

Research Article

Artificial Intelligence and Green Finance in Islamic Economics: An Integrated Framework for ESG-Maqasid Alignment and Sustainable Development Goals Achievement

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Abstract. This paper presents an integrated conceptual framework that bridges Artificial Intelligence (AI), green finance, and Islamic economics through the lens of Maqasid al-Shariah and Environmental, Social, and Governance (ESG) principles. Against the backdrop of the United Nations Sustainable Development Goals (SDGs), the halal industry is undergoing rapid digital transformation, yet the convergence of AI-enabled FinTech, Shariah-compliant green sukuk, social finance instruments such as waqf and zakat, and robust governance frameworks remains underexplored in the literature. Using a systematic literature review and conceptual model development, this paper identifies five pillars — Islamic Green Finance, AI-Driven Compliance, Halal Industry Governance, Social Empowerment Finance, and SDG-Maqasid Governance — as the core dimensions of the proposed framework. The findings reveal that AI and FinTech tools significantly enhance Shariah screening efficiency, risk assessment accuracy, and transparent ESG reporting. Furthermore, waqf-based blended finance models and digital sukuk platforms are positioned as catalysts for inclusive growth and SDG achievement in Muslim-majority economies. This paper contributes a synthesised theoretical foundation for researchers, policymakers, and industry practitioners seeking to operationalise sustainable Islamic finance.

Keywords: Artificial Intelligence; Digital Sukuk; ESG; FinTech; Halal Industry; Islamic Green Finance; Maqasid al-Shariah; Social Finance; Sustainable Development Goals; Waqf.

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1. Introduction

The global financial sector is experiencing an unprecedented convergence of disruptive technologies and sustainability imperatives. Central to this transition is the fusion of Artificial Intelligence (AI), ESG finance, and Islamic economics, which together hold transformative potential for achieving the United Nations Sustainable Development Goals (SDGs) by 2030 [26]. The global Islamic finance sector recorded total assets of USD 3.38 trillion in 2023, reflecting 4% year-on-year growth [14], while the halal economy was projected to surpass USD 7.7 trillion by 2025 based on 2022 industry estimates [11]. Despite impressive growth, significant structural challenges persist.

Prior research has examined Islamic finance and sustainability largely in isolation. Foundational contributions by Iqbal and Mirakhor [13] and Chapra [7] established the philosophical and structural dimensions of Islamic finance, while subsequent scholarship has advanced discourse on green sukuk [28], digital waqf platforms [5], and the digitalisation of

Shariah-compliant financial products [3]. However, a unified conceptual framework integrating these threads within a coherent Maqasid al-Shariah and SDG perspective remains absent from the literature.

Three principal gaps characterise the existing literature. First, systematic Shariah-ESG screening processes that are robust against greenwashing risks remain underdeveloped [28]. Second, AI applications in Islamic FinTech lack an ethical governance architecture grounded in Islamic epistemology [20]. Third, Islamic social finance instruments — waqf, zakat, and infaq — have not been systematically linked to SDG financing mechanisms [25].

This study makes four principal contributions: (1) a synthesised review of AI, green finance, and Islamic economics in their interrelationship; (2) development of the Islamic ESG-AI (IESAI) Framework comprising five pillars that integrates Maqasid al-Shariah with SDG objectives; (3) identification of requisite governance and regulatory elements for framework operationalisation; and (4) a comparative assessment against prevailing sustainability frameworks. The paper proceeds as follows: Section 2 reviews the literature; Section 3 outlines the proposed framework and methodology; Section 4 presents and discusses results; and Section 5 offers a comparative analysis. Conclusions and future research directions are presented in Section 6.

2. Literature Review

This section reviews the theoretical foundations and empirical evidence underpinning the proposed framework across four interrelated domains: Islamic green finance and ESG, AI in Islamic FinTech, halal industry governance and public policy, and social finance for empowerment.

Islamic Economics, Green Finance, and ESG

Maqasid al-Shariah — the objectives of Islamic law aimed at protecting din (religion), nafs (life), aql (intellect), nasl (lineage), and mal (wealth) [1] — forms the philosophical bedrock of Islamic economics. Contemporary scholars including Chapra [7] and Asutay [4] have elaborated this framework into a development philosophy consonant with sustainable economics. The prohibitions on *riba* (usury), *gharar* (excessive uncertainty), and *maysir* (gambling) orient Islamic financial instruments inherently towards risk-sharing and social welfare rather than speculative gain.

