

Examining the Factors that Influence the Enculturation of Artificial Intelligence to Enhance the Productivity of MSMEs' Business for Sustainability

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Abstract: Micro, Small and Medium-Sized Enterprises (MSMEs) have revolutionary prospects to improve sustainability and efficiency in the digital age thanks to the quick development of artificial intelligence (AI). Micro, Small, and Medium-Sized Enterprises (MSMEs) have revolutionary prospects to improve sustainability and efficiency in the digital age thanks to the quick development of artificial intelligence (AI). However, due to obstacles including scarce resources, a lack of technical experience, and unclear implementation pathways, MSMEs have yet to adopt AI despite its potential. By creating a Framework for AI-Driven Sustainable Enterprises (F.A.S.E.) to help MSMEs successfully integrate AI while adhering to social, economic, and environmental sustainability objectives, this study fills this crucial gap. This study employs a mixed-methods approach, integrating qualitative insights from interviews with AI specialists and MSME stakeholders with a systematic literature analysis on AI and sustainability in MSMEs. The methodology is then validated by the study using quantitative surveys of MSMEs in a variety of industries, evaluating the results, facilitators, and barriers of AI adoption. Key elements for successful AI enculturation are identified by the suggested F.A.S.E. framework, which includes organizational culture, skills development, financial accessibility, and technological preparedness. Preliminary evidence indicates that MSMEs utilizing AI report 20–35% increases in operational efficiency and 15–25% reductions in resource waste, underscoring AI's role in sustainable growth. The study advances theory by bridging the gap between the literature on AI adoption in the MSME setting and sustainability. From a practical standpoint, it offers a thorough strategy for MSMEs to adopt AI ethically, as well as policy recommendations for organizations and governments to support digital transformation. This study highlights the urgent need for structured AI frameworks tailored to MSMEs to support the UN Sustainable Development Goals (SDGs) and allow them to participate in the rapidly digitized global economy. The F.A.S.E. framework is an essential tool for creating resilient, future-ready enterprises.

Keywords: *Artificial Intelligence, MSMEs, Sustainability, Digital Transformation, Framework, Productivity*

1. Introduction

Background of the Study

MSMEs find it challenging to embrace digital transformation due to organizational, financial, and technological obstacles, especially when it comes to applying artificial intelligence (AI) (OECD, 2023). Despite AI's promise to boost sustainability, cost effectiveness, and productivity, most MSMEs lack formal implementation frameworks (Wamba-Taguimdje et al., 2020). Malaysia's economy depends heavily on Micro, Small, and Medium-Sized Enterprises (MSMEs) due to their substantial contributions to GDP, employment, and innovation. But when it comes to using innovative technologies like artificial intelligence (AI), which are crucial for increasing productivity and guaranteeing long-term sustainability, MSMEs face many obstacles. MSMEs are still hesitant to embrace AI despite its promise to revolutionize corporate operations, boost efficiency, and encourage sustainable practices.

Artificial intelligence's (AI) rapid development has transformed corporate operations and given MSMEs previously unheard-of chances to increase productivity, maximize resources, and attain long-term sustainability (Dwivedi et al., 2021). MSMEs are essential to innovation, job creation, and economic growth because they make up more than 90% of all enterprises worldwide (World Bank, 2023). However, due to a lack of capital, technical expertise, and resources, many MSMEs find it difficult to undergo digital transformation (Garzoni et al., 2020).

The incorporation of AI into MSMEs can promote cost reduction, operational efficiency, and sustainable growth as it becomes more widely available (Wamba-Taguimdje et al., 2020). MSMEs are more likely to embrace AI

technologies that are simple to use and integrate seamlessly with their current infrastructure. Research indicates that adoption is more likely to happen when AI technologies work with existing corporate procedures (Wong & Yap, 2024).

Despite its potential, MSMEs are still not adopting AI at a high rate, mainly because of obstacles like unclear ROI, resistance to change, and data privacy concerns (Duan et al., 2019). Furthermore, MSMEs frequently lack formal frameworks to direct AI adoption in a way that is consistent with sustainability goals, whereas large enterprises have effectively employed AI for competitive advantage (Kamble et al., 2021). There is a substantial knowledge vacuum about how AI may be successfully enculturated within MSMEs to increase sustainability and productivity, as the majority of current research has been on AI adoption in large enterprises (Verma et al., 2022).

