

Automation in Islamic Finance: Revisiting Human Responsibility through the Concept of Khalifah

Muhammad Izzul Syahmi Zulkepli^{1*}

¹ Universiti Malaya, Malaysia

*Corresponding author: izzulsyahmi95@um.edu.my

Abstract: The rapid development of various automation technology has transformed the landscape of financial operations. Artificial intelligence (AI) and smart contract technology, are among the mechanisms that enable the automation. However, the increasing reliance on autonomous technologies raises concerns regarding the diminishing role of human ethical judgment and accountability in financial decision-making. In the contemporary multipolar era, technological governance is increasingly shaped by global competition, digital capitalism, and AI-driven systems. From the perspective of Eco-theology, the concept of khalifah emphasizes that humans remain morally responsible custodians entrusted to preserve justice, balance, and ethical order despite technological advancement. This study aims to examine the implications of automation of AI and smart contracts in Islamic finance through the concept of khalifah. It explores how technological automation challenges human responsibility, moral agency, and accountability within AI-driven financial ecosystems. This study employs a qualitative conceptual approach based on library research and thematic content analysis. Relevant classical and contemporary literature related to Islamic finance, AI ethics, smart contracts, maqasid al-Shariah, and khalifah were systematically reviewed from journal articles, fiqh literature, and fintech studies. The study finds that although AI and smart contracts improve operational efficiency, excessive technological autonomy risks weakening meaningful human ethical oversight. The concept of khalifah remains essential in preserving amanah, accountability, and moral responsibility in financial transactions. The findings also indicate that AI cannot fully replace human ethical agency from the Islamic perspective. This study contributes to Islamic finance, Islamic fintech, AI governance, and digital ethics by proposing khalifah as a human-centered ethical framework for technological governance. Unlike existing studies focusing mainly on technical efficiency and Shariah compliance, this study highlights the importance of moral responsibility and ethical accountability in automated Islamic financial systems while expanding contemporary discussions on Malay-Islamic eco-theology and cultural resilience in the multipolar era.

Keywords: Artificial Intelligence; Eco-theology; Khalifah; Islamic Finance; Smart Contracts.

Introduction

The emergence of Artificial Intelligence (AI) and smart contract technologies has significantly transformed the landscape of the financial industry by enabling greater automation and operational accuracy (Rahim et al., 2018). AI-powered systems are increasingly employed to perform complex financial tasks such as credit assessment, fraud detection, customer profiling, portfolio management, and risk analysis, while smart contracts facilitate the automatic execution of contractual obligations through blockchain technology without requiring continuous human intervention. Within Islamic finance, these technological innovations present considerable opportunities to enhance operational efficiency, reduce transaction costs, improve transparency, and strengthen Shariah compliance through programmable financial contracts. Consequently, many Islamic financial institutions have begun exploring AI-driven decision support systems and blockchain-based smart contracts to modernize their financial services and remain competitive in the era of digital transformation (Hasan et al., 2020).

Despite these technological advancements, the increasing autonomy of AI and smart contracts also introduces important ethical and governance challenges (Sitiris et al., 2024; Saleh et al., 2023). Unlike conventional digital technologies that merely assist human decision-making, AI systems are progressively capable of making recommendations or decisions with limited human intervention, while smart contracts automatically execute predefined contractual clauses once specified conditions are fulfilled. Although such automation enhances operational effectiveness, it may simultaneously reduce meaningful human oversight in financial decision-making and weaken the exercise of moral judgement, ethical deliberation, and accountability. As financial decisions increasingly become embedded within algorithms and executable code, questions arise regarding who should bear responsibility when automated systems produce unjust outcomes, generate unintended consequences, or fail to uphold the ethical objectives of Islamic finance.

These concerns become even more significant within the context of Islamic finance, where financial activities are not solely evaluated based on legal validity or technical compliance but are also guided by Shariah principles and are expected to uphold justice, trust, transparency, accountability, and public welfare. While AI and smart contracts can facilitate operational compliance by automating contractual processes, ethical responsibility cannot be entirely delegated to technological systems (Sitiris et al., 2024). Unlike humans, AI

possesses neither moral consciousness nor legal and religious accountability, making it incapable of independently fulfilling the ethical obligations expected within the Islamic worldview. Therefore, technological efficiency should not replace the human responsibility to ensure that financial decisions remain consistent with Shariah values and ethical objectives.

