

ANALYSIS OF ARTIFICIAL INTELLIGENCE IMPLEMENTATION IN ISLAMIC BANKING DURING AN ERA OF UNCERTAINTY

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ABSTRACT

This study analyzes the impact of Artificial Intelligence (AI) adoption on the performance of Islamic banks in Indonesia, with a focus on the moderating role of economic uncertainty. Using panel data from 12 Islamic commercial banks from 2021 to 2024, AI adoption is measured through a composite index evaluating the scope and depth of technology implementation across four dimensions: customer service, operations and compliance, credit and risk analysis, and strategic investment. The analysis employs a random effects regression model. The findings reveal a nuanced perspective that AI adoption does not yet have a significant effect on Return on Assets (ROA). Similarly, economic uncertainty and its interaction with AI are found to be insignificant. These results indicate that AI integration in Indonesian Islamic banking remains preliminary and lacks strategic depth. The primary determinant of bank performance remains operational efficiency (OE). This study provides critical empirical evidence that AI investment does not automatically translate into profitability in this specific context. The findings enrich the discourse on fintech implementation in emerging markets and offer a foundation for developing more effective digital strategies for Islamic banking.

Keywords: Artificial Intelligence, Economic Uncertainty, Bank Performance, Islamic Banking

INTRODUCTION

The era of digitalization and global economic uncertainty, exacerbated by the pandemic, geopolitical conflicts, and market fluctuations, demands that the financial sector innovate rapidly and adaptively. The global banking industry is undergoing a radical transformation driven by the Fourth Industrial Revolution, with Artificial Intelligence (AI) at its forefront (Baker et al., 2016). Technologies such as machine learning, natural language processing, and robotic process automation offer high operational efficiency, sharper risk management, personalized customer services, and data-driven decision-making (Berger, 2005). Thus, AI adoption is no longer merely an option but a strategic necessity for banks to remain competitive and resilient in the face of disruption.

This digital transformation is also a pressing demand in Islamic banking, including in Indonesia, which has recorded an average asset growth of 15 percent per year since 2018 (OJK, 2023). However, challenges in the Islamic banking sector are more complex. The limitations of hedging instruments, dependence on profit-sharing systems, and strict compliance with Sharia principles, such as the prohibition of *riba* (usury), *gharar* (excessive uncertainty), and *maysir* (gambling), require that technological adoption be carried out cautiously (Beck et al., 2013; Hassan & Aliyu, 2018). AI integration must ensure that algorithms are free from bias, aligned with Sharia ethics, and do not introduce new forms of *gharar* (Rustandi & Arifin, 2024).

Based on this background, this study aims to answer two questions: first, whether the application of AI has a positive effect on the performance of Islamic banks in Indonesia, and second, whether economic uncertainty strengthens the influence of AI adoption on such performance.

LITERATURE REVIEW

Resource-Based View (RBV)

The RBV theory (Barney, 1991) views AI as a strategic asset that is valuable, rare, inimitable, and non-substitutable (VRIN). In Islamic banking, well-implemented AI can enhance efficiency, optimize risk management, and strengthen Shariah compliance, thereby creating the potential for sustainable competitive advantage.

Dynamic Capability Theory (DCT)

DCT (Teece, 2007) emphasizes the organization's ability to adapt and reconfigure resources in response to change. AI represents a manifestation of dynamic capabilities, where Islamic banks can utilize AI for sensing (identifying needs and risks through big data), seizing (making strategic decisions such as AI-based credit scoring), and transforming (restructuring business processes for greater efficiency and Shariah compliance).

Islamic Banking Performance

The performance of Islamic banks is not only measured by conventional financial indicators such as Return on Assets (ROA) but also through the achievement of *Maqasid al-Shariah*, which emphasizes social justice and economic well-being (Mohammed & Taib, 2015). Islamic banks are more vulnerable to economic volatility due to their dependence on the real sector and profit-sharing mechanisms, making innovations like AI necessary to be evaluated not only in terms of efficiency but also in alignment with Shariah principles.

Artificial Intelligence (AI) in Islamic Banking

AI refers to the ability of machines to mimic human cognitive functions such as learning and decision-making. In Islamic banking, AI is applied through chatbots, credit scoring, fraud detection, and Robotic Process Automation (RPA) (Boot et al., 2020). These applications not only provide efficiency but also play a role in ensuring compliance with Shariah principles. Implementations have the potential to improve efficiency by up to 30 percent and significantly reduce the Non-Performing Financing (NPF) ratio (Sarker, 2022). These findings position AI as a strategic instrument to strengthen competitiveness and sustainability in Islamic banking in the digital era.

