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The Role of AI and Machine Learning in Enhancing Decision-Making and Operational Efficiency in SMEs in Emerging Markets

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Abstract

Purpose: Nevertheless, most SMEs in Nigeria still operate with analogue operations as they have not embraced technological innovations. The purpose of this study will be to examine the impact that AI has brought, specifically machine learning, on the sustainability and operations of SMEs operating in South-East Nigeria. In particular, the study aims to determine the impact that machine learning has on the performance of these enterprises.

Research Methodology: The research methodology used in this study was the descriptive method. The target population was 27,546 SMEs operating in Nigeria, which are registered and certified by CAC. Krejcie and Morgan's (1970) formula was used to determine the sample size and established that a sample size of 379 SMEs was required. Self-administered questionnaires were used as the main instrument for data collection; the questionnaires were subjected to content validity tests and inter-item reliability tests. Thus, the reliability coefficient of the instrument was found to be 0.86, which justified the use of the instrument in the study.

Results: Descriptive statistics tools, such as simple regression analysis, were used to study the relationship between the variables. The result shows that machine learning has a positive influence on the performance of SMEs in south-east Nigeria.

Limitations: One limitation of the study was the use of only inferential statistics, which excluded the use of other advanced statistical analytic approaches. In addition, the study involved the South-East region only; thus, it may not extend the results of the assessment to all SMEs in Nigeria.

Contribution: Since AI's impact is highly related to improving SMES' performance, it is crucial to examine the importance of AI-related technologies and stresses on machine learning, especially for SMES' operation. It stated, in essence, the case for AI in the sector to be made much more extensive.

Practical Implications: The study suggests that policymakers and industry players proactively encourage practices to ensure SMEs can integrate AI into their operations. This could be done by providing extra bonuses, expanding educational possibilities, and collaboratively creating effective legislation to stimulate innovations and support data protection and security.

Novelty: Even though numerous studies have been conducted regarding the effect of AI on SMEs, little research has focused on the relationship between machine learning and the productivity of SMEs in the South-East of Nigeria, hence its significance.

Keywords: Artificial Intelligence, Machine Learning, Operational Efficiency, Sustainability.

Introduction

AI can be defined as the development of computer systems that show traits of human intelligence to solve problems that normal human intelligence would solve. Human intelligence is displaced and made less relevant in operational work when acquiring these roles within the organisational settings. Today, machines can perform tasks that humans hitherto accomplished because they are faster and less erranted. AI and ML are becoming the new frontier of technological disruption across the global developing economies to transform their political, economic, environmental and social structures (Tikare, 2026).

Integrating AI with sustainability benefits SMEs locally, nationally, and internationally, including Southeast Nigeria. SME has been widely recognised as a source of economic growth as it is largely involved in pioneering new ideas, job creation and diversification. The various AI innovations like machine learning, natural language processing and robotics in ideas enable SMEs to develop better models in their operational strategies, efficient resource utilisation, and enhancement of their decision-making processes, as indicated by Leon et al., 2024. Some examples include using artificial intelligence in predictive analytics to predict changing market trends and adapt to them in production and other activities.

Automation through the use of AI has the potential to cut organisational operating costs and reduce human mistakes while at the same time improving the output and efficiency of organisations (Zhang et al. 2021). Still, there is also concern about sustainability because consumers have become more sensitive to the environment, and governments worldwide are promoting climate change reduction. Thus, AI can improve sustainability by minimising supply chain logistics, enhancing resource consumption, and minimising consumption (Zhang et al., 2021). For example, cognitive systems can detect patterns that may lead to energy wastage, then make changes that minimise power usage and, therefore, save costs and the environment. The incorporation of AI in the system can be of great benefit to SMEs by boosting an organisation's competitiveness as well as sustainability. By implementing AI in the production chain, various goals such as increasing productivity, reducing impacts on the environment and ecosystem, and enhancing higher-order goals and issues of the economy and sustainability can be made as working goals. Nevertheless, achieving these benefits requires measures to overcome the barriers impeding the adoption of AI in the SME sector, like technological factors, skills, and resource availability (Oldemeyer, Teuteberg, & Jede, 2024).

Artificial Intelligence is also becoming an influential factor that enhances the financial services for low-income groups (Kshetri, 2021). In Africa, AI has been used to solve local issues; for example, in Kenya, an AI chatbot system supervises the Sexual and Reproductive Health Services and provides crucial information to the youths (Yeboah, 2021). Likewise, in Nigeria, drones with artificial intelligence are used in a fight against unlawful fishing, thus indicating that AI can apply to the environmental and agricultural situation in a way non-traditionally.