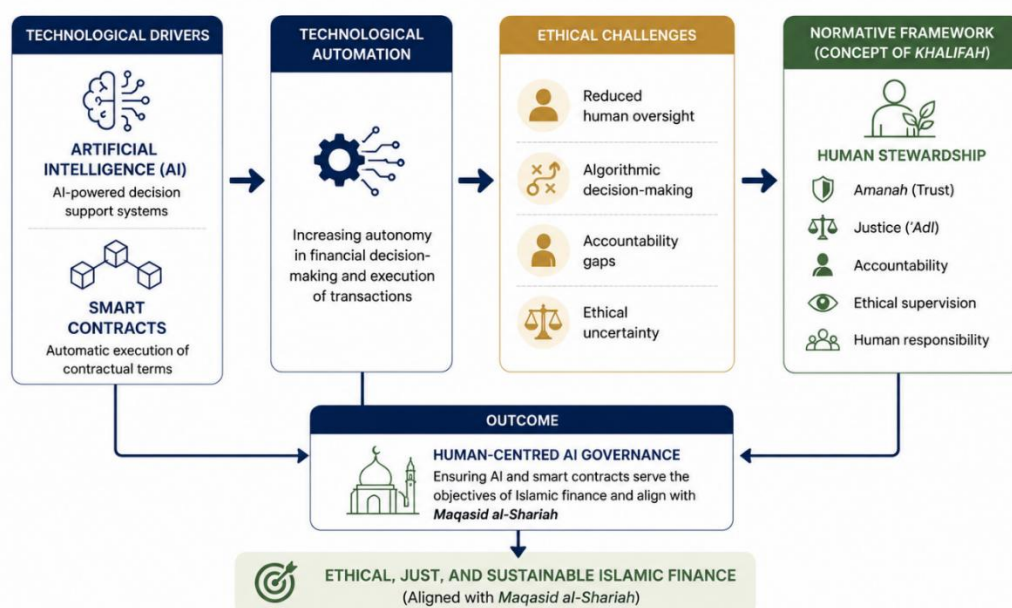
Recent studies on AI and smart contracts in Islamic finance have predominantly focused on technological implementation, operational efficiency, blockchain architecture, fintech innovation, and Shariah compliance mechanisms. Existing research generally examines how these technologies improve transaction execution, reduce operational costs, strengthen transparency, and facilitate compliance with Islamic contractual requirements (Shaarani et al., 2023; Sitiris et al., 2024; Mohd. Zain et al., 2021; Al-Khalaileh et al., 2025; Saleh et al., 2023). However, comparatively limited attention has been devoted to examining how increasing technological autonomy influences human ethical agency, moral responsibility, and accountability in AI-driven Islamic financial ecosystems.

More importantly, although Islamic scholarship has increasingly discussed AI ethics, Shariah governance, and *maqasid al-Shariah* in relation to emerging financial technologies, there remains considerable scope to further explore the concept of *khalifah*, which positions humans as Allah's vicegerents entrusted with preserving justice, ethical order, and responsible stewardship, as a normative framework for governing AI and smart contract automation in Islamic finance. This theoretical gap is particularly relevant in the contemporary multipolar era, where digital capitalism, AI governance, and technological competition increasingly shape global financial systems while simultaneously raising questions concerning ethical responsibility and sustainable technological development.

From the perspective of Islamic eco-theology, the concept of *khalifah* offers a comprehensive ethical foundation for understanding the relationship between humans, technology, and society. Rather than perceiving technology as an autonomous decision-maker, the concept emphasizes that technological tools should remain under responsible human stewardship to preserve justice, balance, and accountability (Rakhmat, 2022). Human beings remain morally accountable for designing, implementing, supervising, and evaluating technological systems, regardless of the degree of automation achieved. Consequently, AI and smart contracts should function as instruments that assist human decision-making rather than replace human ethical responsibility in Islamic financial governance.

Against this background, this study aims to examine the ethical implications of AI and smart contracts in Islamic finance through the concept of *khalifah*. Specifically, it explores how technological automation influences human responsibility, moral agency, and accountability within AI-driven financial ecosystems and proposes *khalifah* as a human-centred ethical framework for governing emerging financial technologies. By integrating Islamic ethical principles with contemporary discussions on AI governance, this study contributes to the growing literature on Islamic finance, Islamic fintech, digital ethics, and eco-theology. Unlike previous studies that primarily emphasize technological efficiency and Shariah compliance, this paper highlights the indispensable role of human ethical stewardship in ensuring that technological innovation remains aligned with the objectives and values of Islamic finance.

Figure 1: Conceptual Framework



Source: Author's Own.

Method

This study adopts a qualitative research design with the primary objective of establishing a conceptual understanding of ethical governance for AI and smart contract automation in Islamic finance through the concept of *khalifah*. Rather than examining empirical evidence or testing hypotheses, the study seeks to synthesise existing knowledge and develop a conceptual framework that explains how the Islamic principle of *khalifah* can address the ethical and accountability challenges arising from increasing technological automation.

The data for this study were collected through library research. Relevant literature was systematically gathered from a wide range of secondary sources, including peer-reviewed journal articles, books, conference proceedings, industry reports, policy documents, and classical as well as contemporary Islamic literature. The literature focuses on several interrelated themes, namely AI, smart contracts, Islamic finance, , Islamic governance and *khalifah*. These sources provide the theoretical foundation for analysing the ethical implications of automation within the Islamic financial ecosystem.

The collected data were analysed using a descriptive qualitative approach. Relevant literature was critically reviewed, organised, and synthesised to identify key concepts, recurring themes, and relationships between technological automation and ethical responsibility. The analysis focused on explaining how AI and smart contracts contribute to automation in Islamic finance, examining the resulting responsibility and accountability issues, and proposing the concept of *khalifah* as a human-centred ethical governance framework. The findings are presented narratively and integrated into a conceptual framework that illustrates the relationship between technological automation, responsibility, and Islamic ethical governance.

