

***A QUALITATIVE SYNTHESIS OF ARTIFICIAL INTELLIGENCE  
ADOPTION IN MSMEs: INSIGHTS INTO OPPORTUNITIES AND  
CHALLENGES***

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**ABSTRACT**

Artificial intelligence (AI) has emerged as a transformative technology that is reshaping business processes, innovation, and competitiveness, particularly for Micro, Small, and Medium Enterprises (MSMEs). Despite its potential, AI adoption among MSMEs remains uneven and is often constrained by various technological, organizational, and environmental factors. This study aims to provide a comprehensive understanding of AI adoption in MSMEs by conducting a qualitative synthesis of existing literature, focusing on the identification of key drivers, barriers, opportunities, and organizational impacts. This research adopts a systematic literature review (SLR) approach, guided by the PRISMA framework, to analyze 25 peer-reviewed articles indexed in Scopus. A thematic analysis was employed to systematically code and categorize the findings, enabling the identification of recurring patterns and critical themes related to AI adoption in MSMEs. The results reveal four major themes: (1) drivers of adoption, including technological readiness, organizational capabilities, competitive pressure, and perceived benefits; (2) barriers to adoption, such as financial constraints, lack of expertise, technological complexity, and organizational resistance; (3) opportunities enabled by AI, including enhanced operational efficiency, improved customer insights, innovation, and market expansion; and (4) organizational impacts, particularly in terms of performance improvement, digital transformation, innovation capability, and strategic alignment. The study contributes to the literature by providing an integrative and qualitative perspective on AI adoption in MSMEs, extending the Technology-Organization-Environment (TOE) framework with AI-specific insights. Practically, the findings offer guidance for MSME managers and policymakers in designing strategies to overcome adoption barriers and leverage AI for sustainable growth. Future research is encouraged to explore empirical and longitudinal approaches to further examine the dynamic nature of AI adoption in MSMEs.

**Keywords:** *Qualitative Synthesis; Artificial Intelligence; MSME; Opportunities; Challenges*

**1. Introduction**

The rapid advancement of digital technologies has significantly transformed the global business landscape, particularly for Micro, Small, and Medium Enterprises (MSMEs). Digital transformation is no longer optional but has become a strategic necessity for firms aiming to remain competitive in increasingly dynamic markets (Vial, 2019). In this context, artificial intelligence (AI) emerges as a key driver of innovation and efficiency, enabling organizations to optimize processes, enhance decision-making, and create new value propositions (Cockburn et al., 2018; Dwivedi et al., 2021).

MSMEs, as the backbone of many economies, are particularly impacted by this technological shift. Despite their limited resources, these enterprises are increasingly adopting digital technologies to improve operational performance and market reach (Ghobakhloo & Ching, 2019). Prior studies indicate that digitalization enables MSMEs to enhance agility, innovation, and competitiveness, especially in uncertain and rapidly changing environments (Matarazzo et al., 2021).

Artificial intelligence, as a core component of Industry 4.0, offers substantial opportunities for MSMEs, including automation, predictive analytics, and customer personalization. The

integration of AI technologies into business processes has been shown to foster innovation and productivity growth, contributing to overall economic development (Bughin et al., 2018). Moreover, AI-driven insights allow MSMEs to better understand customer behavior and optimize strategic decisions (Ransbotham et al., 2017).

However, the adoption of AI in MSMEs remains uneven and complex. While large firms often lead in technological implementation, MSMEs face unique challenges such as limited financial resources, lack of technical expertise, and organizational constraints (Nguyen et al., 2015). These barriers significantly influence the extent and effectiveness of AI adoption within smaller enterprises.

Previous research on technology adoption in MSMEs has highlighted the importance of organizational, technological, and environmental factors. The Technology-Organization-Environment (TOE) framework proposed by Tornatzky and Fleischer (1990) remains widely used to explain how firms adopt new technologies. Studies on cloud computing and digital tools adoption confirm that external pressures, internal readiness, and perceived benefits play critical roles in shaping adoption decisions (Alshamaila et al., 2013).