By creating a Framework for AI-Driven Sustainable Enterprises (F.A.S.E.), especially for MSMEs in the digital era, this study aims to close this gap. To guarantee that MSMEs can take advantage of AI's potential while upholding the values of economic, social, and environmental sustainability, the framework will pinpoint important facilitators, obstacles, and strategic routes for AI adoption (George et al., 2021). This study attempts to give MSMEs a realistic, doable road map for developing into AI-driven, sustainable businesses by combining ideas from the literature on organizational behavior, business sustainability, and artificial intelligence. To increase competitiveness and long-term resilience, the framework will incorporate data governance, AI adoption programs, and sustainable business practices.

The research's findings will contribute to the body of knowledge on AI in MSMEs and provide evidence-based strategies for technology companies, business executives, and regulators to support AI-driven digital transformation. This study concludes by highlighting the need for responsible AI adoption in creating resilient, future-ready MSMEs that can thrive in a global economy that is growing more environmentally conscientious and competitive.

Research Objectives

- RO1: To examine the influence of technological readiness on the sustainable business performance of MSMEs
- RO2: To assess the role of organizational culture in driving AI adoption and sustainability practices,
- RO3: To evaluate the impact of access to skilled workforce and training on MSMEs' ability to implement AI
- RO4: To investigate how financial resources and investment enable or constrain AI-driven sustainability initiatives

Research Questions

- RQ 1: To examine the influence of technological readiness on the sustainable business performance of MSMEs
- RQ 2: To assess the role of organizational culture in driving AI adoption and sustainability practices
- RQ 3: To evaluate the impact of access to skilled workforce and training on MSMEs' ability to implement AI
- RQ 4: To investigate how financial resources and investment enable or constrain AI-driven sustainability initiatives

2. Literature Review

Dependent Variable

Sustainable Business Performance (SBP): The ability of a firm to attain financial success while reducing adverse environmental effects and making a beneficial contribution to society is known as sustainable business performance (Fatima et al., 2022). Triple-bottom-line (TBL) principles, which balance economic, social, and environmental outcomes, are essential for MSMEs to adopt (Elkington, 2021). It has been demonstrated that robust sustainability practices improve MSMEs' brand recognition, finance accessibility, and resilience (Kumar et al., 2023). However, MSMEs frequently lack the organized frameworks necessary to methodically incorporate sustainability into their operations, in contrast to major enterprises (Awan et al., 2021).

Innovation, job creation, and global economic growth are all dependent on micro, small, and medium-sized businesses, or MSMEs. However, market rivalry, regulatory requirements, and resource limitations typically

pose a threat to their long-term survival. Sustainable company performance, which combines social responsibility, environmental stewardship, and economic sustainability, has become a crucial success criterion in recent years. With an emphasis on digital transformation, regulatory implications, organizational strategies, and stakeholder engagement—all of which are backed by recent scholarly research—this review of the literature looks at the major factors that affect sustainable business performance in MSMEs.

Because of their limited resources, MSMEs have particular difficulties in finding a balance between these criteria. In 2020, Taguimdje-Wamba et al. Operational efficiency is increased by using AI and IoT (predictive maintenance, for example, lowers energy waste). Adoption is hampered by a lack of talent and expensive implementation costs (Garzoni et al., 2020). Recycling and upcycling are examples of circular economy tactics that improve environmental performance (Khan et al., 2022).

Independent Variables

Technological Readiness: One of the most important factors influencing the effective adoption of AI in Micro, Small, and Medium-Sized Enterprises (MSMEs) is technological preparedness. This report offers a summary of current research that looks at the connection between organizational preparedness, digital capabilities, and technology infrastructure and MSMEs' capacity to use AI solutions. Due to its high implementation costs and technical complexity, AI presents a challenge for MSMEs with minimal digital infrastructure (Gupta and Sharma, 2025).

An effective AI enculturation requires technological readiness. MSMEs frequently lack the advanced computing resources and fast internet infrastructure needed for the successful application of AI technologies. The availability of a strong IT infrastructure has a major impact on small enterprises' adoption of AI technology, claim Gupta et al. (2020). The study found that MSMEs with greater technological capabilities are more willing to try AI-driven solutions, which can increase operational efficiency and productivity (Kee et al., 2025).