Results and Discussion

The results and discussion are discussed through the themes below

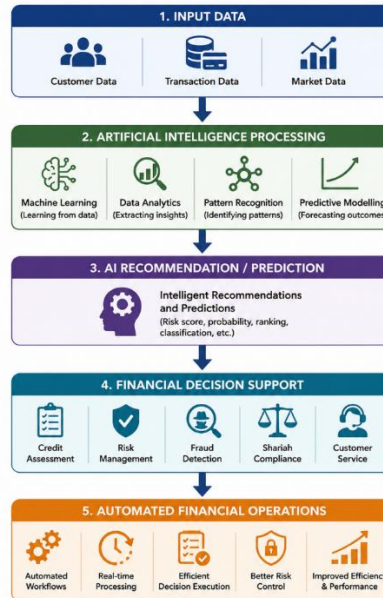
1. Automation Element in AI and Smart Contract

AI and smart contracts represent two complementary technologies that have significantly accelerated automation within the financial ecosystem. AI enhances decision-making through data-driven analysis and predictive capabilities. Smart contracts automate the execution of contractual obligations through predefined codes deployed on blockchain networks. The integration of these technologies enables financial institutions to automate various operational processes, ranging from customer profiling, credit assessment, fraud detection, compliance monitoring, and risk management to the execution of contractual transactions without requiring continuous human intervention. Consequently, automation is no longer limited to operational efficiency but increasingly extends into decision-making functions that were traditionally performed by human professionals.

AI refers to the capability of computer systems to perform tasks that normally require human intelligence, including learning, reasoning, problem-solving, pattern recognition, and decision-making (Abozaid, 2024). Unlike conventional information systems that merely execute predefined instructions, AI systems continuously analyse large volumes of structured and unstructured data, recognise hidden patterns, learn from previous experiences, and generate recommendations or predictions based on sophisticated computational models. Through machine learning, deep learning, and predictive analytics, AI enables financial institutions to transform raw data into actionable insights that support more efficient, accurate, and timely decision-making.

The application of AI has expanded rapidly across the financial industry, where it functions as a technological enabler for automating both operational and strategic activities. Rather than replacing human expertise entirely, AI complements human decision-making by automating repetitive analytical tasks, reducing processing time, and improving the consistency of financial assessments (Kismawadi et al., 2025). In Islamic finance, AI technologies are increasingly utilised to support financing decisions, customer due diligence, fraud detection, anti-money laundering monitoring, portfolio management, Shariah compliance assessment, and customer service (Arsyad et al., 2025). These applications demonstrate that AI has evolved from a simple decision-support tool into an intelligent system capable of performing analytical functions that traditionally required significant human involvement.

The automation process introduced by AI differs fundamentally from conventional digital technologies. While traditional systems execute fixed instructions provided by users, AI systems dynamically generate recommendations based on continuous learning and predictive analysis. Consequently, the level of human involvement in routine financial decision-making gradually decreases as institutions become increasingly reliant on algorithmic intelligence to improve operational efficiency, risk management, and service delivery (Mohd Najib et al., 2025). Figure 2 illustrates the general workflow of AI in financial decision-making, demonstrating how data are transformed into intelligent recommendations that support automated financial operations.

Figure 2: General Workflow of Artificial Intelligence in Financial Decision-Making

Source: Author's own

The increasing integration of AI into financial services demonstrates that automation is no longer confined to administrative processes but increasingly extends to analytical and decision-oriented functions. Table 1 summarises the major applications of AI in Islamic finance and explains how each application contributes to the automation of financial operations.

Table 1: Applications of Artificial Intelligence in Islamic Finance and Their Automation Functions

AI Application	Automation Function
Credit Assessment	Analyses customer data to evaluate financing eligibility and predict credit risk (Aziz et al., 2025).
Customer Due Diligence (CDD)	Automates customer identification, verification, and Know Your Customer (KYC) procedures (Arsyad et al., 2025).
Anti-Money Laundering (AML) Monitoring	Detects suspicious transactions using anomaly detection and behavioural analysis (Tariq, 2025).
Fraud Detection	Identifies unusual transaction patterns and potential fraudulent activities in real time (Tariq, 2025).
Portfolio Management	Analyses market data and customer preferences to support investment allocation and portfolio optimisation (Kismawadi et al., 2025).
Customer Service	Provides automated responses through intelligent virtual assistants and chatbots (Miharja et al., 2023).
Risk Management	Continuously evaluates financial, operational, and market risks using predictive analytics (Zulkepli et al., 2026).

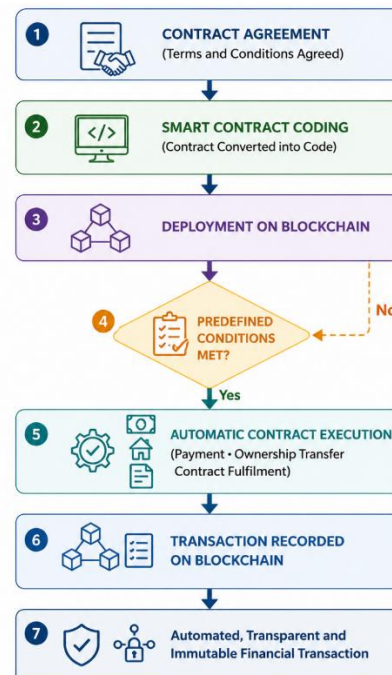
Smart contracts complement AI by automating the execution of contractual. Smart contracts are self-executing digital agreements in which contractual obligations are automatically performed once predefined conditions are satisfied. Built upon blockchain technology, smart contracts consist of programmable codes that translate contractual clauses into executable instructions, allowing transactions to be executed without requiring continuous human intervention (Safina & Oseni, 2019). Unlike conventional contracts, which rely on manual verification and intermediary involvement during execution, smart contracts enforce contractual terms automatically according to the logic embedded within the code. Their immutable and transparent nature enhances transaction integrity by ensuring that contractual obligations are executed consistently and recorded permanently on the distributed ledger.

