising smart contracts.

### **Scope and Methodological Limitations**

The scope of this study is limited to normative and conceptual analysis. It does not conduct fieldwork, interviews, surveys, experiments, or technical testing of actual smart contract code. Therefore, the findings do not measure the empirical effectiveness, security performance, or market acceptance of any specific blockchain platform. Instead, the study focuses on legal reasoning, sharia compatibility, and regulatory design. This limitation is consistent with the objective of the research, which is to formulate a normative foundation and conceptual model for the integration of smart contracts with Islamic economic law.

Another limitation is that the study relies on available legal materials, fatwas, and academic literature. Because the regulation of blockchain and smart contracts continues to develop, future legal changes may require further analysis. Nevertheless, the normative-judicial method remains suitable for the present study because it allows a structured examination of existing legal norms and sharia principles. By combining doctrinal analysis, comparative review, and conceptual synthesis, the method provides a rigorous basis for proposing a sharia-compliant smart contract framework that is legally grounded, ethically informed, and relevant to Indonesia's digital Islamic economy.

## RESULTS

### Smart Contracts as Technical Instruments for Sharia Contracts

The first finding shows that smart contracts can be understood in Islamic economic law as technical instruments for executing contracts rather than as independent sources of contractual validity. Their legal status depends on whether the underlying transaction fulfills the essential pillars and conditions of a valid sharia contract. In this sense, automation does not alter the normative foundation of *fiqh al-muamalat*. The validity of a transaction remains determined by the existence of competent contracting parties, valid offer and acceptance, lawful subject matter, clear contractual terms, mutual consent, and freedom from *riba*, *gharar*, and *maysir*. Therefore, smart contracts may be accepted only when their code-based execution reflects a valid and lawful contractual relationship.

The “if-then” structure of smart contracts is compatible with the concept of conditional stipulations in Islamic contracts, particularly when the conditions are clear, possible to occur, and do not produce excessive uncertainty. This finding indicates that automated execution is not inherently contrary to sharia principles. However, the permissibility of automation depends on the quality of contractual design and the clarity of the programmed conditions. If the code executes obligations based on vague, speculative, or unlawful triggers, the transaction may become problematic from the perspective of Islamic law. Thus, technical automation must be subordinated to sharia-based contractual validity and not treated as a substitute for it.

### Contractual Intent, Consent, and Legal Capacity

The study finds that contractual intent remains a central issue in the use of smart contracts for Islamic transactions. In sharia contracts, intention reflects the conscious will and purpose of the contracting parties. In smart contracts, such intention may be represented through digital consent mechanisms, including informed consent, explicit confirmation, time-stamped digital signatures, and multi-layer approval before execution. These mechanisms can function as modern expressions of *ijab* and *qabul* if they clearly show that the parties understand the terms and intend to be legally bound. However, the validity of digital consent requires transparency, accessibility, and sufficient disclosure of the contract’s consequences.

Legal capacity also emerges as a key condition for sharia-compliant smart contracts. Public blockchain systems often allow anonymity or pseudonymity, which may make it difficult to verify whether contracting parties possess the required legal capacity. In Islamic law, *ahliyya* is essential because a contract entered into by a party lacking legal competence may be invalid or defective. This finding suggests that permissioned blockchains or identity-verified platforms are more suitable for Islamic financial transactions. Electronic know-your-customer procedures, biometric validation, and integration with reliable identity systems can help ensure that the parties are legally competent before a smart contract is activated.

### **Subject Matter, Consideration, and Constructive Possession**

The study further finds that the object of a smart contract must be lawful, clear, deliverable, and programmable in a manner consistent with sharia principles. Digital assets, tokens, services, or rights may become valid contractual objects if they represent legitimate benefits and do not involve prohibited activities. The transfer of tokens may also be understood as a form of constructive possession when the recipient obtains full and exclusive control over the asset. This resembles the concept of hukmi qabd, because the economic substance of delivery is achieved even though the object exists in digital form.