Economic Uncertainty

Economic uncertainty is a condition in which economic actors find it difficult to predict future developments (Knight, 1921). Phenomena such as health crises and geopolitical tensions exacerbate market volatility and put pressure on banking performance. For Islamic banks, uncertainty represents both a challenge and a catalyst for innovation, prompting institutions to adapt more rapidly through technologies such as AI.

HYPOTHESIS

Based on the RBV perspective, AI is considered a VRIN resource capable of generating competitive advantage. Empirical studies show that AI can enhance efficiency and profitability. Empirical evidence indicates that Artificial Intelligence (AI) significantly enhances financial inclusion, risk assessment, compliance automation, and customer service in Islamic finance (Iqbal et al., 2025). Hence, the first hypothesis is formulated as follows: H1: The implementation of Artificial Intelligence (AI) has a positive effect on the performance of Islamic banks.

From the DCT perspective, economic uncertainty drives organizations to leverage their resources (in this case, AI) more effectively to adapt. Empirical evidence shows that banks adopting AI during crises demonstrate greater resilience (Butt & Chamberlain, 2025). Moreover, banks with advanced AI capabilities are better equipped to perform rapid risk scenario analyses, automate credit evaluation processes, and sustain digital

customer services during periods of crisis, thereby enhancing their resilience and operational continuity (McKinsey, 2021). Hence, the second hypothesis is formulated as follows: H2: Economic uncertainty strengthens the effect of Artificial Intelligence (AI) implementation on the performance of Islamic banks.

METHODS

This study employs a causal quantitative approach with an explanatory design aimed at testing the statistical relationships among variables. Secondary data were collected from the annual reports of 14 Islamic commercial banks in Indonesia for the period 2021–2024. However, due to data limitations, the final sample comprised 12 banks. Additional data were obtained from the World Uncertainty Index (WUI) and Statistics Indonesia (BPS). The measurement of research variables is summarized in the following table:

Table 1. Measurement of Research Variables

Variable	Indicator / Measurement	Scale	Data Source
Islamic Banking Performance (Y)	Return on Assets (ROA) = Net Income / Total Assets x 100%	Ratio	Annual Reports of Islamic Commercial Banks (2021–2024)
Artificial Intelligence Implementation (X)	AI adoption level (score based on the number & type of AI implementations, e.g., chatbot, credit scoring, fraud detection, digital underwriting, etc.)	Ordinal/Score	Annual Reports & Bank Publications
Economic Uncertainty (Z)	1. GDP Volatility; 2. Inflation Rate; 3. Uncertainty Index (World Uncertainty Index – WUI)	Ratio	WUI, BPS
Bank Size (Control 1)	Ln (Total Asset)	Ratio	Annual Reports
Bank Efficiency (Control 2)	OE = Operational Expenses / Operational Income x 100%	Ratio	Annual Reports

Source: Processed Data (2025)

The following (Eq. i) is the panel regression model with interaction variables:

$$ROA_{it} = \beta_0 + \beta_1 AI_{it} + \beta_2 EPU_{it} + \beta_3 (AI_{it} \times EPU_{it}) + \beta_4 Size_{it} + \beta_5 OE_{it} + \varepsilon_{it} \quad (i)$$

The model is estimated using EViews 12, where “i” denotes the cross-sectional unit (bank) and “t” represents the time period (year).

RESULTS

To understand the influence of Artificial Intelligence (AI) implementation, economic uncertainty (EPU), and their interaction on the performance of Islamic banking—proxied by Return on Assets (ROA)—a panel regression analysis was conducted using the EGLS random effects method. Accordingly, descriptive statistics are presented, encompassing the mean, standard deviation, minimum, and maximum values of each variable. Descriptive statistics provide an initial overview of the data distribution, variability, and potential extreme conditions (outliers) that may influence the analysis results. The data were obtained from 12 Islamic commercial banks in Indonesia from 2021 to 2024, resulting in a total of 48 observations. The following is a summary of the descriptive statistics for all variables in this study.