Within the financial sector, smart contracts have emerged as an important technological innovation for automating contractual execution while improving operational efficiency, transparency, and trust (Shaarani et al., 2023). Rather than replacing the legal agreement itself, smart contracts automate the implementation of contractual terms after all predefined conditions have been fulfilled. This capability reduces administrative delays, minimises operational costs, lowers the possibility of human error, and enables real-time execution of financial transactions (Zulkepli et al., 2025).

The application of smart contracts has attracted increasing attention within the Islamic finance industry due to their potential to facilitate Shariah-compliant financial operations. By embedding contractual rules directly into executable code, smart contracts can automate the implementation of various Islamic financial products while preserving contractual transparency and operational consistency (Huseynova, 2025). Existing studies have proposed the utilisation of smart contracts in areas such as Islamic personal financing, trade finance, zakat and waqf management, sukuk administration, and Shariah compliance monitoring. These applications demonstrate that smart contracts are capable of automating not only payment execution but also contract verification, ownership transfer, compliance validation, and transaction recording in accordance with predefined contractual requirements.

Figure 3 illustrates the general workflow of smart contracts in financial transaction execution. The process begins with the formation of a contractual agreement, followed by the deployment of the smart contract onto the blockchain network. Once the predefined contractual conditions are fulfilled, the smart contract automatically executes the agreed contractual obligations and permanently records the transaction on the blockchain, thereby ensuring transparency, immutability, and traceability throughout the transaction lifecycle.

Figure 3: General Workflow of Smart Contracts in Financial Transaction Execution



Source: Adapted from Feng et al. (2019), Nguyen et al. (2021).

The workflow demonstrates that smart contracts automate the execution phase of financial transactions by eliminating repetitive manual verification while ensuring that contractual obligations are implemented consistently according to predetermined rules. As a result, automation extends beyond simple payment processing to encompass multiple stages of Islamic financial transactions, including contract validation, ownership transfer, settlement, and compliance monitoring. Table 2 summarises the major applications of smart contracts in Islamic finance together with their respective automation functions.

Table 2: Applications of Smart Contracts in Islamic Finance and Their Automation Functions

Islamic Financial Contract	Automation Function
Zakat and Waqf Management	Automates collection, verification, fund distribution, and transparent transaction recording (Attar et al., 2023; AlSaudi, 2023).
Trade Finance	Automates payment release upon fulfilment of contractual obligations and verification of supporting documents (Safina & Oseni, 2019; Muneeza & Mustapha 2019).
Personal financing	Automates contract execution and repayment processes using various of Shariah contracts (Roslan et al., 2020; Zulkepli et al., 2025).

The discussion on AI and smart contracts reveals that both technologies share a common objective of enhancing automation within Islamic financial operations, albeit through different functional roles. AI primarily automates analytical activities, including data processing, prediction, and decision support, whereas smart

contracts automate the execution and enforcement of contractual obligations. Together, these technologies create increasingly autonomous financial ecosystems capable of performing both decision-making and contractual execution with minimal human intervention. While such automation significantly improves efficiency, consistency, transparency, and operational performance, it also fundamentally alters the traditional allocation of human responsibility in financial governance. As decision-making and contractual execution become progressively delegated to intelligent algorithms and executable codes, important questions emerge regarding moral accountability, legal liability, and ethical oversight. These challenges form the basis of the next discussion, which critically examines the responsibility issues arising from the automation of AI and smart contracts within Islamic finance.

2. Responsibility Issue on Automation of AI and Smart Contract

The increasing integration of AI and smart contracts into Islamic financial services fundamentally alters the traditional allocation of responsibility in financial decision-making. Consequently, the role of human actors gradually shifts from direct decision-makers to supervisors of automated systems. While this transformation substantially enhances operational efficiency and consistency, it simultaneously raises complex questions regarding ethical responsibility, accountability, and liability when financial decisions are increasingly delegated to autonomous technologies.

One of the primary concerns relates to the diminishing role of human judgement in automated financial decision-making (Shaarani et al., 2023; Mohd. Najib et al., 2025). Islamic finance has traditionally emphasised that financial transactions should not merely satisfy contractual requirements but should also reflect ethical deliberation based on justice (*'adl*), trust (*amanah*), transparency, and public interest (*maslahah*). Human judgement is therefore indispensable because it enables contextual interpretation, moral reasoning, and discretionary evaluation beyond mechanical rule application. By contrast, AI systems generate recommendations through statistical models and machine learning algorithms that optimise predefined objectives based on available data. Although these systems can process information more efficiently than humans, they do not possess moral consciousness, ethical intention, or the capacity to distinguish between legally permissible actions and morally preferable decisions. Consequently, excessive reliance on AI risks reducing ethical deliberation to computational optimisation rather than principled human reasoning.

