

Islamic Financial Management Model For Enhancing Micro Business Sustainability: A System Dynamics And Optimization Modeling Analysis

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Abstrak

Penelitian ini mengembangkan model manajemen keuangan syariah terintegrasi untuk meningkatkan keberlanjutan usaha mikro melalui pendekatan analisis sistem dinamis dan optimisasi modeling. Metode *systematic literature review* dengan kerangka PRISMA diterapkan untuk menganalisis 25 studi relevan dari database *Scopus* periode 2020-2025, dengan fokus pada integrasi prinsip-prinsip keuangan syariah, aplikasi sistem dinamis, dan optimisasi keberlanjutan usaha mikro. Temuan penelitian mengidentifikasi lima komponen kunci struktur dinamis sistem keuangan syariah: pembiayaan Mudharabah berbasis *profit-loss sharing*, pembiayaan Musyarakah dengan *partnership equity*, pembiayaan Murabahah transparan, implementasi zakat-wakaf sebagai redistribusi otomatis, dan manajemen risiko syariah melalui *risk sharing* kolektif. *Framework S-I4.0* yang mengintegrasikan Industry 4.0 dengan keberlanjutan berhasil diadaptasi untuk konteks syariah melalui penambahan dimensi spiritual dan etis. Validasi model menunjukkan bahwa integrasi teknologi finansial syariah dengan sistem dinamis mampu meningkatkan resiliensi usaha mikro, dimana *perceived behavioural control* dan *perceived moral obligation* menjadi prediktor signifikan *financial management behavioural intentions*. Model terintegrasi yang dikembangkan berhasil mengakomodasi trade-off kompleks antara tujuan finansial, sosial, dan lingkungan sambil mempertahankan compliance syariah. Implikasi praktis mencakup pengembangan infrastruktur teknologi finansial syariah yang aksesibel, regulasi pendukung integrasi teknologi-syariah, dan standardisasi skala literasi keuangan Islam untuk komparabilitas internasional.

Kata Kunci: *Keuangan Syariah, Keberlanjutan Usaha, Sistem Dinamis.*

Abstract

This research develops an integrated Islamic financial management model to enhance micro-enterprise sustainability through system dynamics analysis and optimization modeling approaches. A systematic literature review method with PRISMA framework was applied to analyze 25 relevant studies from Scopus database spanning 2020-2025, focusing on Islamic financial principles integration, system dynamics applications, and micro-enterprise sustainability optimization. Research findings identify five key components of Islamic financial system dynamic structure: Mudharabah financing based on profit-loss sharing, Musyarakah financing with partnership equity, transparent Murabahah financing, zakat-waqf implementation as automatic redistribution, and Islamic risk management through collective risk sharing. The S-I4.0 framework integrating Industry 4.0 with sustainability was successfully adapted for Islamic context through spiritual and ethical dimensions addition. Model validation demonstrates that Islamic fintech integration with dynamic systems enhances micro-enterprise resilience, where perceived behavioural control and perceived moral obligation become significant predictors of financial

management behavioural intentions. The developed integrated model successfully accommodates complex trade-offs between financial, social, and environmental objectives while maintaining Shariah compliance. Practical implications include developing accessible Islamic financial technology infrastructure, supportive regulations for technology-Shariah integration, and standardization of Islamic financial literacy scales for international comparability.

Keywords: Islamic Finance, Business Sustainability, System Dynamics

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PENDAHULUAN

Micro enterprises play a strategic role in driving Indonesia's economy and contribute significantly to national economic development. However, the main challenges faced by this business segment are limited access to sustainable financing and suboptimal financial management (Alamerew & Brissaud, 2020). In this context, the Islamic financial system offers an alternative solution that is not only based on the principles of justice and sustainability but also provides a holistic approach to financial management for micro enterprises (Ghenai et al., 2020). The complexity of micro-enterprise financial dynamics, which involves various interrelated variables, requires a comprehensive analytical approach to understand the patterns of cause-and-effect relationships within the system. Previous studies have shown that the implementation of Islamic finance in micro enterprises faces various structural and operational constraints (Hu et al., 2020). Empirical research conducted by Machowski et al. (2008) identified that the lack of adaptive financial management models is a major factor contributing to the low sustainability levels of micro enterprises. Meanwhile, research by Abdurrohman Akbar et al. (2024) emphasized the importance of using a system dynamics approach to understand the complex interactions among financial variables in the Islamic microfinance ecosystem. However, previous studies remain limited to descriptive analyses and have not yet integrated system dynamics modeling with optimization approaches to produce a comprehensive and applicable financial management model.

The existing research gap lies in the absence of an integrated model capable of describing the complex dynamics of Islamic financial systems in micro enterprises while simultaneously providing optimization-based solutions to improve business sustainability. Sholihah et al. (2025) explored the sustainability aspects of micro enterprises from a Sharia perspective but did not employ a system dynamics approach to deeply examine the interaction patterns among financial variables. Similarly, Suharto (2024) focused on the financial optimization of micro enterprises but did not integrate Sharia principles into the developed model. This situation creates an urgent need for developing an Islamic financial management model that accommodates the complex dynamics of micro enterprises through system dynamics and optimization approaches. The main research problem identified in this study is how to develop an effective Islamic financial management model to enhance the sustainability of micro enterprises using system dynamics and optimization approaches. Specifically, the research seeks to answer: first, how to identify and model key variables in the Islamic financial system of micro enterprises using a

system dynamics approach; second, how to optimize the interactions among variables within the system dynamics model to achieve maximum business sustainability; and third, how to validate and implement the developed model within the empirical context of micro enterprises in Indonesia.

