

# Enhancing MSME Competitiveness Through AI Integration for a Sustainable Global Economic Ecosystem

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## Abstrak

Micro, Small, and Medium Enterprises (MSMEs) play a vital role in driving national and global economic growth. However, amid rapid digital transformation and intensifying global competition, MSMEs face significant challenges in remaining competitive and adaptive. The integration of artificial intelligence (AI) into the MSME ecosystem is viewed as a strategic solution to enhance operational efficiency, market insights, and product and service innovation. This study aims to examine how AI can be effectively integrated into MSME business processes to strengthen sustainable competitiveness. Using a qualitative approach and exploratory case studies involving MSMEs in Indonesia's manufacturing and service sectors, this research identifies relevant and affordable strategies and models for AI implementation. The findings indicate that the use of AI in customer data analytics, business process automation, and supply chain management can improve productivity and open opportunities for global market expansion. The study also identifies key challenges in technology adoption, including limited digital human resources, technological infrastructure constraints, and low digital literacy among MSME actors. The results are expected to serve as a foundation for national policies and strategies to build an inclusive and sustainable digital economic ecosystem. This study contributes by proposing an AI integration model tailored to the MSME context in developing countries, particularly Indonesia.

**Keyword:** MSMEs; Artificial Intelligence; Competitiveness; Digital Transformation; Sustainable Ecosystem

## 1. INTRODUCTION

MSMEs have long been recognized as a major pillar of the economy in many developing countries, including Indonesia. According to data from the Ministry of Cooperatives and SMEs, MSMEs contributed more than 60% to the Gross Domestic Product (GDP) and absorbed over 97% of the national workforce in 2023 (KemenkopUKM, 2023). Despite their significant contribution, the competitiveness of MSMEs in both domestic and global markets remain relatively low. Shifts in consumer behavior, intense competition, and the rapid acceleration of digital transformation require MSME actors to adapt quickly and strategically.

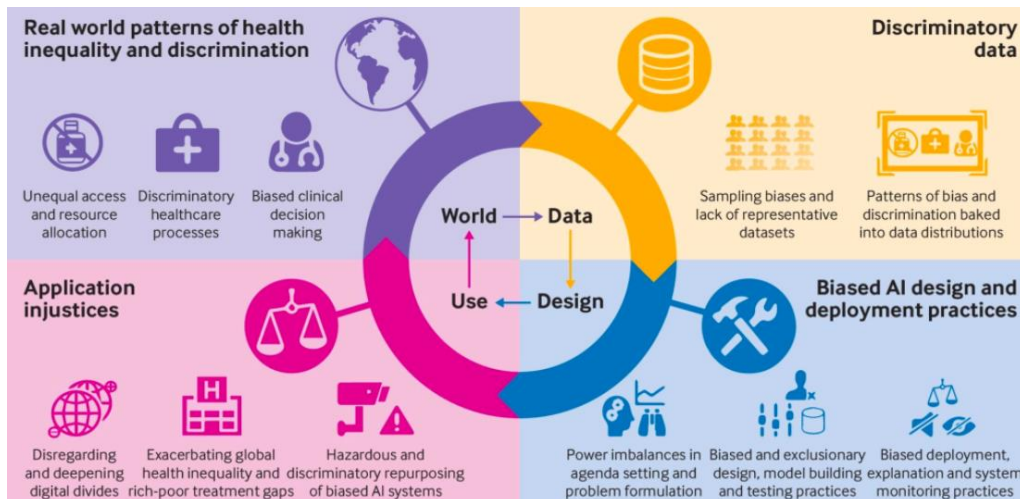
These challenges are further intensified by technological adoption gaps between large enterprises and MSMEs. MSMEs often face difficulties in accessing advanced technologies, including artificial intelligence (AI), which has become a key driving force in the Fourth Industrial Revolution. AI enables firms to analyze large volumes of data quickly and accurately, predict market trends, and automate operational processes (Bughin et al., 2018). However, AI adoption among MSMEs remains very limited due to cost barriers, technical skill gaps, and insufficient understanding of its potential benefits. As a comparison, the development of AI adoption among SMEs in the United Kingdom in 2024 can be observed in the following table:

**Tabel 1.** AI Adoption in SMEs (UK, 2024)

Category	Percentage of SMEs
Already adopting AI	35%
No plans to adopt	42%
Unaware of AI potential	23%

*Source: UK Office for National Statistics (2024)*

According to data from the Management and Expectations Survey (MES) conducted by the ONS during November 2023–March 2024, only about 9% of companies were using AI in 2023, with adoption projected to reach 22% in 2024 (Office for National Statistics, 2025). Several previous studies have examined AI integration in industrial sectors and large corporations, yet there is still limited research specifically addressing AI implementation in the MSME sector, particularly in the context of developing countries such as Indonesia. For instance, Wamba-Taguimdje et al. (2020) highlighted the importance of digital readiness and technology strategy in AI adoption, but their focus remained on large-scale enterprises. Research by Akpan et al. (2022) also indicated the potential of AI to strengthen small business strategies; however, this study was largely conceptual and did not provide an applied model contextualized for MSMEs in developing countries. Another study by Dwivedi et al. (2021) emphasized ethical and social challenges in AI adoption without offering concrete solutions for MSMEs. Meanwhile, Maresova et al. (2020) examined automation in small industries in Europe, but their findings are less relevant to the socio-economic conditions of MSMEs in Southeast Asia. The following figure illustrates various ethical challenges of AI, such as algorithmic bias, discrimination, and transparency issues, aligning with Dwivedi et al.'s (2021) focus on ethical concerns without concrete solutions for MSMEs.



**Figure 1.** Teaching AI Ethics, Bias, and Discrimination (Furze, L., 2023)

Unlike previous studies, this research adopts an applied approach, focusing on the specific needs and constraints of MSMEs in Indonesia, while proposing an adaptive and cost-effective AI integration framework. The urgency of this study is further underscored by the fact that without appropriate digital transformation, MSMEs risk falling further behind in global competition, especially in the digital economy era, which prioritizes speed, personalized services, and data-driven efficiency.

The main objective of this study is to formulate realistic AI integration strategies that can be implemented by MSMEs across various industrial sectors, as well as to identify enablers and barriers to AI adoption. Thus, this research provides not only theoretical contributions through the development of a technology integration model but also practical contributions in the form of guidance for entrepreneurs, policymakers, and local technology developers.

The primary scientific contributions of this study include: (1) developing an AI integration framework tailored to the needs of MSMEs in Indonesia; (2) creating an AI adoption model based on digital readiness and resource affordability; and (3) identifying challenges and strategic policy opportunities for building a sustainable MSME-based digital economic ecosystem.

This research is particularly significant as it can serve as a foundation for developing more inclusive and sustainable digital transformation policies that position MSMEs as active subjects rather than passive objects within the technology ecosystem. Additionally, the study aims to offer alternative solutions to the human, financial, and infrastructure resource limitations that have historically constrained MSME modernization.

Through a multidisciplinary approach and contextual analysis, this article is expected to open new horizons in the discourse on technology integration in the small business sector and to foster collaboration among entrepreneurs, academics, technology providers, and government agencies in building a resilient, adaptive, and inclusive economic future.

## 2. RESEARCH METHODE

### 2.1 Research Framework

This study employs a qualitative approach with an exploratory case study design. This approach was chosen because it allows the researcher to deeply investigate AI technology integration practices within MSMEs in a complex and dynamic context, while considering the surrounding social, cultural, and economic aspects (Yin, 2018). The research was conducted in three Indonesian cities Bandung, Surabaya, and Yogyakarta which are recognized as centers of MSME growth and digital innovation. A total of 15 MSMEs from the manufacturing, culinary, and creative service sectors were selected as study subjects using purposive sampling, based on criteria ranging from early to intermediate levels of digital technology adoption and interest in AI integration.