These concerns become even more pronounced when AI is integrated with smart contracts. Smart contracts execute contractual obligations automatically once predefined conditions are satisfied without requiring further human verification (Charles & Gherman, 2023). Such automation improves consistency and minimises operational delays, however, it also reduces opportunities for human intervention when exceptional circumstances arise. Unlike conventional contracts, which permit parties or authorised institutions to exercise discretion in response to unforeseen situations, smart contracts execute contractual clauses strictly according to their programmed logic. As Ghuddah (2019) argues, contractual implementation should not be reduced solely to technical execution because contractual relationships also involve ethical responsibility, fairness, and human judgement that cannot always be fully translated into executable code. Consequently, AI-enabled smart contracts may successfully fulfil contractual procedures while simultaneously overlooking broader ethical considerations that require contextual human assessment.

The increasing autonomy of AI and smart contracts further complicates the attribution of responsibility when undesirable outcomes occur (Aziz et al., 2025). Autonomous systems often involve multiple stakeholders, including software developers, financial institutions, Shariah advisers, data providers, blockchain operators, and end users. When an AI system produces a discriminatory financing recommendation or when a smart contract executes an unintended transaction due to flawed programming or inaccurate input data, determining responsibility becomes considerably more complex than in conventional financial systems. Responsibility may no longer rest upon a single decision-maker but instead becomes dispersed across multiple actors involved in designing, deploying, supervising, and operating the technological system. This phenomenon, frequently described in AI ethics literature as the “responsibility gap,” challenges conventional legal and ethical frameworks because autonomous technologies themselves cannot bear legal or moral accountability despite performing functions traditionally undertaken by humans.

From the perspective of Islamic jurisprudence, this responsibility gap may be analysed through the concept of *ahliyyah* (legal capacity). *Ahliyyah* refers to the legal competence that enables a person to acquire rights and assume obligations under Islamic law. Classical jurists generally distinguish between *ahliyyah al-wujub* (the capacity to possess legal rights and obligations) and *ahliyyah al-ada'* (the capacity to exercise legal responsibilities through intentional actions). These forms of legal capacity are inseparable from attributes that belong exclusively to human beings, including intellect (*'aql*), discernment (*tamyiz*), free will (*ikhtiyar*), and legal accountability (*taklif*). Since AI systems and smart contracts possess neither consciousness nor intentionality, they cannot independently qualify as legal or moral agents under Shariah. Regardless of their degree of technological sophistication, they remain instruments created and utilised by human beings rather than independent entities capable of assuming legal responsibility (Sitiris et al., 2024).

Accordingly, the automation of financial processes should not be interpreted as transferring ethical responsibility from humans to technological systems. Instead, Islamic legal principles suggest that responsibility remains with the human actors who design, authorise, supervise, and implement these technologies. Financial institutions, software developers, AI engineers, Shariah advisers, and regulators continue to bear responsibility for ensuring that automated systems operate consistently with the objectives and ethical principles of Islamic law. Technology may execute programmed instructions with remarkable speed and precision, yet it cannot exercise moral judgement, evaluate exceptional circumstances, or assume accountability for the consequences of its actions. Therefore, automation should be understood as enhancing human capabilities rather than replacing human ethical agency.

The foregoing discussion demonstrates that the principal challenge associated with AI and smart contract automation is not the technology itself but the growing disconnect between technological capability and human ethical accountability. As autonomous systems increasingly perform analytical and contractual functions, maintaining meaningful human responsibility becomes essential to preserve justice, transparency, and public trust within Islamic finance. This responsibility gap highlights the need for a comprehensive ethical framework capable of reaffirming human stewardship over technological innovation. The following section therefore examines the concept of *khalifah* as a normative framework for reconstructing human responsibility and guiding the ethical governance of AI and smart contracts in Islamic finance.

3. *Khalifah* as Ethical Governance for Automation

The preceding discussion demonstrates that the increasing automation enabled by AI and smart contracts creates significant ethical challenges concerning responsibility, accountability, and human oversight in Islamic finance. While AI systems enhance decision-making through predictive analytics and smart contracts execute contractual obligations autonomously, neither technology possesses the moral agency or legal capacity required to assume responsibility for the consequences of their actions. Consequently, the responsibility gap created by technological automation necessitates an ethical governance framework capable of reaffirming the central role of human beings in supervising, controlling, and directing technological innovation. Similar concerns have also been emphasised within international AI governance literature, which consistently argues that increasing levels of automation require meaningful human oversight to ensure accountability, transparency, and contestability of automated decisions (Floridi et al., 2018).

Although several ethical and governance perspectives may be employed to address these automation-related issues within Islamic finance, one of the most fundamental concepts embedded in the Islamic worldview is the concept of *khalifah*. Rather than viewing technology as an autonomous authority, the concept of *khalifah* places human beings at the centre of governance by emphasising stewardship, moral responsibility, and accountability before Allah in every aspect of life, including technological development and financial decision-making (Rakhmat, 2022).