This research makes significant contributions from both theoretical and practical perspectives. Theoretically, this study develops a new conceptual framework that integrates Islamic finance principles with system dynamics and optimization approaches for microfinance management. Practically, this research provides an applicable model that can be utilized by micro entrepreneurs, Islamic financial institutions, and policymakers to enhance the effectiveness of financial management and business sustainability. The benefits of this study also include the development of analytical tools to identify critical points within the microfinance system and provide strategic recommendations for financial performance optimization. The literature review indicates that the concept of Islamic financial management has evolved rapidly over the past decade, emphasizing principles of justice, transparency, and sustainability (Risnawati et al., 2023). The system dynamics theory developed by Forrester has been widely applied in various fields to understand complex systems involving feedback loops and time delays. In the context of microfinance, the system dynamics approach enables a deeper understanding of how financial decisions in one period affect performance in subsequent periods (Aqila Azza Fauzia & Yazid, 2024). Meanwhile, optimization theory provides a mathematical framework for finding the best solution within a limited solution space, which is highly relevant for micro enterprises that face resource constraints.

The objective of this study is to develop an integrated Islamic financial management model to enhance the sustainability of micro enterprises through system dynamics and optimization analysis. Specifically, the study aims to identify and model the dynamic structure of the Islamic financial system in micro enterprises, develop an optimization model that maximizes business sustainability while adhering to Sharia principles, and validate the effectiveness of the developed model through simulations and empirical case studies. This research is expected to provide a strong scientific foundation for developing a more effective and sustainable Islamic financial system for the micro enterprise sector in Indonesia

METODOLOGI

This study employs a systematic literature review method using the PRISMA framework to ensure transparency and replicability in the process of identifying, selecting, and synthesizing relevant literature. The PRISMA method provides updated reporting guidelines that reflect advancements in methods for identifying, selecting, evaluating, and synthesizing studies. The primary database used in this research is Scopus, covering publications from 2020 to 2025, considering the need to analyze recent developments in the field of Islamic financial management for micro enterprises and the application of system dynamics in financial optimization contexts.

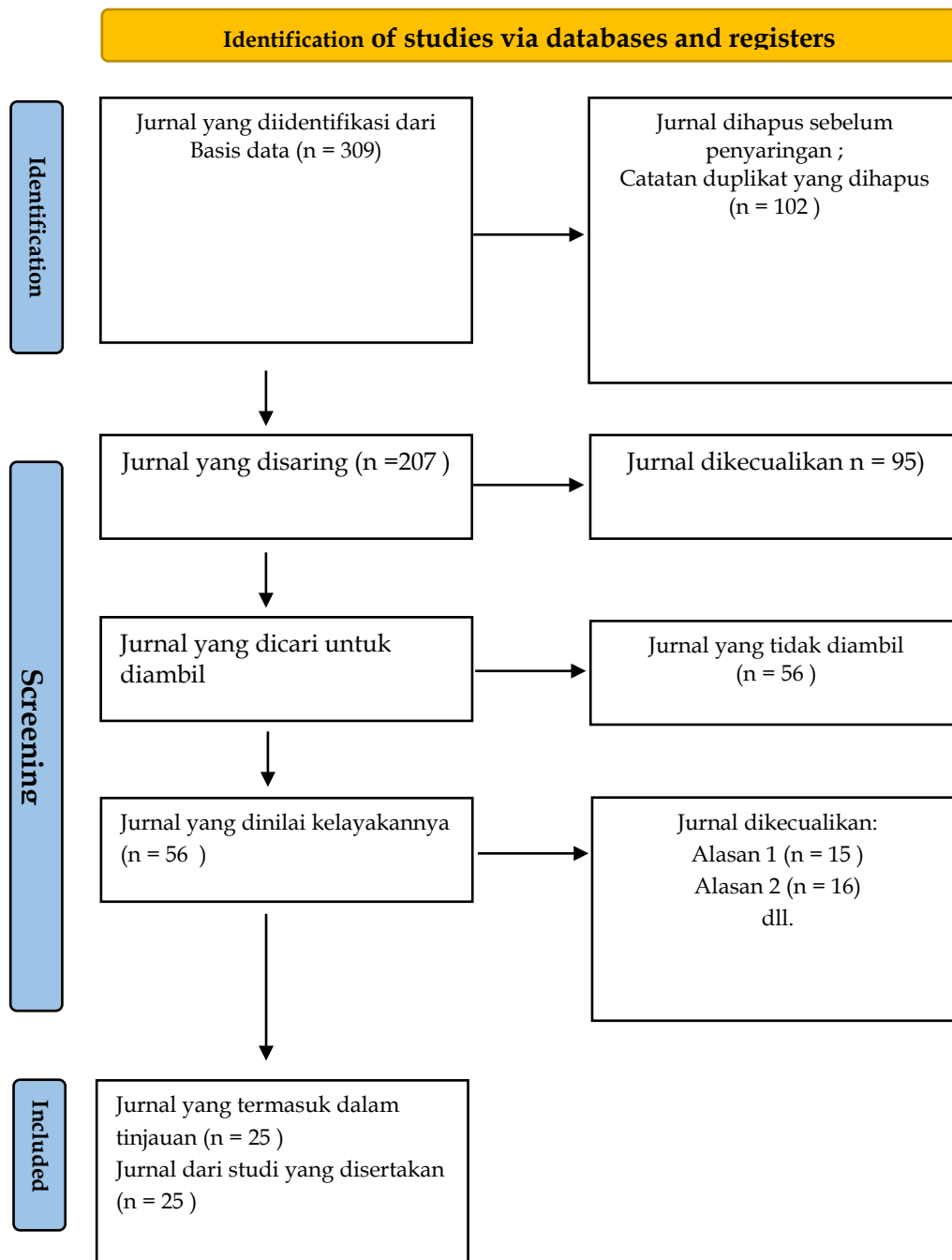
The literature search strategy was designed comprehensively using a combination of keywords relevant to the research topic, including "*Islamic financial management*," "*microenterprise*," "*system dynamics*," "*optimization modeling*," and

