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"ARTIFICIAL INTELLIGENCE AND DIGITAL TECHNOLOGIES AS DRIVERS OF SUSTAINABLE BUSINESS PERFORMANCE IN MSMES AND STARTUPS: EVIDENCE FROM EMERGING ECONOMIES"

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ABSTRACT

https://doi.org/10.53555/827nvc84Artificial intelligence and digital technologies are increasingly transforming how micro, small, and medium-sized businesses and startups pursue resilient growth in emerging economies. These enterprises play a crucial part in inclusive economic development but often face constraints related to resources, technology, and sustainability implementation. The rapid adoption of Intelligent systems–driven tools and electronic technology such as cloud computing, data analytics, digital platforms, and automation offers new opportunities to overcome these limitations and improve sustainable business performance. The relationship between the adoption of digital technology and sustainability results was examined using primary data gathered from business owners, founders, and senior managers. The findings demonstrate that artificial intelligence driven digital technologies significantly enhance operational efficiency, innovation capability, and sustainable business performance, thereby supporting strategic managerial decision making and long-term competitiveness. Improvements were also observed in resource optimization, waste reduction, workforce engagement, and market expansion. Furthermore, digital capabilities emerge as a key organizational factor that strengthens the relationship between technology adoption and sustainability outcomes. From a business management perspective, integrating business intelligence and digital transformation strategies strengthens operational performance and organizational capabilities. The results add to the expanding body of literature on digital sustainability while providing useful insights for entrepreneurs, managers and legislators looking to use artificial intelligence-enabled transformation for sustainable development in emerging economies.

Keywords: *Digital transformation, Business sustainability, Digital capabilities, Business intelligence*

1. Introduction

Social inequality, environmental degradation, and economic instability are global challenges that are interlinked and that businesses need to move away with their traditional growth oriented models to sustainability oriented approaches. Sustainability embodied in environmental, social, and economic aspects of the triple bottom line has become a strategic focus of companies that want to gain competitiveness and resiliency in the long-term (Elkington and Rowlands, 1999). As big businesses are continuously becoming more sustainable, small, medium, and micro enterprises (MSMEs) and startups, especially those in developing economies, are structural, financially, and technologically constrained. Since MSMEs are more than 90 percent of the total businesses worldwide and contribute to a considerable amount of employment and economic development, their role in the realization of sustainable development goals is obligatory.

Over the past years, artificial intelligence (AI) and digital technology spread at a very high pace and has altered how companies compete, innovate, and generate value. Big data analytics, cloud computing, blockchain, the Internet of Things (IoT), machine learning, and digital platforms have been identified as technologies capable of making businesses stay sustainable (Nambisan, 2017). Such technologies can assist MSMEs and startups to address resource limitations and overcome them, making it possible to achieve operational efficiency, optimized resource usage, and facilitated market penetration (Elia et al., 2020; Vial, 2021). Digital transformation also opens up new business models and ecosystems to become more agile and competitive (Verhoff et al., 2021) and provides scalable and affordable solutions to smaller companies (Bharadwaj et al., 2013; Li, 2020).

Ecologically, AI-based technologies enable companies to track the use of resources, energy, waste, and minimize it with predictive analytics and intelligent automation. Traces using blockchain and digital supply chain systems increase the transparency and facilitate environmentally friendly sourcing (Saberi et al., 2019). As per empirical research, analytics and digital monitoring systems based on AI can enhance the performance of an environment as it allows planning production efficiently, optimization of inventory, and resource management (Khan et al., 2025). As such, these technologies allow businesses to minimize their environmental impact and increase their efficiency at work.

In addition to the positive environmental changes, digital technologies can also bring social sustainability. Digital platforms help MSMEs to reach global markets that are geographically separated and join global digital ecosystems. Customer analytics enabled by AI maximize the engagement and personalization of services, as well as the satisfaction of the customer and increase social value. In the developing economies, workforce inclusion and employment flexibility are further enhanced with the help of digital technology (Floridi et al., 2018). Nevertheless, the issues of digital disparity, information privacy, and algorithm prejudice emphasize the need to adopt AI responsibly and govern digital ethically.