While existing governance frameworks, such as AI ethics, Shariah governance, and *maqasid al-Shariah*, provide important guidance for regulating emerging technologies, the concept of *khalifah* offers an additional perspective by placing human stewardship at the centre of technological governance. Rather than focusing primarily on regulatory compliance or institutional governance, *khalifah* emphasises that human beings remain morally responsible for the design, implementation, supervision, and consequences of technological systems. This human-centred perspective makes *khalifah* a particularly relevant lens for addressing the responsibility gap created by AI and smart contract automation.

The concept of *khalifah* originates from the Qur'anic understanding that human beings are appointed as Allah's vicegerents (*khulafa'*) on earth with the responsibility of managing creation according to divine guidance. This appointment is not merely an honourable status but a continuous trust that obliges humans to preserve justice, balance, and public welfare while avoiding corruption and harm. Unlike technological systems, which operate solely according to programmed instructions and computational logic, human beings possess intellect, moral consciousness, free will, and legal accountability, enabling them to distinguish between what is technically possible and what is ethically appropriate. Accordingly, the concept of *khalifah* establishes that technological advancement should remain subordinate to human moral judgement rather than replacing it.

From the perspective of AI governance, *khalifah* provides an ethical framework that redefines the relationship between humans and intelligent technologies. AI and smart contracts should be regarded as instruments that assist human decision-making instead of autonomous entities capable of exercising independent authority. Their primary function is to improve efficiency, accuracy, and transparency in financial operations, while ultimate responsibility remains with the human actors who design, develop, implement, supervise, and continuously evaluate these systems. This perspective rejects the assumption that responsibility can be transferred to algorithms or executable codes simply because technological systems perform decision-making or contractual execution autonomously. Instead, automation is viewed as an extension of human capability, with ethical accountability remaining inseparable from the individuals and institutions responsible for its governance. This perspective closely resembles the principle of human-in-the-loop governance, whereby AI systems are designed

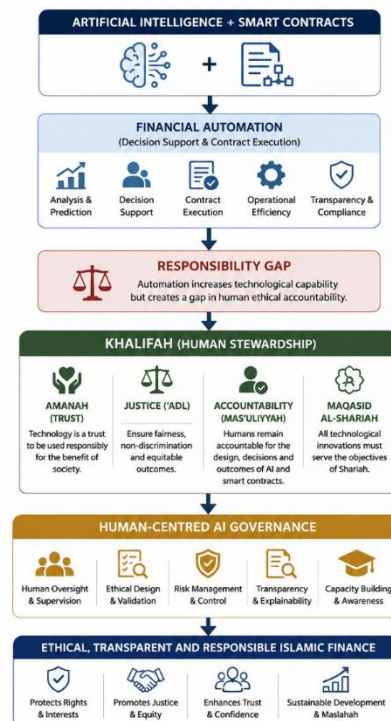
to augment rather than replace human judgement in high-impact decisions (Smart Dubai, 2022).

The application of *khalifah* within AI-driven Islamic finance also strengthens the institutional responsibilities of various stakeholders involved in technological innovation. Software developers are responsible for designing algorithms that minimise bias and promote fairness; financial institutions must ensure that AI systems operate transparently and responsibly; Shariah advisers remain accountable for validating that automated processes comply with Islamic legal and ethical principles; while regulators are entrusted with establishing governance frameworks that safeguard justice, consumer protection, and public interest. Rather than concentrating responsibility upon a single actor, the concept of *khalifah* promotes a shared model of stewardship in which every stakeholder bear responsibility according to their respective roles while remaining collectively accountable for the ethical consequences of technological implementation.

More importantly, *khalifah* operationalises several fundamental principles that collectively form the ethical foundation of AI governance in Islamic finance. First, the principle of trust requires every technological system to be designed and utilised responsibly, recognising that technological authority ultimately remains a trust rather than an unrestricted right. Second, the principle of justice demands that AI algorithms and automated contractual mechanisms operate fairly, avoid discrimination, and ensure equitable treatment for all parties involved. Third, the principle of accountability affirms that responsibility for technological decisions remains with human beings regardless of the level of automation achieved. Finally, these principles collectively support the realisation of the *maqasid al-Shariah* (the objective of Shariah), ensuring that technological innovation promotes public welfare, protects individual rights, prevents harm, and contributes to sustainable socioeconomic development.

Based on these principles, this study proposes a human-centred ethical governance framework in which the concept of *khalifah* functions as the normative foundation for governing AI and smart contract automation in Islamic finance. As illustrated in Figure 4, AI and smart contracts serve as technological enablers that facilitate automation and operational efficiency. However, their implementation remains subject to continuous human stewardship guided by the ethical principles of trust, justice, accountability, and the objectives of *maqasid al-Shariah*. Within this framework, technology enhances human capability without diminishing human responsibility, thereby ensuring that automation remains aligned with the ethical objectives of Islamic finance rather than becoming an autonomous source of authority. Figure 4 illustrates the concept *Khalifah* in govern the application of AI and smart contract automation.

Figure 4: Khalifah as a Human-Centred Ethical Governance Framework for AI and Smart Contract Automation



Source: Author's Own.

In essence, the concept of *khalifah* demonstrates that the principal challenge of AI and smart contract automation is not whether technology can perform increasingly sophisticated financial functions, but whether human beings continue to fulfil their divinely entrusted responsibility in governing such technologies ethically.