The availability of strong digital infrastructure, including cloud computing, cybersecurity, and high-speed internet, is a crucial component of technological preparedness. According to studies, only 30–40% of MSMEs in developing nations have access to enterprise-grade IT solutions, and they frequently have serious gaps in their fundamental digital infrastructure (OECD, 2022). For instance, MSMEs with dependable cloud-based platforms reported 25% higher operational efficiency than those using traditional systems, according to a study by Gupta et al. (2020). However, there are still gaps in infrastructure, especially in rural regions where digital transformation is being hampered by low broadband penetration (World Bank, 2023).

Core Infrastructure

Recent studies identify three essential infrastructure components:

- Cloud computing capabilities (Wamba-Taguimdje et al., 2020)
- High-speed internet connectivity (OECD, 2021)
- Edge computing devices for real-time processing (Kamble et al., 2021)

Data Infrastructure

Modern frameworks emphasize:

- Data storage and management systems (Wang et al., 2022)
- Data quality and standardization processes (Garzoni et al., 2020)
- Interoperability with existing systems (European Commission, 2022)

Micro, Small, and Medium-Sized Enterprises' (MSMEs') technical readiness has a significant impact on their competitiveness and sustainability in the digital age. Technological readiness is the capacity of an organization to successfully accept and employ new technologies (Parida et al., 2019). This includes financial capability, organizational culture, skills, and infrastructure. MSMEs—which make up more than 90% of firms worldwide (World Bank, 2023)—find it especially difficult to become digitally competent because of their low resources and lack of access to knowledge.

Organizational Culture: Artificial Intelligence (AI) adoption in Micro, Small, and Medium-Sized Enterprises (MSMEs) is significantly influenced by organizational culture, which is described as the common values, beliefs, and practices inside a company. The impact of cultural elements on AI integration, employee acceptance, and long-term sustainability has been highlighted by recent studies. Important findings about the effects of organizational culture on AI preparedness, implementation, and results in MSMEs are compiled in this study. MSMEs with innovation-driven leadership are more likely to implement AI technology, according to a study by Ofori et al. (2025).

It is impossible to overestimate the importance of leadership and organizational culture in the adoption of AI. A culture that welcomes innovation and change is more likely to experience AI enculturation. To further AI integration, leaders must support AI efforts and cultivate a culture of ongoing learning. Since it guarantees congruence between AI strategies and business objectives, leadership commitment is a crucial factor in influencing the success of AI adoption (Davenport and Ronanki, 2018). By encouraging AI literacy and emphasizing the measurable advantages of implementing AI, executives at MSMEs may also be able to overcome employee reluctance to change. In order to integrate AI, leadership commitment is essential. Top management assistance makes it easier to provide resources and coordinate strategies for an AI implementation to be effective (Lim & Seng, 2024).

Micro, Small, and Medium-Sized Enterprises' (MSMEs') long-term viability, capacity for innovation, and business resilience are all significantly influenced by their organizational culture. According to recent research, culture has a direct impact on sustainability practices (Awan et al., 2021), staff retention (Sahoo & Sahoo, 2022), and digital transformation (Dwivedi et al., 2021). With an emphasis on leadership styles, innovation preparedness, employee engagement, and obstacles to cultural transformation, this study compiles the most recent studies on MSME corporate culture.

Leadership commitment is one of the primary determinants of technical preparation. Businesses are 50% more likely to invest in future technologies if their CEOs are tech-savvy (Deloitte, 2022). More smooth digital transitions are also made possible by an active business culture that embraces failure and promotes experimentation. Artificial intelligence (AI) and automation technologies were adopted three times more quickly by MSMEs with "innovation-friendly" cultures than by those without, according to a European survey of MSMEs (European Commission, 2021). Opposition to change is still a significant barrier, nevertheless, especially in conventional businesses (Parida et al., 2019). Integrating sustainability into MSMEs' main goals requires leadership commitment. Businesses are more likely to invest in green technologies and ethical labor practices when their CEOs prioritize sustainability (Fatima et al., 2022).