AI and the digital technologies are also crucial in enhancing economic sustainability of the MSMEs and startups. Artificial intelligence, automated processes, and digital financial tools enhance the accuracy of the forecasts, productivity of the operations and availability of finance to the firms that are usually underserved by conventional financial institutions (Gomber et al., 2017). The AI-driven change increases the ability of organizations to withstand turbulent market conditions by facilitating the ability to make data-driven decisions and develop innovative digital business models (Bouncken et al., 2021).

In the terms of business and management science, the combination of AI and digital technologies is transforming organizational practices, decision-making by managers, and competitive strategy. Digital transformation helps companies to increase the efficiency of operations, facilitate the use of data-driven decisions, and maximize the use of resources. In the case of MSMEs and startups in the emerging economies, AI-driven technologies are strategic capabilities to improve sustainable business performance, organizational resilience, and long-term value creation. Such advances bring into the limelight the increased importance of the digital transformation research within business intelligence, analytics, the operations management discipline, and business economics (Tornatzky et al., 1990; Kraus et al., 2020).

The business and management research theoretical points elucidate the impact of digital technologies on the performance of firms. Technology-Organization-Environment (TOE) framework focuses on technology preparation, organizational preparedness, and environmental conditions in the technology adoption (Tornatzky et al., 1990). The Resource-Based View (RBV) states that the competitive advantage of firms is attained due to the possession of valuable digital capabilities and technological knowledge. The AI-powered technologies are thus strategic assets that advance innovation and operation. Also, the Dynamic Capability Theory and Digital Transformation Theory emphasize the process of adaptation by firms, reorganization of business models, and the enhancement of competitiveness in the rapidly changing environment (Elia et al., 2020; Vial, 2021).

In accordance with these theoretical views, the proposed study suggests a conceptual model, where the adoption of AI and digital technologies is the independent variable, and the results of sustainability are the dependent variables. Digital capability is perceived as an intermediate that allows firms to have access to technological resources and utilize them effectively. Environmental sustainability, social sustainability, economic sustainability, and overall business performance are the dependent variables. Besides this, the relationship between the adoption of digital technology and the sustainability outcomes can be moderated by contextual factors like the size of the firm, and the industry.

Although there is an increasing academic interest in digital transformation and sustainability, the current research is scattered and, mostly, limited to large companies in the developed world. There is still scarce empirical research on how emerging economies through MSMEs and startups can use AI and digital technologies to enhance integrated sustainability in terms of the environment, society, and economy. This paper thus investigates AI and digital technology applications as a catalyst to sustainable business performance in MSMEs and startups in emerging economies, exploring

trends in digital adoption and sustainability performance and implications to managers, policymakers, and stakeholders facilitating sustainable digital innovation.

2. Research Methodology

2.1 Research Design

The research design in the study is quantitative and cross-sectional research design to investigate AI's role and digital technologies in environmental, social, and economic sustainability of micro, small, and medium enterprises (MSMEs) and startups in emerging economies. The cross-sectional approach will also be utilized to record the prevailing level of digital technology adoption and its concomitant sustainability results within various organizational settings. The objective of the study is oriented to the MSMEs and startups that may be operational in the various sectors, such as manufacturing, services, agriculture, retail, logistics, and technology, to provide a comprehensive understanding of how the AI-enabled digital technologies influence the performance across sustainability in the new markets.

2.2 Sampling and Data Collection

The research uses multi-stage sampling approach in the selection of firms involved. First, the large business hubs in the urban and semi-urban areas were considered, and smaller businesses, micro and small entrepreneurs and startups were then selected through stratified random sampling. The owners of the firms, founders and senior managers who took part in technology adoption and sustainability decisions were used to collect data. An initial target sample was set to 250 firms in order to facilitate multivariate statistical analysis and structural equation modelling. Primary data were collected with the help of a structured survey put into practice in the forms of online surveys and offline surveys to cover the firm characteristics and the digital technology adoption, as well as the outcomes of environment, social, and economic sustainability.