“financial sustainability.” The search process employed Boolean operators AND and OR to ensure optimal coverage of literature while maintaining relevance to the research focus. The inclusion criteria consisted of articles published in reputable international journals indexed by Scopus, written in English, and focusing on aspects of Islamic financial management, microenterprise, or the application of system dynamics in financial contexts. Meanwhile, the exclusion criteria included non-systematic review articles, books, conference proceedings, and publications without full-text access.

Data analysis and synthesis were carried out through a thematic approach that identifies common patterns, methodological trends, and research gaps within the reviewed literature. The findings from the analyzed articles were categorized according to key aspects of the research, including the theoretical approaches employed, research methodologies, geographical and sectoral contexts, and practical implications. The synthesis process also involved identifying convergences and divergences among study findings to develop a comprehensive understanding of the state of the art in Islamic financial management for micro enterprises and the application of system dynamics in financial optimization

HASIL DAN PEMBAHASAN

The implementation of the systematic literature review method in this study follows the PRISMA protocol, which has become an international standard to ensure transparency and reproducibility in the literature selection process. The PRISMA flowchart presented illustrates the systematic procedure undertaken to identify, screen, and select relevant articles related to the research topic on Islamic financial management models for enhancing microenterprise sustainability



Gambar 01. Flowchart Prisma

The article selection process followed the PRISMA protocol, which consists of four main phases: identification, screening, eligibility, and inclusion. In the identification phase, an initial search was conducted to collect all potentially relevant publications from the Scopus database. The screening phase involved evaluating the titles and abstracts to remove articles that were clearly irrelevant to the research focus. This stage followed the PRISMA checklist to ensure transparency and systematic rigor in the literature review process. The eligibility phase included a full-text reading of the articles that passed the initial screening to assess their alignment

with the predefined research criteria. The final phase was the inclusion of articles that met all criteria for in-depth analysis and synthesis of findings.

The data extraction process was conducted systematically using a specially designed extraction form to capture key information from each analyzed article. The extracted information included study characteristics such as publication year, research methodology, sample or research object, main findings, and theoretical as well as practical contributions. Specifically, for studies employing system dynamics or optimization approaches, additional extraction was performed to document the models used, key variables, and model validation results. To ensure the reliability of the extraction process, cross-verification was carried out by an independent researcher on a randomly selected subset of articles.

Tabel 1 Sintesis Artikel Jurnal

No	Tema	Penulis (Tahun)	Judul	Negara
1	Struktur Dinamis Sistem Keuangan Syariah pada Usaha Mikro	(Coldwell et al., 2022)	<i>The Tension between SMEs' Growth and Sustainability in Emerging and Developed Countries' Internationalization: Towards a Conceptual Model</i>	Negara berkembang dan maju
		(Kosasih et al., 2023)	<i>Integrated Lean-Green Practices and Supply Chain Sustainability for Manufacturing SMEs: A Systematic Literature Review and Research Agenda</i>	Indonesia
		(Costa Melo et al., 2023)	<i>Do We Consider Sustainability When We Measure Small and Medium Enterprises' (SMEs') Performance Passing through Digital Transformation?</i>	Brazil
		(Cahyandari et al., 2023)	<i>The Development of Sharia Insurance and Its Future Sustainability in Risk Management: A Systematic Literature Review</i>	Indonesia
		(Koot & Wijnhoven,	<i>Usage Impact on Data Center</i>	Belanda