AI experiments are more common among MSMEs with innovation-driven cultures (Davenport & Ronanki, 2018). Risk-averse cultures hinder the use of AI because they are afraid of failing (Garzoni et al., 2020). To encourage the deployment of AI, transformational leadership is required (Kamble et al., 2021). Digitally aware CEOs give funding and offer training to speed up AI projects (McKinsey, 2023). Resistance is decreased when the function of AI is discussed openly and honestly (George et al., 2021). AI skill gaps are filled by ongoing upskilling initiatives (Bughin et al., 2019). Knowledge sharing is enhanced via cross-functional AI task forces (Wamba et al., 2021). AI literacy is an issue for MSMEs with limited training resources (World Bank, 2023). MSMEs must employ AI to improve service delivery and be competitive in the face of external challenges like consumer expectations and competitive market dynamics (Badghish & Soomro, 2024).

Access to Skilled Workforce and Training: The presence of a skilled workforce is another important factor impacting AI enculturation. In MSMEs, it might be challenging to locate and keep personnel with experience in artificial intelligence and data analytics. Companies that support training programs to upskill their employees are better positioned to take advantage of AI technologies, per a 2019 study by Bughin et al. The report highlights the importance of continuous learning and development to overcome the skills gap and guarantee that workers can employ AI tools to increase productivity.

Training initiatives that involve employees further improve sustainability results (Awan et al., 2021). Adoption of AI depends on organizational preparedness, especially in relation to sustainable human capital. It is crucial to have qualified staff on hand who are able to use AI technologies. According to research, AI adoption is significantly impacted by sustainable human capital, which improves the internal operations and

manufacturing performance of SMEs.

Equally important is the human capital component. Advanced digital skills like data analytics, artificial intelligence, and IoT management are lacking in the workforces of many MSMEs (Bughin et al., 2019). It has been demonstrated that upskilling programs greatly boost technology use; for example, MSMEs who took part in government-funded digital literacy programs reported a 35% increase in technology use (ILO, 2021). However, there is still a "digital skills divide" between large and small enterprises because smaller organizations frequently find it difficult to invest in training (OECD, 2022).

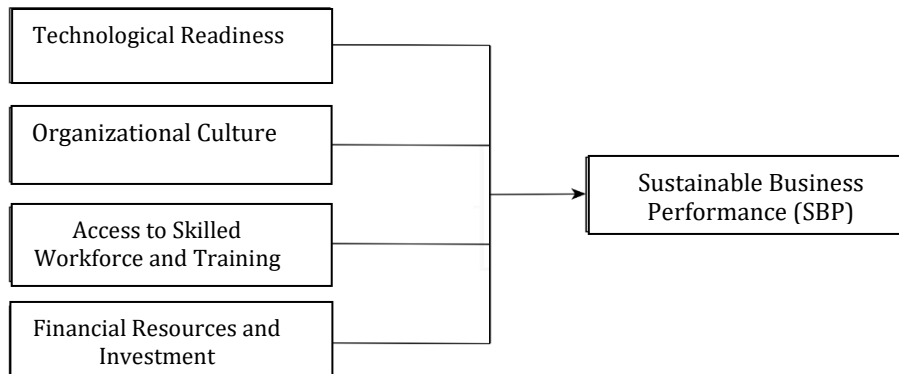
Having access to qualified employees and successful training programs is one of the most important success elements for Micro, Small, and Medium-Sized Enterprises (MSMEs) in the digital economy. Due to their limited resources, informal training programs, and competition from larger companies, MSMEs find it more difficult to hire, retain, and upskill staff than large enterprises (OECD, 2023). According to recent studies, 58% of MSMEs think that the biggest obstacle to deploying cutting-edge technology like automation and artificial intelligence is a lack of skills (World Bank, 2022). This paper reviews recent studies on workforce skill challenges in MSMEs, looking at training effectiveness, governmental interventions, digital upskilling, and regional differences. The results point out fundamental flaws and offer workable fixes for MSME resilience.