Furthermore, the emergence of big data analytics and AI capabilities has reinforced the importance of data-driven decision-making in MSMEs. Firms that successfully leverage analytics capabilities tend to exhibit higher levels of supply chain agility and performance (Dubey et al., 2020; Wamba et al., 2017). This highlights the strategic value of integrating AI technologies into business operations.

Despite these benefits, the digital transformation journey of MSMEs is often constrained by their limited maturity levels. Studies on Industry 4.0 adoption reveal that many SMEs are still in the early stages of digital transformation, lacking the infrastructure and strategic alignment required for advanced technologies such as AI (Mittal et al., 2018; Agostini & Nosella, 2019). This gap underscores the need for a deeper understanding of how MSMEs navigate AI adoption.

In addition, digital entrepreneurship and innovation ecosystems play a crucial role in facilitating AI adoption among MSMEs. Entrepreneurial orientation and digital capabilities enable firms to explore new opportunities and adapt to technological changes (Kraus et al., 2019; Nambisan, 2017). Collaboration and alliances, particularly in digital ecosystems, also enhance firms' ability to access knowledge and resources (Bresciani et al., 2018).

Another important dimension is the role of digital platforms and social technologies in supporting MSME growth. The use of social media and digital marketing tools has been shown to positively influence firm performance and innovation outcomes (Ainin et al., 2015; Scuotto et al., 2017). These technologies often serve as entry points for more advanced digital adoption, including AI integration.

Nevertheless, existing literature on AI adoption in MSMEs remains fragmented, with a predominant focus on quantitative approaches and limited exploration of contextual and experiential factors. There is a lack of comprehensive qualitative synthesis that integrates insights on opportunities, challenges, and adoption dynamics across different contexts. Therefore, this study aims to address this gap by conducting a qualitative synthesis of existing literature to provide a deeper understanding of AI adoption in MSMEs, particularly in terms of opportunities and challenges.

## **2. Literature Review**

### **2.1 Digital Transformation and MSMEs**

Digital transformation has become a central theme in understanding how MSMEs adapt to technological change and maintain competitiveness. It refers to the integration of digital technologies into all areas of business, fundamentally changing how organizations operate and deliver value to customers (Vial, 2019). For MSMEs, digital transformation is not merely a technological upgrade but a strategic shift that requires alignment between business models, processes, and digital capabilities (Bharadwaj et al., 2013). Empirical evidence suggests that MSMEs that embrace digital transformation can enhance customer value creation and improve business performance (Matarazzo et al., 2021).

However, the adoption of digital technologies among MSMEs varies significantly due to differences in organizational readiness and external pressures. Studies show that MSMEs often lag behind larger firms in adopting advanced technologies, primarily due to resource constraints and lack of strategic direction (Ghobakhloo & Fathi, 2020). Despite these limitations, digital transformation offers MSMEs opportunities to increase flexibility, innovation, and market responsiveness (Li et al., 2018).

## ***2.2 Artificial Intelligence and Innovation in MSMEs***

Artificial intelligence (AI) has emerged as a transformative technology that significantly influences innovation and organizational performance. AI enables firms to automate processes, analyze large datasets, and generate predictive insights, thereby improving decision-making and operational efficiency (Cockburn et al., 2018). At a broader level, AI is expected to contribute substantially to global economic growth and productivity (Bughin et al., 2018).

In the context of MSMEs, AI adoption can enhance innovation capabilities and support the development of new business models. AI-driven tools allow MSMEs to better understand customer behavior, optimize marketing strategies, and improve service delivery (Ransbotham et al., 2017). Furthermore, AI contributes to knowledge creation and innovation by enabling firms to leverage data as a strategic asset (Dwivedi et al., 2021).