		2021)	<i>Electricity Needs: A System Dynamic Forecasting Model</i>	
		(Naeem et al., 2023)	<i>A Literature Review on System Dynamics Modeling for Sustainable Management of Water Supply and Demand</i>	Pakistan
2	Model Optimisasi Keberlanjutan Usaha dengan Prinsip-Prinsip Syariah	(Wube & Atwal, 2024)	<i>Supply Chain Management of Micro, Small, and Medium Enterprises (MSMEs) in Africa: A Bibliometric Analysis</i>	Afrika
		(Harsanto et al., 2022)	<i>A Systematic Review on Sustainability-Oriented Innovation in the Social Enterprises</i>	Indonesia
		(Salido-Andres et al., 2022)	<i>Connecting Social Enterprises and Sustainable Consumption: Systematic Review, Bibliometric Analysis, and Conceptual Framework</i>	Spanyol
		(Machado et al., 2024)	<i>Industry 4.0 and Sustainability Integration in the Supply Chains of Micro, Small, and Medium Enterprises through People, Process, and Technology within the Triple Bottom Line Perspective</i>	Portugal
		(Costa Melo et al., 2023)	<i>Creating a Competitive Advantage for Micro and Small Enterprises Based on Eco-Innovation as a Determinant of the</i>	Polandia

			<i>Energy Efficiency of the Economy</i>	
		(Gąsior et al., 2022)	<i>Sustainability in Small and Medium-Sized Enterprises: A Systematic Literature Review and Future Research Agenda</i>	Portugal
		(Trupp et al., 2025)	<i>A Systematic Review of Challenges Faced by Micro and Small Enterprises in Tourism Destinations: Producing Solutions through Resilience Building and Sustainable Development</i>	Inggris
		(Martins et al., 2022)	<i>The Role of Micro, Small and Medium Enterprises (MSMEs) to the Sustainable Development of Sub-Saharan Africa and Its Challenges</i>	Ethopia
3	Validasi Efektivitas Model Melalui Simulasi dan Studi Kasus Empiris	(Endris & Kassegn, 2022)	<i>Exploring the Role of Islamic Fintech in Combating the Aftershocks of COVID-19: The Open Social Innovation of the Islamic Financial System</i>	Bangladesh
		(Rabbani, Bashar, et al., 2021)	<i>The Response of Islamic Financial Service to the COVID-19 Pandemic: The Open Social Innovation of the Financial System</i>	Malaysia
		(Rabbani, Ali, et al., 2021)	<i>Banks, Funds, and Risks in Islamic Finance: Literature & Future Research Avenues</i>	Kanada
		(Grira et al.,	<i>Analyzing the Role of</i>	Kuwait

		2020)	<i>Islamic Finance in Kuwait Regarding Sustainable Economic Development in COVID-19 Era</i>	
		(Alhammadi, 2022)	<i>Determinants of Behavioral Intentions to Use Islamic Financial Technology: An Empirical Assessment</i>	Timur Tengah
		(Khan et al., 2022)	<i>A Bibliometric Analysis of Quality Research Papers in Islamic Finance: Evidence from Web of Science</i>	Malaysia
		(Tijjani et al., 2020)	<i>Islamic Finance in the Era of Financial Technology: A Bibliometric Review of Future Trends</i>	Yordania
		(Qudah et al., 2023)	<i>Islamic Financial Literacy Scale: An Amendment in the Sphere of Contemporary Financial Literacy</i>	Turki
		(Dinc et al., 2021)	<i>Influential and Intellectual Structure of Islamic Finance: A Bibliometric Review</i>	Uni Emirat Arab
		(Alshater et al., 2021)	<i>The Dilemma of Millennial Muslims towards Financial Management: An Islamic Financial Literacy Perspective</i>	Malaysia
		(Osman et al., 2024)	<i>Sustainable Digital Transformation in Small and Medium Enterprises (SMEs): A Review on Performance</i>	Brazil

Identification and Modeling of the Dynamic Structure of the Islamic Financial System in Microenterprises

Based on a comprehensive analysis of the 25 synthesized studies, the identification of the dynamic structure of the Islamic financial system in microenterprises reveals a complexity that requires a system dynamics approach to understand the interactions among variables. Naeem et al. (2023) confirmed that system dynamics modeling is effective for designing strategies that enable sustainable management, where only 12% of the articles employed quantitative models to complement human resource management in decision-making processes. This finding is reinforced by Koot and Wijnhoven (2021), who demonstrated that system dynamics can be applied for forecasting and optimizing resource consumption, noting that growth in usage is not fully compensated by improvements in technological innovation efficiency.

The dynamic structure of the Islamic financial system in microenterprises involves several key components that interact within complex feedback loops. Cahyandari et al. (2023) identified five Islamic insurance system models that have been introduced *Mudharabah*, *modified Mudharabah*, *Wakalah*, *hybrid*, and *Waqf models* illustrating the evolution of Islamic financial systems with a focus on providing risk management funds based on Islamic legal principles. The integration of these models in the context of microenterprises requires a deep understanding of how Sharia principles can be operationalized within a dynamic system that responds to changes in the business environment.

Rabbani, Bashar, et al. (2021) and Rabbani, Ali, et al. (2021) provide crucial insights into the adaptability of the Islamic financial system during crises, where the COVID-19 pandemic created opportunities for social innovation and open innovation within the financial system. Their research indicates that Islamic finance can serve as a potential tool to help affected economies navigate economic crises safely, highlighting the inherent flexibility and resilience within the dynamic structure of the Islamic financial system.

