

The Role of the Board of Trustees in the Era of Artificial Intelligence and Automation

Maudyna Dzakhirah*, Nabila Nuranjani, Ramah Dini Tarigan, Sri Rahayu

Faculty of Economics and Business, Accounting Study Program, Universitas Islam Sumatera Utara, Medan, Indonesia

Jl. Sisingamangaraja No. Kelurahan, Teladan Barat, Kec. Medan Kota, Kota Medan, Sumatera Utara, Indonesia

Email: ^{1*}maudynadzakhirah71@gmail.com, ²nabilanuranjani2006@gmail.com, ³ramadini0311@gmail.com, ⁴sri.rahayu@fe.uisu.ac.id

Correspondence Author Email: maudynadzakhirah71@gmail.com

Submitted: 01/01/2026; Accepted: 07/01/2026; Published: 25/01/2026

Abstract—The development of artificial intelligence and automation has brought significant changes in the operations of Islamic financial institutions, especially in the decision-making process, risk management, and compliance supervision. This transformation presents opportunities to increase efficiency, but at the same time poses new challenges in maintaining compliance with sharia principles. In this context, the role of the Sharia Supervisory Board has become increasingly strategic and demands an adjustment of the supervisory function from a transactional approach to system-based supervision. This study aims to analyze the development of scientific studies related to the role of the Sharia Supervisory Board in the era of artificial intelligence and automation through the Systematic Literature Review approach combined with bibliometric analysis using VOSviewer. Data was obtained from Scopus and Google Scholar-indexed scientific publications for the 2020–2025 period that are relevant to Islamic finance and digital technology. The results of the bibliometric analysis show a significant increase in research on the themes of artificial intelligence, fintech, and Shariah governance, with the main clusters covering sharia governance, digital technology, risk and ethics, sharia financial innovation, and sharia supervision. The content analysis revealed that the Sharia Supervisory Board is required to have a technical understanding of algorithms, data security, and automated systems to ensure sustainable sharia compliance. This research emphasizes the importance of strengthening capacity and a framework for sharia governance that is adaptive to the development of digital technology.

Keywords: Sharia Supervisory Board; Artificial Intelligence; Automation; Shariah Governance; Islamic Finance

1. INTRODUCTION

The development of digital technology in the last five years has brought fundamental changes to the financial services industry, including the Islamic finance sector. The application of artificial intelligence and automation is increasingly widespread in various operational functions of financial institutions, such as financing feasibility analysis, risk management, transaction monitoring, and fraud detection. This technology allows business processes to run faster, more accurately, and more efficiently compared to conventional systems. In the context of Islamic finance, digital transformation is not only seen as a means of improving performance, but also as a serious challenge in maintaining compliance with the principles of sharia that are the basis for the operations of Islamic financial institutions. Islamic finance has special characteristics that distinguish it from the conventional financial system, namely the prohibition of *riba*, *gharar*, and *maysir*, as well as an emphasis on the value of justice, transparency, and benefits. Therefore, any technological innovation applied in Islamic financial institutions must be ensured not to contradict these principles. In this case, the Sharia Supervisory Board holds a strategic role as the party responsible for ensuring sharia compliance in all activities, products, and business processes of Islamic financial institutions. However, the increasing use of automated and algorithm-based systems poses new challenges for sharia supervision mechanisms that have tended to be manual and transactional (Hassan et al., 2020).

A number of studies show that the use of artificial intelligence makes a positive contribution to the efficiency and quality of decision-making in Islamic finance. (Alshater, 2022) explained that artificial intelligence technology is able to increase the effectiveness of risk management, strengthen internal supervisory systems, and support data-based decision-making. These findings are in line with research (Aldasoro et al., 2023) which confirms that financial technology innovation plays an important role in improving the operational resilience of financial institutions. Nonetheless, most of the research still focuses on the technical benefits and operational performance, while its implications for the sharia supervisory function have not been discussed in depth. The application of artificial intelligence and automation also poses new challenges in sharia compliance supervision. Algorithm-based systems, especially those that use machine learning, are adaptive and can change over time based on the data processed. This condition causes the decision-making process to be less transparent and difficult to trace. (Abdullah & Ismail, 2022) emphasized that the digital readiness of Islamic financial institutions must be balanced with strengthening sharia governance, especially in terms of the capacity and competence of the Sharia Supervisory Board. Without an adequate understanding of technology, Sharia Supervisory Boards risk information gaps in assessing the compliance of automated systems with sharia principles.