Consideration in smart contracts requires careful assessment, especially when crypto-assets are used as payment instruments. The findings show that crypto-assets may function as valid consideration only if they satisfy certain conditions, including relative value stability, acceptance as a medium of exchange, clear ownership, and absence of excessive speculation. If a crypto-asset is highly volatile, speculative, or used primarily for gambling-like gains, it may raise concerns related to gharar and maysir. Therefore, the sharia status of crypto-assets in smart contracts should not be generalized. It depends on their function, economic substance, regulatory recognition, and compliance with Islamic financial principles.

### **Compatibility with Indonesian Positive Law**

The study finds that Indonesian positive law provides a general normative basis for recognizing smart contracts as electronic contracts. The Electronic Information and Transactions Law recognizes electronic contracts as agreements made through electronic systems, while the Civil Code continues to provide the general requirements of valid contracts, including agreement, legal capacity, lawful object, and lawful cause. This indicates that smart contracts may be legally recognized if they fulfill the substantive requirements of contract law. However, the recognition of smart contracts is still indirect because Indonesian law has not yet provided specific regulations governing code-based, self-executing, and blockchain-based contracts.

The study also finds that several Indonesian legal instruments are relevant to the implementation of sharia-compliant smart contracts. The Sharia Banking Law, the Personal Data Protection Law, consumer protection rules, and regulations issued by OJK and Bank Indonesia provide partial legal foundations for digital financial transactions. In addition, DSN-MUI fatwas on online sale and purchase, murabahah, digital financial products, information technology-based financing services, transparency, and dispute resolution offer sharia guidance for digital contracts. Nevertheless, these rules and fatwas operate in separate domains. They have not yet been integrated into a unified regulatory standard for sharia smart contracts.

### **Sharia Compliance, Audit, and Dispute Resolution**

A significant finding is that smart contracts can strengthen transparency and legal certainty but cannot independently guarantee sharia compliance. Their automatic execution may reduce the risk of non-performance, but it does not automatically

ensure that the transaction reflects maqasid al-shariah, moral intent, fairness, or public benefit. Ethical elements such as qasd, ridha, maslahah, and the avoidance of exploitation must be assessed through sharia governance. Therefore, smart contracts require a supervisory layer that can evaluate both the technical code and the legal substance of the transaction before, during, and after execution.

The study also finds that hybrid dispute resolution is necessary. Fully automated execution may be problematic when coding errors, oracle failures, ambiguous terms, or unexpected external events occur. In Islamic law, rights such as khiyar and iqalah should remain available where applicable. However, because blockchain-based smart contracts are generally immutable, these rights must be programmed into the contract structure from the beginning or supported by off-chain dispute mechanisms. Sharia arbitration, regulatory dispute channels, and human review are therefore needed to ensure that technological finality does not override justice, fairness, and legitimate contractual remedies.

### **Islamic Smart Contract Framework**

The main conceptual finding of this study is the formulation of the Islamic Smart Contract Framework. The framework consists of four integrated components: sharia contract validation, contract code structure, algorithmic sharia audit, and blockchain-based execution. Sharia contract validation ensures that the agreement satisfies the pillars and conditions of Islamic contracts before it is translated into code. Contract code structure ensures that the programmed logic accurately reflects the approved sharia contract. Algorithmic sharia audit provides an automated or semi-automated mechanism to detect potential violations of sharia rules. Blockchain-based execution ensures transparency, immutability, and verifiable transaction records.

The framework is designed as a sharia-by-design model. This means that compliance is embedded from the earliest stage of contract development rather than assessed only after the transaction has occurred. The findings indicate that such an approach is more appropriate for smart contracts because errors or non-compliant structures may be difficult to reverse once execution has taken place. The study identifies rule-based and ontology-based auditing as the most realistic current methods for algorithmic sharia supervision, while AI-assisted compliance may be developed in the future. This layered model allows technology to support sharia objectives without replacing scholarly and institutional supervision.