### 2.2 Research Stages

Data collection was conducted through in-depth interviews, participatory observations, and document review. Interviews were carried out with business owners, operational managers, and IT staff (if available), guided by semi-structured interview protocols covering topics such as understanding of AI, current AI usage, implementation challenges, and future expectations. To strengthen primary data, direct observations were also conducted on work processes and operational flows that could potentially be automated using AI.

Data analysis was performed thematically using open, axial, and selective coding approaches (Saldaña, 2021). All interview data were transcribed and coded to identify relevant patterns, categories, and themes. Data validity was ensured through source and method triangulation, as well as member checking with informants to confirm the accuracy of the researcher's interpretations.

## 2.3 Conceptual Framework

The theoretical framework employed in this analysis includes technology adoption models such as the Technology-Organization-Environment (TOE) Framework (Tornatzky & Fleischer, 1990), adapted to accommodate the context of Indonesian MSMEs, as well as Rogers' (2003) innovation theory regarding diffusion of innovations and technology adoption readiness.

Within this framework, variables such as technological infrastructure, human resource capacity, institutional support, and business characteristics serve as the main points of analysis to evaluate the potential and readiness for AI adoption. This study also adopts a pragmatic approach, combining normative and empirical perspectives to formulate feasible AI implementation strategies for MSME actors. Research ethics were maintained by obtaining written consent from all participants, ensuring data confidentiality, and preventing any coercion or conflicts of interest during the data collection process

## 3. RESULT AND DISCUSSION

### 3.1 Initial Portrait: MSME Understanding and Readiness for AI

Based on interviews with 15 MSME actors in Bandung, Surabaya, and Yogyakarta, it was found that most business owners have a limited understanding of the concept of artificial intelligence. The majority of respondents equated AI with simple automation or accounting software. Only 20% were able to associate AI with machine learning, predictive analytics, and customer service personalization. This indicates a significant digital literacy gap, which contributes to the low level of AI adoption in the MSME sector (Setiawan & Mahesa, 2023).

Nevertheless, there is high optimism regarding the potential use of AI if properly guided and supported. Some respondents expressed willingness to try new technology if it could demonstrably improve efficiency or revenue. This aligns with findings by Chatterjee et al. (2021), which emphasize that perceived benefits of technology strongly influence the intention to adopt digital technologies among small business actors. The following figure, Benefits of AI in SMEs, illustrates how AI has transformed the business market by providing various advantages in both internal processes and interactions with customers or suppliers.



Figure 2. Benefits of AI in SMEs (Acelera Pyme, 2024)

### 3.2 Most Relevant Forms of AI Implementation for MSMEs

This study identified three main forms of AI implementation that are most relevant and likely to be adopted by MSMEs in Indonesia:

- a. **AI-Based Customer Analytics:**  
 Some MSMEs, particularly in the culinary and fashion sectors, have started leveraging e-commerce platforms that provide real-time customer data. With AI-driven analytics features (e.g., automated product recommendations, purchase trend predictions), MSME actors can understand consumer shopping patterns and adjust their sales strategies accordingly. Studies by Kose et al. (2022) indicate that predictive analytics can improve marketing effectiveness by up to 40% in small-scale businesses.
- b. **Chatbots and Customer Service Automation:**  
 Four out of five MSMEs with active websites or business social media accounts have experimented with AI-based chatbots, either through WhatsApp Business or Facebook Messenger. Chatbots have been shown to save time and labor while enhancing customer satisfaction through rapid responses (Fosso Wamba et al., 2021).
- c. **Production and Inventory Process Automation:**

Small-scale manufacturing MSMEs have begun using AI-based applications capable of predicting raw material needs, optimizing production schedules, and preventing overstock. Cloud-based AI inventory systems such as Odoo AI or Zoho AI are emerging solutions being adopted (Wang et al., 2020).