## ***2.3 Technology Adoption in MSMEs***

The adoption of new technologies in MSMEs has been extensively studied through various theoretical lenses. One of the most widely used frameworks is the Technology-Organization-Environment (TOE) framework, which emphasizes the role of technological readiness, organizational characteristics, and environmental factors in shaping adoption decisions (Tornatzky & Fleischer, 1990). This framework has been applied in numerous studies examining cloud computing and digital technology adoption in SMEs (Alshamaila et al., 2013).

Additionally, organizational factors such as firm size, managerial support, and technological competence play a critical role in technology adoption (Nguyen et al., 2015). External factors, including competitive pressure and customer demand, also influence adoption decisions. Research on social media adoption indicates that perceived usefulness and ease of use significantly affect technology acceptance and performance outcomes in SMEs (Ainin et al., 2015).

Industry 4.0 represents the next phase of industrial evolution characterized by the integration of cyber-physical systems, IoT, and AI. For MSMEs, adopting Industry 4.0 technologies can enhance operational efficiency and competitiveness (Mittal et al., 2018). However, studies indicate that many MSMEs are still in the early stages of digital maturity and face challenges in implementing advanced technologies (Agostini & Nosella, 2019).

The adoption of digital technologies, including AI, is closely linked to organizational capabilities and strategic orientation. Firms that develop strong digital capabilities are more likely to successfully integrate advanced technologies into their operations (Ghobakhloo & Ching, 2019). Moreover, Industry 4.0 adoption requires a holistic approach that integrates technology, strategy, and organizational culture.

Big data analytics plays a crucial role in enabling AI adoption by providing the necessary data infrastructure and analytical capabilities. Studies show that firms with strong analytics capabilities achieve higher levels of supply chain agility and performance (Dubey et al., 2020; Wamba et al., 2017). For MSMEs, the ability to leverage data effectively can lead to improved decision-making and competitive advantage.

The adoption of big data analytics in SMEs is influenced by factors such as technological readiness, data quality, and organizational support (Maroufkhani et al., 2022). Integrating AI with big data analytics further enhances firms' ability to generate insights and create value. This integration is particularly important in dynamic markets where timely and accurate information is critical.

#### ***2.4 Digital Entrepreneurship and Innovation Ecosystems***

Digital entrepreneurship provides a framework for understanding how MSMEs leverage digital technologies to create and capture value. It emphasizes the role of digital platforms, ecosystems, and innovation networks in shaping business opportunities (Nambisan, 2017). MSMEs engaged in digital entrepreneurship are more likely to adopt emerging technologies such as AI to enhance their competitive position (Kraus et al., 2019).

Collaboration and strategic alliances also play a significant role in facilitating technology adoption. Participation in innovation ecosystems enables MSMEs to access external knowledge, resources, and capabilities that are critical for implementing advanced technologies (Bresciani et al., 2018). These collaborations are particularly important for overcoming resource constraints and enhancing innovation capacity.

#### ***Social Media, Digital Platforms, and MSME Performance***

Digital platforms and social media technologies have become essential tools for MSMEs in enhancing customer engagement and market reach. Research shows that the use of social media positively influences firm performance and innovation outcomes (Ainin et al., 2015; Scuotto et al., 2017). These technologies enable MSMEs to interact directly with customers and gather valuable feedback for product and service improvement.

Moreover, digital platforms serve as entry points for more advanced technological adoption, including AI. The integration of AI into digital platforms allows MSMEs to automate customer interactions, personalize services, and optimize marketing strategies (Rialti et al., 2019). This highlights the interconnected nature of digital technologies in shaping MSME performance.

### **3. Research Methodology**

This study employs a qualitative literature review approach using a systematic literature review (SLR) design to synthesize existing knowledge on artificial intelligence (AI) adoption in Micro, Small, and Medium Enterprises (MSMEs). The qualitative synthesis approach is particularly suitable for exploring complex phenomena such as AI adoption, as it enables the integration of diverse findings and the identification of underlying themes, patterns, and contextual insights. The study follows established SLR procedures to ensure transparency, rigor, and reproducibility in the selection and analysis of relevant literature.

