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Adoption of Artificial Intelligence in Micro Small and Medium Enterprises

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Abstract

ABSTRACT
Background of study: Artificial Intelligence (AI) is transforming business operations globally, yet its adoption in Micro, Small, and Medium Enterprises (MSMEs) remains limited, particularly in developing economies. MSMEs face multiple constraints, including limited digital infrastructure, lack of awareness, and resistance to change, making it challenging to integrate AI technologies effectively.
Aims and scope of paper: This paper aims to explore the enabling factors and barriers to AI adoption among MSMEs, with a focus on the mediating role of accounting automation and the influence of institutional support. The study also highlights the importance of organizational readiness and external policy frameworks in driving digital transformation at the MSME level.
Methods: A qualitative exploratory approach was adopted, incorporating data from in-depth interviews with MSME owners, government representatives, and technology experts. The study also utilized secondary sources such as policy reports, prior academic research, and case studies. Thematic content analysis was used to extract key themes from the data.
Result: Findings indicate that while awareness of AI benefits is increasing, practical adoption remains low due to cost concerns, inadequate infrastructure, and limited technical expertise. Government support programs are inconsistently accessed, and accounting automation acts as both a driver and a challenge depending on the firm's digital maturity.
Conclusion: The adoption of AI in MSMEs requires a multi-dimensional strategy that includes targeted policy interventions, awareness campaigns, and capacity-building efforts. Organizational culture, leadership commitment, and access to affordable digital tools are essential to accelerating AI integration in the MSME sector.

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INTRODUCTION

Businesses are using artificial intelligence (AI) more and more as a vital tool to boost creativity, efficiency, and productivity. The use of AI technologies by micro, small, and medium-sized

enterprises (MSMEs) in developing nations has garnered increased attention in recent years. MSMEs in developing nations frequently struggle to maximize productivity and optimize their operations. By automating tedious operations, delivering real-time data insights, and expediting the decision-making process, AI can assist in addressing these issues. For example, AI-driven chatbots can effectively respond to consumer questions, and AI-driven IMSs can minimize expenses by optimizing inventory levels (Le Dinh et al., 2025). According to Kulkarni et al. (2024), MSMEs can use AI to boost decision-making, improve customer experiences, and streamline supply chain processes. Predictive analytics driven by AI can also assist MSMEs in anticipating demand trends and modifying their inventory accordingly, saving waste and enhancing operational effectiveness. Artificial Intelligence has the potential to assist MSMEs in discovering unexplored markets and new business prospects due to its rapid and accurate processing of large amounts of data. These are but a handful of the numerous options available.

MSMEs are now embracing artificial intelligence alongside enterprise companies due to a number of technological factors, including productivity and efficiency, cost savings, competitiveness, and innovation. AI can help MSMEs in two ways, according to an OECD publication: either by changing their business environment and making it easier for them to conduct business, or by allowing them to modify their business models and procedures, which may eventually allow them to expand their reach and productivity and scale up. These two dynamics are intertwined because MSMEs innovate to change market conditions or adapt their processes and products to changing business conditions (Ayinaddis, 2025). However, a number of studies (Schwaeke et al., 2025; Iftikhar & Nordbjerg (2021); Szedlak et al., 2021) found that less than 10% of MSMEs have used AI to date. Therefore, by offering support through policies, regulations, programs, and facilities, governments in developing nations play a critical role in fostering an environment that is favorable to the adoption of AI in MSMEs. This study looks into the different ways that developing-nation governments assist and motivate MSMEs to adopt AI technologies.

Artificial intelligence is increasingly prevalent across numerous sectors, addressing the needs of diverse businesses. Initially viewed as a means of enhancing automation within different industries, AI has since unlocked a spectrum of opportunities in creativity and design. Moreover, with the rise of Industry 4.0 standards, AI has risen to prominence, assuming a crucial function in facilitating its integration across different industries. AI is regarded as an instrument that empowers Micro, Small, and Medium-Sized Enterprises with restricted means to achieve expedited expansion. The MSME sector in India primarily encompasses industries such as textiles, machinery and components, mining and excavation, fundamental metal industries, electrical machinery and equipment, transportation vehicles and components, paper goods and printing, food items, chemicals and chemical derivatives, leather, wood, rubber, plastic, and other non-metallic mineral products, drinks, and tobacco goods, although this varies by State. This research study endeavors to pinpoint effective governmental strategies that can bolster the successful integration of AI within MSMEs, fostering their advancement and long-term viability through the examination of current scholarly works and real-world examples.