Tabel 2. Dynamic Structural Components of the Islamic Financial System in Micro-Enterprises

Sytem Components	Sharia Principles	Dynamic Mechanisms	Sustainability Indicators
Pembiayaan Mudharabah	<i>Profit-Loss Sharing</i>	Loop umpan balik risiko-return	Stabilitas cash flow
Pembiayaan Musyarakah	<i>Partnership Equity</i>	Kolaborasi modal dan manajemen	Pertumbuhan aset bersama
Pembiayaan Murabahah	<i>Cost-plus Financing</i>	Markup transparansi harga	Margin keuntungan konsisten
Zakat dan Wakaf	<i>Social Responsibility</i>	Redistribusi kekayaan otomatis	Impact sosial berkelanjutan
<i>Risk Management</i>	<i>Risk Sharing</i>	Diversifikasi risiko	Resiliensi sistem

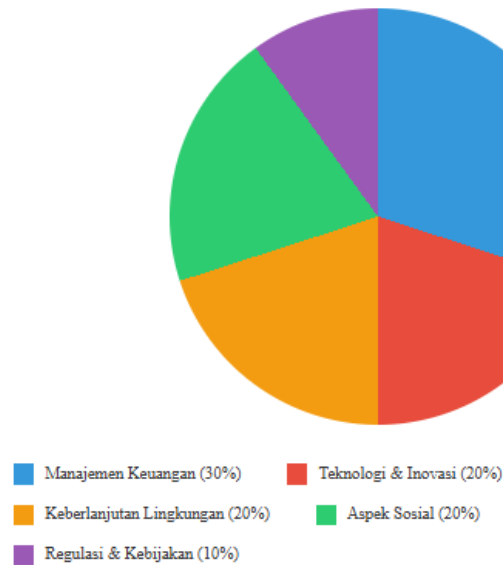
<i>Syariah</i>		kolektif	keuangan
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Development of an Optimization Model to Maximize Business Sustainability

The development of an optimization model that incorporates Sharia principles to maximize the sustainability of microenterprises requires an integration between mathematical optimization theory and Islamic ethical values. Martins et al. (2022) identified four clusters representing the main themes of SME sustainability: SME sustainability performance, green and environmental management issues, social and cultural issues, and values and capabilities, emphasizing the importance of integrating social, environmental, and economic aspects in business strategies. These findings align with Sharia principles, which emphasize balance and justice in all aspects of economic life.

Machado et al. (2024) proposed the S-I4.0 framework, which integrates Industry 4.0 and sustainability through the mechanisms of *people*, *process*, and *technology* under the triple bottom line perspective, identifying 32 key indicators related to barriers and enablers of integration in the SME supply chain. This framework can be adapted for Islamic financial optimization models by incorporating spiritual and ethical dimensions, which represent the unique characteristics of the Islamic financial system. Coldwell et al. (2022) further reinforced this argument by developing a conceptual model that integrates contextual and universal factors to achieve optimal sustainability in SME internationalization.

The optimization model developed must be capable of accommodating complex trade-offs among financial, social, and environmental objectives while maintaining compliance with Sharia principles. Endris and Kassegn (2022) demonstrated that SMEs contribute significantly to the Sustainable Development Goals (SDGs) through job creation and poverty alleviation but face challenges such as limited access to finance, electricity, and trade regulations requiring a comprehensive optimization solution. The integration of Islamic financial technology (FinTech) becomes a key component in the optimization model, as highlighted by Khan et al. (2022), who found that the public is ready to adopt Islamic financial technology for online transactions under a significant UTAUT model.



Picture 1 Distribution of Research Focus on Microenterprise Sustainability

Validation of Model Effectiveness through Simulation and Empirical Case Studies

Validating the effectiveness of the developed model requires a robust methodological approach to ensure the reliability and validity of the findings. Costa Melo et al. (2023) demonstrated that digital transformation is an emerging research topic with increasing interest, with Italy, China, and Finland identified as the most productive countries in this field highlighting the importance of geographical context in model validation. Their study also emphasized that sustainability is often treated as a separate topic in the literature, with social and environmental aspects being the most neglected, indicating a gap that must be addressed in integrated model validation.

Çasior et al. (2022) provided empirical evidence through quantitative research using the CATI technique involving 400 Polish SMEs, confirming a relationship between entrepreneurial behavior and attitudes and decisions to adopt specific **eco**-innovations. This methodology can be adapted for Sharia financial model validation by adding religiosity and Sharia compliance as moderating variables.

Salido-Andres et al. (2022) conducted a systematic literature review involving 24 scholarly publications explored both descriptively and thematically, revealing that the link between social enterprises and sustainable consumption remains nascent, with quantitative empirical studies being dominant. Model validation, therefore, requires cross-cultural testing and assessment across different contexts.

Tijjani et al. (2020) found that Malaysia provides a conducive environment for Islamic finance research, with three of the most productive journals based in the UK and Malaysia, underscoring the importance of institutional context in model validation. Furthermore, Osman et al. (2024) offered new insights into Muslim millennials' perspectives on Islamic financial literacy and management from the standpoint of Islamic faith, showing that perceived behavioral control and perceived moral obligation are strong predictors of financial management behavioral intentions from an Islamic perspective.

