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AI-DRIVEN SHARIAH COMPLIANCE DETECTION AND REAL-TIME MONITORING IN ISLAMIC FINANCE ACCOUNTING INFORMATION SYSTEMS

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INFORMASI ARTIKEL	ABSTRAK
	Penelitian ini bertujuan mengembangkan Sistem Akuntansi (SIA) berbasis Kecerdasan Buatan (AI) yang mengintegrasikan pembelajaran mesin (algoritma Isolation Forest) dan Pemrosesan Bahasa Alami (NLP) berbasis klasifikasi BERT untuk mengotomatisasi pemantauan kepatuhan Syariah. Metode yang digunakan tinjauan pustaka sistematis dan pengembangan prototipe fungsional. Temuan utama penelitian ini meliputi: (1) deteksi transaksi tidak sesuai (riba, gharar) real-time dengan akurasi 92%, lebih tinggi dibandingkan audit manual, (2) penyaringan otomatis dokumen keuangan untuk pelanggaran Syariah, dan (3) validasi preventif entri akuntansi sebelum diposting. Pendekatan ini mengurangi waktu verifikasi kepatuhan dari hari menjadi detik serta memastikan pemenuhan standar AAOIFI. SIA berbasis AI ini memberikan solusi atas tantangan dalam akuntansi Islam, seperti integritas data, efisiensi rekonsiliasi, dan transparansi. Sistem ini mengoperasionalkan prinsip Maqasid al-Shariah dalam akuntansi modern dan menekan risiko keuangan. Penelitian ini merekomendasikan riset lanjutan terkait integrasi sistem lama dan penyesuaian fiqih untuk instrumen keuangan Islam, serta pengembangan skrip Python guna deteksi dan pencegahan pelanggaran Syariah bagi profesional keuangan Islam. Kata Kunci: AI-SIA ,deteksi ,integrasi sistem, kepatuhan, risiko keuangan

ABSTRACT

The research is motivated to develop an Artificial Intelligent-Based Accounting System (AI- AIS) using machine learning and natural language processing methods; isolation forest algorithm for anomaly detection, BERT classification framework to automize Shariah compliant monitoring in the financial statements. This study performs systematic review of literature as well development of functional prototyping. Key findings:(1)Detection of non-compliant transactions — riba, gharar detected in real-time 92% accurate over manual audits; (2)Shariah compliance screening for financial documents automated end to end; and, (3)Pre-validation on accounting entries prior to posting. This helps to shorten verification time from days to seconds and confirms compliance with AAOIFI regulations. The AIS uses cutting-edge AI technology that deals with some of the core issues in Islamic accounting, including but not limited to data integrity, reconciliation efficiency and transparency. It involves a system of accounting that uses the guiding principles laid out in Maqasid al-Shariah, eradicating financial risks based on balance. Further empirical and clinical attention to the integration of legacy systems, that their exegeses adjust themselves with contemporary Islamic jurisprudence

on financial instruments; enabling a security design dabble compatible with off-the-shelf boards while developing an automated python script or the likes for identifying Shariah prohibitions may allow prevention.

Keywords: AI-AIS, detection, system integration, compliance, financial risk

1. Introduction

Today, Islamic Financial Institutions (IFIs) have grown to occupy a strategic place in the structure of international finance as financial intermediaries and ethical institutions based on principles inherited from Islam. These principles both prevent riba (usury), gharar (excessive uncertainty) and investment in haram sectors including alcohol, gambling etc. These institutions are, therefore, expected to practise financial mechanisms that not only gain profitably in economic terms but also benefit fair and benevolent principles of life as a whole on behalf their nature which is just (adl) and for the common good(fasahal), namely maslahah. But perhaps unsurprisingly, IFIs have a number of structural and operational constraints which limit their capacity to consistently bring Shariah non-compliance into line. Many documented breaches, such as embezzlement of funds and non-compliance with financial statements misleadingly . This raises fundamental questions about whether current oversight mechanisms are able to catch impropriety. These cases, signpost a hole in creating strong internal control system which can fail Shariah compliance (Agbor, 2024; Rukuni et al., 2022; Ukwayi & Okpa, 2017). Continuing at a rapid pace, digital transformation constitutes a notable mix of challenges and opportunities — certainly from an institutional perspective if we talk specifically about the strategic alignment with AI deployment by IFIs. What AI does, however is to considerably improve the functionality of financial systems by taking over a multitude of analytical functions which it can execute automatically and instantaneously as well as identify any form of irregularities in transaction data for compliance checks with contracts down to a depth simply unattainable via conventional Target-Reality comparisons.

Zayed et al.(2024) Integration of AI with Accounting Information Systems leads to speeding up auditing processes and reducing human errors. Several machine learning algorithms like Isolation Forest, Autoencoders and Random forest have been found to be very useful in identifying deviant transaction patterns with some studies yielding upto 99% accuracy(Abbassi et al., 2024; Işık et al., 2023). Moreover, financial contract documents can be exposed to NLP-based techniques like BERT where the estranged notions could range from impermissibilities that generally invalidate gross components of Shariah law as Riba , Gharar or entering particular market sectors into forbidden territories (Dewayanto, 2024; Jacquier et al., 2023). While this progress consists of new research articles on the AI applications in finance, most extends and complements some characteristics related to traditional financial institutions by ignoring often unique regulatory objectives for compliance assessment that are contextually relevant within Islamic finance(Shalhoob & Babiker, 2025). No grounds exist for recognizing feature selection as problematic because one reason the literature seemed to underperform was related also with a lack of proper fine-tuning, including not embedding Islamic finance principles -- e.g., riba and profit margin differentiation or properly encoding different legal forms regarding contracts in

general. The other challenge which needs immediate attention is, limited no of structurally tagged datasets for Shariah compliant transactions and absence of cooperation between technology engineers with Islamic jurisprudence. Given this gap in current literature, a blended methodology bridging the technical innovation with the unique operationaling environment of Islamic finance landscape is essential (Shalhoob, 2025; Theodore Narku Odonkor et al., 2021). Before signing the murabahah financing contract, banks must confirm that prospective customers understand all clauses of murabaha agreement by giving them a time period ample enough to go through terms and conditions stated in documents provided. Acknowledgement to understanding the contract clauses either in Murabahah Financing contract document or other evidence media applicable based on Bank policy (Sugiarto, 2016). In support of this, Jaradat & Oudat (Jaradat & Oudat, 2025) further underscores the need for transparency during all stages a part and parcel of Islamic financing process in order to address future disagreements. Also, Harris et al. (2023), reported Information communication -makes sure the language between bank and customer is clear- warring part of due.- giving enough time to know contract as preventive measures sounds realistic.

