*Available online at https://www.asjp.cerist.dz/en/PresentationRevue/85*

***Economic Researcher Review***

ISSN: 2335-1748, EISSN: 2588-235X VOL 14,N$^{O}$1..(2026),PP214-224

# Artificial Intelligence and Cybersecurity in Islamic Banking An Empirical Study on Shariah Governance and Customer Trust at Bank Syariah Indonesia (BSI)

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**Received:**08 /05/2025 ;**Accepted:**05/26/2026 ;**Published:**06/30 /2026

**Abstract :**

In light of the rapid digital transformation in the financial sector, cybersecurity has become a critical concern for Islamic banks, where both technological efficiency and Shariah compliance are essential.

This study investigates the role of Artificial Intelligence (AI) in enhancing cybersecurity within Islamic banking, focusing on Bank Syariah Indonesia (BSI) as a case study. Employing a mixed-method approach, the research integrates descriptive-analytical insights with empirical statistical analysis.

Data were collected through a structured survey of 350 employees and customers of BSI during 2024 and analyzed using SPSS v.25 through frequency distribution, cross-tabulation, and multiple regression modeling.

The findings reveal that more than half of respondents (51.4%) demonstrate high cybersecurity awareness, which is positively associated with elevated levels of customer trust. Regression results indicate that AI-based threat detection (β = 0.42), fraud prevention (β = 0.36), and Shariah compliance monitoring (β = 0.31) collectively explain 59% of the variance in customer trust.

The study concludes that AI technologies not only strengthen cybersecurity measures but also enhance customer trust by ensuring compliance with Islamic ethical principles. The research contributes both theoretically, by bridging the gap between AI and Shariah-compliant cybersecurity, and practically, by providing evidence-based recommendations for Islamic financial institutions seeking secure and ethical digital transformation.

**Keywords:** Artificial Intelligence; Cybersecurity; Shariah Governance;Islamic Banking;Customer Trust; Bank Syariah Indonesia (BSI); SPSS Analysis; Empirical Study

**Jel Classification Codes :**G21; G28; O33; C83; M15.

**How to cite this article by the APA method:**

Hamel DALILA(2026), ***Artificial Intelligence and Cybersecurity in Islamic Banking An Empirical Study on Shariah Governance and Customer Trust at Bank Syariah Indonesia (BSI),*** *Economic Researcher Review*,Volume14(01),Algeria: University of skikda, pp214-224

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## 1. Introduction.

The accelerating pace of digital transformation has fundamentally reshaped the financial services industry, exposing banking institutions to increasingly complex cybersecurity threats. For Islamic banks, the challenge is twofold: to safeguard sensitive financial and personal data while ensuring strict compliance with Shariah law. This dual responsibility underscores the need for innovative technological solutions that integrate both advanced security mechanisms and ethical governance principles .

In recent years, Artificial Intelligence (AI) has emerged as a transformative tool in cybersecurity, offering capabilities such as predictive threat modeling, real-time fraud detection, and automated incident response. By enabling rapid data processing and behavioral analytics, AI has the potential to significantly reduce cyber risks and ensure the continuity of Shariah-compliant financial services .

Despite the growing attention to digital security, much of the literature remains conceptual, with limited empirical evidence regarding the actual effectiveness of AI applications in the context of Islamic banking. To address this gap, the present study examines the impact of AI on cybersecurity enhancement at Bank Syariah Indonesia (BSI)—the largest Islamic bank in Indonesia—through a combination of descriptive analysis and quantitative statistical methods .

Specifically, this study seeks to answer the central research question: **How does artificial intelligence contribute to strengthening cybersecurity at Bank Syariah Indonesia while preserving compliance with Islamic Shariah principles?** By employing survey data collected from 350 BSI employees and customers and analyzing the results through SPSS, the study not only identifies the key mechanisms through which AI enhances security but also quantifies their influence on customer trust .

This empirical dimension contributes to both theory and practice: theoretically, by filling a knowledge gap on the integration of AI and Shariah-compliant cybersecurity; and practically, by offering evidence-based recommendations for Islamic banks seeking to achieve secure and ethical digital transformation.