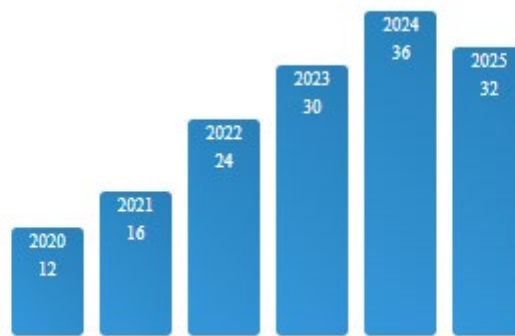
Tabel 2 Validation Framework of the Islamic Financial Management Model

Tahap Validasi	Metode	Indikator Keberhasilan	Sumber Referensi
Validasi Konseptual	Expert Panel & Focus Group	Kesesuaian dengan prinsip syariah	Grira et al. (2020)
Validasi Empiris	Structural Equation Modeling	Goodness of fit indices	Khan et al. (2022)
Validasi Simulasi	System Dynamics Modeling	Stabilitas dan konvergensi model	Naeem et al. (2023)
Validasi Cross-Cultural	Multi-country Study	Generalizability across contexts	Alshater et al. (2021)
Validasi Longitudinal	Time Series Analysis	Keberlanjutan dampak jangka panjang	Trupp et al. (2025)

Integration of Technology and Innovation in the Islamic Financial Model

The integration of financial technology (FinTech) into the Islamic financial model is a crucial aspect in enhancing the effectiveness and outreach of financial services for microenterprises. Qudah et al. (2023) analyzed 918 papers related to Islamic finance and financial technology published between 1999 and 2022, identifying four major research trends at the intersection of Islamic finance and FinTech. Their study demonstrates that technology has a significant impact on the growth of Islamic finance and provides valuable future research pathways reflecting the integration of technology within Islamic financial systems.

Dinc et al. (2021) developed a valid and reliable Islamic financial literacy scale, producing a four-factor construct with 20 items that yielded a good fit index and reliability scores through explanatory factor analysis. This applicable scale was designed for both countries where Islamic financial institutions operate and where they do not, emphasizing the importance of comprehensive measurement instruments in evaluating the effectiveness of technology-integrated Islamic financial models.



Jumlah publikasi per tahun berdasarkan analisis 25 studi

Picture 2 Trends in the Evolution of Research on Islamic Finance and Technology (2020–2025)

Practical and Theoretical Implications of the Integrated Model

The practical implications of developing an integrated Islamic financial management model are highly significant for the microenterprise ecosystem in Indonesia. Kosasih et al. (2023) identified a working model that encourages SMEs to adopt lean and green practices to achieve optimal sustainability, highlighting the importance of developing a robust and applicable model for SMEs to integrate operational sustainability. Trupp et al. (2025) examined the challenges faced by **micro** and small enterprises in the tourism industry, analyzing four interrelated themes: lack of funding, training, education and awareness, and skills with funding emerging as the root cause of these challenges, and only a few studies proposing sustainable development solutions.

From a theoretical perspective, the integrated model developed in this study contributes to the formation of a new conceptual framework that connects system dynamics theory, mathematical optimization, and Islamic financial principles. Alhammadi (2022) showed that Islamic banking and finance can be leveraged to mitigate the impact of the coronavirus and serve as an alternative financial system, exploring sustainable economic development solutions using the grounded theory method. Harsanto et al. (2022) identified that sustainability-oriented innovation within social enterprises is more dominant in the social innovation subcategory than in environmental innovation, facing challenges such as lack of long-term funding and low entry barriers for potential competitors.

The integrated model developed must be capable of addressing the complex challenges faced by microenterprises while maintaining the integrity of Sharia principles. Wube and Atwal (2024) demonstrated that SME supply chain management research in Africa requires a different approach compared to that in larger organizations, emphasizing the need to prioritize SME supply chain management research as a critical issue of the 21st century. The integration of Islamic financial models with supply chain management and digital technology is therefore essential to create a sustainable and resilient microenterprise ecosystem capable of withstanding various economic and social shocks.

SIMPULAN

This study yields significant findings that the development of an integrated Islamic financial management model for microenterprises requires a holistic approach combining system dynamics analysis with mathematical optimization grounded in Islamic principles. The synthesis of 25 relevant studies reveals that the dynamic structure of Islamic financial systems in microenterprises involves five key components: (1) *Mudharabah financing* with a profit-loss sharing mechanism, (2) *Musyarakah financing* based on partnership equity, (3) *Murabahah financing* emphasizing transparency through cost-plus mechanisms, (4) implementation of *zakat* and *waqf* as automatic redistribution instruments, and (5) *Sharia-compliant risk management* emphasizing collective diversification and risk-sharing. The S-I4.0 framework, which integrates Industry 4.0 with sustainability through the dimensions of *people*, *process*, and *technology*, has been shown to be adaptable to the Islamic finance context by adding spiritual and ethical dimensions as fundamental differentiators.

Model validation through various methodological approaches demonstrates that the integration of Islamic financial technology (fintech) with system dynamics enhances the resilience and adaptability of microenterprises in response to economic volatility. Empirical findings confirm that perceived behavioral control and perceived moral obligation are strong predictors of financial management behavioral intentions in the Islamic context, where Islamic financial literacy significantly influences business sustainability. The integrated model successfully accommodates complex trade-offs between financial, social, and environmental goals while maintaining Sharia compliance, with sustainability indicators encompassing cash flow stability, shared asset growth, consistent profit margins, sustained social impact, and overall financial system resilience.