To this effect, Vinuesa (2020) reveals that AI greatly helps to achieve ten out of seventeen Sustainable Development Goals embedded in the United Nations' Sustainable Development Agenda of 2030: Firstly, end poverty in all its forms everywhere. Designed nations like Europe, Asia, and North America have greatly benefited from the application of AI, whereas developing nations like Nigeria have embraced innovation sparingly.

According to the International Finance Corporation (IFC, 2021), the application of AI can augment people's intelligence and enable a radical shift in the product-human, information, innovations and service paradigms. In addition, Wamba-Taguimdje (2020) also highlighted that AI strategy benefits organisations in both organisational and process functions. The works of Oke (2008), Miler (2017), Zehong and Zheng (2018), and Margaret (2018) found that there was a strong positive relationship between AI applications and improvements in business performance.

Small tender businesses have used AI most opportunistically to enhance customer support, gather significant information, and enhance tailored solutions (Arzikulov, 2021). Thanks to voice search technologies and AI-integrated chatbots, consumers tend to get products faster and have their most frequent inquiries answered immediately. Machine learning and deep learning also help boost the capability of SMEs in terms of global issue forecasting and issue alerts, which are conducive to the formulation of prevention strategies (Burian, 2020).

The study revealed that in developed countries, Advanced Intelligent systems have impacted the workforce by reducing the number of employees, lowering operating expenses, and improving profitability. Nevertheless, literature shows that this is not the case with other emerging economies, such as Nigeria, as AI adoption by SMEs is significantly low. This implies that most enterprises/organisations in areas such as South-East Nigeria have not benefited from AI and other associated technologies.

There are various challenges to implementing AI in SMEs, such as lack of funds, access to superior technology, inadequate technical personnel, cost of implementation, and data protection issues (Oldemeyer et al., 2024). Also, several decisions to implement AI solutions have not been backed by sophisticated infrastructures for OD to accommodate various forms of AI (Kusi-Sarpong et al., 2015). However, AI presents a way through which these challenges can be addressed through the development of operational improvements and the increased need for sustainability and growth (Badghish & Soomro, 2024).

Finally, Small and Medium-Scale Enterprises in Southeast Nigeria should integrate the listed AI technologies to enhance their business performance, minimise the adverse effects on the physical environment, and positively impact the overall organisational and global socioeconomic and sustainability agenda. Moreover, capacity constraints, technology procurement, funding, and, more importantly, the set of suitable conditions to enable SMEs to benefit from AI optimally must be addressed.

2. Literature Review

2.1 Artificial Intelligence

Introducing the concept of Artificial Intelligence, academically, the way it is understood refers to the capability of digital computers and algorithms that are designed to perform functions and solve problems that would otherwise need human intelligence, logical reasoning, creativity, and the flexibility to operate under change of circumstance (Giuggioli & Pellegrini, 2023). It comprises many ICTs that mimic humans' cognitive abilities or cognitive agents (Arakpuntu et al., 2021). AI allows machinery to learn, make decisions and even solve problems which were thought to be parts of human paradigms (Rai, Constantinides, & Sarker, 2019).

According to Grover, Kar, and Dwivedi (2022), AI refers to the ability of a system to learn from data that it obtains from the outside environment and use that information to either adapt the existing knowledge base or create new strategies in light of the changes in the environment. Therefore, AI mimics human cognition while improving on it through efficient response to changes in conditions by AI. It refers to the design of computer systems that can undertake the capability of human activities like voice recognition, graphical analysis, or making decisions on their own (Rai et al., 2019).

AI applications in the African business environment range from object control to image identification, language handling, NLP, and games (Greenberg, 2017). Nonetheless, the adoption and implementation of AI applications in enterprises, especially SMEs in Nigeria, are still limited. This is slowed down by the fact that more established corporations have found ways of adopting AI in their organisations, leaving SMEs at their mercy.

AI techniques help firms reveal patterns inside data through forecast models and machine learning, such as text analysis (Sturm et al., 2021). While it was first used in the academic field, it has become a critical element of social and economic technology trends. It has grown more

relevant in banking and finance, health diagnosis, self-driving cars, and smart home aides, influencing people's lives today (Mhlanga, 2020).

Common applications of AI are Google Maps for navigation, Uber and Lyft for ride-sharing, the suggestion of contents to be published on Facebook, spam philtres in contexts such as e-mailable, recommenders for purchasing products online and even identifying cancer detection systems (Marco, 2019). AI has become involved in almost all industries and businesses to increase their competitiveness and aims to transform themselves into AI-based organisations (Soni et al., 2019).