### Significance of the Study

The significance of this study lies in its dual theoretical and practical contributions to the field of Islamic banking and cybersecurity. Theoretically, it addresses a notable research gap by providing empirical evidence on the integration of Artificial Intelligence (AI) into cybersecurity frameworks specifically tailored for Shariah-compliant financial institutions. Unlike previous studies that have largely remained conceptual, this research employs quantitative methods to validate the effectiveness of AI-driven mechanisms in mitigating cyber threats and reinforcing customer trust .

Practically, the findings offer valuable insights for decision-makers, policymakers, and practitioners in Islamic banking. By highlighting the measurable impact of AI on reducing cyberattacks, enhancing fraud prevention, and accelerating Shariah compliance audits, the study provides a roadmap for adopting innovative security strategies. Moreover, the results underscore the role of AI not only as a technological solution but also as a tool for reinforcing ethical credibility and operational resilience in line with Islamic values.

Ultimately, the study contributes to the sustainable digital transformation of Islamic financial institutions, promoting greater transparency, security, and trustworthiness in the global financial system.

**Research Objectives:**

This study seeks to achieve the following objectives:

-To clarify the concept of cybersecurity and its unique requirements in Shariah-compliant banking environments .

-To analyze AI-based mechanisms applied in Islamic financial institutions to prevent and mitigate cyber threats .

-To empirically assess the impact of AI applications on cybersecurity and customer trust at Bank Syariah Indonesia .

- To propose integrated strategies leveraging AI technologies to enhance cybersecurity in a manner consistent with Shariah governance principles

**Research Methodology**

This study adopts a mixed-method approach, combining descriptive-analytical techniques with empirical statistical analysis to provide a comprehensive understanding of the role of Artificial Intelligence (AI) in enhancing cybersecurity within Islamic banks .

**Data Collection**

Primary data were collected through a structured survey distributed to 350 respondents, including both employees and customers of Bank Syariah Indonesia (BSI), during the second half of 2024. The survey comprised three main sections :

- Cybersecurity awareness levels ,
- Perceptions of AI-driven security measures ,
- Levels of customer trust in BSI's digital services .

**Data Analysis**

The collected data were processed using SPSS version 25. The analysis included:

- Frequency Distribution: To measure levels of cybersecurity awareness among respondents .
- Cross-Tabulation: To examine the relationship between cybersecurity awareness and customer trust .
- Multiple Regression Modeling: To assess the impact of AI-based applications—specifically threat detection, fraud prevention, and Shariah compliance monitoring—on customer trust .

**Justification of the Case Study**

Bank Syariah Indonesia (BSI) was selected as the case study because it is the largest Islamic bank in Indonesia, recognized for its rapid digital transformation and substantial investment in AI-powered cybersecurity systems. The case study design enables a deeper exploration of the practical implementation of AI within a Shariah-compliant framework .

By combining descriptive insight with empirical validation, the methodology ensures both academic rigor and practical relevance, enhancing the reliability and applicability of the study's findings.

**1. Concept of Cybersecurity and Its Importance in Islamic Banks**

**1.1 Definition of Cybersecurity in Islamic Banks**

Cybersecurity in Islamic banks encompasses a set of principles, procedures, and technologies designed to protect clients' financial and personal information while maintaining compliance with Shariah law. Various scholarly and institutional definitions highlight different dimensions of cybersecurity in the Islamic banking context:

- **Definition 1:** Cybersecurity in Islamic banks refers to "a set of processes and measures aimed at protecting banking systems and clients' financial data from cyber threats, while adhering to the Shariah-compliant regulations governing Islamic banking operations. This includes the use of protective software, network monitoring, and enhancing security awareness among employees and clients" (Al-Abadi, 2023).

This definition emphasizes the holistic and preventative nature of cybersecurity as a comprehensive protective shield.

- **Definition 2:** Cybersecurity is defined as "an ongoing risk management process that addresses digital threats to data and financial transactions while ensuring compliance with Shariah principles. It involves designing resilient systems to counter cyberattacks and to maintain the continuity and safety of banking services" (Communications and IT Environment, 2021).

Cybersecurity is portrayed as a dynamic risk management framework.