### 3.3 Factors Inhibiting AI Implementation in MSMEs

There are several key barriers to integrating AI into MSME operations:

- a. **Limited Digital Literacy:**  
 Nearly all informants acknowledged that they do not yet understand how AI works or how to utilize it within their business context. This limitation is compounded by the lack of accessible technical training that is relevant to MSME needs (Fitriani & Herlina, 2021).
- b. **High Initial Investment Costs:**  
 Although there are AI services available through software-as-a-service (SaaS) at relatively affordable prices, the prevailing perception that technology investments are expensive discourages many MSME owners from trying them. This is reinforced by findings from Alsharif et al. (2022), which note that cost-related barriers are among the primary reasons for slow AI adoption in microbusiness sectors.
- c. **Insufficient Technological Infrastructure:**  
 Many MSMEs especially those outside major urban areas still face limited access to high-speed internet and adequate hardware needed to run AI-based systems efficiently (Indrawan et al., 2020).

### 3.4 Factors Supporting the Acceleration of AI Adoption

Several key enabling factors that accelerate AI integration in the MSME sector, as identified in this study, include:

- a. **Support from E-Commerce and Fintech Platforms:**  
 The presence of platforms such as Tokopedia, Shopee, Gojek, and Bukalapak which provide built-in AI features facilitates indirect access to intelligent technologies for MSME actors. For example, automated product recommendations and dynamic pricing features have been widely used without requiring deep technical understanding from users (Wijayanto et al., 2023).
- b. **Partnerships with Universities and Technology Incubators:**  
 Some MSMEs that participate in campus-based business incubators (such as those at Universitas Gadjah Mada and ITS) are more proactive in recognizing and implementing AI within their operations, especially in product design, customer data processing, and logistics optimization (Hastuti et al., 2021).
- c. **Government Initiatives Through MSME Digitalization Programs:**  
 The Ministry of Cooperatives and SMEs and the Ministry of Communication and Informatics have launched several digitalization training programs and technology adoption incentives since 2021. Programs such as "UMKM Go Digital" and "100 Smart SMEs" have served as early drivers for introducing AI to micro and small business actors (Kominfo, 2023).

### 3.5 AI Integration Model for MSMEs: A Conceptual Framework

Based on the findings of this study, the author developed the following AI integration framework for MSMEs:

- a. **Preparation Stage (Awareness & Readiness):**  
 This includes basic digital literacy training and data-driven business needs assessment.
- b. **Modular Implementation Stage:**  
 AI adoption begins with modules that deliver the most immediate impact, such as chatbots, customer analytics, or automated inventory management.
- c. **Advanced Integration Stage:**  
 AI systems are integrated across functions, including demand forecasting, personalized marketing, and supply chain optimization.
- d. **Evaluation and Development Stage:**  
 System performance is evaluated, followed by continuous development through feedback loops and collaboration with local data scientists.

This model emphasizes an incremental approach grounded in actual business needs and the internal readiness of MSMEs. Such an approach prevents technical and financial burdens while enabling businesses to transform adaptively and progressively (Ghobakhloo & Iranmanesh, 2021).

### 3.6 The Contribution of AI to the Competitiveness of MSMEs

The integration of AI has the potential to generate a significant impact on enhancing the competitiveness of MSMEs through:

- a. **Operational Efficiency:**  
 AI can reduce dependence on manual labor and accelerate business processes, increasing productivity by up to 25% (McKinsey, 2019).

**Table 2.** Improvement of Operational Efficiency with AI

Aspect	Percentage Improvement
Operational efficiency (based on SMEs survey)	32,7% (Akpan et al., 2022)
Reduction of manual tasks	40% (Small Business and Entrepreneurship Council, 2024)
Decrease in workflow bottlenecks	25% (Chatterjee et al., 2021)
Reduction of critical response actions	20% (Wamba-Taguimdje et al., 2020)

b. Enhanced Customer Service:

The use of AI in customer service provides responsive and personalized experiences, directly impacting customer loyalty (Chatterjee et al., 2021).

c. Product Innovation and Marketing Strategy:

AI supports the innovation process through trend prediction, sentiment analysis, and product personalization, which are highly valuable for competing in the digital marketplace (Wang et al., 2020).