The data collection process was conducted through a structured search of academic databases, including Scopus, Web of Science, and ScienceDirect. Keywords used in the search process included combinations of “artificial intelligence,” “AI adoption,” “MSMEs,” “SMEs,” “digital transformation,” and “Industry 4.0.” Inclusion criteria were defined as follows: (1) peer-reviewed journal articles indexed in Scopus, (2) studies focusing on AI, digital technologies, or advanced analytics in MSMEs or SMEs, (3) publications written in English, and (4) articles published within a relevant time frame to capture recent developments. Exclusion criteria included non-peer-reviewed articles, conference papers without rigorous review processes, and studies not directly related to MSMEs or AI adoption.

To ensure methodological rigor, this study adopts the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework in the screening and selection process. The initial search results were filtered by removing duplicates, followed by title and abstract screening to assess relevance. Full-text screening was then conducted to ensure alignment with the research objectives. A final set of 25 articles was selected for in-depth analysis based on their relevance, quality, and contribution to the topic of AI adoption in MSMEs.

The data analysis was carried out using a thematic analysis approach. Selected articles were systematically reviewed and coded to identify key themes related to AI adoption, including drivers, barriers, opportunities, and organizational impacts. The coding process involved open coding, followed by categorization and theme development to generate meaningful insights. This qualitative synthesis allows for a comprehensive understanding of AI adoption in MSMEs by integrating findings across different contexts and providing a structured interpretation of the existing literature.

#### 4. Results and Discussion

##### 4.1 Result

Based on the qualitative synthesis of 25 selected studies, the findings reveal four major themes related to artificial intelligence (AI) adoption in MSMEs: (1) drivers of adoption, (2) barriers to adoption, (3) opportunities enabled by AI, and (4) organizational impacts. These themes were derived through a systematic coding and categorization process, allowing for a structured interpretation of the existing literature.

**Table 1.** Thematic Analysis of AI Adoption in MSMEs

Theme	Sub-Themes	Key Insights	Supporting Studies
<b>Drivers of AI Adoption</b>	Technological readiness	Availability of digital infrastructure and data capabilities enables AI adoption	Dubey et al. (2020); Wamba et al. (2017); Maroufkhani et al. (2022)
	Organizational readiness	Leadership support and digital skills influence adoption decisions	Nguyen et al. (2015); Ghobakhloo & Ching (2019)
	Competitive pressure	Market competition pushes MSMEs to adopt digital technologies	Bharadwaj et al. (2013); Li et al. (2018)
	Perceived benefits	Efficiency, cost reduction, and innovation potential drive adoption	Dwivedi et al. (2021); Bughin et al. (2018)
<b>Barriers to AI Adoption</b>	Financial constraints	Limited capital restricts investment in AI technologies	Nguyen et al. (2015); Ghobakhloo & Fathi (2020)
	Lack of expertise	Shortage of technical knowledge and AI skills	Dwivedi et al. (2021)
	Technological complexity	Difficulty in integrating AI into existing systems	Mittal et al. (2018); Agostini & Nosella (2019)
	Organizational resistance	Cultural resistance and lack of strategic vision	Vial (2019)
<b>Opportunities of AI Adoption</b>	Operational efficiency	Automation improves productivity and reduces costs	Cockburn et al. (2018)
	Customer insights	AI enables better understanding of customer behavior	Ransbotham et al. (2017); Rialti et al. (2019)
	Innovation and new business models	AI supports product and service innovation	Nambisan (2017); Kraus et al. (2019)
	Market expansion	Digital tools enable global market access	Zhou et al. (2007); Matarazzo et al. (2021)
<b>Organizational Impacts</b>	Performance improvement	AI adoption enhances firm performance and agility	Dubey et al. (2020); Wamba et al. (2017)
	Digital transformation	AI accelerates overall digital maturity	Vial (2019); Li et al. (2018)
	Innovation capability	Increased ability to innovate and adapt	Scuotto et al. (2017); Bresciani et al. (2018)
	Strategic alignment	Integration of AI into business strategy is critical	Bharadwaj et al. (2013)