Green finance encompasses financial instruments and arrangements designed to channel investment into environmentally beneficial projects. This aligns closely with Islamic prohibitions against environmental degradation (*fasad fi al-ard*). Green sukuk — Shariah-compliant analogues to green bonds — exemplify this convergence: Malaysia issued the world's first sovereign green sukuk in 2017 to fund renewable energy and sustainable transport infrastructure [23]. By 2023, total global green sukuk outstanding exceeded USD 28 billion [8].

The ESG model, introduced through the UN Global Compact in 2004, provides a three-dimensional framework for evaluating corporate and investment behaviour. Derigs and Marzban [9] identified significant complementarities between Shariah screening principles and ESG criteria. Nevertheless, Zain et al. [28] observe that without a formalised Maqasid-ESG linkage matrix, integration risks remaining superficial and susceptible to greenwashing. The present study addresses this gap through an explicit Maqasid-ESG alignment architecture.

Artificial Intelligence and FinTech in Islamic Finance

The digitalisation of financial services through FinTech has disrupted traditional banking models globally [3]. Within Islamic finance, emerging applications include automated Shariah screening, Shariah-compliant robo-advisory services, blockchain-based sukuk settlement, and AI-assisted zakat calculation. Domain-specific language models, such as the FinAI-BERT architecture developed by Zafar [27], demonstrate the potential for automated monitoring of AI disclosures in Islamic banking — a development that substantially enhances screening scalability.

Natural language processing (NLP) and large language model (LLM) architectures are being applied to automate Shariah compliance auditing. Sarfaraz and Memon [22] demonstrate that retrieval-augmented generation (RAG) pipelines can automate manual Shariah audit processes in Islamic banking, addressing critical scalability constraints. Blockchain-based smart contracts offer further operational efficiencies: Desky and Hye [10]

examine the compatibility of blockchain programs with Shariah principles for instruments including murabahah, ijarah, and sukuk, finding that smart contracts can automate transactional compliance while reducing settlement friction.

In the domain of robo-advisory, Kharisma et al. [17] identify the legal and Shariah governance dimensions of automated investment advice for Islamic mutual funds, highlighting that transparency and explainability are prerequisites for Shariah board acceptance. The concept of 'Responsible AI in Islamic Finance' (RAIF), articulated by Mustafa [20], posits that AI ethics in Islamic contexts must be grounded in amanah (trustworthiness), adl (justice), and maslahah (public interest). This body of literature directly informs the AI Governance pillar of the IESAI Framework.

Halal Industry Governance, Law, and Public Policy

The global halal industry — encompassing food and beverages, pharmaceuticals, cosmetics, tourism, logistics, and fashion — represented a market valued above USD 2.8 trillion as of 2022 [11]. Governance mechanisms have evolved from national standards (Malaysia: MS1500; Indonesia: LPPOM-MUI; UAE: ESMA) towards international harmonisation through OIC/SMIIC frameworks [24]. Regulatory fragmentation nonetheless persists, generating jurisdictional uncertainty and non-tariff trade barriers.

AI is increasingly applied to halal certification processes. Haider [12] reviews computer vision systems for slaughter-line monitoring and DNA-based product authentication, finding that AI-driven inspection substantially reduces certification timelines compared to manual processes. Malaysia's Halal Industry Master Plan 2030 explicitly situates halal governance within SDG 8 (Decent Work) and SDG 12 (Responsible Consumption and Production) [15]. Legal scholars have emphasised the necessity of supra-national regulatory coordination for halal FinTech, given that cross-border digital transactions traverse multiple Shariah jurisdictions simultaneously. The proposed IESAI Framework addresses this through a unified governance tier grounded in AAOIFI, IFSB, and ISO/SMIIC standards

Social Finance and Empowerment: Waqf, Zakat, and Blended Finance

Islamic social finance instruments — waqf (endowment), zakat (almsgiving), sadaqah (voluntary charity), and infaq (expenditure for the sake of God) — constitute a pre-modern welfare architecture with significant contemporary relevance [16]. The digitalisation of waqf presents particular opportunities: Augusna [5] synthesises literature on digital waqf in Malaysia and Indonesia, finding that cash waqf combined with crowdfunding platforms demonstrably supports economic recovery and SDG-aligned outcomes.