- **Definition 3:** According to the Saudi Arabian Monetary Authority (2022), cybersecurity entails "the commitment of Islamic banks to applying digital governance and security standards to ensure the confidentiality of financial data and customer privacy in accordance with local and international regulations, while also complying with Islamic Shariah principles."

This definition underscores the regulatory and ethical dimensions of cybersecurity in Islamic finance.

### 1.2 Importance of Cybersecurity in Islamic Banks

Cybersecurity plays a critical role in ensuring the operational integrity, data protection, and Shariah compliance of Islamic banking systems. Its importance can be summarized in the following key areas:

- Protection of Sensitive Data: Securing customer financial records and personal information against unauthorized access, data breaches, and cyber intrusions (Ali &Hussain, 2023).
- Identity Management and Access Control: Implementing systems that ensure only authorized personnel can access sensitive platforms, utilizing mechanisms such as multi-factor authentication and encryption technologies (Khan & Ahmed, 2022).
- Threat Monitoring and Incident Response: Utilizing AI-driven tools for real-time monitoring of networks and detection of suspicious activities to enable timely intervention (Smith, 2021).
- Compliance with Shariah Standards: Designing and implementing cybersecurity solutions that adhere to Islamic ethical principles, including privacy, confidentiality, and harm prevention (Ali &Hussain, 2023).
- Cybersecurity Awareness and Education: Conducting training programs for both employees and clients to promote understanding of cybersecurity practices and the importance of personal vigilance (Khan & Ahmed, 2022).
- Emergency Response and Disaster Recovery: Developing and maintaining response frameworks that allow the bank to recover swiftly from cyberattacks, minimizing service interruptions and ensuring operational continuity (Smith, 2021).

### 1.3 Applications of Artificial Intelligence to Enhance Cybersecurity in Islamic Banks

Artificial intelligence (AI) applications play a vital role in enhancing cybersecurity, enabling Islamic banks to efficiently predict and address threats within the framework of Sharia compliance. This is achieved through:

- Automated Threat Detection: Analyzing network behaviors to identify anomalous activities using deep learning techniques (Brown & Jones, 2023).
- Incident Response Systems: Automating responses to cyberattacks, thereby reducing reaction times to threats (Smith, 2022).
- Big Data Analytics: Utilizing AI to process vast amounts of data to detect patterns indicative of intrusion attempts (Ali & Ahmed, 2021).
- Predictive Attack Modeling: Building machine learning-based predictive models to forecast potential vulnerabilities before exploitation (Williams et al., 2023).
- Real-Time Fraud Detection: Monitoring financial transactions to instantly detect suspicious activities while ensuring adherence to Sharia principles (Khan & Lee, 2022).
- Enhanced Encryption and Protection: Developing dynamic encryption algorithms that adapt to evolving cyber threats (Zhang & Miller, 2021).

**1.4 Theoretical Framework: Trust and Technology Adoption in Islamic Banking**

The integration of Artificial Intelligence in Islamic banking cybersecurity can be better understood through established theoretical models that explain customer acceptance of digital technologies.

According to the Technology Acceptance Model (TAM), customers' intention to adopt digital financial services is primarily influenced by perceived usefulness and perceived ease of use (Davis, 1989). In the context of Islamic banking, these constructs are complemented by Shariah compliance, which functions as a non-negotiable determinant of trust .

Similarly, the Unified Theory of Acceptance and Use of Technology (UTAUT) emphasizes performance expectancy, effort expectancy, social influence, and facilitating conditions as critical factors (Venkatesh, Morris, Davis, & Davis, 2003). Within Islamic banks, AI-based cybersecurity strengthens performance expectancy and facilitating conditions by providing robust protection of sensitive financial data and ensuring adherence to Shariah principles.

Furthermore, trust theory highlights that digital trust is a multidimensional construct encompassing competence, integrity, and benevolence (Mayer, Davis, &Schoorman, 1995). AI-powered cybersecurity systems contribute to all three dimensions by ensuring secure transactions, maintaining transparency, and protecting client privacy.

This theoretical integration underscores the hypothesis that AI-driven cybersecurity measures not only enhance system efficiency but also directly reinforce customer trust, particularly in institutions bound by Islamic ethical standards.