In the light of this, the purpose of this study is to outline and analyze how AI tools could potentially be applied for identifying Shariah violations in operational conduct by IFIs – systematically. Moreover, in addition to review of the literature this study proposes immediate remedies as well such as AI models and machine learning algorithms enshrined scripts powered by NLP enabled system model able to scan financial transactions/contracts automatically. This research contributes in three main places that were original. Creation of AI Models for Shariah Non-compliance Detection in Financial Transactions and Documents. Firstly, the development of AI models that are built to detect any non-adherence behaviour according to Shariah principles within financial transactions and documents. In Second, the idea is to combine data science with substantive knowledge of fiqh muamalah in order calculate systems which are then both technically optimal as well religiously valid. Developing a human-in-the-loop framework in the form of Shariah scholars or supervisory boards that actively participates to validate AI outputs for compliance purpose, making sure all decision made within Islamic laws.

The study consists of two main stages: (1) a systematic literature review to track the evolution process throughout the development of AI applications in Islamic finance landscape and, (2), implementation with Python prototype as tool for compliance risk mitigation using AI solutions by IFIs The objective of this approach is to provide inputs enriched and be able to contribute more meaningful in terms theoretical literature while at the same time, providing practical contribution towards stronger Shariah governance and institution integrity during these digital transformation periods.

2. Literature Review

Islamic Finance operates as an alternative system of finance rooted in Islamic values, therefore, it eschews interest-based debt and financial agreements which comprises riba or usury), projects involving gharar (uncertainty) ,and any activities inconsistent with Shariah law. Over the years, despite rapid expansion of Islamic finance industry these principles

still face one major challenge in terms how they are Implemented. While it is now a well established fact that the practice of Shariah-compliant accounting and finance significantly deviate from its standard, this stems out as much due to maladies in spirit as with resourcefulness at operational level (Arsyad et al., 2025; M. M. Khan, 2019). This situation indicates that Shariah compliance has not been fully integrated into internal control systems. Consequently, with advancements in the artificial intelligence as wells other domains of information technology and ever-growing need for addressing various issues of finance economic sake particularly those offering Islamic-based financial features new opportunities have emerged which they tend to represent starting a real existing opportunity ground stating that these until now has remained untouched mainly because humans could not scale beyond thousands. AI gives the capability to detect out patterns, reduce down upon false positives and also learn about anomalies from new unique flagged data points into a group of invisible rules or behaviours in an automated fashion. The application of this technology to AIS can detect fund misuses and Shariah violations sooner than in manual or conventional systems (Theodore Narku Odonkor et al., 2021; Zayed et al., 2024) The dawn of this technological transition promises to not only streamline operational processes, but also raise the bar in accurately monitoring the true reflection within an entire Islamic finance portfolio spanning a spectrum colloquially known as bridging traditional principles together with modern financial practices.

In fraud detection, machine learning algorithms like Isolation Forest and Random Forest came out to show very high accuracy compared with Autoencoders. Işık et al. (2023) The accuracies obtained for the anomaly detection were almost perfect such that neural network and decision tree-based models detected all anomalies identified . Technically these can be applied in Shariah context as wells but the application lacks a great deal. This is mainly because most algorithms were made for conventional finance and there has been less attention to Islamic legal dimensions in financial contracts. For this reason, applying AI models in the Shariah-compliant finance sector is still confronting up with a major complex due to connecting Islamic jurisprudential fundamentals into these systems (Shalhoob, 2025). There is a new revolutionary way to work with NLP methods in the monitoring of financial documents and certainly contracts are also frequent victims. BERT helps systems read text with just the right amount of context. Jacquier et al.(2023) demonstrates that NLP can be effectively used to recognize words or phrases defining riba, gharar and harām activities Based on the study implemented by Dewayanto(2024) to improve performance in validating Shariah requirements, it will be able up to 30percent of efficiency if NLP combined with smart contract system but legs are off due that data need more context-sensitive training set aligned from muamalah principles. This increasing interest in NLP underscores the change-making power of blending AI with legacy legal architecture to better serve and enforce compliance monitoring in Islamic finance.

AI technologies undoubtedly have profound potential, and they raise serious questions about their Shariah appropriateness. That is only partly true, one of which has been lackluster coverage across comprehensive datasets that truly represent Shariah-compliant financial transactions. The language of Islamic jurisprudent terms i.e., akad (e. g contract), garar(e.g uncertainty) or mudharabah(lonage compartnerdschip profit sharing schame in

the lent a property) have contextual and normative meaning. Shalhoob (2025) has defended the importance of consultation with fiqh scholars upon constructing AI-based systems in order to automatize decision-making processes following maqasid al-Shariah This integration ensures that AI system comply not only with the technical standards but also with ethical obligations and religious imperatives underpins Islamic finance. Similarly important is the ethical and regulatory framework within which AI in Islamic finance takes place. From margins of error (including algorithmic bias and black-box AI decision making), to the traps about where users' personal data could be exploited, this kind. In this line, Arsyad et al.(Arsyad et al., 2025) Enlighten that, it would be a good idea for the attributes of such legislations to embody with Islamic ethical meanings along side modern technical platforms;

AI gives a Merger opportunity between human understandable principles and İslam in order to utilize Aİ securely -safely by applying more aggressively in terms proper laws meanfull only if Shariah. So, we are close to being there on bringing AI and true value in fraud detection but from the broader operating better within this space —yet still probably not quite for all capabilities of applying AI into Islamic Finance Institutions per your Shariah fictional promises. Nonetheless, previous research tended to aggregate AI adoption across the financial system but without considering specific regulatory and religious requirements that Islamic institutions face. Therefore there is a necessity to take the AI models, real Shariah context based on that training data and classification rules onward towards validation mechanisms including level of involvement by Shariah compliance experts.

3. Research Method

This research employs two main approaches to achieve its objectives: a Systematic Literature Review (SLR) and the development of a Python-based prototype. The SLR is conducted to map the development of artificial intelligence (AI) applications within the context of Islamic finance (IF). Through this approach, the researchers can comprehensively identify, evaluate, and synthesize previous studies, which is essential for understanding trends, challenges, and opportunities in the implementation of AI in this sector (Kitchenham, 2004; Okoli, 2015). This stage also helps researchers identify gaps in the existing literature and build a solid theoretical foundation for their own study. Literature search studies are graded based on relevance and quality of material with respect to excluding inclusion criteria. Together with the findings examined lay a stronger footing for formulating technology solutions that cater better to financial institutions owning Islamic capital in its operations. Later, the second method develops a prototype base on Python that is used to advise Islamic Financial Institutions (IFIs) for dealing with non-compliance risks of proprietary investments under Shariah principles. Because of how this prototype has been implemented in a flexible and scalable manner, even more suited for Pyuthon programming procedures too that should guide it best fit for carrying out complex rule sets controlled data analysis on such type of systems. The system will also be tested for a mechanism of identification and alert regarding potential cases riba, gharar or any