2.3 Measurement of Variables

The research evaluates major constructs regarding adoption and sustainability in digital technology use. The use of AI and digital technology signifies the adoption of AI tools, cloud computing, big data analytics, IoT, blockchain, and digital platforms in the firm operations. The sustainability performance was evaluated regarding social, economic, and environmental aspects. Environmental sustainability is concerned with efficiency of resources and fewer negative effects on the environment, and social sustainability is concerned with workforce inclusion, customer engagement, and involvement of the community. Economic sustainability indicates the enhancement of productivity, profitability, ability to innovate and organizational resiliency. Every variable was measured using a five-point Likert scale, ranging from strongly disagree to strongly agree.

2.4 Data Analysis Techniques

Data that was gathered were analyzed with SPSS and JMP statistical software. Describing statistics was originally used to present the characteristics of firms and determine trends related to the adoption of digital technology between the MSMEs and startups. The purpose of the correlation analysis was to investigate the relationships between the most important variables. The proposed relationships were tested using structural equation modeling (SEM) amid digital technology adoption, organizational digital capability, and sustainability outcomes because it allows estimating multiple relationships at once and evaluating complex models. Also, a multivariate regression analysis was carried out to assess the direct effect of AI and digital technologies on the results of environmental, social, and economic sustainability.

2.5 Reliability and Validity Assessment

In order to guarantee the accuracy of the measurements, the reliability and validity tests had to be performed. The reliability was checked through Cronbach alpha which is a method to estimate the internal consistency of the constructs used in the survey. The analysis of Confirmatory Factors (CFA) was used to determine create validity whereby the indicators are found to be sufficiently represented by the theoretical variables. Moreover, the mediating effect of digital capability between AI adoption and sustainability outcomes was determined by means of mediation and moderation analyses, and the moderating effect of firm characteristics was also investigated.

3. Results

3.1 Level and Pattern of Adoption of AI and Digital Technologies

Table 1 shows the distribution of adoption of digital technologies and artificial intelligence among MSMEs and startups in the developing economies.

Table 1: Adoption Pattern of AI and Digital Technologies

Technology	Low (%)	Medium (%)	High (%)
AI Tools	35	40	25
Cloud Computing	20	45	35
IoT	45	35	20
Big Data Analytics	30	45	25
Digital Platforms	15	40	45
Blockchain	60	30	10

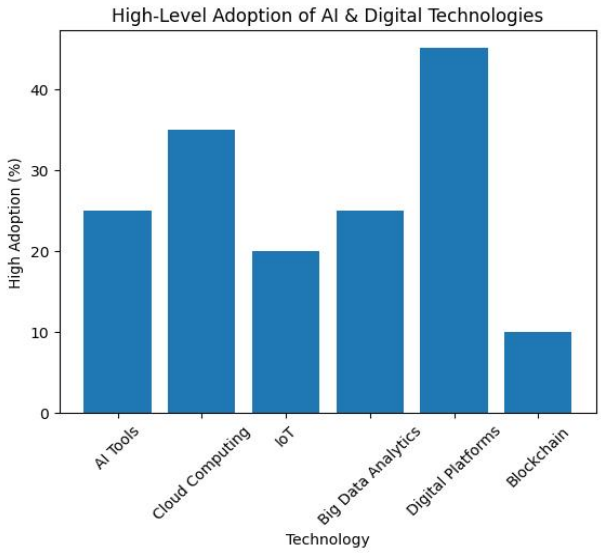

Figure 1: Adoption Pattern of AI and Digital Technologies among MSMEs and Startups

According to Table 1 and Figure 1, the digital platforms have the greatest high adoption (45%), which proves that the MSMEs and startups are highly concerned with customer-facing and market-access technologies. Cloud computing comes in second with 35% being high adoption as a component of its significance to scalability and to efficiency in operations. Both AI tools and big data analytics show moderate adoption rates (25%), implying slow adoption as required by cost and skill limitations. The adoption levels of IoT and blockchain are rather low because of the infrastructural constraints and technical complexity. The medium-adoption category is composed of a significant percentage of firms, which means that a considerable number of MSMEs are at the transition phase of digital transformation.