##### 1. Drivers of AI Adoption

The analysis indicates that AI adoption in MSMEs is primarily driven by a combination of internal readiness and external pressures. Technological readiness, particularly in terms of data availability, digital infrastructure, and analytics capabilities, serves as a foundational enabler. Firms that possess stronger data ecosystems and IT capabilities are more likely to adopt AI successfully (Dubey et al., 2020; Wamba et al., 2017). Additionally, organizational readiness—

including leadership commitment, digital literacy, and employee competencies—emerges as a critical determinant of adoption (Nguyen et al., 2015).

Beyond internal factors, external forces such as competitive pressure and market dynamics significantly accelerate AI adoption. MSMEs operating in highly competitive and digitally advanced environments are more inclined to adopt AI to maintain relevance and competitiveness (Bharadwaj et al., 2013; Li et al., 2018). Moreover, perceived benefits—such as cost efficiency, improved decision-making, and innovation potential—act as strong motivators for adoption (Dwivedi et al., 2021; Bughin et al., 2018). This suggests that AI adoption is not purely technology-driven but also shaped by strategic and market considerations.

## 2. Barriers to AI Adoption

Despite strong drivers, MSMEs face multiple structural barriers that limit AI adoption. Financial constraints are consistently identified as the most significant challenge, as MSMEs often lack the capital required for investing in AI infrastructure and expertise (Nguyen et al., 2015). This limitation is further exacerbated by uncertainty regarding return on investment, which discourages experimentation with advanced technologies.

Another critical barrier is the lack of technical expertise and digital skills. Many MSMEs do not have access to skilled professionals capable of developing or managing AI systems (Dwivedi et al., 2021). In addition, the complexity of AI technologies presents integration challenges, particularly for firms with legacy systems or low digital maturity (Mittal et al., 2018). Organizational resistance, including reluctance to change and lack of strategic vision, also hinders adoption (Vial, 2019). These barriers highlight the multidimensional challenges faced by MSMEs, encompassing financial, technical, and cultural aspects.

## 3. Opportunities of AI Adoption

The findings demonstrate that AI offers substantial opportunities for MSMEs across multiple dimensions. One of the most prominent benefits is improved operational efficiency through automation and process optimization (Cockburn et al., 2018). AI enables firms to reduce operational costs, minimize errors, and enhance productivity, which is particularly valuable for resource-constrained MSMEs.

AI also enhances customer insights and engagement by enabling firms to analyze large volumes of data and understand customer behavior more effectively (Ransbotham et al., 2017; Rialti et al., 2019). This capability supports personalized marketing strategies and improved customer experiences. Furthermore, AI facilitates innovation and the development of new business models, allowing MSMEs to create value in novel ways (Nambisan, 2017; Kraus et al., 2019). The ability to access global markets through digital platforms further expands growth opportunities, enabling MSMEs to compete internationally (Zhou et al., 2007).

## 4. Organizational Impacts of AI Adoption

AI adoption has significant implications for organizational performance and transformation. The findings show that firms adopting AI tend to experience improvements in efficiency, agility, and overall performance (Dubey et al., 2020; Wamba et al., 2017). AI also acts as a catalyst for digital transformation, accelerating the transition toward more advanced digital maturity levels (Vial, 2019).

In addition, AI enhances innovation capabilities by enabling firms to experiment with new ideas, products, and services (Scuotto et al., 2017). Collaboration and ecosystem participation further strengthen innovation outcomes (Bresciani et al., 2018). Importantly, successful AI adoption requires alignment with organizational strategy, as firms must integrate AI into their broader business models and long-term objectives (Bharadwaj et al., 2013).