Financial Resources and Investment: One of the biggest obstacles to MSMEs' adoption of AI is their lack of funding. Small firms may not be able to afford the significant costs of deploying AI, especially those related to recruiting staff, software, and technology. Nonetheless, research has indicated that well-timed investments in AI can result in substantial long-term gains. For example, MSMEs that invest in AI-driven innovations report increased operational efficiency and competitive advantage, per a McKinsey & Company (2021) report. By offering financing and incentives for the adoption of AI, governments and financial institutions may significantly help MSMEs.

Lack of funding is one of the biggest obstacles to being technologically ready. According to EY (2023), 60% of MSMEs cite money as their biggest obstacle, and many are deterred by the high upfront expenditures of new technology (such as ERP systems and AI tools). Examples of innovative financial strategies that have lessened this problem include government subsidies and pay-per-use cloud services. For instance, digital tools were twice as common among MSMEs in Southeast Asia that used fintech-based lending solutions (ADB, 2022). Access to capital is still uneven, nevertheless, especially for MSMEs that are informal and held by women (World Bank, 2023).

One of the biggest obstacles to MSMEs' expansion, uptake of new technologies, and sustainability worldwide is their incapacity to obtain sufficient capital (Beck & Demirgüç-Kunt, 2021). MSMEs frequently struggle to obtain capital in comparison to larger companies due to perceived risks, a lack of collateral, and a lack of financial awareness (OECD, 2023). According to recent studies, traditional financial institutions either underserve or do not serve 40–50% of MSMEs in developing nations (World Bank, 2023). This review of the literature looks at recent studies on the financial difficulties MSMEs confront, new financing choices, and how investments affect business success and digital transformation.

Figure 1: Theoretical Framework



Hypotheses:

H₁: There is a relationship between Technological Readiness and Sustainable Business Performance.

H₂: There is a relationship between Organizational Culture and Sustainable Business Performance.

H₃: There is a relationship between Access to Skilled Workforce and Training and Sustainable Business Performance.

H₄: There is a relationship between Financial Resources and Investment and Sustainable Business Performance.

3. Methodology

Examining the factors influencing Artificial Intelligence (AI) adoption in Micro, Small, and Medium-Sized Enterprises (MSMEs) and its implications for productivity and sustainability requires a robust study technique. Below is a summary of the recommended research methodology, which blends qualitative and quantitative approaches to ensure comprehensive and reliable findings.

Research Design

The study will adopt a mixed-methods research design, combining qualitative and quantitative approaches to provide a holistic understanding of the research problem.

Research Philosophy

The research will be guided by a pragmatic research philosophy, which emphasizes the practical application of knowledge and the use of multiple methods to address research questions.

Research Approach

Inductive Approach: To explore and identify patterns and themes related to AI enculturation in MSMEs.

Deductive Approach: To test hypotheses about the relationships between factors influencing AI adoption and outcomes such as productivity and sustainability.

Data Collection Methods

Data will be collected through both primary and secondary sources.

Primary Data Collection

Surveys: Structured questionnaires will be distributed to MSME owners, managers, and employees to collect quantitative data on factors such as technological readiness, organizational culture, and AI adoption outcomes.

Interviews: Semi-structured interviews will be conducted with key stakeholders (e.g., business owners, AI experts) to gather qualitative insights into the challenges and opportunities of AI enculturation.

Secondary Data Collection

Review of academic journals, industry reports, and government publications to gather contextual information and validate findings.

Sampling Strategy

Target Population: MSMEs across various sectors (e.g., manufacturing, retail, services) that have adopted or are in the process of adopting AI technologies.

Sampling Technique: A combination of purposive sampling (for qualitative interviews) and stratified random sampling (for surveys) will be used to ensure representation across different industries and sizes of MSMEs.

Sample Size: Surveys: 100-200 respondents.

Interviews: 10-20 participants.