Digital zakat management systems have similarly demonstrated efficiency gains. Maraliza [18] reports that digital automation expands outreach, improves collection accountability, and enhances disbursement targeting relative to conventional institutional approaches. The concept of blended Islamic finance — integrating concessional waqf capital with commercial Islamic banking and Development Finance Institutions — has attracted growing interest from the IsDB and UNDP. Tok et al. [25] demonstrate that zakat and waqf instruments can fill humanitarian funding gaps and achieve coherence with international SDG programming when properly institutionalised.

Social impact sukuk, which blend green and social finance objectives, represent the frontier of Islamic blended finance — channelling investment toward specific social outcomes under SDGs 1, 2, 3, and 4. This convergence constitutes the Social Empowerment Finance pillar of the IESAI Framework

3. Proposed Framework: The Islamic ESG-AI (IESAI) Framework

The IESAI Framework is a five-pillar conceptual model integrating Maqasid al-Shariah, ESG principles, AI, halal industry governance, and social finance instruments within a unified SDG-aligned architecture. Its development follows a systematic literature review using PRISMA 2020 guidelines [21], supplemented by content analysis of policy documents from AAOIFI, IFSB, the Securities Commission Malaysia, IsDB, and the United Nations.

Framework Architecture and Five Pillars

The IESAI Framework is structured around five interdependent pillars, each corresponding to a Maqasid al-Shariah objective and a cluster of SDG targets (Table 1). Three horizontal enablers — Digital Infrastructure, Regulatory Governance, and Stakeholder Engagement — operate across all five dimensions.

Table 1. IESAI Framework: Five Pillars, Maqasid Correspondence, and SDG Alignment.

Pillar	Maqasid Objective	Core Instruments	SDG Targets
Islamic Green Finance	Preservation of Wealth (Hifz al-Mal)	Green Sukuk, ESG Screening, Climate Waqf	SDG 7, 13, 15
AI-Driven Compliance	Preservation of Intellect (Hifz al-Aql)	NLP Shariah Engine, Robo-Advisory, RegTech	SDG 9, 16, 17
Halal Industry Governance	Preservation of Life (Hifz al-Nafs)	Certification Standards, Supply Chain AI, ISO/SMIIC	SDG 3, 12, 17
Social Empowerment Finance	Preservation of Lineage (Hifz al-Nasl)	Waqf, Zakat Tech, Blended Finance, Social Sukuk	SDG 1, 2, 4, 10
SDG-Maqasid Governance	Preservation of Religion (Hifz al-Din)	Policy Frameworks, IFSB Standards, Impact Metrics	SDG 16, 17

Research Design and Methodological Approach

The methodological approach is conceptual-analytical, combining (1) a systematic literature review, (2) framework development through thematic synthesis, and (3) comparative analysis against established sustainability frameworks. The systematic review followed PRISMA 2020 guidelines [21], with searches conducted across Scopus, Web of Science, SSRN, and the IFSB/AAOIFI digital libraries. Search terms included combinations of: 'Islamic finance', 'green finance', 'ESG', 'Maqasid al-Shariah', 'FinTech', 'AI', 'halal', 'waqf', 'SDG', and 'social finance'. A total of 187 articles published between 2010 and 2024 were screened, with 64 meeting inclusion criteria for full review.

Framework construction proceeded through three iterative phases. Phase 1 involved thematic coding of the reviewed literature using NVivo 14, identifying recurring constructs and inter-relationships. Phase 2 mapped constructs against Maqasid al-Shariah objectives using Chapra's [7] extended Maqasid framework and the SDG target architecture [26]. Phase 3 validated the framework through structured expert consultation involving eight Shariah scholars, five Islamic finance practitioners, three FinTech specialists, and two policy analysts from Malaysia, Indonesia, the UAE, and the United Kingdom.

Validation employed a Delphi method across two rounds, achieving consensus (defined as greater than 75% agreement) on all five pillars and three horizontal enablers. This non-empirical validation approach reflects practitioner reality and scholarly consensus, providing a robust foundation for future quantitative operationalization.

4. Results and Discussion

AI Applications in Islamic Green Finance: Efficiency and Trust

The systematic review identifies AI integration in Islamic green finance across four functional layers: (1) automated Shariah screening and ESG scoring; (2) intelligent risk assessment for sukuk pricing; (3) NLP-based regulatory compliance monitoring; and (4) blockchain-AI hybrid settlement systems. Table 2 summarises key AI technologies, their Islamic finance applications, and documented performance improvements drawn from the reviewed literature.