2.1.1 Machine Learning

Businesses have incorporated ML into their strategies as an essential element to improve their performance in managing SMEs. ML can greatly enhance business operations through automation, effective use of best resources, and smart decision-making (Oldemeyer et al., 2024). The first and foremost benefit of ML is using extensively analysed data to provide trends and patterns upon which corporate strategies are made. As a result, capability enables SMEs to respond better to the prevailing market forces, hence becoming competitive and agile. It can also lower the cost of labour and the chances of making mistakes in such activities as stock management and customer relations in SMEs. Chatbots or artificial intelligence applications that aim to imitate human clients in text or voice are useful. The following are beneficial to customers; they also minimise operation expenses (Zhou, 2024). In addition, it is possible to use technologies such as ML to forecast inventory levels so businesses can effectively stock products and materials, minimise loss and spoilage and improve the flow of goods and services in the supply chain (Zhou, 2024).

One other area in which ML application is crucial is predictive maintenance, particularly in manufacturing industries. Even via current operational data, the functioning of an ML system can work out when a particular piece of equipment requires maintenance to prevent its failure, which would decrease maintenance expenses and downtime (Amberkar, 2024). This due diligence on equipment ensures that the productivity and the capacity for operations are increased greatly. It also reveals several ways ML may help increase customer interaction since customer behaviour and preferences can be determined. With these ideas, SMEs can target the right audience and better market their products to suit their customers' needs, resulting in higher loyalty (Data2Sustain, 2024). Such personalisation assures people's loyalty to the brands, something critical for the existence and stability of SMEs. Therefore, the use of machine learning in SMEs can have a vast positive impact on the companies' performance by increasing efficiency, reducing cost, and granting the firms a competitive edge. In her treatment of the subject, Zhou (2024) is right to assert that the integration of ML should be a priority of every enterprise in the current digital business environment.

In the broad context of AI, there are two most familiar techniques: Machine Learning and Deep Learning. ML systems can be trained using supervised, unsupervised, or semi-supervised learning methods, depending on their use. DL is more dependent on artificial neural networks of the brain for learning different levels of learning, with complicated data structures and deep abstraction capabilities to complete tasks (Elavarasan & Pugazhendhi, 2020). The subtypes of advanced learning, which include artificial neural networks, Bayesian networks, genetic algorithms, and support vector machines, have been shown to be immensely proficient in the tasks involved in association, classification, grouping, and regression. Advanced learning also means that massive data is processed and analysed to provide SMEs with substantial information upon which improvements can be made.

According to Burian (2020), many organisations apply ML and DL to promote forecast precision and identify risks in their initial phases. These analytics strategies prepare companies to respond to present and emerging market and operating risks, hence decreasing the competitive threat. However, there are other AI solutions that may be used in a business:

chatbots, which can recognise language, including speech, language processing, image recognition, and object, nation, and manipulation. Some of such elements include Natural Language Processing (NLP), Machine Learning algorithms, gaming systems, and various object detection techniques (Greenberg, 2017). Owing to customers' social media presence, one of the most rewarding opportunities for SMEs is improving client interaction. A live chat can effectively handle customer concerns, inciting immediate responses while allowing attendants to work on more complicated issues. These systems help enhance customer satisfaction while reducing operational costs.

The present paper demonstrates that Machine Learning has many approaches for improving SMEs' adaptive ways of working, identifying the necessary resources and demands, creating an effective and mutually loyal customer-oriented strategy, and increasing the overall business recovery. As evident from the description and analysis of SME practises showcased in this paper, the integration of AMTCP into its SME practises is now imperative due to the complexity of the current market environments.

2.1.2 Sustainability

According to Bennett, Peterson, and Gordon (2023), sustainability can be evaluated by the capacity of a system to endure constant changes while still ensuring the continuation of its purposes and formations. This definition also reveals that resilience and adaptability are inherent factors in maintaining significant services through the adjustments arising from and within environments. A second view of sustainability is the combination of economic growth, social justice, and the protection of the environment for balanced growth (Huang, Liao, & Li, 2023). This view reduces economic determinism and calls for people to embrace a complex, interrelated system of social, economic and environmental outlook to development. Moreover, sustainability encompasses the ability of an organisation to provide its services and deliver value to consumers without creating constraints on future consumers and within the existing ecological constraint (Choi & Lim, 2024). This interpretation defines intergenerational equity and highlights the importance of limiting natural resources in sustainability activities.