### **Regulatory and Practical Implications**

The findings indicate that the Islamic Smart Contract Framework has practical implications for regulators, sharia authorities, and fintech developers. OJK may use the framework as a basis for developing compliance testing guidelines within a regulatory sandbox. DSN-MUI may formulate digital contract standards that can be translated into algorithmic parameters. Bank Indonesia may support infrastructure standardization for blockchain-based financial transactions. Fintech developers may also use the

framework to design products that integrate sharia validation, transparent code, audit trails, and dispute-resolution mechanisms from the beginning of the product lifecycle.

The study finally finds that Indonesia requires more specific regulation for sharia-compliant smart contracts. Existing legal frameworks provide a foundation, but they are not yet sufficient to address the distinctive features of code-based execution, immutability, digital identity, algorithmic compliance, and blockchain evidence. Comparative practices from Malaysia, Bahrain, and the United Arab Emirates show that regulatory sandboxes, centralized sharia governance, and digital Islamic finance supervision can support innovation while maintaining compliance. Therefore, the development of national standards for Islamic smart contracts is necessary to strengthen legal certainty, sharia legitimacy, consumer protection, and the digital transformation of Islamic finance.

## DISCUSSION

### Smart Contracts, Transparency, and Legal Certainty in Islamic Finance

The findings of this study indicate that smart contracts have strong potential to improve transparency, legal certainty, efficiency, auditability, and trust in sharia-compliant digital transactions. Their automated execution allows contractual obligations to be performed once predefined conditions are fulfilled, while blockchain records provide verifiable evidence of transactions. In the context of Islamic finance, these features are significant because sharia contracts require clarity, accountability, and the prevention of uncertainty. This study therefore confirms that smart contracts may support Islamic economic law when their technical architecture is connected to valid contractual formation, lawful subject matter, and transparent execution mechanisms.

This finding is consistent with previous studies showing that blockchain-based smart contracts can enhance transparency and auditability by creating traceable execution histories (A. A. Ahmad et al., 2024; Attoyibah et al., 2022; Laksono & Sumidartini, 2023; Mustafa & Ab Rahman, 2023). Other studies also argue that automation can reduce intermediary dependence, accelerate settlement, and increase transaction efficiency in Islamic financing models such as murabahah, ijara, mudarabah, and musharakah (Desky & Hye, 2025; Nurkholidah et al., 2024; Sami, 2025; Wahid et al., 2023). However, scholars also warn that legal certainty depends on the recognition of blockchain records and encoded terms by national legal systems (Ferdiansyah et al., 2019; Uddin & Ahmad, 2020; Vorobiova et al., 2023).

Theoretically, these findings strengthen the argument that technological automation can serve the objectives of Islamic economic law when it enhances clarity, accountability, and fairness. Practically, Islamic financial institutions can use smart contracts to improve contract performance and reduce operational inefficiencies, provided that the encoded terms are understandable and auditable. From a policy perspective, regulators need to provide clearer legal recognition for smart contracts as electronic contracts and define how blockchain records may be used as evidence.



Without such regulatory certainty, smart contracts may improve technical efficiency but remain vulnerable to legal ambiguity and institutional hesitation.

### **Limits of Automation in Representing Islamic Contractual Values**

This study also finds that smart contracts cannot fully represent the ethical and spiritual dimensions of Islamic contracts. While code can execute predefined obligations, it cannot independently verify contractual intent, *ridha*, fairness, *maslahah*, or *maqasid al-shariah*. In Islamic economic law, a valid contract is not merely a technical exchange but a moral commitment grounded in justice, lawful benefit, and avoidance of harm. Therefore, the automatic execution of smart contracts must be distinguished from the substantive validity of sharia contracts. Code may facilitate execution, but it cannot replace the interpretive and ethical judgment required in Islamic jurisprudence.