These findings reinforce the conclusion that AI adoption is not merely a technological necessity but a strategic requirement to sustain and enhance MSME business continuity in the digital era.

#### 4. CONCLUSION

This study demonstrates the potential of artificial intelligence (AI) to enhance the competitiveness of MSMEs in Indonesia amid globalization and digitalization. A qualitative case study of 15 MSMEs across manufacturing, culinary, and creative service sectors revealed that, despite low AI literacy, owners recognize the strategic importance of digital transformation. Key AI applications include customer analytics, chatbots, and automation of production and inventory processes. Adoption is constrained by limited digital skills, high initial costs, and uneven technological infrastructure, while support from digital platforms, incubators, and government initiatives facilitates integration. The study proposes a staged AI integration model tailored to the capacities and needs of Indonesian MSMEs, allowing modular and sustainable digital adoption. This approach frames AI not merely as an automation tool but as a strategic driver for innovation, customer engagement, and business growth. Limitations include a small sample and urban-only focus, suggesting future national-scale quantitative research across diverse sectors and regions, including community-based MSMEs. Collaborative training among government, academia, and technology providers is recommended to build an inclusive and resilient digital ecosystem. Overall, the study shows how MSMEs can adopt AI incrementally, achieving efficient, equitable, and sustainable digital transformation.

#### REFERENCES

- Acelera Pyme. (2024). *Artificial intelligence for SMEs [Infographic]*. Gobierno de España. <https://www.acelerapyme.gob.es/en/means/infographics/artificial-intelligence-smes>
- Akpan, I. J., Soopramanien, D., & Kwak, D.-H. (2022). Cutting-edge technology in small businesses: The role of artificial intelligence in enhancing entrepreneurial outcomes. *Technological Forecasting and Social Change*, 174, 121278. <https://doi.org/10.1016/j.techfore.2021.121278>
- Alsharif, M. H., Nordin, R., & Ismail, M. (2022). AI adoption in emerging economies: The role of cost, skill, and infrastructure. *Technological Forecasting and Social Change*, 182, 121845. <https://doi.org/10.1016/j.techfore.2022.121845>
- Bughin, J., Seong, J., Manyika, J., Chui, M., & Joshi, R. (2018). Notes from the AI frontier: Modeling the impact of AI on the world economy. McKinsey Global Institute. <https://www.mckinsey.com/featured-insights/artificial-intelligence>
- Chatterjee, S., Rana, N. P., Tamilmani, K., & Sharma, A. (2021). The adoption of AI in SMEs: A multi-theory perspective. *Journal of Business Research*, 134, 573–584. <https://doi.org/10.1016/j.jbusres.2021.05.026>
- Dwivedi, Y. K., Hughes, L., Coombs, C., Constantiou, I., Duan, Y., Edwards, J. S., ... & Upadhyay, N. (2021). Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. *International Journal of Information Management*, 57, 101994. <https://doi.org/10.1016/j.ijinfomgt.2019.08.002>
- Fitriani, H., & Herlina, S. (2021). Digital skill readiness in Indonesia's SMEs. *Journal of Small Business Strategy*, 31(4), 35–49. <https://jsbs.scholasticahq.com/article/24536>
- Fosso Wamba, S., Gunasekaran, A., & Akter, S. (2021). Impact of AI-driven customer service on SME performance. *Information Systems Frontiers*, 23, 419–437. <https://doi.org/10.1007/s10796-019-09925-1>
- Furze, L. (2023, Maret 6). *Teaching AI ethics, bias and discrimination* [Infografik]. leonfurze.com. <https://leonfurze.com/2023/03/06/teaching-ai-ethics-bias-and-discrimination/>
- Ghobakhloo, M., & Iranmanesh, M. (2021). Digital transformation success factors in SMEs: A systematic review. *Information Systems and e-Business Management*, 19, 437–471. <https://doi.org/10.1007/s10257-020-00489-1>
- Hastuti, R. D., Pamungkas, B., & Anggraeni, N. (2021). Peran inkubator bisnis dalam adopsi teknologi oleh UMKM. *Jurnal Riset Ekonomi dan Bisnis*, 14(1), 25–40. <https://ejournal.upi.edu/index.php/JREB/article/view/40292>
- Indrawan, M. D., Sari, N. P., & Ramdani, R. (2020). Infrastruktur digital dan kesiapan UMKM terhadap revolusi industri 4.0. *Jurnal Teknologi dan Manajemen Industri*, 5(3), 120–131. <https://jurnal.its.ac.id/jtmi/article/view/6521>
- KemenkopUKM. (2023). *Laporan Statistik UMKM 2023*. <https://www.kemenkopukm.go.id>