Table 2. AI Technologies and Their Applications in Islamic Green Finance.

AI Technology	Islamic Finance Application	Documented Outcomes
Machine Learning (ML)	Shariah-ESG composite scoring; AI disclosure monitoring in Islamic banking	Enhanced screening scalability and automation of innovation mandate monitoring [27]

Natural Language Processing / LLMs	Fatwa database parsing; Shariah audit automation via RAG pipelines	Reduced manual compliance audit workload; improved scalability of Shariah checks [22]
Blockchain Smart Contracts	Automated murabahah/ijarah execution; sukuk settlement; waqf registry	Automated Shariah-compliant transactional execution; reduced settlement friction [10]
Robo-Advisory	Shariah-compliant portfolio construction for Islamic mutual funds	Improved investor access; enhanced transparency and Shariah compliance reporting [17]
Predictive Analytics / ML	Green sukuk investment interest modelling	Improved prediction of green sukuk adoption drivers in emerging markets [2]
Computer Vision	Halal product inspection; slaughter-line monitoring; DNA-based authentication	Substantially reduced certification timelines relative to manual inspection [12]

The findings indicate that AI-driven automation significantly reduces the principal-agent problem in Islamic finance by minimising information asymmetry — a form of *gharar* prohibited under Shariah. Domain-specific language models demonstrate the feasibility of automated AI disclosure screening in Islamic banking [27], while RAG-based architectures address the scalability bottleneck of manual Shariah audit [22]. Machine learning models applied to green sukuk investment modelling provide actionable predictive analytics for sustainable Islamic debt instruments [2].

A critical finding concerns the trustworthiness dimension of AI in Islamic finance. Expert consultants consistently emphasised that AI systems must demonstrate *amanah* (trustworthiness) through explainability, auditability, and alignment with Shariah board oversight [20]. This aligns with global Responsible AI frameworks but extends them with distinctly Islamic epistemic commitments — notably the distinction between *maslahah ammah* (public benefit) and *mafsadah* (harm) — which must govern AI decision boundaries.

Governance Architecture: Regulatory Enablers and Challenges

The governance analysis reveals significant regulatory fragmentation across OIC member states. While Malaysia has developed the most comprehensive Islamic FinTech regulatory sandbox [6], Indonesia's OJK sandbox, the UAE's DIFC FinTech Hive, and Saudi Arabia's SAMA regulatory framework operate with limited interoperability. The absence of a harmonised cross-border Islamic FinTech regulatory framework creates jurisdictional uncertainty, particularly for digital sukuk and cross-border waqf platforms.

Four governance prerequisites emerge from expert consultations and the literature review: (1) a dedicated AAOIFI or IFSB standard for AI applications in Islamic finance, establishing ethical AI requirements grounded in *Maqasid al-Shariah* [20]; (2) a blockchain-based Cross-Jurisdictional Digital Halal Passport enabling mutual recognition of halal certification across OIC member states [12]; (3) an Integrated ESG-Maqasid Reporting Framework requiring Islamic financial institutions to report ESG metrics mapped to *Maqasid* objectives [28]; and (4) a standardised Waqf Digital Registry and AI impact measurement system aligned with SDG indicators [5].

Social Finance, Waqf Technology, and SDG Financing

Convergence between digital technology and Islamic social finance instruments represents an innovative avenue for harnessing SDG financing opportunities. Annual estimated zakat potential in OIC member countries is approximately USD 600 billion; however, effective collection and disbursement remain far below potential due to institutional inefficiencies. Digital zakat management systems demonstrate that automation improves operational efficiency, expands outreach, and enhances accountability in collection and distribution [18].

The Social Empowerment Finance pillar of the IESAI Framework proposes a blended finance model operating at three levels. At the first level, waqf endowments provide risk-free equity capital to social enterprises [16]. At the second level, Islamic microfinance institutions provide debt-type financing (Qard Hassan) to micro-entrepreneurs. At the third level, commercial Islamic banks and the sukuk market provide scale-up capital through Shariah-compliant risk-sharing arrangements. AI coordinates across all three levels through borrower scoring, impact measurement, and disbursement optimisation, simultaneously advancing SDG 1 (No Poverty) and SDG 8 (Decent Work).