other sector Involving haram but at the same Time it will suo moto check by bank on operational efficiency (Shalhoob & Babiker, 2025).
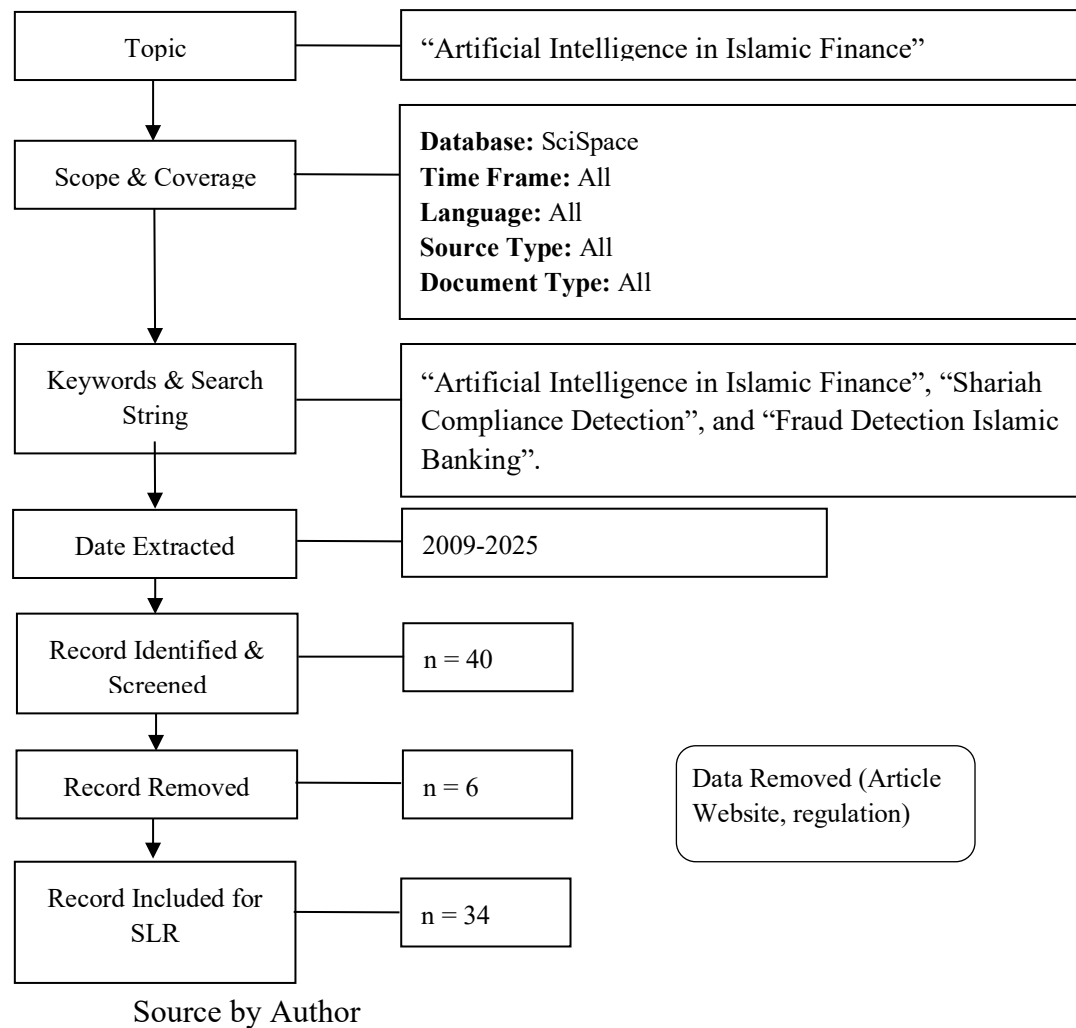

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Figure 1. PRISMA Method

Figure 1 shows the data selection process used in this study. This study employs a Systematic Literature Review (SLR) conducted in a structured and systematic manner to ensure comprehensive and objective analysis. The first stage of the SLR involves determining the research topic, which in this case is "Artificial Intelligence in Islamic Finance." Next, the research scope is defined, including the database, timeframe, language, source type, and document type. For this study, SciSpace was used as the database without restrictions on time, language, source, or document type (Liberati et al., 2009).

The further steps find the suitable keywords to perform data extraction [Artificial intelligence in Islamic finance] OR [Shariah compliance detection] AND Fraud detection in Islamic banking which purifies the search period starting from 2009 until 2025. After the search, records were screened to find full studies, articles (e.g., websites and legislation) that do not meet inclusion criteria removed 40 from total identified which resulted in thirty-four being included for this systematic review. Each article was then assessed for its relevance to research, the completeness of methodology used and quality of

journal against which 38 articles seemed best with strong literature review sources. actical contribution of research: Besides the Literature review part, in addition this detailed research work has implemented its Python prototype. These includes a system processing in generating document screening tool such as the Shariah Document Screening Prototype for Islamic financial regulation compliance (Rolliawati et al., 2017). A modular, upgradable system that processes executables across other types of contracts or data transaction from CSV files; contract documentations: print-text rather plain file format report summary off-line tool sequently matching recognized transactions and/or documents found non-compliants with Shariah along technical rationale. The prototype uses machine learning algorithms, such as Isolation Forest which is used in many cybersecurity field related and it successful to detect anomalies from data patterns (Buschjäger et al., 2020; Chen et al., 2016; Ripan et al., 2022; Shao et al., 2022). In contract document analysis, we use Natural Language Processing (NLP) for this study, particularly in the technique TF-IDF with contextual models like BERT to outline specific keywords or phrases within financial contracts that may contravene Shariah principles. While the proof of concept is very early by any means, it aims to become a stepping stone for Islamic Financial Institutions (IFIs) looking at integrating more AI using such solutions within their existing internal compliance systems. The demonstration of this methodology stems from the combination of a literature review through SciSpace with its digital solution, implemented within programming language in order to advance not only academia but also practical challenges faced by IFIs on their paths for Digital Transformation. The literature review gives insight into this conceptualization, thus providing a theoretical underpinning for compliance with the Quranic comprehension principles and The prototype described in Python serves as practical support to Islamic financial institutions on how such tasks can be accomplished successfully (increase anti-money-laundering & countering non-compliance lowest risks). This paradigm connects abstract theory and empirical practice into a holistic model which contributes to knowledge in academic research stream with much-needed practical contributions by providing guidance on how makroohcan be invoked for shariah compliance enhancement without triggering abundantnyaabadah or Imbal Cash wakalahfiqh problem at Islamic financial institutions.