### 4.2 Discussion

The findings of this study provide a comprehensive understanding of artificial intelligence (AI) adoption in MSMEs by synthesizing insights from prior literature. Consistent with the

Technology-Organization-Environment (TOE) framework (Tornatzky & Fleischer, 1990), this study confirms that AI adoption is shaped by the interaction between technological readiness, organizational capabilities, and environmental pressures. Technological readiness, particularly in terms of data infrastructure and analytics capabilities, plays a critical role in enabling AI adoption (Dubey et al., 2020; Wamba et al., 2017). However, MSMEs often face limitations in these areas, which restrict their ability to fully leverage AI technologies.

From an organizational perspective, leadership support, digital skills, and strategic orientation are key determinants of AI adoption. Studies indicate that firms with strong managerial commitment and digital competencies are more likely to adopt advanced technologies (Nguyen et al., 2015; Ghobakhloo & Ching, 2019). Furthermore, digital transformation requires a fundamental shift in business strategy, where digital technologies are integrated into core business processes (Bharadwaj et al., 2013). This aligns with the concept of digital business strategy, which emphasizes the importance of aligning technological initiatives with organizational goals.

Environmental factors, including competitive pressure and market dynamics, also play a significant role in driving AI adoption. MSMEs are increasingly compelled to adopt digital technologies to remain competitive in rapidly evolving markets (Li et al., 2018). The rise of digital ecosystems and platforms further intensifies this pressure, as firms must adapt to new modes of value creation and competition (Nambisan, 2017). In this context, collaboration and alliances become essential mechanisms for accessing resources and knowledge, particularly for resource-constrained MSMEs (Bresciani et al., 2018).

Despite the strong drivers of adoption, the findings highlight persistent barriers that hinder AI implementation in MSMEs. Financial constraints remain one of the most significant challenges, as the cost of AI technologies and infrastructure can be prohibitive (Nguyen et al., 2015). Additionally, the lack of technical expertise and skilled personnel limits the ability of MSMEs to implement and manage AI systems effectively (Dwivedi et al., 2021). These challenges are compounded by the complexity of AI technologies and the difficulty of integrating them into existing organizational processes (Mittal et al., 2018; Agostini & Nosella, 2019).

The study also reveals that organizational resistance and lack of strategic vision can impede AI adoption. Digital transformation requires not only technological investment but also cultural change and organizational learning (Vial, 2019). Many MSMEs struggle to align their organizational structures and processes with the requirements of digital transformation, resulting in slow or unsuccessful adoption (Ghobakhloo & Fathi, 2020).

On the other hand, the opportunities associated with AI adoption are substantial. AI enables MSMEs to enhance operational efficiency through automation and process optimization (Cockburn et al., 2018). It also facilitates better understanding of customer behavior, allowing firms to deliver personalized products and services (Ransbotham et al., 2017; Rialti et al., 2019). These capabilities contribute to improved customer satisfaction and competitive advantage.

Moreover, AI plays a crucial role in fostering innovation and supporting the development of new business models. Digital entrepreneurship literature highlights that MSMEs can leverage AI to create new value propositions and explore emerging market opportunities (Kraus et al., 2019; Nambisan, 2017). The integration of AI with digital platforms and social media further enhances firms' ability to innovate and engage with customers (Ainin et al., 2015; Scuotto et al., 2017).

The role of big data analytics in enabling AI adoption is also evident in the findings. Firms that effectively utilize data analytics are better positioned to implement AI and achieve superior performance outcomes (Maroufkhani et al., 2022). This underscores the importance of developing data-driven capabilities as a foundation for AI adoption. Additionally, AI adoption contributes to supply chain agility and organizational performance, highlighting its strategic value for MSMEs (Dubey et al., 2020; Wamba et al., 2017).