By reaffirming humans as moral agents rather than passive observers of technological systems, *khalifah* bridges the accountability gap created by automation and provides a comprehensive ethical governance framework through which AI and smart contracts can contribute to a more responsible, transparent, and Shariah-compliant Islamic financial ecosystem.

Conclusion

The findings of this study demonstrate that although AI and smart contract automation significantly enhance operational efficiency, transparency, and the execution of financial transactions, they cannot replace human ethical judgement, moral agency, or legal accountability within the Islamic finance ecosystem. The study highlights that the responsibility gap created by increasing technological autonomy necessitates a human-centred ethical governance framework. In this regard, the concept of *khalifah* provides a normative foundation by reaffirming that human beings, as Allah's vicegerents, remain entrusted with the responsibility of designing, implementing, supervising, and governing technological systems in accordance with the principles of trust, justice, accountability, and *maqasid al-Shariah*. These findings contribute to the literature on Islamic finance, AI governance, and Islamic fintech by extending the discourse beyond technological efficiency and Shariah compliance towards ethical stewardship and responsible technological governance. Practically, the proposed framework offers useful guidance for Islamic financial institutions, regulators, technology developers, and Shariah advisers in strengthening the governance of AI- and smart contract-enabled financial services. As this study is conceptual in nature, future research should empirically validate the proposed framework through case studies, expert assessments, or industry-based investigations, while also examining its applicability across different AI applications, smart contract implementations, and Islamic financial institutions.

Acknowledgement

This research was supported by the Universiti Malaya, under Bantuan Khas Penyelidikan - Early Career Research Grant (BKP-ECRG), titled “Model Kontrak Pintar dalam Operasi Kad Kredit Islamik Berasaskan Murabahah di Perbankan Islam Malaysia” (Grant No. BKP066-2024-ECRG).

References

- Abozaid, A. (2024). Financial applications of artificial intelligence: Shariah issues and maqasid considerations. In *Islamic Finance in the Digital Age* (pp. 165–189). Edward Elgar Publishing.
- Abu Ghuddah, A. S. (2019). Al-‘uqūd al-zakiyyah wa al-bunūk al-raqamiyyah wa al-bulūkshīn. 24th Al-Baraka Symposium on Islamic Economics, Jeddah.
- Al-Khalaileh, L., Al-Billeh, T., Al-Findi, A. S., & Al-Hailat, O. (2025). Smart contracts in light of the provisions of Islamic jurisprudence and the civil law of Jordan [Article]. *Corporate Law and Governance Review*, 7(3 Special Issue), 180–189. <https://doi.org/10.22495/clgrv7i3sip3>
- Al-Saudi, H. A. (2023). Waqf Fund Management and the Blockchain Horizon. In *Eurasian Studies in Business and Economics* (Vol. 26, pp. 271–284). https://doi.org/10.1007/978-3-031-30061-5_17
- Arsyad, I., Kharisma, D. B., & Wiwoho, J. (2025). Artificial intelligence and Islamic finance industry: problems and oversight. *International Journal of Law and Management*, 68(4), 653–675. <https://doi.org/https://doi.org/10.1108/IJLMA-07-2024-0236>
- Attar, A., Saqib, M., & Dubey, S. (2023). Blockchain-based collection and distribution of zakat. In *Emerging Applications of Blockchain Technology* (pp. 111–126). Nova Science Publishers.
- Aziz, M. S. A., & Zulkepli, M. I. S. (2025). Algorithmic Bias In Ai-Based Credit Assessment In Islamic Financial Institutions: A Quranic Ethical Approach [Article]. *Quranica*, 17(2), 125–156. <https://doi.org/10.22452/quranica.vol17no2.6>
- Charles, V., Emrouznejad, A., & Gherman, T. (2023). A critical analysis of the integration of blockchain and artificial intelligence for supply chain. *Annals of Operations Research*, 327(1), 7–47. <https://doi.org/10.1007/s10479-023-05169-w>
- Feng, T., Yu, X., Chai, Y., & Liu, Y. (2019). Smart contract model for complex reality transaction. *International Journal of Crowd Science*, 3(2), 184–197. <https://doi.org/10.1108/IJCS-03-2019-0010>
- Floridi, L., Cowls, J., Beltrametti, M., Chatila, R., Chazerand, P., Dignum, V., Luetge, C., Madelin, R., Pagallo, U., Rossi, F., Schafer, B., Valcke, P., & Vayena, E. (2018). AI4People-An Ethical Framework for a Good AI Society: Opportunities, Risks, Principles, and Recommendations. *Minds and machines*, 28(4), 689–707. <https://doi.org/10.1007/s11023-018-9482-5>
- Hasan, R., Hassan, M. K., & Aliyu, S. (2020). Fintech and Islamic finance: Literature review and research agenda. *International Journal of Islamic Economics and Finance (IJIEF)*, 3(1), 75–94. <https://doi.org/https://doi.org/10.18196/ijief.2122>