Research on the digitalization of Islamic finance in the last five years shows that the focus of the study is still fragmented. (Mukhlisin et al., 2021) examines the digitalization of Islamic banking from the perspective of operational efficiency and institutional performance. Meanwhile, (Khan, Mohamed, et al., 2023) discuss the utilization of blockchain technology in the sukuk market, focusing on transaction efficiency and market transparency. On the other hand, (S. Yahaya et al., 2022) highlight the increasing cyber risks and consumer protection challenges as a result of the adoption of digital technology in Islamic financial institutions. Although these studies make important contributions, studies that specifically address the role of the Sharia Supervisory Board in dealing with artificial intelligence and automation are still relatively limited. These limitations show a significant research gap. In an automation-based financial system, the potential for

sharia non-compliance does not only appear at the transaction stage, but also at the stage of system design, data selection, and algorithmic logic used. Without adequate supervision at the system level, sharia violations can occur systematically and are difficult to detect. This indicates that the role of the Sharia Supervisory Board needs to be adjusted, from reactive supervision to more proactive and system-based supervision. Indonesia as a country with the largest Muslim population in the world has great potential in the development of digital Islamic finance. The growth of digital Islamic banks and Islamic fintech is driving the acceleration of the adoption of artificial intelligence and automation. This condition requires strengthening the role of the Sharia Supervisory Board to be able to ensure that technological innovation remains in line with sharia principles. Without strengthening sharia supervision, digital transformation has the potential to pose reputational risks and reduce the level of public trust in the Islamic finance industry.

Based on this background, this study aims to analyze the role of the Sharia Supervisory Board in the era of artificial intelligence and automation through literature review and bibliometric analysis using VOSviewer. This research is important to map the development of research, identify dominant themes and research gaps that are still open, and provide an overview of the direction of development of sharia supervision in the digital era. The contribution of this research is expected to enrich the Islamic financial literature and become a conceptual basis for regulators and practitioners in designing adaptive and sustainable Islamic governance.

2. RESEARCH METHODS

This study uses a qualitative approach through Systematic Literature Review (SLR) combined with bibliometric analysis to obtain a comprehensive overview of the development of the study of the role of the Sharia Supervisory Board (DPS) in the era of artificial intelligence and automation. The data collection process is carried out through two main databases, namely Scopus and Google Scholar, with a publication range of 2020–2025. The literature search uses a combination of keywords such as Shariah Supervisory Board, Sharia Supervisory Board, Shariah governance, artificial intelligence, automation, Islamic finance, and fintech combined using Boolean operators. From the initial search results, the articles were then selected based on inclusion criteria, namely articles from reputable scientific journals, relevant to Islamic finance and digital technology, and explicitly discussed aspects of sharia supervision or governance. Through the process of filtering titles, abstracts, and full texts, 50 selected articles were obtained which were used as the basis for analysis.

Bibliometric analysis was carried out using VOSviewer software to map knowledge structures and research trends through keyword co-occurrence analysis. Metadata from 50 filtered articles was extracted and analyzed using network visualization, overlay visualization, and density visualization to identify dominant thematic clusters, the relationships between concepts, and the dynamics of the development of research topics over time. The results of the bibliometric mapping were further deepened through content analysis to interpret changes in the role of DPS, the challenges of sharia supervision due to the integration of digital technology, and the implications of system-based sharia governance. This combined approach of SLR and bibliometrics allows the research not only to map the research landscape quantitatively, but also to provide an in-depth conceptual understanding of the transformation of sharia supervision in the digital age (van Eck & Waltman, 2010; Donthu et al., 2021).