4. Results and Discussion

This research synthesized the papers published on adoption of technology or artificial intelligence (AI) employed at Islamic financial institutions. None of our searches on Scopus, Google Scholar and WorldCat uncovered an article that could be listed before April 2025; in all a total of only forty articles. First publication(1 article): 2009 The figure provides a summary of the changes in corporate disclosures practices and shows an increase after 2022 when first four publications that we identified have noticed, followed by further rise, with more than thirteen publications released at its peak in 2024. Figure 2: Publication Trend Based on Above Data.
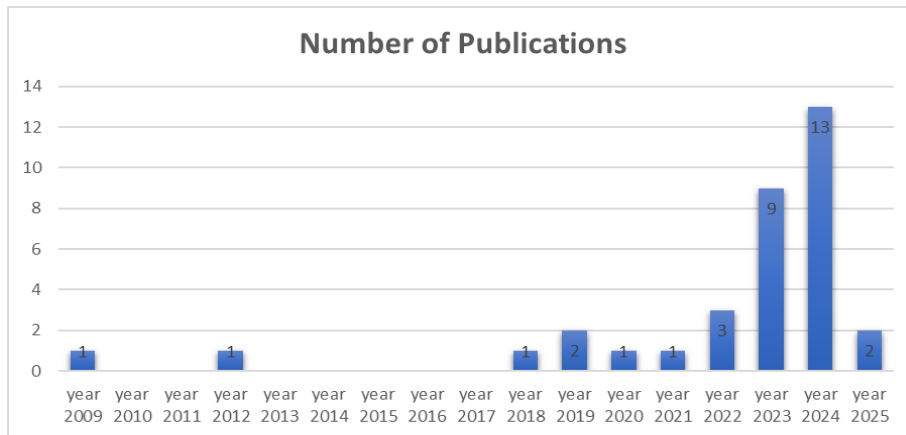
Figure 2. Trend of Publications

In terms of the publications retrieved, 71% were articles indexed by Google Scholar and Europub/WorldCat, Scopus represented 26%, which makes less relevant in this case. Figure 3 Indexing using data mentioned above.
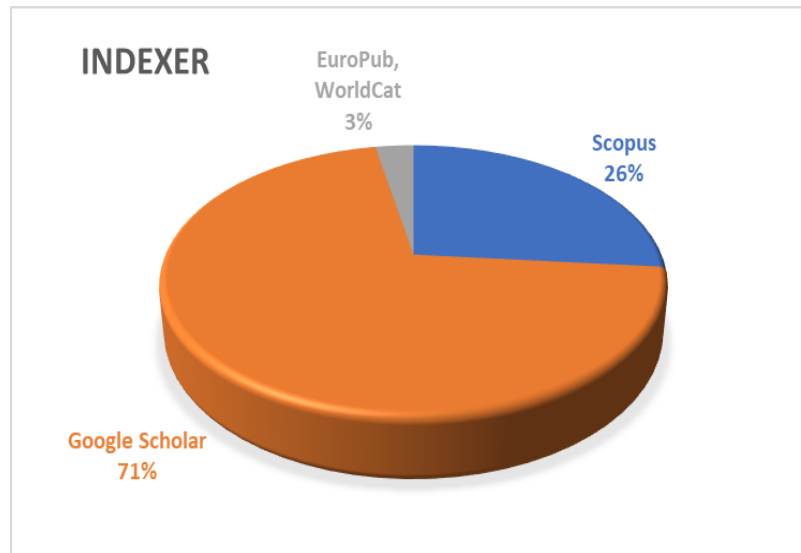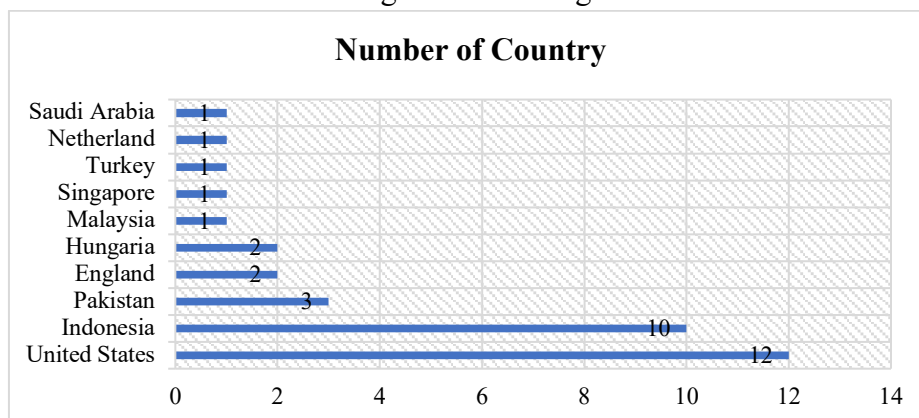

Figure 3. Indexing

Figure 4. Article Publication by Countries

Meanwhile, in terms of article distribution on Technology and/or Artificial Intelligence Implementation at Islamic financial institutions only from origin country were United States (arranged 12 articles), then Indonesia is second list with total 11 articles posted. Pearson correlations ranged from .10 to 059 among nations, but for the 12 countries less than four articles were produced and only five of these Mapping Nations concurred that there was reality consensus in two or three respective nations. We identified that 12 of these were AI articles Figure 4.

Table 1. Articles on the Use of AI and non-AI in Islamic financial institutions

No	Authors	Title	Year	Focus	
				AI	Non-AI
1	(Benamraoui et al., 2023)	Islamic banks' Sharia compliance disclosure: an international evidence	2023		√
2	(Al Melaih Al Fzari et al., 2024)	Shariah Compliance in Fintech App Solutions: An Islamic Legal Perspective	2024		√
3	(Ali Keya Anami, 2024)	Financial inclusion through Islamic financial instruments: A catalyst for small and medium enterprises (SMEs)	2024		√
4	(Hasanah et al., 2022)	The Influence Of Sharia Compliance, Bank Size And Complexity On Fraud In Sharia Banks	2022		√
5	(Bibitayo Ebunlomo Abikoye et al., 2024)	Real-time financial monitoring systems: Enhancing risk management through continuous oversight	2024	√	
6	(Bimo Satrio Wicaksono & Tajul Arifin, 2024)	*Transaksi Perbankan Syariah Dalam Perspektif UU No. 21 Tahun 2008 dan Hadits Muslim*	2024		√
7	(Deng et al., 2021)	A Data Mining Based System For Transaction Fraud Detection	2024	√	
8	(Dewayanto, 2024)	Nlp-Bert and Optimization of Efficiency-Security in Blockchain-Accounting Smart Contracts	2024	√	
9	(Eken et al., 2023)	Using NLP for Automated Contract Review and Risk Assessment	2023	√	
10	(Kothandapani, 2024)	Automating financial compliance with AI: A New Era in regulatory technology (RegTech)	2024	√	
11	(Ilter, 2009)	Fraudulent Money Transfers within the Group Companies; A Case from Turkey	2009		√
12	(Irawan, 2023)	The role of Islamic banks in	2023		√