This conclusion is supported by studies emphasizing that smart contracts do not automatically guarantee authentic *niyyah*, genuine consent, or informed *ridha* (Hidayat & Ahmad, 2023; Mohamed Shaarani et al., 2023). Other scholars argue that *maqasid al-shariah* should guide the design of digital Islamic financial products so that they protect wealth, prevent injustice, and avoid *riba*, *gharar*, and *maysir* (Amin, 2022; Hassan et al., 2021; Smolo, 2026). The literature also notes that ethical accountability requires transparency, redress mechanisms, and institutional oversight because automated contracts alone cannot assess hardship, exploitation, or changing social circumstances (Asif et al., 2023; Billore, 2026; Labazanov, 2025).

Theoretically, this finding reinforces the distinction between formal execution and substantive sharia validity. It implies that Islamic contract theory should not be reduced to code-based performance, because Islamic law also evaluates purpose, consent, benefit, and justice. Practically, fintech developers must ensure that users understand contractual consequences before execution and that digital consent mechanisms are not merely procedural. Policy makers should require disclosure standards, user protection mechanisms, and sharia review before deployment. These safeguards are essential so that smart contracts do not create a technologically efficient but ethically incomplete model of Islamic finance.

### **Sharia Governance, Fatwa Validation, and Algorithmic Audit**

The study further shows that sharia governance is indispensable for ensuring the compliance of smart contracts with Islamic economic law. The proposed Islamic Smart Contract Framework addresses this need by integrating sharia contract validation, contract code structure, algorithmic sharia audit, and blockchain-based execution. This model assumes that compliance should be embedded from the design stage rather than evaluated only after a transaction occurs. Such a sharia-by-design approach is necessary because once a smart contract is deployed and executed, non-compliant outcomes may be difficult to reverse, especially in immutable blockchain environments.

This finding is in line with literature that identifies sharia supervisory boards, fatwa-based validation, and AAOIFI-aligned standards as essential mechanisms for

legitimizing digital Islamic financial products (Bhuiyan et al., 2020; Faza' et al., 2024; Hardiyono et al., 2023; Tuzzahroh & Laela, 2022). Previous studies also emphasize the need for digital sharia supervision, machine-readable fatwas, formal verification, and auditable evidence trails to link on-chain actions with authoritative sharia decisions (AISalih, 2025; Benali et al., 2025; Muryanto, 2023). These studies support this article's argument that smart contracts require both technological and jurisprudential validation.

The theoretical implication is that sharia governance must evolve from conventional review toward continuous digital supervision. Practically, Islamic fintech platforms should integrate fatwa-based templates, audit logs, compliance metadata, and formal verification tools into the product lifecycle. Policy makers should support the creation of a digital sharia audit standard that can be used by DSN-MUI, OJK, Bank Indonesia, and Islamic financial institutions. However, algorithmic auditing should assist rather than replace sharia scholars, because Islamic legal reasoning contains interpretive nuance that cannot be fully translated into machine-readable rules.

### **Regulatory and Institutional Challenges in Indonesia**

The results reveal that Indonesia already has several legal foundations relevant to smart contracts, including electronic transaction law, sharia banking regulation, personal data protection law, and financial technology rules. Nevertheless, these instruments remain fragmented and do not yet provide a specific regulatory framework for sharia-compliant smart contracts. This creates uncertainty regarding the status of encoded agreements, blockchain evidence, algorithmic sharia audit, consumer protection, and dispute resolution. The absence of integrated standards may limit the adoption of smart contracts in Islamic finance, even when the technology offers clear benefits for efficiency and transparency.

The literature supports this conclusion by showing that regulatory uncertainty is a major challenge in Indonesia and other Islamic finance jurisdictions (Ab Razak et al., 2020; Amalia et al., 2024; Harahap et al., 2023; Kachkar & Yilmaz, 2023; Kunhibava et al., 2024; Ulfi, 2022). Malaysia is often cited for its centralized sharia governance and regulatory sandbox, Bahrain for its AAOIFI-aligned framework, and the United Arab Emirates for its federated governance and cross-border dispute mechanisms (Ab Razak et al., 2020; Ayub, 2012; Kachkar & Yilmaz, 2023). These comparative models show that innovation requires institutional coordination, not merely technological adoption.