METHOD

Research Approach

This study adopts a qualitative exploratory approach to examine the adoption of Artificial Intelligence (AI) in MSMEs. The approach aims to understand the underlying factors, organizational readiness, and policy implications that influence AI integration at the micro-enterprise level.

Data Sources and Collection

The data for this study were obtained from both primary and secondary sources. Primary data were collected through in-depth interviews and case study analysis involving relevant stakeholders. These included MSME owners and managers who are directly involved in decision-making processes

related to digital transformation, government officials overseeing policies and programs that support AI adoption in small businesses, as well as technology consultants and practitioners with experience implementing AI solutions in the MSME context.

In addition to primary data, secondary data were gathered from various documented sources, including government policy documents such as national digital transformation roadmaps, academic publications, industry reports, and case studies from reputable institutions. These secondary sources provided contextual and comparative insights to support the interpretation of the primary data.

Sampling Technique

A purposive sampling strategy was used to select informants actively involved in MSME digital transformation and AI-related decision-making.

Data Analysis

Thematic content analysis was used to code interview responses and case data. Emerging themes were compared against existing frameworks, such as the Technology–Organization–Environment (TOE) model.

RESULTS AND DISCUSSION

The following are several forms of using AI in MSME businesses

The use of Artificial Intelligence (AI) in Micro, Small, and Medium Enterprises (MSMEs) has manifested in various practical forms that significantly enhance operational performance. One of the primary advantages is the efficiency of operations. By automating business processes such as scheduling, inventory control, and transaction processing, MSMEs can save both time and operational costs. For example, AI-based stock management systems and real-time data analysis help streamline logistics and supply chains.

In addition, AI supports advanced data analysis, allowing MSMEs to analyze large volumes of data to better understand customer preferences, market trends, and behavioral patterns. This enables them to make more informed decisions, such as adjusting marketing strategies or optimizing inventory based on accurate AI-generated forecasting. Marketing efficiency is another area where AI proves beneficial. It helps MSMEs develop more targeted and personalized marketing campaigns. Through machine learning algorithms, businesses can tailor advertisements and product recommendations to individual customer preferences, thereby improving conversion rates and customer retention. AI also facilitates more precise market segmentation and ad targeting. From a security standpoint, AI enhances data protection by detecting and preventing cybersecurity threats. AI-powered systems can automatically identify suspicious behavior and safeguard company data from cyberattacks. Furthermore, AI assists MSMEs in gaining access to financial services by evaluating creditworthiness, making rapid loan decisions, and expanding financial inclusion for underserved entrepreneurs.

AI also contributes to staff training and development by personalizing learning experiences based on each employee's needs. Customized training programs increase workforce productivity and skill levels. Finally, AI enables MSMEs to explore new markets by analyzing global data patterns, identifying emerging opportunities, and helping businesses overcome geographical limitations to scale their operations..

MSMEs Challenges in AI Adoption

Considering the aforementioned limitations, MSMEs find it extremely difficult to implement AI in developing nations. The main obstacle that MSMEs encounter is the lack of knowledge and comprehension regarding AI technologies and their possible advantages. It's possible that many

MSMEs in developing nations are unaware of the effects artificial intelligence (AI) can have on their operations and how it can be incorporated into their business processes. For MSMEs, access to and cost of AI technologies are major obstacles. For many small and medium businesses with limited funding, the initial investment needed for AI implementation which includes infrastructure, software, and training can be prohibitive. The lack of qualified AI specialists to help with the setup and upkeep of AI systems is another issue that makes adoption of these systems more difficult in developing nations. The issues MSMEs face are further compounded by worries about data privacy, security, and ethical issues surrounding the use of AI. When incorporating AI into corporate operations, data security and privacy are crucial, and MSMEs might not have the means or know-how to properly handle these issues. The adoption process for MSMEs is further complicated by ethical issues surrounding AI, such as bias in algorithms or unintended consequences of automation. Governments in developing nations need to be more proactive in helping MSMEs use AI in light of these obstacles. To fully realize the potential benefits of AI in MSMEs, policies and initiatives targeted at resolving these issues and creating an AI-friendly environment for these businesses are essential.