3. RESULTS AND DISCUSSION

3.1 Results

Bibliometric analysis using VOSviewer was conducted on 50 selected articles published between 2020 and 2025, retrieved from Scopus and Google Scholar, focusing on the role of the Sharia Supervisory Board (SSB/DPS) in the context of artificial intelligence and automation in Islamic finance. Keyword co-occurrence analysis was employed to identify dominant research themes, conceptual linkages, and the evolution of scholarly attention within this field. The minimum occurrence threshold was applied to ensure that only keywords with strong analytical relevance were included in the mapping process.

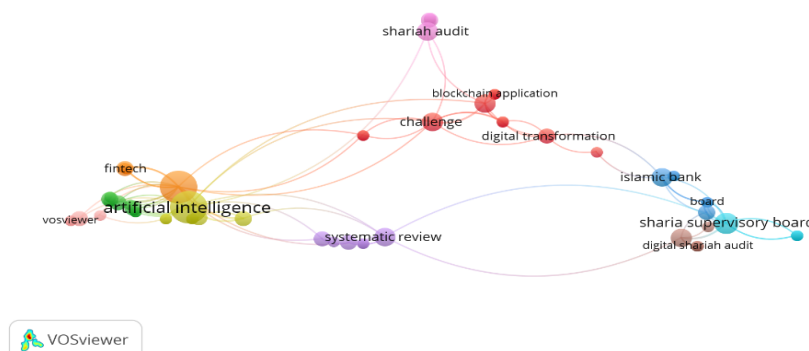


Figure 1. Network Visualization

The network visualization (Figure 1) reveals that Islamic finance and Shariah governance function as the central nodes with the highest total link strength, indicating their pivotal role in structuring the research landscape. Closely connected to these core concepts are keywords such as Sharia Supervisory Board, compliance, and Shariah audit, reflecting the continued emphasis on supervisory mechanisms within Islamic financial institutions. The strong interconnections among these terms suggest that discussions on digital transformation remain firmly anchored in the governance and compliance framework of Islamic finance rather than being treated as purely technical innovations.

Cluster analysis identifies five major thematic clusters. The first cluster centers on Shariah governance, Sharia Supervisory Board, and compliance, highlighting governance as the foundational dimension of the literature. The second cluster focuses on artificial intelligence, fintech, and automation, emphasizing the growing role of algorithm-based systems in financial decision-making and operational processes. A third cluster links risk management, ethics, and data security, indicating scholarly concern over algorithmic opacity, cyber risk, and ethical challenges arising from AI adoption. The fourth cluster relates to Islamic financial innovation, including blockchain and smart contracts, while the fifth cluster connects digital transformation with institutional performance and operational efficiency. This clustering structure is fully consistent with the thematic descriptions presented in the uploaded manuscript.