Table 2. Descriptive Statistics

	AI	EPU	ROA
Mean	0.604167	0.002500	0.088125
Median	1.000000	0.195000	1.315000
Maximum	1.000000	0.810000	4.080000
Minimum	0.000000	-1.190000	-10.85000
Std. Dev.	0.494204	0.753591	3.291655

Source: Processed Data (2025)

Based on the descriptive statistics results, the AI variable has a mean value of 0.604 with a standard deviation of 0.494, indicating that the level of AI adoption in Islamic banking remains at a moderate level with relatively low variation. The maximum AI value of 1.00 and the minimum of 0.00 suggest significant differences among banks, where some have fully adopted AI while others have not adopted it at all. Next, the EPU (Economic Policy Uncertainty) variable has a mean of 0.0025 with a standard deviation of 0.753, reflecting fairly fluctuating economic uncertainty conditions throughout the research period. The range of EPU values from -1.19 to 0.81 indicates significant dynamics in economic policy stability that may affect banking performance. Meanwhile, the ROA (Return on Assets) variable recorded a relatively low mean of 0.088 with a standard deviation of 3.29. The maximum ROA value of 4.08 and the minimum of -10.85 illustrate considerable differences in profitability among Islamic banks, likely influenced by varying levels of technology adoption and macroeconomic conditions. Thus, the descriptive statistics provide an initial overview of the variation among the research variables and indicate potential relationships worthy of further analysis.

To test the proposed hypotheses, this study employs a panel data regression model using the Generalized Least Squares (GLS) Random Effects approach. The selection of this model is deemed appropriate as it accounts for variation across banks (cross-sectional) and changes over time (time series), while also addressing potential heteroscedasticity and correlation among individuals. Through this approach, a comprehensive analysis can be conducted to examine how the implementation of Artificial Intelligence (AI), economic uncertainty (EPU), and their interaction influence the performance of Islamic banking, proxied by Return on Assets (ROA). The following presents the estimated regression parameters, including coefficients, standard error values, t-statistics, and significance levels for each independent and control variable used in the study.

Table 3. Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Adjusted squared	R- squared	Prob(F-statistic)
C	5.127723	0.769832	6.660837	0.0000	0.812917		0.0000
AI	-0.280258	0.438296	-0.639426	0.5260			
EPU	0.143159	0.397651	0.360013	0.7206			
AI_EPU	-0.521717	0.553670	-0.942290	0.3514			
SIZE	-0.012842	0.034566	-0.371528	0.7121			
OE	-0.043329	0.003169	-13.67385	0.0000			

Source: Processed Data (2025)

The results of panel data regression analysis using the Random Effects method indicate that among all independent variables tested, only operational efficiency (OE) has a significant effect on the performance of Islamic banking, proxied by ROA. In contrast, the implementation of Artificial Intelligence (AI), economic uncertainty (EPU), the AI×EPU interaction, and bank size (Size) show no significant influence. These findings provide important insights into the dynamics of Islamic banking performance in Indonesia in the digital era and amid economic uncertainty.

AI Implementation and Islamic Banking Performance

The results show that AI implementation does not significantly affect ROA ($\beta = -0.280258$; $p = 0.5260$), leading to the rejection of Hypothesis 1. This finding contradicts initial expectations based on the Resource-Based View (RBV), where AI is considered a strategic asset that is valuable, rare, inimitable, and non-substitutable (Barney, 1991). However, the context of Islamic banking in Indonesia reveals a different reality. AI in Indonesian Islamic banks is still in its early stages and has not yet become an integral part of business strategies. The majority of banks (10 out of 12) have very low AI implementation scores (0.25), except for BSI and BJB Syariah, which only increased AI adoption in 2024. Moreover, AI adoption has not yet touched core processes such as financing assessment or sharia risk management, remaining limited to basic services like chatbots or administrative automation.

This finding aligns with studies by Hamadou et al. (2024), Lasmiatun & Manteghi (2025), Maulani et al. (2025), Safriatullah et al. (2025) which state that AI adoption in Islamic finance is still experimental and has not yet delivered a direct impact on financial performance. Additionally, research by Meero (2025) highlights a gap in AI adoption between conventional banks, which score higher, and Islamic banks. Furthermore, studies by Shalhoob (2025), Tayachi & Brahim (2023) found that the impact of AI is only significant in countries with mature digital ecosystems, such as Malaysia and Saudi Arabia, while Indonesia lags in infrastructure and human resource capacity. Thus, although AI has potential as a strategic resource, it does not yet meet the VRIN criteria (Valuable, Rare, Inimitable, Non-substitutable) in Indonesia, as it has not been widely adopted and has not produced tangible differentiation among banks.