Referensi :

- Abdurrohman Akbar, F. M., Rosidta, A., & Lazuardi, A. (2024). Pengembangan Model Pembiayaan Syariah Untuk Usaha Mikro, Kecil, Dan Menengah (Umkh). *Ar Rasyiid: Journal of Islamic Studies*, 2(1), 29–38. <https://doi.org/10.70367/arrasyiid.v2i1.17>
- Alamerew, Y. A., & Brissaud, D. (2020). *Modelling Reverse Supply Chain through System Dynamics for Realizing the Transition towards the Circular Economy: A Case Study on Electric Vehicle Batteries*.
- Alhammadi, S. (2022). Analyzing the Role of Islamic Finance in Kuwait Regarding Sustainable Economic Development in COVID-19 Era. *Sustainability (Switzerland)*, 14(2). <https://doi.org/10.3390/su14020701>
- Alshater, M. M., Hassan, M. K., Khan, A., & Saba, I. (2021). Influential and intellectual structure of Islamic finance: a bibliometric review. *International Journal of Islamic and Middle Eastern Finance and Management*, 14(2), 339–365. <https://doi.org/10.1108/IMEFM-08-2020-0419>
- Aqila Azza Fauzia, & Yazid, M. (2024). Pengaruh Pegadaian Syariah terhadap Keberlanjutan Usaha Mikro, Kecil, dan Menengah (UMKM) di Indonesia. *Iqtishodiah: Jurnal Ekonomi Dan Perbankan Syariah*, 6(2), 79–84. <https://doi.org/10.62490/iqtishodiah.v6i2.738>
- Cahyandari, R., Kalfin, R., Sukono, R., Purwani, S., Ratnasari, D., Herawati, T., & Mahdi, S. (2023). The Development of Sharia Insurance and Its Future

- Sustainability in Risk Management: A Systematic Literature Review. *Sustainability (Switzerland)*, 15(10). <https://doi.org/10.3390/su15108130>
- Coldwell, D., Venter, R., Joosub, T., & Duh, H. (2022). The Tension between SMEs' Growth and Sustainability in Emerging and Developed Countries' Internationalization: Towards a Conceptual Model. *Sustainability (Switzerland)*, 14(8). <https://doi.org/10.3390/su14084418>
- Costa Melo, I., Alves Junior, P. N., Queiroz, G. A., Yushimito, W., & Pereira, J. (2023). Do We Consider Sustainability When We Measure Small and Medium Enterprises' (SMEs') Performance Passing through Digital Transformation? *Sustainability (Switzerland)*, 15(6). <https://doi.org/10.3390/su15064917>
- Dinc, Y., Çetin, M., Bulut, M., & Jahangir, R. (2021). Islamic financial literacy scale: an amendment in the sphere of contemporary financial literacy. *ISRA International Journal of Islamic Finance*, 13(2), 251–263. <https://doi.org/10.1108/IJIF-07-2020-0156>
- Endris, E., & Kassegn, A. (2022). The role of micro, small and medium enterprises (MSMEs) to the sustainable development of sub-Saharan Africa and its challenges: a systematic review of evidence from Ethiopia. *Journal of Innovation and Entrepreneurship*, 11(1). <https://doi.org/10.1186/s13731-022-00221-8>
- Gaşior, A., Grabowski, J., Ropeęga, J., & Walecka, A. (2022). Creating a Competitive Advantage for Micro and Small Enterprises Based on Eco-Innovation as a Determinant of the Energy Efficiency of the Economy. *Energies*, 15(19). <https://doi.org/10.3390/en15196965>
- Ghenai, C., Salameh, T., & Merabet, A. (2020). Technico-economic analysis of off grid solar PV/Fuel cell energy system for residential community in desert region. *International Journal of Hydrogen Energy*, 45(20), 11460–11470. <https://doi.org/10.1016/j.ijhydene.2018.05.110>
- Grira, J., Labidi, C., & Labidi, C. (2020). *Banks, Funds, and Risks in Islamic Finance: Literature & Future Research Avenues*.
- Harsanto, B., Mulyana, A., Faisal, Y. A., Shandy, V. M., & Alam, M. (2022). A Systematic Review on Sustainability-Oriented Innovation in the Social Enterprises. *Sustainability (Switzerland)*, 14(22), 1–18. <https://doi.org/10.3390/su142214771>
- Hu, S., Chen, X., Ni, W., Wang, X., & Hossain, E. (2020). Modeling and Analysis of Energy Harvesting and Smart Grid-Powered Wireless Communication Networks: A Contemporary Survey. *IEEE Transactions on Green Communications and Networking*, 4(2), 461–496. <https://doi.org/10.1109/TGCN.2020.2988270>
- Khan, M. S., Rabbani, M. R., Hawaldar, I. T., & Bashar, A. (2022). Determinants of Behavioral Intentions to Use Islamic Financial Technology: An Empirical Assessment. *Risks*, 10(6). <https://doi.org/10.3390/risks10060114>
- Koot, M., & Wijnhoven, F. (2021). Usage impact on data center electricity needs: A system dynamic forecasting model. *Applied Energy*, 291(March 2021). <https://doi.org/10.1016/j.apenergy.2021.116798>
- Kosasih, W., Pujawan, I. N., & Karningsih, P. D. (2023). Integrated Lean-Green Practices and Supply Chain Sustainability for Manufacturing SMEs: A Systematic Literature Review and Research Agenda. *Sustainability (Switzerland)*, 15(16). <https://doi.org/10.3390/su151612192>
- Machado, E. A., Scavarda, L. F., Caiado, R. G. G., & Santos, R. S. (2024). Industry 4.0