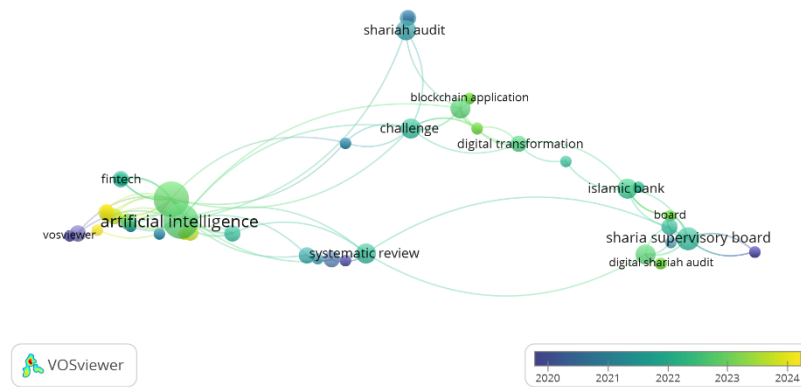


Figure 2. Overlay Visualization

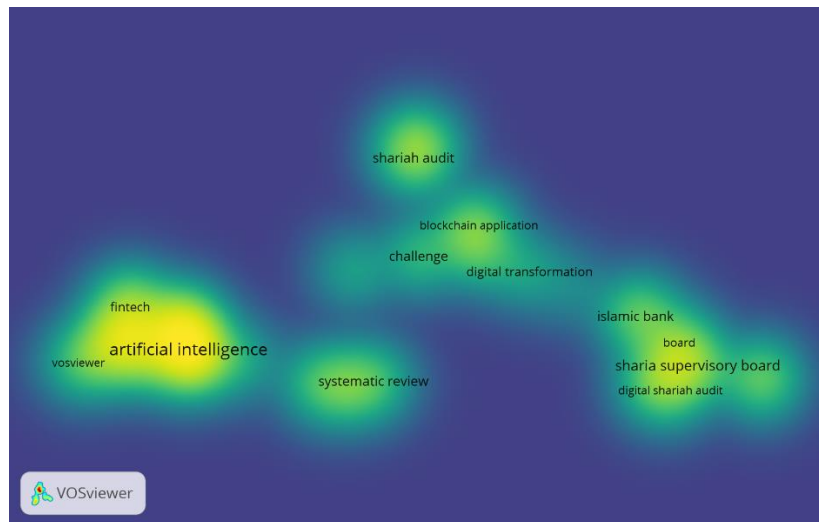


Figure 3. Density Visualization

The overlay visualization (Figure 3.) demonstrates a clear temporal shift in research focus. Earlier studies (2020–2021) predominantly addressed Islamic banking, Shariah compliance, and governance frameworks, while more recent publications (2023–2025) increasingly emphasize artificial intelligence, automation, fintech, and digital Shariah audit. This trend indicates a transition from conceptual and regulatory discussions toward applied and system-based governance issues. Meanwhile, the density visualization (Figure 3.3) shows the highest concentration around Shariah governance, Islamic finance, and artificial intelligence, confirming that these topics represent the most intensively researched areas. Collectively, these results suggest that the role of the Sharia Supervisory Board is evolving from transactional oversight toward system-level and technology-informed supervision, aligning with the conclusions drawn in the main body of the article.

3.2 Discussion

The findings of the VOSviewer analysis indicate that the rapid adoption of artificial intelligence (AI), automation, and fintech in Islamic financial institutions has not diminished the importance of Shariah governance; instead, it has reinforced

the strategic role of the Sharia Supervisory Board (SSB). The dominance of keywords such as Shariah governance, compliance, and Islamic finance in the network visualization confirms that governance remains the conceptual backbone of digital transformation in Islamic finance (Hassan et al., 2020; Wahab, 2020; Yusoff, 2022). This result aligns with prior studies suggesting that technological innovation in Islamic finance must be anchored in robust Shariah oversight to maintain legitimacy and stakeholder trust (Karim, 2022; Aliyu, 2023; Kasri & Ath Thahirah, 2023). Thus, AI-driven systems are increasingly viewed not as substitutes for Shariah supervision, but as domains requiring deeper and more specialized supervisory engagement.

The cluster structure further reveals a strong linkage between AI, fintech, and risk management, highlighting the growing reliance on algorithm-based decision-making in Islamic financial operations. Previous empirical and conceptual studies have demonstrated that AI enhances efficiency in credit assessment, fraud detection, and risk mitigation; however, these benefits are accompanied by heightened governance risks, particularly related to algorithmic opacity and adaptive machine learning systems (Alshater, 2022; Aldasoro et al., 2023; Farooq & Rahman, 2022). From a Shariah perspective, such opacity may conflict with principles of transparency and fairness, thereby necessitating a more system-oriented supervisory approach (Abdullah & Ismail, 2022; Sani, 2024). The results suggest that effective Shariah supervision in the digital era must extend beyond transactional review to encompass algorithm design, data selection, and model validation processes.