**2.3 Artificial Intelligence and Cybersecurity in Sharia Governance of Islamic Banks**

Sharia governance plays a pivotal role in ensuring Islamic banks comply with Sharia rulings. With the acceleration of digital transformation, new opportunities and challenges have emerged, requiring a balance between innovation and adherence to Sharia regulations. Key aspects include:

- Compliance with Sharia Guidelines in Digital Solutions: Designing digital systems to align with Sharia fatwas and supervisory board decisions (Ahmed & Khalid, 2022).
- Activation of Digital Sharia Supervisory Committees: Leveraging AI technologies to support Sharia supervisory boards in real-time transaction monitoring and compliance verification (Al-Rahimi&Hasan, 2023).

- Sharia-Compliant Cybersecurity: Developing security systems that protect data and ensure privacy while respecting Islamic values such as trustworthiness and safeguarding rights (Ibrahim & Noor, 2021).
- Smart Contracts and Islamic Finance: Employing smart contracts to execute Islamic financing structures like Murabaha and Ijarah, incorporating automated Sharia compliance mechanisms (Yusuf & Abdullah, 2023).
- Development of Digital Fatwa Platforms: Creating AI-powered platforms that provide instant fatwas on digital financial products (Karim&Latif, 2022).
- Enhancement of Digital Transparency and Accountability: Applying digital analytics tools to promote transaction transparency and strengthen accountability according to Sharia standards (Rahman et al., 2021).

Building upon the theoretical insights discussed above, it becomes essential to formulate research hypotheses and a conceptual framework that will guide the empirical analysis. This framework aims to clarify the relationships between AI-driven cybersecurity applications, Shariah governance, and customer trust in Islamic banking.

### 2.5 Research Hypotheses and Conceptual Framework

Based on the theoretical foundation, this study proposes the following hypotheses:

-H1a: AI-based threat detection has a positive effect on customer trust in Islamic banking.

-H1b: AI-driven fraud prevention has a positive effect on customer trust in Islamic banking.

-H1c: AI-powered Shariah compliance monitoring has a positive effect on customer trust in Islamic banking.

-H1d: Shariah governance moderates the relationship between AI applications in cybersecurity and customer trust, strengthening the positive impact .

**Conceptual Framework Variables and Measurement**

| Variable | Type | Indicators (Measurement Items) | Scale | Statistical Tools |
|---|---|---|---|---|
| AI-BasedThreatDetection | Independent Variable | - Real-time monitoring efficiency - Accuracy in detecting anomalies - Response speed | Likert (1–5) | Multiple Regression; FrequencyAnalysis |
| FraudPrevention | Independent Variable | - Effectiveness of fraud detection systems - Reduction in unauthorized access - Biometric 2FA adoption | Likert (1–5) | Cross-tabulation; Regression |
| ShariahCompliance Monitoring | Independent Variable | - Automated compliance audits - Transparency in digital services - Consistency with Shariah fatwas | Likert (1–5) | Regression; ReliabilityAnalysis |

| | | | | |
|---|---|---|---|---|
| Customer Trust | Dependent Variable | - Perceived security - Confidence in Shariah-compliant services - Willingness to use digital platforms | Likert (1–5) | Regression (DV) |
| ShariahGovernance | Moderating Variable | - Role of Shariah supervisory boards - Digital fatwa platforms - Ethical oversight in AI use | Likert (1–5) | Interaction Analysis |

All variables were measured using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Data were analyzed with SPSS v.25 using frequency distribution, cross-tabulation, Cronbach's Alpha for reliability, and multiple regression modeling to test the hypotheses.

## 3. The Role of Artificial Intelligence in Enhancing Cybersecurity at Bank Syariah Indonesia

### 3.1 Overview of Bank Syariah Indonesia (BSI)

Bank Syariah Indonesia (BSI), established in 2021 through the merger of three state-owned Islamic banks, is the largest Islamic financial institution in Indonesia. It is widely recognized for its proactive investment in digital transformation and Artificial Intelligence (AI)-based cybersecurity systems, aiming to protect customer data, ensure Shariah compliance, and enhance operational resilience .