Economic Uncertainty and Islamic Banking Performance

The coefficient for EPU (Economic Policy Uncertainty Index) is not significant ($\beta = 0.143159$; $p = 0.720$), indicating that economic uncertainty does not directly affect the performance of Islamic banking. This supports the unique characteristics of the Islamic banking system, which relies not on interest rates but on profit-sharing principles. When monetary policy fluctuations, inflation, or GDP volatility occur, conventional banks are immediately affected due to changes in benchmark interest rates. However, Islamic banks are more resilient because their income is determined by the real performance of the real sector (customer businesses), not by financial market fluctuations. This is consistent with findings by Beck et al. (2013) that Islamic banks tend to be more stable during financial crises due to their healthier risk structure and avoidance of excessive leverage. Additionally, IFSB (2023) explains that Islamic banks have internal mechanisms to absorb macroeconomic shocks through contracts such as mudharabah and musharakah, which promote risk-sharing between banks and customers. Thus, Islamic banks are less vulnerable to fiscal and monetary policies, explaining why EPU does not significantly impact ROA.

Interaction Between AI and Economic Uncertainty

The hypothesis that economic uncertainty strengthens the effect of AI on performance is also rejected ($\beta = -0.521717$; $p = 0.3514$). According to Dynamic Capability Theory (Teece, 2007), organizations capable of sensing, seizing, and transforming are more resilient in uncertain environments. AI should serve as an adaptive capability to help banks respond quickly to external changes. However, empirical findings show the opposite. Although EPU increased from 2022 to 2024, there is no evidence that banks with higher AI adoption performed better. In fact, some banks with high AI adoption (e.g., BSI) experienced performance pressure in 2021–2022, while banks with low AI adoption (e.g., Bank Aceh) remained stable. This indicates that Islamic banks in Indonesia have not yet developed sufficient dynamic capabilities to leverage AI as an adaptation tool. AI adoption remains partial and is not integrated with risk management systems or strategic planning. Therefore, AI has not yet become a strategic enabler in addressing uncertainty.

Bank Size (Size) and Economies of Scale

The Size variable (LnAsset) does not significantly affect ROA ($\beta = -0.012842$; $p = 0.7121$). This suggests that bank size has not yet become a competitive advantage in Indonesian Islamic banking. Theoretically, larger banks should enjoy economies of scale, achieving better cost efficiency due to their extensive operational scale. However, in reality, large Islamic banks such as BSI and BJB Syariah have not fully optimized their scale. Complex organizational structures, post-merger integration costs, and IT system limitations have instead increased operational expenses. Moreover, some smaller banks, such as Bank Kepri Syariah and Bank NTB Syariah, have demonstrated competitive performance, indicating that a focus on local markets and operational efficiency is more critical than large scale. This finding aligns with the research by Rakan (2022), which states that size has no significant effect on the ROA of Islamic banks.

Operational Efficiency (OE) as the Key Determinant of Performance

Operational efficiency (OE) emerges as the only statistically significant variable ($\beta = -0.043329$; $p = 0.0000 < 0.05$) influencing Islamic banking performance. The negative coefficient indicates an inverse relationship, where a lower OE ratio corresponds to a higher ROA. This finding underscores that effective cost management, reflected in operational efficiency, serves as the primary determinant of profitability in Indonesia's Islamic banking sector. Banks with low OE, such as BSI (69.93%), Bank Mega Syariah (77.64%), and Bank Kepri Syariah (81.2%), demonstrate stable and high ROA. Conversely, banks with very high OE, such as Bank Aladin Syariah (109.29%) and KB Bukopin Syariah (192.58%), experienced significant losses (negative ROA). This finding aligns with studies by Alfianda and Widiyanto, (2020); Irawan et al., (2019), and of Islamic commercial banks in Indonesia. Thus, in the current context, efficiency strategies are more relevant than digitalization or scale expansion strategies.