Overlay visualization results indicate a temporal shift in the literature from general discussions on Islamic banking and governance toward more specialized themes such as AI governance, digital Shariah audit, and ethical risk. This evolution reflects a maturation of the research field, where scholars increasingly recognize the need to address second-order effects of digitalization, including bias, cybersecurity risks, and data privacy concerns (Yahaya & Osman, 2022; Yahaya et al., 2022; Aldasoro et al., 2023). Recent studies argue that without adequate technological literacy, SSBs face information asymmetry that weakens their supervisory effectiveness (Aliyu, 2023; Huda & Abdullah, 2022). Consequently, the literature converges on the view that capacity building and continuous upskilling of SSB members are critical prerequisites for sustainable Shariah governance in AI-enabled environments.

At the same time, the findings highlight significant opportunities for strengthening Shariah supervision through digital tools. Several studies emphasize that AI-assisted Shariah audits, automated compliance monitoring, and blockchain-based transaction records can enhance audit accuracy, timeliness, and transparency (Khan et al., 2023; Farooq & Rahman, 2022; Rahman & Fauzi, 2021). These innovations may reduce human error and improve consistency in Shariah compliance assessment, provided that they are embedded within a well-defined governance framework (Wahab, 2020; Hassan et al., 2020). However, the literature also cautions that technological solutions should complement, rather than replace, human judgment, particularly in areas requiring ethical interpretation and *maqasid al-shariah* considerations (Sani, 2024; Karim, 2022).

Overall, this study reinforces the argument that the role of the Sharia Supervisory Board is undergoing a structural transformation in the era of artificial intelligence and automation. The bibliometric evidence suggests a shift from reactive, transaction-based supervision toward proactive, system-based governance that integrates technological, ethical, and Shariah dimensions. While this transformation presents challenges related to skills, institutional readiness, and regulatory alignment, it also offers substantial opportunities to enhance the effectiveness and credibility of Shariah governance (Donthu et al., 2021; van Eck & Waltman, 2010; Zupic & Čater, 2015). Future research should therefore focus on developing integrated frameworks for AI governance in Islamic finance that align technological innovation with Shariah principles and sustainability objectives, ensuring the long-term integrity and resilience of the Islamic financial system.

4. CONCLUSION

This study examines the evolving role of the Sharia Supervisory Board (SSB) in the era of artificial intelligence (AI) and automation within Islamic financial institutions through a Systematic Literature Review combined with bibliometric analysis using VOSviewer. Based on 50 selected articles published between 2020 and 2025 from Scopus and Google Scholar, the findings indicate a substantial increase in academic attention to digital transformation, fintech, and AI-driven governance in Islamic finance. The bibliometric results confirm that Shariah governance remains the core foundation of the research landscape, closely linked with compliance, risk management, ethics, and technological innovation. Rather than reducing the relevance of Shariah supervision, AI and automation have expanded the scope and strategic importance of the SSB. The study reveals a clear shift from traditional, transaction-based supervision toward system-based oversight that encompasses algorithm design, data governance, and automated decision-making processes. This transformation reflects growing concerns over algorithmic opacity, bias, cybersecurity, and data privacy, which pose new risks to Shariah compliance if not properly governed. At the same time, technological innovation offers significant opportunities to strengthen Shariah supervision through AI-assisted audits, automated compliance monitoring, and blockchain-enabled transparency, potentially improving efficiency and consistency in supervisory practices. Overall, the study concludes that enhancing the technical literacy of SSB members, promoting interdisciplinary collaboration between Shariah scholars and technology experts, and developing adaptive Shariah governance frameworks are critical for ensuring the sustainability and credibility of Islamic finance in the digital era. Although limited to secondary data and bibliometric methods, this research provides a structured overview of current scholarly trends and identifies key gaps for future empirical research on operationalizing AI governance in alignment with Shariah principles and *maqasid*-based objectives.