According to its annual reports, BSI invested over IDR 846 billion in digital infrastructure and cybersecurity between 2022 and 2023, focusing on AI-driven fraud detection, biometric authentication, and automated compliance systems .

### 3.2 Survey-Based Data Collection:

To empirically assess the impact of AI on cybersecurity, a structured questionnaire was distributed to 350 respondents in 2024, including :

- 200 BSI employees working in IT security, risk management, and compliance departments ;
- 150 BSI customers who actively use digital banking services .

The survey covered three main dimensions :

- Awareness of cybersecurity risks ,
- Perceptions of AI applications at BSI ,
- Levels of trust in Shariah-compliant digital banking services .

### 3.3 Statistical Analysis of Findings

To provide empirical evidence, the study relied on a structured survey conducted in 2024 among 350 employees and customers of Bank Syariah Indonesia (BSI). The collected data were analyzed using SPSS version 25, applying frequency distribution, cross-tabulation, and multiple regression.

***Table 1:*** *Distribution of Cybersecurity Awareness among BSI Respondents*

| AwarenessLevel | Frequency | Percentage (%) |
|---|---|---|
| Low | 52 | 14.9% |
| Moderate | 118 | 33.7% |

| | | |
|---|---|---|
| High | 180 | 51.4% |
| **Total** | **350** | **100%** |

***Source:*** *Author's field survey, 2024 (analyzed using SPSS v.25).*

The results in Table 1 show that a majority of respondents (51.4%) reported a high level of cybersecurity awareness, while 33.7% demonstrated a moderate level, and only 14.9% exhibited low awareness. This distribution highlights that most employees and customers at BSI are relatively well-informed about cybersecurity risks and protective measures. Such awareness is critical, as it forms the foundation for effective adoption of AI-driven security solutions and compliance with Shariah governance.

***Table 2****: Stakeholders' Perceptions of AI-Based Cybersecurity Applications at (BSI)*

| AI Application | StronglyAgree | Agree | Neutral | Disagree | StronglyDisagree |
|---|---|---|---|---|---|
| EarlyThreatDetection | 140 | 120 | 60 | 20 | 10 |
| Real-Time FraudPrevention | 128 | 132 | 54 | 26 | 10 |
| ShariahCompliance Monitoring | 112 | 140 | 62 | 26 | 10 |
| BiometricAuthentication (2FA) | 150 | 130 | 40 | 20 | 10 |

***Source:*** *Author's field survey, 2024 (analyzed using SPSS v.25).*

The table above reveals positive perceptions toward AI applications in BSI. The highest agreement was recorded for Biometric Authentication (280 respondents agreed or strongly agreed), followed by Early Threat Detection and Real-Time Fraud Prevention. Shariah Compliance Monitoring also received a strong level of agreement, with 252 respondents recognizing its importance. These findings suggest that BSI's stakeholders not only value AI for its technical efficiency but also trust its role in ensuring Shariah compliance and enhancing security in digital banking services.

The findings from Tables 1 and 2 collectively indicate that while the majority of respondents at BSI demonstrate high levels of cybersecurity awareness, their positive perceptions of AI applications further reinforce the role of advanced technologies in safeguarding Islamic banking operations. To quantify these relationships and examine the predictive power of AI-driven measures on customer trust, a multiple regression analysis was conducted. The results are presented in Table 3.

***Table 3:*** *Multiple Regression Results Predicting Customer Trust*

| Predictor Variable | Beta (β) | t-value | Sig. (p-value) |
|---|---|---|---|
| AI ThreatDetection | 0.42 | 6.12 | 0.000 |
| FraudPreventionSystems | 0.36 | 5.47 | 0.000 |
| ShariahCompliance Monitoring | 0.31 | 4.89 | 0.000 |

| | | | |
|---|---|---|---|
| **Model $R^2$ = 0.59** | | | |

***Source:*** *Author's statistical analysis based on field survey data, 2024 (SPSS v.25)*

The regression model explains 59% of the variance in customer trust, with AI threat detection being the strongest predictor ($\beta = 0.42$, $p < 0.001$), followed by fraud prevention ($\beta = 0.36$) and Shariah compliance monitoring ($\beta = 0.31$).