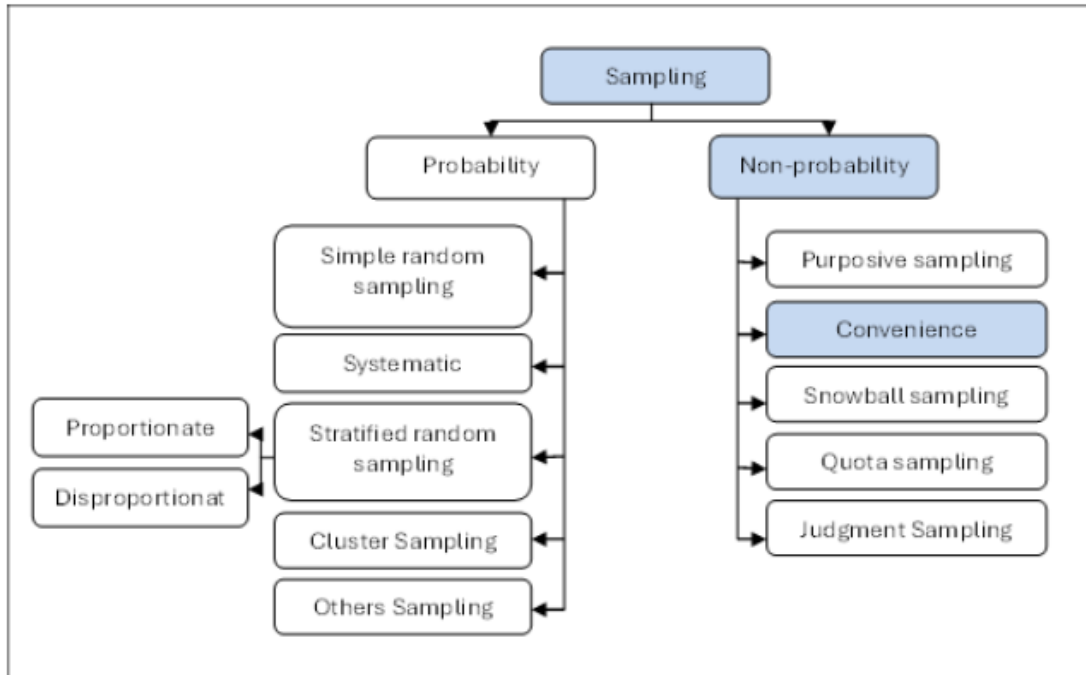
Data Analysis Methods: Quantitative Data Analysis

Descriptive statistics (e.g., mean, standard deviation) to summarize survey data.

Inferential statistics (e.g., regression analysis, correlation analysis) to examine relationships between variables (e.g., AI adoption and productivity).

Tools: Statistical software such as SPSS or PLS-SEM

Figure 2: Quantitative Data Analysis



Qualitative Data Analysis

Thematic analysis to identify patterns and themes from interview transcripts and case study data.

Coding and categorization of qualitative data using tools like NVivo or Atlas. Ti.

Expected output/outcomes/implications:

The research project is expected to yield significant findings, outputs, and consequences that will benefit MSMEs, decision-makers, and the overall economy. The long-term implications of the study will extend beyond Malaysia and offer valuable insights to other countries seeking to deploy AI for sustainable and equitable growth.

The successful enculturation of AI in MSMEs is expected to yield the following outcomes:

Enhanced Productivity

- Automation of repetitive tasks, reducing operational costs.
- Improved decision-making through data-driven insights.
- Streamlined supply chain and inventory management.

Sustainability

- Resource optimization, leading to reduced waste and energy consumption.
- Support for environmentally friendly practices (e.g., predictive maintenance, sustainable sourcing).
- Long-term business resilience and competitiveness.

Significance of output from the research project:

The findings of the study project are crucial because they offer practical solutions to the issues that MSMEs face while integrating AI. By addressing issues including organizational culture, skills shortages, technology readiness, and financial constraints, the study assists MSMEs in utilizing AI to its fullest potential, boosting their sustainability and productivity.

4. Conclusion

In conclusion, a number of factors, including organizational culture, technological preparedness, data availability, financial resources, access to qualified labor, and regulatory considerations, influence the enculturation of AI in MSMEs. These issues need to be resolved if MSMEs are to properly employ AI and experience sustainable growth.

The proposed framework provides a thorough approach to understanding and fostering AI enculturation in MSMEs. By focusing on the enculturation process and addressing the critical input elements, MSMEs can employ AI to increase productivity and achieve sustainable growth.

While prior research highlights the importance of sustainability for MSMEs, few of these studies provide useful frameworks tailored to their unique constraints. To bridge this gap, the F.A.S.E. framework proposed in this study aims to enhance sustainable company performance.

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