Barriers to AI Adoption

Numerous studies demonstrate that when compared to large enterprises (LEs), MSMEs lag far behind in the adoption of AI-based technologies, both in developing and developed nations. When comparing MSMEs in Denmark and other European countries to their larger counterparts, research by, for example, Larsen et al. (2022), Amalia & Hayati (2025), Hızarcı et al. (2024), and Akhtar (2024) revealed that MSMEs are far behind in using AI-based technologies. The common issues that MSMEs in Denmark, the surrounding Nordic countries, and Germany face include a lack of organizational commitment to and support for artificial intelligence (AI), a high degree of ROI restraint, a lack of appropriate skills and competencies, a lack of digital standards, concerns about data security and privacy, inadequate funding, and a lack of appropriate tools and technologies. Iftikhar & Nordbjerg, (2021) carried out an investigation focusing on micro, small, and medium-sized enterprises in Denmark, revealing that the execution of AI-driven strategies remains a challenge for these companies. This difficulty persists despite various hurdles, such as the application of business practices, the accessibility of data, the prevailing organizational mindset concerning the integration of innovative technologies, investments allocated to these technologies, insufficient skill sets, the procedures involved in development, and the formulation of successful strategies.

Table 1. Barriers Discouraging MSMEs to Adopt AI Technology

(T) = Technological Context (O) = Organizational Context (E) = Enviromental Context	
1. Lack of AI competence (O/E)	12. Resources constraints (O)
2. Dependency on external help (E)	13. Lack of clear business case and strategy (O)
3. Lack of IT competence or knowledge (O)	14. Insufficient employee training (O)
4. No or little prior AI experience (O)	15. Financial constraints (O)
5. AI or technology skepticism (O)	16. Incompatibility of an AI solution with an organization's legacy IT systems or processes (T/O)
6. Change resistance (O)	
7. Unclear benefits of an AI initiative (O/T)	17. Not following AI trends (O)
8. Competing priorities (O)	18. Price of an AI solution (O/E)
9. Employee age (O)	19. Risk of losing reputation and damaging customer relationships (E)
10. Firefighting (O)	
11. Lack of AI understanding (O/T)	20. Tasks or processes that are challenging to streamline (O)

The study by Rawashdeh et al. (2023) looks at the technological aspects that affect AI adoption. Their research also looks at how accounting automation influences the adoption of AI in MSMEs. Through the use of convenience sampling, an online survey was administered to MSMEs' owners and managers. SEM was used to test the suggested model. The results validated the associations between the predictors and the adoption of AI. The findings demonstrated that the relationship between predictive variables and AI adoption was partially mediated by accounting automation. It is the

responsibility of managers to comprehend the viability and advantages of implementing AI solutions, claims (Grünbichler, 2023). Across a multitude of countries, only a small fraction of companies possess a fully developed framework for data collection and the application of artificial intelligence. The primary impediment to integrating AI is the absence of a strategic plan, coupled with a shortage of comprehensive AI solutions that are effectively controlled, a deficient governance structure for putting plans into action, and an inadequacy of required skills. As highlighted by Bettoni et al. (2021), these deficiencies are commonly observed in MSMEs, thereby amplifying the challenges they face in surmounting these obstacles. More precisely, (i) The deployment of AI necessitates the allocation of funds and resources, and (ii) AI-driven projects must utilize data that is carefully prepared and obtained from dependable origins. Furthermore, examination of the results obtained from face-to-face discussions and a review of current advancements as presented in Pamungkas et al. (2023), von Garrel & Jahn (2023), and Rehman et al. (2021), there are five main obstacles that stop businesses from implementing AI: Lack of data, a lack of tailored solutions, a lack of AI lifecycle assessment techniques, a shortage of knowledgeable workers and business owners, and a lack of experience with applying AI solutions are the first five reasons.