Theoretically, the Indonesian case illustrates the need to harmonize positive law, sharia norms, and digital governance. Practically, regulators should create a sandbox specifically for sharia-compliant smart contracts, allowing developers to test contract templates, oracle systems, audit mechanisms, and dispute-resolution procedures under supervision. From a policy perspective, DSN-MUI should develop fatwa standards that can be operationalized digitally, OJK should formulate compliance testing guidelines, and Bank Indonesia should support infrastructure standardization. Such coordination is necessary to avoid regulatory fragmentation and to build public trust in Islamic digital finance.

### Positioning the Islamic Smart Contract Framework

The proposed Islamic Smart Contract Framework can be positioned as a governance-first model rather than a purely technical architecture. Its main contribution is to integrate Islamic legal validation with programmable contract design, algorithmic audit, and blockchain-based execution. The framework responds to the limitations of smart contracts by ensuring that sharia compliance is embedded before deployment, monitored during execution, and supported after execution through dispute mechanisms. In this sense, the model does not assume that technology is inherently sharia-compliant, but that it must be structured through legal, ethical, and institutional safeguards.

This positioning is consistent with existing literature on blockchain governance, sharia fintech regulation, hybrid dispute resolution, and compliance-by-design. Studies argue that smart contracts require governance overlays to address sharia interpretation, data integrity, enforceability, and cross-border recognition (AL-Khalaileh et al., 2025; Baso et al., 2024; Busari & Aminu, 2022; Hannani, 2023). Other works recommend fatwa-to-code workflows, digital supervision, machine-readable sharia predicates, formal verification, and hybrid dispute resolution mechanisms to connect automated outcomes with Islamic and civil legal remedies (Abdulrazzaq et al., 2025; Suyatna et al., 2025; Wazin et al., 2025; Wijananto et al., 2021). These perspectives confirm that the ISCF contributes by consolidating scattered governance ideas into a structured implementation model.

Theoretically, the ISCF contributes to Islamic economic law by extending contract theory into the digital environment without abandoning classical requirements of validity, consent, lawful object, and justice. Practically, it provides fintech developers with a design model for building sharia-compliant smart contract products. For policy makers, it offers a basis for developing standards on digital sharia audit, contract certification, sandbox testing, and dispute resolution. Its broader significance lies in showing that Islamic finance can adopt technological innovation while maintaining maqasid al-shariah, maslahah, accountability, and legal certainty.

### CONCLUSION

This study concludes that smart contracts have significant potential to support the development of Islamic economic law in the digital era, particularly by strengthening transparency, legal certainty, transaction efficiency, and auditability. The findings show that smart contracts may be compatible with sharia contracts when they function as technical instruments for executing valid agreements rather than as independent sources of legal validity. Their permissibility depends on the fulfillment of essential Islamic contractual requirements, including *ijab-qabul*, *ridha*, *ahliyya*, lawful subject matter, contractual clarity, and freedom from *riba*, *gharar*, and *maysir*.

At the same time, the study emphasizes that smart contracts cannot fully replace the ethical, moral, and interpretive dimensions of Islamic contracts. Code-based automation can execute predefined obligations, but it cannot independently verify

contractual intent, *maslahah*, *maqasid al-shariah*, fairness, or ethical accountability. Therefore, sharia-compliant smart contracts require a governance layer that integrates fatwa-based validation, sharia supervision, digital audit, and hybrid dispute resolution. This finding has practical implications for regulators, Islamic fintech developers, sharia supervisory institutions, and financial authorities seeking to balance innovation with religious and legal legitimacy.