REFERENCES

- Abdullah, N., & Ismail, S. (2022). Digital readiness and Shariah compliance governance in Islamic financial institutions. *Journal of Islamic Accounting and Business Research*, 13(4), 589–606.
- Aldasoro, I., Gambacorta, L., & Whyte, K. (2023). Fintech innovation and operational resilience: Evidence from global financial institutions. *Journal of Financial Stability*, 65, 101123. <https://doi.org/10.1016/j.jfs.2023.101123>
- Aldasoro, I., Gambacorta, L., Giudici, P., & Leach, T. (2023). The role of big data and advanced analytics in financial supervision. *Journal of Financial Stability*, 65, 101088. <https://doi.org/10.1016/j.jfs.2023.101088>
- Aliyu, S. (2023). Artificial intelligence readiness and implications for Islamic finance governance. *International Journal of Islamic Economics and Finance Studies*, 9(1), 45–60.
- Alshater, M. M. (2022). Artificial intelligence in Islamic finance: A systematic literature review and future research agenda. *Journal of Islamic Accounting and Business Research*, 13(4), 553–576. <https://doi.org/10.1108/JIABR-10-2020-0311>
- Arifa. (2025). Artificial intelligence (AI) in Islamic accounting: Opportunities, challenges, and solutions based on Islamic ethics. *Balance: Journal of Accounting and Finance*, 267–290.
- Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research*, 133, 285–296. <https://doi.org/10.1016/j.jbusres.2021.04.070>
- Fadillah, A., Nasution, S. N. R., Intan, S. M., & Rahayu, S. (2025). Green sukuk dan investasi berkelanjutan dalam perspektif ekonomi syariah: Peluang, tantangan, dan inovasi pasar modal Islam global. *Prosiding Seminar Nasional Teknologi Komputer dan Sains (SAINTEKS)*, 3(1), 89–96.
- Farooq, M., & Rahman, A. (2022). Artificial intelligence assisted Shariah audit: Opportunities and challenges. *Journal of Islamic Accounting Research*, 4(2), 89–105.
- Farooq, M., & Rahman, A. (2022). Digital transformation and operational enhancement in Islamic banks. *International Journal of Islamic Business and Management*, 6(3), 1–15.
- Hassan, M. K., Aliyu, S., & Huda, M. (2020). Shariah governance challenges in Islamic financial institutions. *International Journal of Islamic and Middle Eastern Finance and Management*, 13(3), 453–472. <https://doi.org/10.1108/IMEFM-11-2018-0371>
- Huda, N., & Abdullah, A. (2022). System-based Shariah audit in digital finance. *Journal of Islamic Finance*, 7(2), 51–62.
- Khan, M. A., Hassan, M. K., & Rabbani, M. R. (2023). Fintech, blockchain, and the future of Islamic finance. *Journal of Islamic Monetary Economics and Finance*, 9(2), 251–274. <https://doi.org/10.21098/jimf.v9i2.1650>
- Khan, M., Hassan, R., & Rahman, A. (2023). Blockchain technology adoption in sukuk structuring and markets. *Journal of Islamic Finance*, 12(1), 45–62.
- Khan, M., Mohamed, S., & Yusof, R. (2023). Blockchain application in sukuk markets: Opportunities and regulatory concerns. *Pacific-Basin Finance Journal*, 78, 102003. <https://doi.org/10.1016/j.pacfin.2023.102003>
- Kitchenham, B., & Charters, S. (2007). Guidelines for performing systematic literature reviews in software engineering. EBSE Technical Report.
- Kurnianingsih, H. T., Rahayu, S., Nainggolan, F. R., Chandra, R., & Harahap, F. (2024). Pengaruh etika dan tata kelola perusahaan terhadap pengungkapan laporan keuangan. *Brilian Dinamis Akuntansi Audit*, 6(3).
- Mukhlisin, M., Haron, R., & Kassim, S. (2021). Efficiency of Islamic digital banking: Empirical evidence from Southeast Asia. *International Journal of Islamic and Middle Eastern Finance and Management*, 14(2), 234–250.