In order to provide additional analysis of adoption trends, descriptive statistics were calculated as provided in Table 2.

Table 2: Descriptive Statistics of Digital Technology Adoption

Variable	Mean	Standard Deviation
AI Adoption	3.45	0.85
Cloud Computing Adoption	3.60	0.72
Big Data Analytics	3.32	0.80
Digital Platforms	3.78	0.69

The findings show that digital platforms were found to have the highest level of adoption (3.78), and then cloud computing (3.60), and this confirms the significant role digital transformation plays in MSME digital transformation strategies.

3.2 Impact of AI and Digital Technologies on Environmental Sustainability

Table 3 shows the scores of AI and digital technologies on the dimensions of environmental sustainability.

Table 3: Environmental Sustainability Impact

Sustainability Dimension	Impact Score (0–100)	Interpretation
Resource Efficiency	65	Moderate–high improvement
Waste Reduction	75	High impact
Emission Control	55	Moderate impact

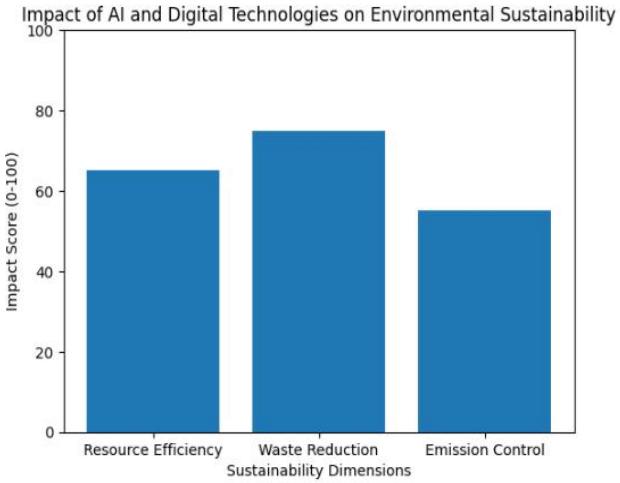

Figure 2: Impact of AI and Digital Technologies on Environmental Sustainability

According to Table 3 and Figure 2, the waste reduction has the strongest impact (75), then resource efficiency (65), and emission control (55). These findings signify that digital technologies provide substantial assistance to the waste management and resource optimization practices.

3.3 Influence of AI and Digital Technologies on Social Sustainability

AI's and digital technologies' effects on social sustainability outcomes is described in Table 4.

Table 4: Social Sustainability Outcomes

Social Sustainability Outcome	Influence Score (0–100)
Employment Quality	75
Inclusion	68
Customer Engagement	82
Community Impact	70

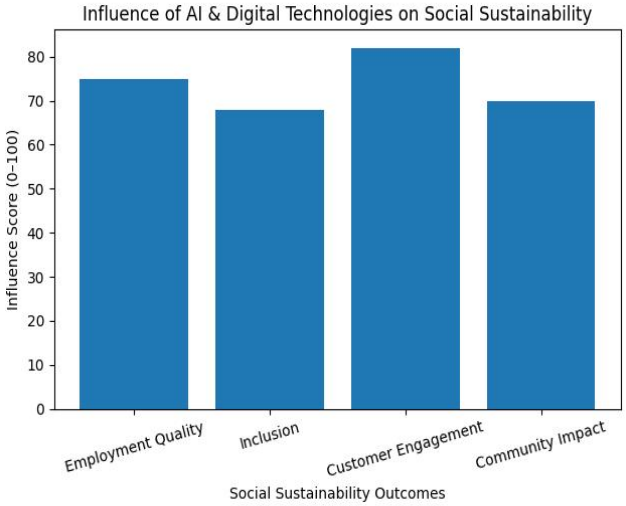

Figure 3: Influence of AI and Digital Technologies on Social Sustainability Outcomes

Customer engagement is the area with the overall highest score of influence (82) as shown in Table 4 and Figure 3, which means that AI-powered customer analytics and digital platforms play an important role in enhancing service delivery. Another area that scored highly is employment quality (75) and lowest score is inclusion (68) with the implication that there are still troubles with digital literacy and access.