To complement the regression analysis and provide a clearer picture of the practical outcomes, a comparative evaluation was conducted to measure BSI's cybersecurity performance before and after the adoption of AI technologies. The results are summarized in Table 4.

### 3.4 Impact Indicators Before and After AI Implementation

***Table 4:*** *Comparative Cybersecurity Performance at Bank Syariah Indonesia (BSI)*

| Metric / Indicator | Before AI | After AI | Change (%) |
|---|---|---|---|
| Number of Cyberattacks per Year | 500 | 350 | -30% |
| Time for Shariah Compliance Auditing (hrs) | 100 | 60 | -40% |
| Customer Trust Index (scale 1–10) | 6.0 | 7.5 | +25% |
| Hacking Attempts Blocked via Biometric 2FA | 400 | 700 | +75% |
| Compliance Policy Updates per Year | 2 | 5 | +150% |

***Source:*** *Author's compilation based on BSI Annual Reports (2022–2024) and field survey, 2024.*

The results indicate substantial improvements in BSI's cybersecurity performance following AI adoption. Notably, the number of cyberattacks decreased by 30%, compliance auditing time dropped by 40%, and customer trust increased by 25%. Moreover, the adoption of biometric two-factor authentication significantly enhanced system security, blocking 75% more hacking attempts compared to the pre-AI period.

### 3.5 Challenges Identified

Despite its progress, BSI faces ongoing challenges, including :

- Shortage of AI and cybersecurity specialists;
- High financial costs of maintaining advanced systems;
- Regulatory complexities related to Shariah and international data protection standards;
- Potential risks targeting AI systems themselves, requiring continuous upgrades.

These findings emphasize the need for sustainable investment in human capital, infrastructure, and regulatory harmonization to further strengthen cybersecurity resilience.

## 4. Conclusion.

The findings of this study confirm that Artificial Intelligence (AI) plays a pivotal role in enhancing cybersecurity within Islamic banks, while simultaneously ensuring compliance with Shariah principles. The case study of Bank Syariah Indonesia (BSI) provided empirical evidence of the measurable benefits of AI adoption .

Statistical analysis revealed that AI-driven systems—such as early threat detection, real-time fraud prevention, and automated Shariah compliance monitoring-contributed to a 30% reduction in

cyberattacks, a 40% improvement in compliance auditing efficiency, and a 25% increase in customer trust levels. Regression analysis further demonstrated that AI applications accounted for nearly 59% of the variance in customer trust, underscoring their effectiveness in both security enhancement and reputation building .

Moreover, the widespread acceptance of biometric two-factor authentication (80% agreement among respondents) highlights the importance of user-friendly yet secure digital solutions in reinforcing customer confidence .

However, the study also identified persistent challenges, including skill shortages in cybersecurity, financial burdens of AI implementation, and regulatory complexities. These obstacles highlight the necessity for continuous adaptation and strategic planning to sustain long-term digital resilience.

**Research Recommendations:**

Based on the empirical results, the following recommendations are proposed to strengthen the role of AI in Islamic banking cybersecurity :

- **Expand Investment in AI Infrastructure:** Islamic banks should allocate dedicated budgets to continuously upgrade AI-driven security systems, ensuring adaptability to evolving cyber threats .
- **Develop Human Capital through Specialized Trainin:** Establish training programs in cybersecurity and AI for bank employees to reduce reliance on external expertise and improve institutional readiness .
- **Strengthen Collaboration with Shariah Supervisory Board:** AI tools should be integrated into Shariah governance mechanisms to accelerate compliance auditing and ensure real-time monitoring of financial transactions .
- **Enhance Customer Awareness Programs:** Regular awareness campaigns should be launched to educate customers about the role of AI in protecting their data, thereby increasing trust and digital engagement .
- **Promote Regulatory Harmonization:** Work closely with both national and international regulatory bodies to align cybersecurity frameworks with global best practices while respecting Shariah principles .
- **Establish Cyber Resilience Frameworks:** Islamic banks should design robust incident response and disaster recovery systems that leverage AI to minimize downtime and preserve customer trustduring cyber incidents.

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