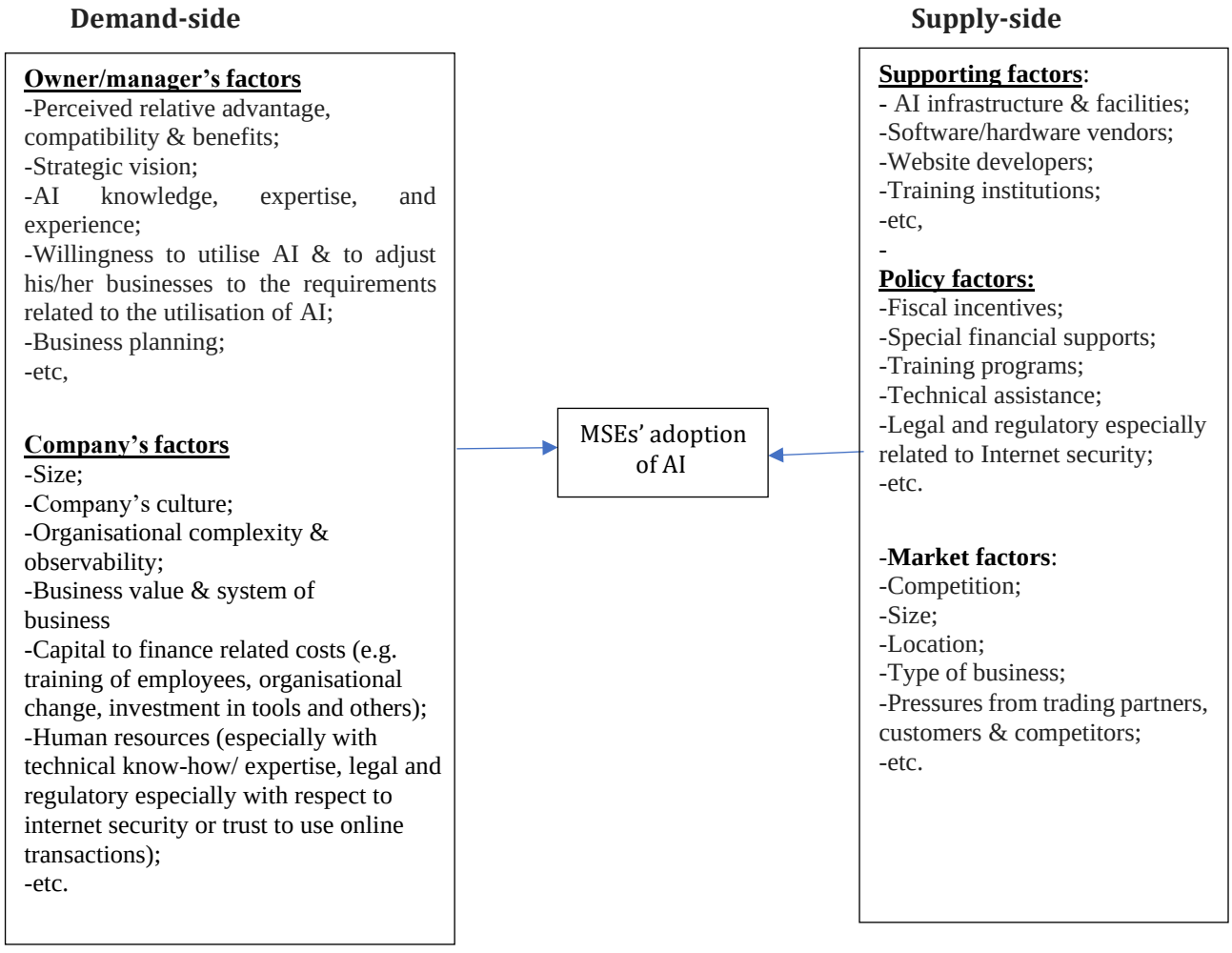

Figure 1. Factors Affecting Directly the Willingness or Ability of MSMEs to Adopt AI