Evidence from digital waqf research in Malaysia and Indonesia confirms the viability of this approach: cash waqf combined with crowdfunding demonstrates meaningful leverage of invested capital, with recipients reporting improved economic outcomes following provision of blended financing [5]. Tok et al. [25] further demonstrate that coordinated deployment of zakat and waqf instruments can bridge humanitarian funding gaps and achieve alignment with SDGs 1.1, 1.4, 8.3, and 8.10.

5. Comparison

The IESAI Framework is benchmarked against three established sustainability and Islamic finance frameworks: (1) the UN SDG Finance Framework [26]; (2) the Islamic Social Finance Model [16]; and (3) the Responsible Finance Framework of the Principles for Responsible Investment (PRI, 2006). Table 3 presents a structured comparative analysis across six dimensions.

Table 3. Comparative Analysis: IESAI Framework vs. Existing Frameworks.

Dimension	IESAI Framework	UN SDG Finance	Islamic Social Finance	PRI Framework
Shariah Compliance	Fully integrated (Maqasid) [7]	Not applicable	Partial	Not applicable
AI/FinTech Integration	Core pillar [27, 22, 17]	Incidental	Absent	Emerging
ESG Alignment	Mapped to Maqasid [28]	Core (TCFD, GRI)	Implicit	Core (UNPRI)
SDG Linkage	Explicit (5 pillars) [26]	Direct	Indirect	Indirect
Social Finance	Waqf, Zakat, Sukuk [5, 18, 25]	Blended Finance	Waqf-centric	Impact Investing
Governance Standard	AAOIFI/IFSB proposed [20]	UN/OECD-based	OIC-based	PRI Signatory
Halal Industry	Dedicated Pillar [12, 15]	Absent	Absent	Absent

The comparative analysis demonstrates that the IESAI Framework advances existing approaches in three critical respects. First, it is the only framework to explicitly map ESG dimensions to Maqasid al-Shariah objectives — resolving the conceptual gap identified by Zain et al. [28]. Second, AI and FinTech integration is treated as a structural pillar rather than a peripheral enabler [27, 22, 17], reflecting the transformative role of digital technologies in Islamic finance. Third, the dedicated Halal Industry Governance pillar [12, 15] addresses a governance-finance integration gap absent from the PRI, UN SDG Finance Framework, and traditional Islamic Social Finance models. The IESAI Framework thereby offers a more comprehensive and contextually appropriate architecture for Muslim-majority economies pursuing sustainable development.

6. Conclusions

This paper has proposed the Islamic ESG-AI (IESAI) Framework — a five-pillar conceptual model integrating Artificial Intelligence, green finance, Islamic economics, halal industry governance, and social finance within a unified Maqasid al-Shariah and SDG perspective. Systematic literature review and expert consultation demonstrate that the proposed architecture addresses gaps unresolved by existing frameworks, including the absence of a Maqasid-ESG linkage matrix, fragmentation of AI applications in Islamic finance, and the disconnect between social finance mechanisms and SDG financing.

The principal findings are threefold. First, AI and FinTech solutions — including domain-specific language models for Shariah screening [27], NLP-based compliance automation [22], robo-advisory for Islamic portfolios [17], and blockchain-based smart contracts [10] — enhance efficiency and transparency in Islamic finance operations. Second, halal industry governance requires cross-jurisdictional regulatory harmonisation, a Shariah-AI governance standard, and an ESG-Maqasid reporting framework [20, 28]. Third, digital waqf and zakat platforms demonstrate measurable impact on poverty alleviation and SDG-aligned outcomes [5, 18, 25], confirming the viability of the Social Empowerment Finance pillar.

The study carries three implications. For policymakers, the IESAI Framework provides a blueprint for national Islamic sustainable finance strategies aligned with SDGs and Shariah requirements. For practitioners, it offers an architecture for designing products including green sukuk and waqf-AI platforms. For scholars, the framework furnishes testable hypothesised relationships amenable to structural equation modelling and longitudinal study.

Limitations include the framework's dependence on empirical validation and the restricted geographic and demographic composition of the expert panel. Future research priorities include: empirical validation through large-scale surveys in OIC member states; development of standardised Maqasid-ESG indices; operationalisation of AI explainability criteria for Shariah compliance; and investigation of the political economy of cross-jurisdictional halal governance harmonisation.

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