CONCLUSION

Based on panel data analysis using the Random Effects method, this study concludes that the implementation of Artificial Intelligence (AI) has not yet had a significant partial effect on the performance (ROA) of Islamic banking in Indonesia. This finding indicates that AI adoption in this sector remains at an early and limited stage, thus failing to realize the competitive advantage hypothesized by the Resource-Based View (RBV). Furthermore, the negative coefficient suggests that AI investment without strategic integration may potentially increase cost burdens without directly contributing to profitability. Meanwhile, economic uncertainty (EPU) also did not significantly affect performance, which is consistent with the resilient nature of Islamic banking based on profit-sharing and minimal speculation. However, the interaction between AI and EPU was not significant, indicating that AI has not yet functioned as a dynamic capability to help banks adapt to uncertainty in accordance with Dynamic Capability Theory. Among the control variables, bank size (Size) had no significant effect, suggesting that economies of scale have not been optimally achieved due to organizational complexity and integration costs. Conversely, operational efficiency (OE) proved to be a dominant determining factor with a negative and highly significant influence, affirming that effective management of operational costs remains the key to profitability in Indonesian Islamic banking.

This study has several limitations, including the use of secondary data that does not fully capture the depth and complexity of AI adoption comprehensively, a relatively short observation period (four years) that may not reflect long-term impacts, and the use of an Economic Policy Uncertainty (EPU) Index whose original data contained negative values, an economically unrealistic condition, meaning that even after adjustments, the resulting interpretation still requires caution and certain assumptions. Furthermore, the sample coverage is limited to Islamic commercial banks and does not include Islamic Windows (IW), which may cause the findings to not fully represent the entire landscape of Islamic banking in Indonesia.

Based on the findings and limitations identified in this study, several suggestions can be offered for future research. First, it is necessary to develop more comprehensive and qualitative indicators to measure the depth of AI adoption, for instance through in-depth interviews or surveys of banking stakeholders to capture strategic aspects and implementation maturity not represented by secondary data. Second, future research periods should be extended to cover more complete economic cycles, enabling the analysis of long-term dynamics and the impact of AI across various economic phases to be more robust. Third, the measurement of economic uncertainty needs to be refined by using verified and theoretically meaningful positive indicators, such as the World Uncertainty Index (WUI) or other macroeconomic indicators, to make the estimation results more reliable. Finally, future studies should expand the sample coverage by including Islamic Business Units (IBU) to obtain a more comprehensive picture of AI's impact on the entire Islamic banking entity in Indonesia.

REFERENCES

- Alfianda, V., & Widiyanto, T. (2020). Pengaruh Car, Npf, Fdr Dan Bopo Terhadap Roa Effect of Car, Npf, Fdr and Bopo on Roa. *AKTUAL: Jurnal Akuntansi Dan Keuangan*, 5(2), 137–146.
- Baker, S. R., Bloom, N., & Davis, S. J. (2016). Measuring Economic Policy Uncertainty. *Lecture Notes in Electrical Engineering*, 87 LNEE(VOL. 2), 383–391. https://doi.org/10.1007/978-3-642-19712-3_48
- Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal Management*, 17, 27.
- Beck, T., Demirgüç-Kunt, A., & Merrouche, O. (2013). Islamic vs. conventional banking: Business model, efficiency and stability. *Journal of Banking and Finance*, 37(2), 433–447. <https://doi.org/10.1016/j.jbankfin.2012.09.016>
- Berger, A. N. (2005). The Economic Effects of Technological Progress: Evidence from the Banking Industry. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.332900>
- Boot, A., Hoffmann, P., Central, E., Ratnovski, L., & Central, E. (2020). *Fntech: What's Old, What's New? December*.
- Butt, U., & Chamberlain, T. (2025). Performance of Islamic Banks During the COVID-19 Pandemic: An Empirical Analysis and Comparison with Conventional Banking. *Journal of Risk and Financial Management*, 18(6), 1–25. <https://doi.org/10.3390/jrfm18060308>
- Hamadou, I., Yumna, A., Hamadou, H., & Jallow, M. S. (2024). Unleashing the power of artificial intelligence in Islamic banking: A case study of Bank Syariah Indonesia (BSI). *Modern Finance*, 2(1), 131–144. <https://doi.org/10.61351/mf.v2i1.116>
- Hassan, M. K., & Aliyu, S. (2018). A contemporary survey of islamic banking literature. *Journal of Financial Stability*, 34, 12–43. <https://doi.org/10.1016/j.jfs.2017.11.006>
- IFSB. (2023). *Regulatory Practices in Digital Islamic Banking*. December. www.ifsb.org.
- Iqbal, M. S., Sukanto, F. A. M. S. B., Norizan, S. N. B., Mahmood, S., Fatima, A., & Hashmi, F. (2025). AI in Islamic finance: Global trends, ethical implications, and bibliometric insights. *Review of Islamic Social Finance and Entrepreneurship*, 4(1), 70–85. <https://doi.org/10.20885/risfe.vol4.iss1.art6>
- Irawan, D., Haryadi, & Puspa Arum, E. D. (2019). Analisis Pengaruh NPF, BOPO, CAR, FDR dan NIM Terhadap Return on Asset (ROA) Pada Bank Umum Syariah di Indonesia Tahun 2013-2017. *Jurnal Akuntansi & Keuangan Unja*, 4(1), 1–14. <https://doi.org/10.22437/jaku.v4i1.7424>
- Knight, F. H. (1921). Knight, Frank Hyneman: Risk, Uncertainty, and Profit. In *Die 100 wichtigsten Werke der Ökonomie* (pp. 108–109). <https://doi.org/10.34156/9783791046006-108>
- Lasmiatun, K., & Manteghi, N. (2025). The Impact of Artificial Intelligence (AI) Implementation on Islamic Financial Literacy and Global Economic Changes in the Banking World. *Journal of Lslamic Economics and Bussines Ethics*, 2(1), 23–43. <https://doi.org/10.24235/jiesbi.v2i1.253>