- Huseynova, F. (2025). The digital era and codified law: Legal regulation of smart contracts [Article]. *Baku State University Law Review*, 11(2), 269–298.
- Kismawadi, E. R., Irfan, M., & Harahap, I. (2025). Integrating Artificial Intelligence in Islamic Financial Management: Opportunities and Challenges in Maintaining Shariah Compliance. In I. Ghosal, Gupta, S., Rana, S. and Saha, D. (Ed.), *Indigenous Empowerment through Human-Machine Interactions* (pp. 273–288). Emerald Publishing Limited. <https://doi.org/https://doi.org/10.1108/978-1-83608-068-820251016>
- Miharja, M. N. D., Fahamsyah, M. H., & Nugroho, A. T. (2023). Chatbot development on an interactive services on Sharia contracts using natural language processing (NLP). *AIP Conference Proceedings*, Magelang, Indonesia.
- Mohd Najib, N. W., Basarud-din, S. K., & Fazial, F. (2025). Artificial Intelligence (AI) in Islamic Finance: A Maqāṣid al-Sharī'ah Perspective. *International Journal of Law, Government and Communication*, 10(40), 41–50. <https://doi.org/10.35631/IJLGC.1040003>
- Mohd. Zain, N. R., & Mohamad, K. A. (2021). An Evaluation of Smart Contracts: Practices, Legality, and Sharī'ah. In M. M. s. Billah (Ed.), *Islamic FinTech: Insights and Solutions* (pp. 91–110). https://doi.org/10.1007/978-3-030-45827-0_6.
- Muneeza, A., & Mustapha, Z. (2019). Blockchain and its Shariah compliant structure. In M. M. s. Billah (Ed.), *Halal cryptocurrency management* (pp. 69–106). Palgrave Macmillan. https://doi.org/10.1007/978-3-030-10749-9_6
- Nguyen, S., Chen, P. S.-L., & Du, Y. (2021). Risk identification and modeling for blockchain-enabled container shipping. *International Journal of Physical Distribution & Logistics Management*, 51(2), 126–148. <https://doi.org/10.1108/IJPDLM-01-2020-0036>
- Rahim, S. R., Mohamad, Z. Z., Bakar, J. A., Mohsin, F. H., & Isa, N. M. (2018). Artificial intelligence, smart contract and islamic finance. *Asian Social Science*, 14(2), 145–154. <https://doi.org/10.5539/ass.v14n2p145>
- Rakhmat, A. (2022). Islamic Ecotheology: Understanding The Concept Of Khalifah And The Ethical Responsibility Of The Environment. *Academic Journal of Islamic Principles and Philosophy*, 3(1), 1–24. <https://doi.org/10.22515/ajipp.v3i1.5104>
- Roslan, M. F., Bamahriz, O., Muneeza, A., Chu, J., Mustapha, Z., & Ahmad, M. Z. (2020). Application of tawarruq in Islamic banking in Malaysia: towards smart tawarruq. *International Journal of Management and Applied Research*, 7(2), 104–119. <https://doi.org/10.18646/2056.72.20-008>
- Safina, L., & Oseni, U. A. (2019). The potentials of smart contract in Islamic trade finance. In U. S. Oseni & S. N. Ali (Eds.), *Fintech In Islamic Finance* (pp. 215–230). Routledge. <https://doi.org/10.4324/9781351025584>
- Saleh, A. O. H., Halawani, A. S., & Qatawneh, M. A. S. (2023). The Shariah Framework for Smart Contracts, an Original Analytical Study. *Lecture Notes in Networks and Systems*,
- Shaarani, A. Z. M., Muhammad, F., Noor, A. M., & Osman, M. F. (2023). Smart Contract: Shariah Analysis and Parameter. *UMRAN-Journal of Islamic and Civilizational Studies*, 10(2), 1–14. <https://doi.org/10.11113/umran2023.10n2.638>
- Sitiris, M., & Busari, A. (2024). The legal capacity (al-Ahliyyah) of Artificial Intelligence from an Islamic jurisprudential perspective. *Malaysian J. Syariah & L.*, 12, 31–42. <https://doi.org/https://doi.org/10.33102/mjssl.vol12n1.453>
- Smart Dubai. (2022). *AI Ethics Principles and Guidelines*. Smart Dubai. Retrieved 1 October from <https://www.digitaldubai.ae/docs/default-source/ai-principles-resources/ai-ethics.pdf>
- Tariq, M. U. (2025). Fraud Detection and Mitigation in Cybersecurity Insurance: AI-Driven Approaches and Best Practices. In M. Alawida, A. Almomani, & M. Alauthman (Eds.), *AI-Driven Cybersecurity Insurance: Innovations in Risk, Governance, and Digital Resilience* (pp. 169–194). IGI Global. <https://doi.org/10.4018/979-8-3373-5545-0.ch007>
- Zulkepli, M. I. S., Mohamad, M. T., Azzuhri, S. R., Noh, M. S. M., & Jasim, A. A. (2025). Smart Contract Technology Potential in Mitigating Defects of Islamic Banks' Tawarruq Operations. *Islamiyyat*, 47(1), 171–181. <https://doi.org/10.17576/islamiyyat-2025-4701-14>
- Zulkepli, M. I. S., Muneem, A., Norazelan, S. H., & Abdul Hamid, M. A. (2026). A Shariah Analysis On Artificial Intelligence And Its Adoption In Islamic Financial Institutions. *Jurnal Fiqh*, 23(1), 112–164. <https://doi.org/10.22452/fiqh.vol23no1.4>