Government Initiatives in AI Supports

Governments in developing nations must prioritize and invest in comprehensive policies, programs, and infrastructure that foster an AI-friendly environment, given the importance and potential of AI adoption for MSMEs. Governments can enable MSMEs to leverage the transformative potential of artificial intelligence (AI) to drive economic growth and improve global competitiveness by providing

targeted support and fostering collaborative efforts. After obtaining the requisite infrastructure, support, and expertise, MSMEs must comprehend the integration of AI into their business operations and decision-making procedures. Furthermore, the development of an innovative and experimenting culture within MSMEs is essential to the successful implementation of AI. By encouraging cooperation, networking opportunities, and industry partnerships where MSMEs can share experiences and best practices related to AI integration, governments can foster a dynamic and adaptable business environment. For MSMEs, this cooperative approach can shorten their learning curve and encourage them to adopt an AI-driven culture of innovation and constant improvement. Through an emphasis on knowledge sharing, training, and capacity building, governments can enable MSMEs to successfully navigate the challenges of adopting AI and realize its transformative potential. These initiatives, when coupled with financial assistance, regulatory guidance, and cooperative efforts, have the potential to greatly boost AI adoption in the MSME sector and create a more resilient, inventive, and competitive landscape for small and medium-sized businesses. Examining effective case studies from various developing nations can provide valuable insights into how governments can effectively support the adoption of AI in MSMEs. Comprehensive strategies to support the adoption of AI in MSMEs can be formulated by applying the valuable lessons learned from the analysis and benchmarking of these initiatives.

The strategy's main goals are to foster the moral and responsible use of AI technologies while also creating an environment that is supportive of AI research and innovation. The government has also set up funding initiatives and AI research centers to assist MSMEs in utilizing AI in their day-to-day operations. These programs have helped MSMEs overcome their difficulties with awareness and skill development in addition to providing easier access to AI technologies.

CONCLUSION

In conclusion, governments in developing nations ought to be proactive in encouraging MSMEs to use AI by providing support and incentives. These actions could involve putting laws and rules into place that establish. an atmosphere that is conducive to the adoption of AI, such as offering grants or tax breaks to MSMEs who invest in AI technologies. Additionally, MSMEs can be greatly empowered to incorporate AI into their operations by creating specialized programs and facilities that provide funding and resources for the adoption of AI.

Initiatives aimed at increasing capacity and providing training are crucial in ensuring that MSMEs have the know-how to use AI efficiently. Governments can create specialized training programs suited to the particular requirements of MSMEs by working with academic institutions and industry experts, guaranteeing that the workforce is knowledgeable in AI-related competencies. The workforce becomes more dynamic and adaptive as a result of this investment in skill development, making it ready to take advantage of the opportunities that the adoption of AI brings. Furthermore, the successful adoption of AI within MSMEs depends on cultivating a culture of innovation and experimentation. Governments can encourage companies to share best practices and insights about AI integration by providing opportunities for knowledge sharing, mentorship, and collaboration within the MSME sector. With the help of AI technologies, this collaborative approach helps MSMEs learn more quickly and fosters a culture of continuous improvement. Governments can facilitate the widespread adoption of AI among MSMEs by adopting a comprehensive strategy that includes financial support, regulatory guidance, capacity building, and the promotion of an innovative culture. In addition to increasing MSMEs' ability to innovate and compete, this coordinated effort advances the general economic expansion and well-being of developing nations. Through fostering an atmosphere that welcomes AI integration, governments can set up MSMEs for success in the rapidly changing technology landscape and promote sustainable development.

Furthermore, government and relevant agencies should enforce existing environmental and forestry regulations to curb illegal logging and land degradation. There is a need to support community-based forest management initiatives that involve local people in the stewardship of natural resources.

Alternative livelihood programs, such as beekeeping, fish farming, and eco-tourism, can help reduce dependence on deforestation-driven income sources. Ultimately, aligning environmental protection with socio-economic development will foster sustainable agriculture, preserve biodiversity, and secure the livelihoods of rural communities in Benue South.

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AUTHOR CONTRIBUTION STATEMENT

Abdul Jamal M. conceptualized the research idea, framed the theoretical background, and led the development of the manuscript. Hanh Thi Pham contributed to the literature review, provided international policy perspectives, and supported the structuring of the discussion section. Shahul Hameed M. was responsible for collecting and synthesizing qualitative data, identifying barriers to AI adoption, and drafting the methodology section. Sadique Ahmed R. performed content analysis, developed the implications and conclusion sections, and coordinated the final manuscript editing. All authors read and approved the final version of the manuscript submitted for publication.

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