- Kominfo. (2023). *Program Digitalisasi UMKM*. [https://www.kominfo.go.id/content/detail/42414/digitalisasi-umkm/0/sorotan\\_media](https://www.kominfo.go.id/content/detail/42414/digitalisasi-umkm/0/sorotan_media)
- Kose, U., Sert, S., & Deperlioglu, O. (2022). AI-based customer analytics in SMEs: A case study from Turkey. *Procedia Computer Science*, 200, 497–504. <https://doi.org/10.1016/j.procs.2022.01.228>
- Maresova, P., Mohelska, H., & Krulicky, T. (2020). Industry 4.0 in small and medium-sized enterprises: Challenges and opportunities. *Technological and Economic Development of Economy*, 26(2), 1108–1130. <https://doi.org/10.3846/tede.2020.11980>
- Office for National Statistics. (2025, Maret 24). *Management practices and the adoption of technology and artificial intelligence in UK firms*. ONS. <https://www.ons.gov.uk/economy/economicoutputandproductivity/productivitymeasures/articles/managementpracticesandtheadoptionoftechnologyandartificialintelligenceinukfirms2023/2025-03-24>
- Saldaña, J. (2021). *The coding manual for qualitative researchers* (4th ed.). Sage.
- Setiawan, D., & Mahesa, G. (2023). Kesiapan pelaku UMKM terhadap digitalisasi: Studi pada pelaku usaha mikro di Yogyakarta. *Jurnal Ekonomi dan Kewirausahaan*, 21(2), 105–117. <https://doi.org/10.31227/osf.io/rbkw2>
- Small Business and Entrepreneurship Council. (2024, January 22). *AI can boost small business efficiency by 40%, says new report*. Alibaba Reads. <https://reads.alibaba.com/ai-can-boost-small-business-efficiency-by-40-says-new-report/>
- Tornatzky, L. G., & Fleischer, M. (1990). *The Processes of Technological Innovation*. Lexington Books.
- Wang, Y., Kung, L. A., & Byrd, T. A. (2020). Big data analytics: Understanding its capabilities and potential benefits for SMEs. *Journal of Small Business Management*, 58(3), 548–568. <https://doi.org/10.1080/00472778.2019.1659674>
- Wijayanto, T., Nugroho, Y., & Susanto, A. (2023). Marketplace sebagai sarana adopsi teknologi oleh UMKM Indonesia. *Jurnal Teknologi Informasi dan Bisnis*, 17(2), 45–59. <https://doi.org/10.31294/jtib.v17i2.21547>
- Wamba-Taguimdje, S.-L., Fosso Wamba, S., Kala Kamdjoug, J. R., & Tchatchouang Wanko, C. E. (2020). Influence of artificial intelligence (AI) on firm performance: The business value of AI-based transformation projects. *Business Process Management Journal*, 26(7), 1893–1924. <https://doi.org/10.1108/BPMJ-10-2019-0411>
- Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed.). SAGE Publications.