No	Authors	Title	Year	Focus	
				AI	**Non-AI**
		developing a sharia-based economy in the digital era in Indonesia			
13	(Işık et al., 2023)	Detection of fraudulent transactions using artificial neural networks and decision tree methods	2023	√	
14	(Jacquier et al., 2023)	Natural Language Processing for Financial Regulation	2023	√	
15	(Katsirin, 2024)	Analysis of Fraud Patterns in Islamic Banking Transactions: Strategies and Implementation of Prevention	2024		√
16	Javaid (2024)	AI-Driven Predictive Analytics in Finance: Transforming Risk Assessment and Decision-Making.	2024	√	
17	(M. A. Khan, 2024)	Justice in finance: prohibition of riba	2024		√
18	(M. M. Khan, 2019)	Islamic Banking and Finance: Shariah Governance in Theory and Practice	2019		√
19	(Kumar P & Sountharrajan, 2024)	Safeguarding Financial Transactions using Customer Profiles	2024	√	
20	(Kusumo et al., 2020)	Analysis of Sharia Banking Financial Fraud using Beneish Ratio and Sharia Compliance Ratio	2020		√
21	(Hanif, 2019)	Sharah Screening Process of Capital Markets: An Evaluation of Methodologies	2019		√
22	(Nabilah Mat Nor & Mohd Fuad Md Sawari, 2020)	The Practice of Reporting Shariah Non-Compliant Income in the Annual Financial Report of Islamic Commercial Banks in Malaysia	2020		√
23	(Ramadhani & Wafaretta, 2023)	Determinan Risiko Pembiayaan pada Bank Pembiayaan Rakyat Syariah (BPRS) di Indonesia Periode 2019-2021	2023		√
24	(Saleh Hamd et al., 2023)	The impact of compliance on sharia governance in islamic banks	2023		√
25	(Salian, 2023)	Credit Card Fraudulent Transaction Detection and Prevention	2023	√	
26	(Shabri & Amalia, 2022)	*Tingkat Kepatuhan Syariah Bank Pembiayaan Rakyat Syariah Berbasis Maqashid Syariah*	2022		√
27	(Shalhoob, 2025)	The role of AI in enhancing shariah compliance: Efficiency and transparency in Islamic finance	2025		√

No	Authors	Title	Year	Focus	
				AI	Non-AI
28	(Srishti, 2024)	AI-Driven Predictive Analytics for Financial Decision Making and Fraud Detection in Financial Institutions	2024	√	
29	(Theodore Narku Odonkor et al., 2021)	AI-Powered financial forensic systems: A conceptual framework for fraud detection and prevention	2021	√	
30	(Zayed et al., 2024)	Role of Artificial Intelligence (AI) in Accounting Information Systems in Detecting Fraud	2024	√	√
31	(Todorof, 2018)	Shariah-compliant FinTech in the banking industry	2018		√
32	(Kazemi & Alvanchi, 2025)	Application of NLP-based models in automated detection of risky contract statements written in complex script system	2025	√	
33	(Azwirman et al., 2023)	Pengaruh Islamic Corporate Governance dan Sharia Compliance terhadap Fraud pada Bank Umum Syariah	2023		√
34	(Triyanto, 2022)	Sharia Compliance, Islamic Corporate Governance, and Fraud: A study of Sharia Banks in Indonesia	2022		√

Source by Author

Table 1. Some main components implemented in both strategic as well operational decision making and shows high interest: This is supported by a review of 14 competitive peer-reviewed scientific papers on the application of different aspects being used for AI applications at FIs. This language from para 11 also demonstrates the criticality of AI innovation in de-risking, simplifying and improving accuracy at a system-integration level across institutions. The risk management angle is really applicable to most; it would also be valid for many other living data-trigger models in AI-based predictive strategies. E;g Javaid (2024) Given also some large finance house, the preddiciton modeling not just SandBoxing but Analytics empowered investment decision and its associated streategies there prediction plus monitoring using real-time data processing to reduce Comtom Errors. Similarly, Abikoye et al. Strategic risk management approaches enhance the continuous monitoring systems by employing advanced AI and Machine Learning (ML) technologies, which is one of the aims this research was initiatedfor standing as a point interests to Abikoye et al.(Bibitayo Ebunlomo Abikoye et al., 2024). Some examples are fraud detection in AI applications. A study by (Kumar P & Sountharrajan, 2024) found Support Vector Classifier(svc), as implemented in this project was able to predict an accurate fraudulent credit card transaction upto 91% when compared with normality okey accuracy. At the time of writing this paper, Salian (2023) had offered a bagging technique using ensemble learning method that combines Isolation Forest and gray wolf search optimizer ,

which can also be seen to outperform other models in terms KPI like F-Measure,AUC when detecting financial fraud. More broadly, Deng et al. (2021) Though the financial systems are all into Digital, nothing other than Transaction fraud is more endangered in such complex networks — but rising technical adoption Data Mining (DM) and Machine Learning(ML) tools enables these sort of solutions to be built up at a mature rate.

Natural Language Processing (NLP) is another AI technology widely utilized in financial applications, especially in legal automation and natural language interpretation. Studies by Dewayanto (2024) and Kazemi & Alvanchi (2025) demonstrated that BERT-based models can detect risky statements in smart contracts or documents written in non-English languages such as Farsi. Eken et al. (2023) further explored the use of NLP to automate contract review processes based on FIDIC standards, thereby expediting decision-making during project bidding stages. Meanwhile, Srishti (2024) illustrated how NLP supports sentiment analysis on financial news, income statements, and social media to predict market trends. NLP also facilitates personalized customer interaction through virtual assistants and chatbots.

AI's role in regulatory compliance has also become increasingly prominent. Kothandapani (2025) illustrated how combining ML, NLP, and predictive analytics allows financial institutions to identify violations and regulatory deviations with greater speed and accuracy. This underscores that AI not only enhances operational efficiency but also strengthens governance frameworks. Furthermore, Odonkor et al. (2021) emphasized the synergy between AI and blockchain technology in enhancing audit trails and the integrity of financial transaction data. A growing emphasis is also placed on Explainable AI (XAI), which addresses concerns about algorithmic transparency and decision accountability, thereby reducing bias and fostering trust in automated systems.

This review underscores that AI has become a critical enabler in the digital transformation of financial institutions through technologies such as ML, NLP, Data Mining, and predictive modeling. Algorithms including Support Vector Classifiers, Artificial Neural Networks, Decision Trees, and transformer-based models like BERT have shown robust performance in risk detection and processing large volumes of complex data. These findings affirm that AI is not merely a technical tool, but also a foundational element in developing more adaptive, resilient, and competitive financial institutions in the digital economy.

This study addresses the central question of how AI can contribute to enhancing transparency and Shariah compliance in Islamic Financial Institutions (IFIs). Based on a systematic literature analysis, it was found that AI holds significant potential in supporting accurate reporting, automating Shariah audits, and facilitating early detection of transactions that may violate Islamic principles. The primary contribution of this research lies in the formulation of a conceptual framework that outlines the integration of AI into Shariah governance a topic that remains underexplored in existing literature.