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., et al. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, 372, n71. <https://doi.org/10.1136/bmj.n71>
- Parlindungan, P., Kurniawan, H., Gunawan, R., & Rahayu, S. (2025). Ekonomi hijau dalam perspektif ekonomi syariah: Solusi untuk pembangunan berkelanjutan. *Prosiding Seminar Nasional Teknologi Komputer dan Sains (SAINTEKS)*, 3(1), 1–8.
- Pertiwi, I. D., Yani, M., & Rahayu, S. (2025). Green sukuk dan pembiayaan berkelanjutan: Analisis empiris terhadap efektivitas instrumen keuangan Islam dalam mendukung transisi energi bersih. *Prosiding Seminar Nasional Teknologi Komputer dan Sains (SAINTEKS)*, 3(1), 81–88.
- Rahayu, S. (2019). Kualitas informasi akuntansi dan tingkat penerimaan dana zakat pada lembaga amil zakat di Kota Medan. *Jurnal Investasi Islam*, 4(2), 116–126.
- Rahayu, S. (2021). Problematika implementasi akuntabilitas keuangan Badan Amil Zakat Nasional (BAZNAS) di Sumatera dengan pendekatan analytic network process (ANP) (Disertasi doctoral). Universitas Islam Negeri Sumatera Utara, Medan.
- Rahayu, S., Ismail, I., Sitompul, S., & Nurhudawi, N. (2025). Akuntabilitas dan transparansi pengelolaan keuangan masjid. *Jurnal Manajemen dan Akuntansi Medan*, 7(1).
- Rahayu, S., Sarifah Tullah, D., Suginam, S., & Nur, S. (2025). Digitalisasi, artificial intelligence, dan kualitas layanan di bank syariah: Kepuasan dan pengetahuan nasabah sebagai mediator paralel terhadap kinerja keuangan yang dirasakan nasabah. *JlAKES: Jurnal Ilmiah Akuntansi & Keuangan Syariah*, 13(3).
- Rahman, A., & Fauzi, F. (2021). Smart contracts in Islamic finance: Shariah opportunities and challenges. *Journal of Islamic Economics, Banking and Finance*, 17(2), 23–38.
- Sani, A. (2024). Ethical considerations of AI in Islamic finance: A maqasid-based perspective. *Journal of Islamic Ethics and Technology*, 3(1), 11–29.
- Sembiring, P. B., Rahayu, S., & Effendi, S. (2025). Efisiensi kinerja keuangan Badan Amil Zakat Nasional (BAZNAS) di Provinsi Sumatera Utara. *Jurnal Keuangan dan Manajemen*, 6(2), 805–816.
- Siregar, D., Rahayu, S., Saputra, I., Sari, D. P., & Sari, V. W. (2025). Peningkatan daya saing UMKM kerajinan lokal melalui penerapan konsep bluepreneur berbasis sumber daya ramah lingkungan. *Buletin Pengabdian Masyarakat ADA*.
- Suginam, N. H., Pamungkas, B., & Rahayu, S. (2025). Integrasi nilai-nilai Islam dan strategi keuangan: Peran manajemen keuangan berbasis syariah dalam meningkatkan kinerja UMKM Muslim. *Jurnal Ilmiah Akuntansi Kesatuan*.
- Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management*, 14(3), 207–222. <https://doi.org/10.1111/1467-8551.00375>
- van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, 84(2), 523–538. <https://doi.org/10.1007/s11192-009-0146-3>

- Wahab, A. A. (2020). Shariah governance framework in Islamic financial institutions. *Journal of Islamic Accounting and Business Research*, 11(2), 405–423. <https://doi.org/10.1108/JIABR-07-2018-0104>
- Yahaya, M. H., & Osman, A. (2022). Cybersecurity, data protection, and Shariah compliance in digital Islamic finance. *Journal of Islamic Financial Studies*, 8(2), 66–79.
- Yahaya, S., Ibrahim, A., & Osman, Z. (2022). Cybersecurity risks and digital governance in Islamic banks. *International Journal of Islamic Economics and Finance Studies*, 8(2), 120–138.
- Zupic, I., & Čater, T. (2015). Bibliometric methods in management and organization. *Organizational Research Methods*, 18(3), 429–472. <https://doi.org/10.1177/1094428114562629>