- Maulani, S., Rakhmawati, A., Budiman, M. A., Sadewa, M. M., & Ainun, B. (2025). Artificial Intelligence in Islamic Financial Institutions in Indonesia: A Systematic Literature Review. *International Journal of Economics, Business Management and Accounting (IJEbMA)*, 7(1), 231–246. <https://doi.org/10.59890/ijebma.v7i1.2733>
- McKinsey. (2021). Indonesia and Islamic banking: An interview with Hery Gunardi. *McKinsey & Company, December*, 1–4. <https://www.mckinsey.com/capabilities/m-and-a/our-insights/indonesia-and-islamic-banking-an-interview-with-hery-gunardi#/>
- Meero, A. (2025). *Islamic vs. Conventional Banking in the Age of FinTech and AI: Evolving Business Models, Efficiency, and Stability (2020–2024)*.
- Mohammed, M. O., & Taib, F. M. (2015). Developing Islamic Banking Performance Measures Based on Maqasid Al-Shari'Ah Framework: Cases of 24 Selected Banks. In *Journal of Islamic Monetary Economics and Finance* (Vol. 1, Issue 1, pp. 55–78). <https://doi.org/10.21098/jimf.v1i1.483>
- OJK. (2023). Weekly Statistics Report. *Capital Market Statistics*.
- Rakan, F. (2022). *ROA Bank Umum Syariah Di Indonesia (Studi Pada Tahun 2015-2020)*. 11, 2015–2019.
- Rustandi, & Arifin, A. H. (2024). AI in Finance: A Systematic Literature Review. *Proceeding International Collaborative Conference on Multidisciplinary Science*, 1(2), 323–338. <https://doi.org/10.70062/iccms.v1i2.66>
- Safriatullah, S., Auliadi, R., Amrullah, A., Nurmawati, N., & Jais, M. (2025). Tantangan Implementasi AI di Perbankan Syariah: Perspektif Regulasi dan Etika. *Jurnal Ilmiah Guru Madrasah*, 4(1), 34–51. <https://doi.org/10.69548/jigm.v4i1.40>
- Sarker, I. H. (2022). AI-Based Modeling: Techniques, Applications and Research Issues Towards Automation, Intelligent and Smart Systems. *SN Computer Science*, 3(2), 1–20. <https://doi.org/10.1007/s42979-022-01043-x>
- Shalhoob, H. (2025). The role of AI in enhancing shariah compliance: Efficiency and transparency in Islamic finance. *Journal of Infrastructure, Policy and Development*, 9(1), 11239. <https://doi.org/10.24294/jipd11239>
- Tayachi, T., & Brahimi, T. (2023). Analysis and Visualization of Scientific Research on Islamic Banking and Artificial Intelligence. *IET Conference Proceedings*, 2023(39), 341–352. <https://doi.org/10.1049/icp.2024.0506>
- Teece, D. J. (2007). *Explicating Dynamic Capabilities : The Nature And Microfoundations Of (Sustainable) Enterprise Performance*. 1350(August), 1319–1350. <https://doi.org/10.1002/smj>
- Yuliana, I. R., & Listari, S. (2021). Pengaruh CAR, FDR, Dan BOPO Terhadap ROA Pada Bank Syariah Di Indonesia. *Jurnal Ilmiah Akuntansi Kesatuan*, 9(2), 309–334. <https://doi.org/10.37641/jiakes.v9i2.870>