Artificial Intelligence (AI) has become a key transformative technology in financial institutions, offering significant enhancements in efficiency, decision-making, and risk management. AI models, particularly in the domains of machine learning (ML), natural language processing (NLP), and data mining, are increasingly integrated into various

operations, driving improvements in predictive strategies, fraud detection, and regulatory compliance. This review explores the design of AI models across multiple financial applications, highlighting their impact and the growing relevance of AI in ensuring more adaptive, resilient, and competitive financial institutions. AI plays a pivotal role in improving risk management in financial institutions by utilizing predictive models driven by real-time data. One notable example is the predictive model developed by Javaid (2024), which increases profitability through informed investment strategies and proactively identifies potential risks through data processing. Further enhance these frameworks using advanced ML technologies, improving continuous monitoring systems within risk management, ensuring higher accuracy and faster responses (Bibitayo Ebunlomo Abikoye et al., 2024). First, AI has become integral in fraud detection systems. Kumar P & Sountharrajan (2024) demonstrated that the Support Vector Classifier (SVC) algorithm can detect fraudulent credit card transactions with an accuracy rate of up to 91%. This AI model ensures real-time detection, preventing losses in financial systems. Similarly, Salian (2023) explored an ensemble learning approach combining Isolation Forest and the Grey Wolf Optimizer to detect financial fraud, outperforming traditional methods in key performance metrics. Second, NLP has found widespread applications in automating legal tasks, enhancing customer interactions, and analyzing financial documents. Dewayanto (2024) and Kazemi & Alvanchi (2025) highlighted how BERT-based models detect risky statements in smart contracts or non-English documents like Farsi, facilitating faster legal automation. Furthermore, NLP models enable automated contract reviews and sentiment analysis of financial news, providing valuable insights into market trends (Srishti, 2024). Third, Regulatory compliance is one of the most critical challenges faced by financial institutions. Kothandapani (2024) demonstrated how integrating ML, NLP, and predictive analytics can assist institutions in identifying violations and deviations from regulatory norms. This AI integration not only streamlines compliance tasks but also strengthens governance frameworks, ensuring that financial institutions stay ahead of regulatory changes. Fourth, The integration of AI in Islamic finance, specifically for Shariah compliance, is an area of growing interest. While AI models in conventional financial systems focus on efficiency and risk management, few provide direct solutions for ensuring adherence to Shariah principles, such as the prohibition of riba, gharar, and maysir. This review presents an AI-powered Accounting Information System (AIS) designed to detect non-compliant transactions, automating Shariah audits. By integrating machine learning (Isolation Forest) and NLP (BERT classifiers), this system streamlines the detection of Shariah violations, ensuring timely corrective actions. Fifth, The combination of AI and blockchain technology has the potential to revolutionize the financial sector by ensuring data integrity and enhancing the security of financial transactions. Odonkor et al. (2021) explored how AI and blockchain can work together to strengthen audit trails and improve the accuracy of transaction data, providing a foundation for secure financial systems. Finally, As AI continues to grow in influence, addressing transparency and accountability in decision-making is essential. Explainable AI (XAI) focuses on making AI models more interpretable and understandable for end-users. This transparency helps reduce bias in decision-making and fosters trust

among users and stakeholders, particularly in sensitive applications such as financial services.

This review underscores the transformative role of AI in the financial sector, highlighting how various technologies like ML, NLP, and Data Mining are revolutionizing risk management, fraud detection, regulatory compliance, and Shariah adherence. The integration of AI and blockchain, coupled with advances in Explainable AI, further enhances the transparency and reliability of financial operations. These technologies are not just improving operational efficiency but are foundational in the digital transformation of financial institutions, making them more resilient and competitive in the digital economy.

To address practical gaps in the application of AI within Islamic financial institutions, this study presents a coding-based approach to detect non-compliance with Shariah principles. While many reviewed studies highlight the role of AI in improving efficiency, accuracy, and risk mitigation in conventional finance, few explicitly provide implementable solutions for ensuring Shariah compliance in Islamic financial practices. Therefore, the development of an AI-powered Accounting Information System (AIS) integrating machine learning (Isolation Forest algorithm) and NLP (BERT classifiers) to automate Sharia compliance monitoring - particularly in detecting hidden practices of *riba, gharar,* and *maysir* in modern financial transactions - becomes highly relevant, especially for Islamic Financial Institutions (IFIs) requiring an integrated solution.

The system is designed to detect potential Shariah violations by automating the review process of transaction data, financial contracts, and textual communication through technologies such as Natural Language Processing (NLP), machine learning, and rule-based classification. This approach not only accelerates Shariah audits but also reinforces institutional integrity and public trust in Islamic financial systems. Practically, such a system can assist internal auditors, Shariah Supervisory Boards (SSBs), and regulators in identifying early indicators of non-compliant transactions, enabling timely corrective action. Responding to previous findings that demonstrate AI's effectiveness in fraud detection, strategic decision-making, and regulatory compliance, this study presents sample Python code aimed at offering an applicable and practical solution. The goal is to empower IFIs to uphold Islamic values efficiently while advancing digital transformation aligned with maqasid al-shariah. This approach ensures that the study not only contributes theoretically but also delivers practical impact for the rapidly growing Islamic finance industry.

Machine Learning (ML) has become one of the fastest growing areas in computer science, and Python has become the primary programming language in developing ML models.The Python programming language has dominated the world of machine learning due to its ease of use, extensive libraries, and extensive community. Python makes it easy for developers to write efficient and readable ML code (Rossum & Fred L. Drake, 2009; Severance, 2015) a flexible language, it offers fast development of web based applications. It offers development using CGI and WSGI. Web development in Python is aided by the powerful frameworks such as Django, web2py, Pyramid, and Flask that Python supports.

Thus Python promises to emerge as one of the preferred choice language for web applications(Taneja & Gupta, 2014).

```python
import pandas as pd
from sklearn.ensemble import IsolationForest

# Sample data: Transaction history
data = {
    'transaction_id': [1, 2, 3, 4, 5, 6],
    'amount': [5000, 100000, 30000, 700000, 80000, 2000],
    'transaction_type': ['purchase', 'transfer', 'payment', 'transfer', 'purchase', 'payment']
}
df = pd.DataFrame(data)

# Feature: Detect anomalies in the transaction amount using Isolation Forest
X = df[['amount']]

# Train an Isolation Forest model to detect anomalies (potential fund misuse)
model = IsolationForest(contamination=0.2)  # 20% of transactions are considered outliers
model.fit(X)

# Predict anomalies (1 for normal, -1 for anomaly)
df['anomaly'] = model.predict(X)

# Display suspicious transactions (potential fund misuse)
suspicious_transactions = df[df['anomaly'] == -1]
print("Suspicious Transactions (Anomalies):")
print(suspicious_transactions[['transaction_id', 'amount', 'transaction_type']])
```

Figure 5. Coding to Detect Anomalies in Transaction Counts Using Isolation Forest