3.4 Economic Sustainability Outcomes

Table 5 shows how AI and digital technologies can be used to make the economy more sustainable.

Table 5: Economic Sustainability Impact

Economic Sustainability Dimension	Impact Score (0–100)
Productivity	80
Profitability	75
Innovation	85

Resilience	78

Table 5 demonstrates that innovation has the largest impact score of 85, the next scores are productivity (80), resiliency (78), and profitability (75). These outcomes show that the digital transformation based on AI will bring substantial economic sustainability to MSMEs and startups.

3.5 Correlation Analysis

A correlation analysis was undertaken to examine the connection between important variables as demonstrated in Table 6.

Table 6: Correlation Matrix

Variables	AI Adoption	Environmental Sustainability	Social Sustainability	Economic Sustainability
AI Adoption	1.00	0.62	0.58	0.65
Environmental Sustainability	0.62	1.00	0.54	0.60
Social Sustainability	0.58	0.54	1.00	0.63
Economic Sustainability	0.65	0.60	0.63	1.00

The obtained correlation outcomes reveal that there are positive relations between AI adoption and sustainability outcomes, which implies that the high degree of digital technology adoption correlates with the better economic, social, and environmental performance.

4. Discussion

The results of the current research suggest that AI and digital technologies are important factors that can facilitate sustainability in terms of the environment, society, and economy in the MSMEs and startups of emerging economies. The findings indicate that the digital transformation driven by AI enhances the operational capacities of MSMEs by contributing to the accuracy of decisions, market responsiveness, and providing an opportunity to employ data to formulate a strategy. The results also confirm the perception that digital technologies are strategic organizational assets that improve sustainable business operations in resource-constrained settings (Badghish and Soomro, 2024; Abid et al., 2024).

Based on the environmental sustainability, the outcome indicates that AI-powered analytics, automation, and digital monitoring solutions enhance resource use, waste management, and emissions. The prominent effect in minimized waste implies that the digital technologies are able to help conduct more appropriate supply chain management and predictive maintenance, as well as optimization of lifecycle. Such findings are in line with prior studies that highlight the idea that AI-inspired systems can help the firms to be more resourceful in terms of resources and facilitate economically sustainable operations (Farhana et al., 2025). In light of the fact that MSMEs in emerging economies are usually faced with limited resources, digital technologies thus offer inexpensive ways of enhancing their environmental performance without reducing their operational effectiveness.

The results also indicate that AI and digital technologies play significant roles in ensuring social sustainability. Specifically, customer engagement reflects the greatest positive effect, which demonstrates the relevance of digital platforms, AI-based recommendation systems, and customer relationship management tools to enhancing the quality of services and responsiveness. Improved customer contact will help the MSMEs to build stronger ties with the stakeholders and also their competitive edge in the digital markets. Moreover, digital transformation helps to increase the quality of employment through flexible workplace setups, increases in productivity, and development of digital skills. Nevertheless, the comparatively smaller effect of social inclusion indicates that issues like digital illiteracy, the lack of access to technological systems, and the inequality in the distribution of resources still impact the inclusion potential of digital transformation (Sarker et al., 2026).

Regarding economic sustainability, the findings reveal that AI-based digital transformation is greatly productive, profitable, innovative in nature, and resilient to the organization. The score of innovation is the highest, which implies that digital technologies can help MSMEs and startups develop fresh goods, services, and business strategies. These results help to argue that digital transformation enables companies to reorganize their resources and capabilities to effectively react to a changing market environment (Hsiao, 2024). Moreover, AI-driven data analytics and automation systems enhance strategic decision-making and operational effectiveness, which allows firms to save money and improve their competitiveness in the volatile market spheres (Aiudi et al., 2025).