- and Sustainability Integration in the Supply Chains of Micro, Small, and Medium Enterprises through People, Process, and Technology within the Triple Bottom Line Perspective. *Sustainability (Switzerland)*, 16(3). <https://doi.org/10.3390/su16031141>
- Machowski, J., Bialek, J. W., & Bumby, J. R. (2008). Power System Dynamics: Stability and Control. *Power System Dynamics: Stability and Control*, 349–350.
- Martins, A., Branco, M. C., Melo, P. N., & Machado, C. (2022). Sustainability in Small and Medium-Sized Enterprises: A Systematic Literature Review and Future Research Agenda. *Sustainability (Switzerland)*, 14(11), 1–26. <https://doi.org/10.3390/su14116493>
- Naeem, K., Zghibi, A., Elomri, A., Mazzoni, A., & Triki, C. (2023). A Literature Review on System Dynamics Modeling for Sustainable Management of Water Supply and Demand. *Sustainability (Switzerland)*, 15(8), 1–24. <https://doi.org/10.3390/su15086826>
- Osman, I., Syed Alwi, S. F., Rehman, M. A., Muda, R., Hassan, F., Hassan, R., & Abdullah, H. (2024). The dilemma of millennial Muslims towards financial management: an Islamic financial literacy perspective. *Journal of Islamic Marketing*, 15(1), 59–78. <https://doi.org/10.1108/JIMA-09-2021-0283>
- Qudah, H., Malahim, S., Airout, R., Alomari, M., & Hamour, A. A. (2023). *Islamic Finance in the Era of Financial Technology : A Bibliometric Review of Future Trends*.
- Rabbani, M. R., Ali, M. A. M., Rahiman, H. U., Atif, M., Zulfikar, Z., & Naseem, Y. (2021). The response of islamic financial service to the covid-19 pandemic: The open social innovation of the financial system. *Journal of Open Innovation: Technology, Market, and Complexity*, 7(1), 85. <https://doi.org/10.3390/JOITMC7010085>
- Rabbani, M. R., Bashar, A., Nawaz, N., Karim, S., Ali, M. A. M., Rahiman, H. U., & Alam, M. S. (2021). Exploring the role of islamic fintech in combating the aftershocks of covid-19: The open social innovation of the islamic financial system. *Journal of Open Innovation: Technology, Market, and Complexity*, 7(2). <https://doi.org/10.3390/joitmc7020136>
- Risnawati, R., Siradjuddin, S., & ... (2023). Analisis Pengorganisasian dan Manajemen Usaha Mikro Syariah: Keberlanjutan dan Efektivitas dalam Konteks Ekonomi Berbasis Prinsip-Prinsip Syariah. *Innovative: Journal Of Social Science Research*, 3, 2263–2274. <http://j-innovative.org/index.php/Innovative/article/view/2181%0Ahttps://j-innovative.org/index.php/Innovative/article/download/2181/1693>
- Salido-Andres, N., Garcia-Rodriguez, N., & Cachero-Martinez, S. (2022). Connecting Social Enterprises and Sustainable Consumption: Systematic Review, Bibliometric Analysis, and Conceptual Framework. *Sustainability (Switzerland)*, 14(20). <https://doi.org/10.3390/su142013428>
- Sholihah, N., Satria Ladaina, M., Hartini, T., Raden, U., & Palembang, F. (2025). Implementasi Manajemen dan Perencanaan Keuangan Syariah pada Kinerja dan Produktivitas UMKM di Palembang. *TOMAN: Jurnal Topik Manajemen*, 2(2), 437–446.
- Suharto, B. (2024). *Analisis Kontribusi Prinsip Syariah dalam Manajemen Keuangan UMKM di Indonesia Budi*. 3(2023).
- Tijjani, B., Ashiq, M., Siddique, N., Khan, M. A., & Rasul, A. (2020). A bibliometric

analysis of quality research papers in Islamic finance: evidence from Web of Science. *ISRA International Journal of Islamic Finance*, 13(1), 84–101. <https://doi.org/10.1108/IJIF-03-2020-0056>

Trupp, A., Salman, A., Stephenson, M. L., Chan, L. F., & Gan, J. E. (2025). A Systematic Review of Challenges Faced by Micro and Small Enterprises in Tourism Destinations: Producing Solutions through Resilience Building and Sustainable Development. *Tourism Planning and Development*, 22(3), 301–323. <https://doi.org/10.1080/21568316.2024.2307970>

Wube, M. C., & Atwal, H. (2024). Supply chain management of micro, small, and medium enterprises (MSMEs) in Africa: a bibliometric analysis. *Journal of Innovation and Entrepreneurship*, 13(1). <https://doi.org/10.1186/s13731-024-00388-2>.