The main contribution of this study lies in the formulation of the Islamic Smart Contract Framework as a sharia-by-design model that combines contract validation, programmable code structure, algorithmic sharia auditing, and blockchain-based execution. This framework extends existing discussions on blockchain governance and Islamic fintech by offering a more integrated model for compliance, supervision, and regulatory development. Future research should test this framework empirically through regulatory sandboxes, prototype development, comparative jurisdictional studies, and technical experiments on machine-readable fatwas, oracle reliability, digital identity verification, and smart contract certification.

### **Limitation of the Study**

This study is limited by its normative-juridical and conceptual design. It does not conduct empirical fieldwork, interviews with regulators or sharia scholars, surveys of Islamic fintech users, or technical testing of actual smart contract code. As a result, the study cannot measure the operational effectiveness, cybersecurity performance, market acceptance, or practical feasibility of the proposed Islamic Smart Contract Framework in real digital finance environments. The analysis is based on legal documents, DSN-MUI fatwas, academic literature, and comparative regulatory materials, which provide strong normative foundations but do not capture all practical implementation challenges.

Another limitation concerns the rapidly changing nature of blockchain regulation, fintech supervision, and Islamic digital finance. Smart contract technology, regulatory sandboxes, data protection rules, crypto-asset policies, and digital sharia governance standards continue to evolve across jurisdictions. Consequently, some regulatory conclusions may require adjustment as new laws, fatwas, technical standards, or institutional practices emerge. The proposed framework should therefore be understood as a conceptual foundation rather than a final regulatory model. Further validation is needed before it can be adopted as a binding policy, operational standard, or certified technological architecture.

### **Recommendations for Future Research**

Future research should empirically examine the applicability of the Islamic Smart Contract Framework in real or simulated Islamic finance products. Studies may test the framework in *murabahah*, *ijara*, *musharakah*, *mudarabah*, *takaful*, *sukuk*, or sharia-compliant crowdfunding models. Such research should involve fintech developers, regulators, sharia supervisory boards, Islamic financial institutions, and users to evaluate usability, compliance accuracy, transaction efficiency, consumer protection,

and dispute-resolution effectiveness. Regulatory sandbox studies would be especially useful because they allow controlled experimentation while maintaining institutional supervision and public accountability.

Further research should also develop technical and regulatory tools for digital sharia supervision. Important areas include machine-readable fatwa standards, algorithmic sharia audit systems, formal verification of smart contract logic, trusted oracle mechanisms, digital identity verification, privacy-preserving audit trails, and blockchain-based certification models. Comparative studies involving Indonesia, Malaysia, Bahrain, the United Arab Emirates, and other Islamic finance jurisdictions may help identify best practices for regulatory harmonization and cross-border recognition. These studies would strengthen the theoretical and practical foundations for implementing sharia-compliant smart contracts in the global digital Islamic economy.

### Author Contributions

Conceptualization	H., A.M., & H.T.	Resources	H., A.M., & H.T.
Data curation	H., A.M., & H.T.	Software	H., A.M., & H.T.
Formal analysis	H., A.M., & H.T.	Supervision	H., A.M., & H.T.
Funding acquisition	H., A.M., & H.T.	Validation	H., A.M., & H.T.
Investigation	H., A.M., & H.T.	Visualization	H., A.M., & H.T.
Methodology	H., A.M., & H.T.	Writing – original draft	H., A.M., & H.T.
Project administration	H., A.M., & H.T.	Writing – review & editing	H., A.M., & H.T.

All authors have read and agreed to the published version of the manuscript.

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### Informed Consent Statement

Informed consent was not required for this study.

### Data Availability Statement

The data presented in this study are available on request from the corresponding author.

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### Conflicts of Interest

The authors declare no conflicts of interest.

### Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

During the preparation of this work the authors used ChatGPT, DeepL, Grammarly, and PaperPal in order to translate from Bahasa Indonesia into American English, and to improve clarity of the language

and readability of the article. After using these tools, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

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