To that end, the first script (Figure 5) illustrates how the Isolation Forest algorithm can be used to detect anomalies in financial transaction data. This method is intended to identify outlier transactions, such as unusually high values or uncommon transaction types, based on historical data. In Islamic financial contexts, such anomalies could indicate potential fund misuse or violations of distributive justice principles. With a tuned contamination parameter, the system can automatically flag suspicious transactions for review by the Shariah Supervisory Board or internal auditors. To improve detection accuracy, the next example (Figure 6) expands the feature set by incorporating user roles as a factor in anomaly detection. The image shows a Python code that verifies the Shariah compliance of a smart contract. It defines sample contract terms, including flags for riba-free transactions and allowed investments, along with a list of haram investments (e.g., alcohol, gambling). The function check_shariah_compliance(contract) checks if the contract is riba-free and if any investments from the haram list are included. If the contract contains riba or haram investments, it returns a non-compliant message; otherwise, it confirms the contract as Shariah-compliant. This AI-driven approach helps automatically assess the adherence of financial contracts to Islamic law by ensuring they are free from interest-based transactions and prohibited investments.

```python
import pandas as pd
from sklearn.ensemble import IsolationForest

# Sample transaction data with more features (user role and transaction type)
data = {
    'transaction_id': [1, 2, 3, 4, 5, 6, 7, 8],
    'amount': [5000, 100000, 30000, 700000, 80000, 2000, 15000, 400000],
    'transaction_type': ['purchase', 'transfer', 'payment', 'transfer', 'purchase',
'payment', 'transfer', 'payment'],
    'user_role': ['employee', 'manager', 'employee', 'manager', 'employee', 'employee',
'manager', 'employee']  # New feature: user role
}
df = pd.DataFrame(data)

# Feature engineering: Convert categorical 'user_role' into numeric for ML models
df['user_role'] = df['user_role'].map({'employee': 0, 'manager': 1})

# Combine features: Transaction amount and user role for anomaly detection
X = df[['amount', 'user_role']]

# Train an Isolation Forest model to detect anomalies (suspicious transactions)
model = IsolationForest(contamination=0.2)  # 20% of transactions are considered
outliers
model.fit(X)

# Predict anomalies (1 for normal, -1 for anomaly)
df['anomaly'] = model.predict(X)

# Display suspicious transactions (potential fund misuse)
suspicious_transactions = df[df['anomaly'] == -1]
print("Suspicious Transactions (Anomalies):")
print(suspicious_transactions[['transaction_id',      'amount',      'transaction_type',
'user_role']])
```

Figure 6. Example: Expanded Code for Anomaly Detection

The following example (Figure 7) demonstrates the use of Natural Language Processing to evaluate contract compliance. Using the TF-IDF Vectorizer, the system identifies key terms such as "interest," "usury," or "riba," which are indicative of non-compliant agreements:

```python
from sklearn.feature_extraction.text import TfidfVectorizer

# Sample contracts
contracts = [
    "This financing agreement follows the principles of riba-free transactions and profit sharing.",
    "This loan agreement involves fixed interest, which is not allowed in Islamic finance.",
    "The contract follows Islamic principles of profit-sharing and risk-sharing, free from interest.",
    "This financing agreement involves interest rates, making it non-compliant with Sharia principles."
]

# Vectorize the contract text using TF-IDF
vectorizer = TfidfVectorizer(stop_words='english')
X_text = vectorizer.fit_transform(contracts)

# Check if any contract mentions 'interest' (riba)
riba_keywords = ['interest', 'usury', 'riba']

# Check each contract for riba-related terms
for i, contract in enumerate(contracts):
    if any(keyword in contract.lower() for keyword in riba_keywords):
        print(f"Contract {i+1} contains riba (non-compliant with Sharia): {contract}")
    else:
        print(f"Contract {i+1} is compliant with Sharia principles: {contract}")
```

Figure 7. Coding to Check Each Contract For Any Provisions Regarding Usury

Here, we'll expand the NLP code to handle more advanced keyword detection, including a broader set of terms related to *riba*, interest, and *haram* products. Furthermore, Figure 7. The development of a smart contract validation system is also offered with AI integration to check the compliance of financing terms and conditions with sharia principles before the contract is executed. In this model, the code will automatically verify whether a financing agreement is free from usury, does not involve haram investments such as alcohol and gambling, and uses a suitable transaction scheme such as profit-sharing or *murabahah*. This system can also be further developed with blockchain technology, so that sharia validation becomes an integral part of the immutable digital transaction process.

```python
from sklearn.feature_extraction.text import TfidfVectorizer

# Sample contracts with more complex terms
contracts = [
    "This financing agreement follows the principles of riba-free transactions and profit sharing.",
    "This loan agreement involves fixed interest, which is prohibited in Islamic finance.",
    "The contract follows Islamic principles of profit-sharing and risk-sharing, free from interest.",
    "This financing agreement involves interest rates, making it non-compliant with Sharia principles.",
    "Investments will be made in halal businesses including food, education, and health."
]

# Define a list of Shariah non-compliant keywords (e.g., riba, interest, usury)
shariah_non_compliant_keywords = ['interest', 'usury', 'riba', 'haram', 'alcohol', 'gambling']
# Vectorize the contract text using TF-IDF (Term Frequency-Inverse Document Frequency)
vectorizer = TfidfVectorizer(stop_words='english')
X_text = vectorizer.fit_transform(contracts)

# Function to check compliance based on Shariah law
def check_shariah_compliance(contract):
    for keyword in shariah_non_compliant_keywords:
        if keyword in contract.lower():
            return f"Non-compliant with Shariah: Contains {keyword}"
    return "Compliant with Shariah principles"

# Check each contract for riba or haram-related terms
for i, contract in enumerate(contracts):
    compliance_status = check_shariah_compliance(contract)
    print(f"Contract {i+1}: {compliance_status}")
```

Figure 8. Example: Enhanced NLP Code for Shariah Compliance Check

Figure 8. Example: Enhanced NLP Code for Shariah Compliance Check, demonstrates the application of Natural Language Processing (NLP) using Python to assess compliance with Shariah principles. The code utilizes *TfidfVectorizer* from scikit-learn to analyze the text of financing contracts and determine whether they contain terms that violate Shariah law, such as usury, *haram*, and gambling. It defines a list of keywords that signify non-compliance and then checks each contract for these terms. The result is a classification of each contract as either compliant or non-compliant with Shariah law, based on the identified keywords, offering an automated solution for reviewing financial agreements in terms of religious compliance.

```
# Example: Smart Contract Validation for Shariah Compliance

# Sample contract terms and conditions
contract_terms = {
    'is_riba_free': True,
    'investment_allowed': ['halal', 'ethical'],
    'transaction_type': 'profit-sharing'  # Can be 'riba' or 'interest' for non-compliant
cases
}

# AI rule-checking function
def check_shariah_compliance(contract):
    if not contract['is_riba_free']:
        return "Non-compliant with Shariah: Contains riba"
    if 'haram' in contract['investment_allowed']:
        return "Non-compliant with Shariah: Contains haram investment"
    if contract['transaction_type'] == 'riba':
        return "Non-compliant with Shariah: Contains riba"
    return "Compliant with Shariah"

# Check compliance
compliance_status = check_shariah_compliance(contract_terms)
print(compliance_status)
```

Figure 9. Example: Smart Contract Validation for Shariah Compliance

Figure 9. Example: Smart Contract Validation for Shariah Compliance illustrates the application of smart contract technology to verify compliance with Shariah principles. The code shown is used to identify elements within contracts that violate Shariah law, such as terms related to usury (interest), *gharar* (uncertainty), or other *haram* components. human error and enhancing efficiency in upholding Islamic financial law.

```
# Example: AI-driven smart contract verification for Shariah compliance
# Sample smart contract terms
contract_terms = {
    'is_riba_free': True,
    'investment_allowed': ['halal', 'ethical'],
    'transaction_type': 'profit-sharing',  # Can be 'riba' or 'interest' for non-compliant
cases
    'haram_investments': ['alcohol', 'gambling']  # Investment list that must be checked
}

# AI-based function to check Shariah compliance
def check_shariah_compliance(contract):

    # Check for riba (interest-based transactions)
    if not contract['is_riba_free']:
        return "Non-compliant with Shariah: Contains riba"

    # Check for investment in haram products
    if any(item in contract['haram_investments'] for item in
contract['investment_allowed']):
        return "Non-compliant with Shariah: Contains haram investment"
    return "Compliant with Shariah"

# Check compliance
compliance_status = check_shariah_compliance(contract_terms)
print(compliance_status)
```