Furthermore, AI adoption supports the internationalization of MSMEs by enabling access to global markets and enhancing cross-border operations (Zhou et al., 2007). Digital transformation facilitates the integration of MSMEs into global value chains, allowing them to compete more effectively in international markets (Matarazzo et al., 2021). This highlights the potential of AI to drive economic growth and development at a broader level (Bughin et al., 2018).

Overall, the findings suggest that AI adoption in MSMEs is a complex and multidimensional process that requires alignment between technological, organizational, and environmental factors. While the challenges are significant, the potential benefits of AI adoption make it a critical area for both research and practice. The study contributes to the literature by providing a holistic understanding of AI adoption in MSMEs and identifying key factors that influence its success.

### 4.3 Implications

This study extends the existing literature on technology adoption by integrating AI-specific insights into the TOE framework. It highlights the importance of combining technological readiness with organizational and environmental factors to understand AI adoption in MSMEs. Furthermore, the study contributes to digital transformation and digital entrepreneurship literature by emphasizing the role of AI as a strategic enabler of innovation and value creation (Bharadwaj et al., 2013; Nambisan, 2017). The qualitative synthesis approach also provides a deeper understanding of contextual and experiential factors that are often overlooked in quantitative studies.

For practitioners, the findings suggest that MSMEs should prioritize building digital capabilities, particularly in data analytics and AI-related skills, to enhance their readiness for AI adoption. Managers should also focus on aligning AI initiatives with business strategy and fostering a culture of innovation and learning. Collaboration with external partners, such as technology providers and innovation networks, can help MSMEs overcome resource constraints and access necessary expertise (Bresciani et al., 2018). Additionally, policymakers should provide support in the form of training programs, financial incentives, and infrastructure development to facilitate AI adoption among MSMEs.

From a policy perspective, governments play a crucial role in creating an enabling environment for AI adoption. Policies that promote digital literacy, innovation ecosystems, and access to financing can significantly enhance the ability of MSMEs to adopt AI technologies. Supporting MSMEs in their digital transformation journey is essential for fostering economic growth, innovation, and competitiveness in the digital economy (Bughin et al., 2018).

### 5. Conclusion

This study provides a qualitative synthesis of artificial intelligence (AI) adoption in Micro, Small, and Medium Enterprises (MSMEs), highlighting key drivers, barriers, opportunities, and organizational impacts. The findings demonstrate that AI adoption in MSMEs is shaped by the interplay of technological readiness, organizational capabilities, and environmental pressures, consistent with the Technology-Organization-Environment (TOE) framework. While MSMEs face significant constraints such as limited financial resources, lack of expertise, and low digital maturity, AI presents substantial opportunities to enhance operational efficiency, innovation, and competitiveness. Furthermore, AI enables MSMEs to improve customer engagement, develop new business models, and expand into global markets. Overall, this study contributes to the literature by offering a comprehensive and integrative understanding of AI adoption in MSMEs through a qualitative lens.

Despite its contributions, this study has several limitations. First, the analysis is based on a limited number of 25 selected articles, which may not fully capture the entire body of literature on AI adoption in MSMEs. Second, the study relies on secondary data from published research, which may introduce bias depending on the scope and methodology of the original studies. Third, the qualitative synthesis approach, while providing in-depth insights, does not allow for statistical generalization of findings. Additionally, the inclusion of studies across different contexts and industries may lead to variations that are not fully comparable, potentially affecting the consistency of interpretations.

Future research should expand the scope of analysis by including a larger and more diverse set of studies to enhance the robustness of findings. Empirical research using mixed-methods or longitudinal approaches is recommended to better understand the dynamic process of AI adoption in MSMEs over time. Further studies could also explore sector-specific or region-specific adoption patterns to provide more contextualized insights. Additionally, future research should

investigate the role of emerging technologies such as generative AI and their implications for MSMEs. Finally, there is a need for more in-depth qualitative studies, such as case studies or interviews, to capture the lived experiences of MSME practitioners and provide richer insights into the challenges and opportunities of AI adoption.

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