The next valuable finding of the research is that the implementation of digital technologies by MSMEs is not even. Such technologies as digital platforms and cloud computing demonstrate comparatively increased adoption rates since they directly contribute to market access and scalability of operations. More complex technologies, including AI systems, IoT, and blockchain, on the other hand, are less rapidly adopted because of the limitations of the infrastructure, high cost of investments, and low technical expertise. The same trends have been observed in the past literature analyzing the effect of digital transformation in SMEs and highlighting that access to resources and the lack of capabilities are still considered essential obstacles to further adoption of advanced technology (Chen et al., 2016; Thakkar, 2023).

The business and management perspective of the findings reinforce the importance of digital transformation as a tactical capability that leads to sustainable business performance. The use of AI-based technologies enables companies to incorporate data-based decision-making into their routines, enhance their responsiveness to the external environment, and increase the flexibility of their organizations. Those findings thus back up the new research indicating that digital

transformation does not only enhance the performance of the firm but also enables sustainability goals to be incorporated into the organizational strategies (Cui, 2025; Guandalini, 2022). Specifically, AI implementation in entrepreneurial activities has been demonstrated to make innovation timeshortened and contributes to sustainable startup growth in new markets (Omidmand et al., 2025).

Overall, the findings show that AI-based digital transformation has the potential to significantly increase the triple bottom line of sustainability of MSMEs and startups. The digital technologies, supported by the adequate level of digital infrastructure, technological skills and the policy frameworks, promise powerful instruments of improved environmental functioning, improved social statuses and increased economic stability. This kind of discovery highlights the need to align efforts of governments, industry actors and technology suppliers so as to come up with favourable ecosystems that will enable the MSMEs to optimally utilise AI so as to achieve sustainable development.

5. Scope for Further Study

This study can also be extended in several ways in the future in terms of research findings. The perceived impacts of the AI adoption regarding their sustainability over time may be researched through longitudinal form rather than cross-section surveys. The comparative study of the industries, manufacturing, services, agriculture, and healthcare may provide a better understanding of the effects of digital technologies on the sustainability outcomes in other environments, as well. The emerging and developed economies research would also help in the explanation of the influence of technological infrastructure and institutional environment on the outcome of digital transformation. Moreover, there is a possibility that the provision of digital skills and data governance, ethical AI models, and digital transformation will help startups and MSMEs in the future to embrace responsible and inclusive digital transformation of possibilities provided by digitalisation. Lastly, a study of the effects of government policies, investment in digital infrastructure, and training programs may offer useful insights on how the sustainability aspect of AI implementation can be reinforced to benefit the emerging economies.

6. Conclusion

The current study aims to examine the potentials of AI and digital technologies to aid micro, small and medium-sized enterprises (MSMEs) and startups in the emerging economies in terms of environmental, social and economic sustainability. The findings indicate that digital transformation is a strategic necessity rather than a technical modernization that companies that aspire to become competitive and sustainable in the long-term need to possess. The use of AI, data analytics, automation, and online platforms is involved in the capacity of MSMEs to be more productive in their functioning, utilize more resources, and expand their coverage. On the digital side, there is improved use of resources, reduced wastage, and improved emission control, which is done through the effects of data-based monitoring and intelligent operational systems, which are beneficial to the environment. Digitally, the social aspect of the tools is a positive influence on the customer interaction, the quality of service delivery and employment due to the quality flexibility of work and the ability to develop skills. On the economic front, the use of AI helps to enhance productivity, innovation, cost-effectiveness, and organizational resilience to make MSMEs and startups compete in the dynamic markets of the world with more competitiveness. The study therefore confirms that, AI-driven digital transformation is not only a technological innovation but also a management philosophy, which can contribute to enhancing business competitiveness, innovation capacity and sustainable organizational operations. However, these barriers as the price of high technologies and absence of digital skills and infrastructures still restrict the extent of adoption. This can be reduced through supportive policies, investment in digital infrastructure, and capacity building that will be essential in offering MSMEs and startups to optimize the utilization of AI-driven technologies in making business sustainable in emerging economies.

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