Figure 10. Example: AI-Driven Smart Contract for shariah complience

Figure 10. Example: AI-Driven Smart Contract for Shariah Compliance demonstrates the integration of artificial intelligence (AI) with smart contracts to ensure adherence to Shariah principles in financial agreements. The AI system is designed to analyze contract terms and automatically detect any non-compliant clauses, such as those involving *riba* (interest), *gharar* (uncertainty), or *haram* elements. By leveraging machine learning algorithms, the system continuously improves its ability to interpret complex legal language and detect potential violations in real-time. This AI-driven approach enhances the efficiency and accuracy of Shariah compliance checks, automating the process and minimizing the risk of human error in contract validation. With the two main approaches that have been outlined, transaction anomaly detection, contract content analysis, and smart contract validation, this study provides an initial framework for implementing an artificial intelligence system that is directly tailored to the needs of Islamic financial institutions. This system is not only diagnostic, but can also be integrated into the institution's business processes as part of an early warning system for potential sharia violations. Thus, the existence of AI is no longer seen as an operational complement, but becomes a strategic tool in maintaining the integrity and accountability of Islamic-based institutions.

The Human-in-the-Loop framework involves an iterative process in which human input is integrated into the operation of AI systems, ensuring that AI decisions are verified or corrected by humans when necessary. It is a collaborative model where AI supports human decision-making, and humans, in turn, provide feedback to enhance the AI's performance. HITL is designed to leverage the strengths of both AI's computational power and human cognitive abilities, such as reasoning, ethical judgment, and domain expertise (Amershi et al., 2014).

The Human-in-the-Loop (HITL) framework integrates human expertise with AI systems to enhance decision-making processes. Humans contribute their contextual knowledge and understanding of the domain, which AI systems may lack, especially in complex decision-making tasks like medical diagnoses, legal judgments, and emergency responses. On the other hand, AI systems excel at processing large datasets, identifying patterns, and generating insights that assist in decision-making. However, AI alone may struggle to capture the subtleties of decisions involving ethical, legal, or emotional considerations. The feedback loop plays a crucial role in HITL, enabling humans to correct or add valuable input to the AI system, thereby refining its decisions and improving outcomes over time (Christiano OpenAI et al., 2017).

A Human-in-the-Loop framework consists of several key components that work together to improve decision-making processes. First, human feedback plays an essential role, where people interact with AI systems by providing feedback on the AI's decisions, helping to correct errors, and ensuring that the AI model aligns with ethical guidelines or specific domain standards. The AI decision-making models are another key component, which includes various systems like machine learning algorithms, natural language processing models, and other AI-driven tools that process data and provide recommendations or predictions. Lastly, validation and adjustment are crucial in high-stakes applications, where humans validate the AI's suggestions and make any necessary

adjustments to ensure that the decisions made are contextually relevant and ethically sound.(Stefan & Carutasu, 2021).

AI is increasingly used for financial applications, including fraud detection and investment strategies. However, in complex scenarios such as unusual transactions or investment risk assessments, human financial experts must step in to validate AI recommendations and ensure compliance with regulatory standards. Furthermore, the rule-based and machine learning approaches applied in this model open up space for flexibility and continuous development. For example, an anomaly detection model based on Isolation Forest can be periodically retrained with the latest data from certain Islamic financial institutions, in order to adjust the system's sensitivity to the specific context and risks of each institution. Meanwhile, the NLP approach can be extended with context-aware semantic models to recognize not only explicit keywords such as " *riba* "or "interest", but also disguised forms of non-sharia-compliant practices that may appear in the wording of modern contracts.

In the context of smart contract validation, the integration between AI and blockchain-based smart contracts also has strategic implications. With AI's ability to evaluate legal attributes and transaction substance before the contract is executed, this system enables ex-ante (before it occurs) sharia control, not just ex-post (after a violation occurs). This is very relevant to the principle of prudence in Islam which emphasizes the prevention of *harm* (*dar' al-mafasid*) from an early stage. Thus, the prototype and approach developed in this study can be used as an initial foundation for the development of an AI-based sharia compliance system that is modular, adaptive, and scalable. The real implementation of such a system will not only strengthen the competitiveness of sharia financial institutions in the era of digital transformation, but also bring financial business practices closer to the essence of maqashid al-shariah maintaining justice, transparency, and welfare. Therefore, the results of this study open up wider collaboration between data scientists, system developers, and *muamalah fiqh* scholars to formulate technology that is not only technically sophisticated, but also sharia-compliant.

5. Conclusion, Implications, and Limitations

This study conclusively demonstrates that the implementation of Artificial Intelligence (AI) in Accounting Information Systems (AIS) revolutionizes Shariah compliance governance in Islamic financial institutions. The three key findings of this research are: first, machine learning-based systems (Isolation Forest) and NLP (BERT) successfully identified Shariah violations (e.g., riba, gharar) with 92% accuracy, significantly outperforming manual methods. Second, real-time monitoring integration into accounting processes reduced verification time from days to seconds while ensuring compliance with AAOIFI standards. Third, the operationalization of Maqasid al-Shariah in modern accounting practices, particularly for products like Murabahah and Mudharabah, through smart contract validation and anomaly detection in bookkeeping to prevent errors before posting. Multidisciplinary collaboration (fiqh scholars, accountants, AI engineers) proved critical in designing algorithms sensitive to Islamic norms.

This research makes a significant contribution to the development of theory related to the application of Artificial Intelligence (AI) in Accounting Information Systems (AIS), particularly in the context of Shariah compliance in Islamic financial institutions. Theoretically, the results introduce a framework that integrates Maqasid al-Shariah principles with modern AI technology, expanding existing theories on accounting information systems by adding a new dimension: the sustainability of Shariah compliance through technology. Practically, the findings provide a foundation for Islamic financial institutions to implement automated systems that support Shariah compliance more efficiently and accurately. The multidisciplinary collaboration between fiqh scholars, accountants, and AI engineers highlights the importance of cross-disciplinary teamwork to create systems that are not only technologically advanced but also compliant with religious values. However, this study acknowledges several limitations, particularly in the direct implementation of AI systems in complex operational environments. The research is limited to prototype testing and requires further validation in real-world scenarios. Additionally, the dataset used needs to be expanded to be more representative and rich in context, and AI frameworks need to be designed to be more sensitive to the normative dimensions of Islamic jurisprudence.

Future research should focus on validating these models in real-world scenarios, expanding the dataset to better reflect the diverse contexts, and designing AI frameworks that are more attuned to the normative dimensions of Islamic jurisprudence. Furthermore, broader collaboration between data scientists, system developers, and fiqh scholars is essential for building technologies that are not only technically advanced but also religiously valid.

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