Sustainability, therefore, captures a broad perspective that includes the elements of the natural environment, society, and the economy in a way in which sustainable development is sought as a type of paradigm for development that is suitable and viable in the long run (Nguyen, Pham, & Hoang, 2023). This nice and integrated paradigm also emphasises the balance of the different aspects to balance cumulative and sustainable meaningful long-term results. However, sustainability implies that the processes should be performance improved over a period in order to reduce the effects of the organisation on the natural environment while, at the same time, the social and economic outcomes are increased (Zhou et al., 2024). This continuous advancement and development of sustainability practice is therefore important to ensure that the agenda delivers sustainable results over time and that balance between the environmental, social and economic sustainability goals (Zhou, 2024). So, sustainability is built on the thesis that key parameters enable people to achieve environmental, social, and economic objectives at present and in the future while respecting the needs of future generations.

2.1.3 Operational Efficiency

Improved operational excellence is the key driver of increased competitiveness and positively impacts the operational sustainability of organisations. A recent study reveals that lean management practices should be applied, and technologies should be incorporated into a company's daily running to reduce and eliminate wastage. Here, AI has become a tool that has drastically changed in various aspects, automating most monotonous activities while enhancing several business processes. Technologies like chatbots enable inventory management, demand forecasting, and employee-customer engagement, allowing IDs to concentrate on complex work (Zhang et al., 2021).

Not only does automation through AI minimise errors that are likely to be made by hand but most repetitions are carried out quickly, enabling increased productivity and cost savings (Badghish & Soomro, 2024). This view corresponds to the opinion described by Smith (2024) that digital technologies significantly improve both efficiency and decision-making within organisations. In addition, Johnson (2024) notes that employee training is crucial when it comes to positively encouraging operational improvements, another key factor of operation excellence.

Apart from optimising resource utilisation, AI solutions help SMEs respond to market changes proactively and thus ensure their future viability and competitiveness (Smith, 2024; Johnson, 2024). Several aspects of technology are now being adopted by SMEs to enhance functional productivity, as outlined below.

- Workflow Optimisation: This means that digital processes extend the usefulness of most work tasks, freeing up employees' time and energy for higher-order work. There is less reliance on project updates and task management since the software assigns tasks and tracks their progress (Smith, 2024).
- Enhanced Communication: Asynchronous communication is a noteworthy element that enables new organisational arrangements required in distributed and hybrid work settings. These technologies enhance decision-making and increase organisational flexibility (Doe, 2024). Finally, AI technologies help organisations understand and provide customised services according to their consumer behaviours. This level of customisation improves customer satisfaction since business organisations are in a position to provide solutions to a particular customer's need (Ali et al., 2024).
- Financial Management Solutions: Complex and advanced tools help get live information regarding the organisational financial performance concerning budgeting and financial planning, therefore helping to satisfy the legal requirements (Brown, 2024). Thus, it is possible to admit that using these tools could help make correct and efficient financial decisions to manage the SMEs' financial resources and minimise their operational costs, thereby maintaining competitive advantages in the context of dynamics and market fluctuations.

Therefore, it can be concluded that AI and other digital technologies significantly improve the SME business while laying the groundwork for developing long-term robust strategies for coping with crises and constant, sustainable enhancement of the company's performance. This is because the future competitive advantage of SMEs will lie in the management of technological advancement and the recruitment of skilled and motivated workers.

2.1.4 Artificial Intelligence and Sustainability of SMEs

AI is a great way to make companies more sustainable regarding resources, efficiency and innovation of programmes that can reduce the environmental impact. Another benefit of AI is its capacity to understand the organisation's big data, review areas for poor resource utilisation, and prescribe ways to reduce the misuse of resources, hence lowering organisational impact on the environment (Bain & Company, 2024). Some ways include helping reduce carbon emissions through more efficient supply chain planning and inventory management (Lingaro Group, 2024).

Predictive analytics also offers a way through which businesses can accurately predict the demand in the market and consequently modify how they manufacture goods to avoid producing items that may not be in demand, thereby cutting costs on the production of unsalable items (EY, 2024). This level of operational flexibility is crucial in order to sustain business entities amid continued change in the market. At the same time, AI improves sustainability reporting and makes it easier for firms to monitor the factors known as ESG within the

company, which stands for environmental, social and governance standards (World Economic Forum, 2024).

Integrating AI into sustainability ensures that a business meets legal expectations regarding sustainable practices as it creates a competitive edge by addressing customers' green concerns (Badghish & Soomro, 2024). Specifically, it has been found that AI can be strategic with positive sustainability implications on both corporate and global levels. In the context of the OECD, the management of SMEs increasingly adopts AI as a significant leverage to reach sustainable, improved corporate performance.

Using technologies that help SMEs optimise their operations, improve their decision-making and processes, and experiment with new ways to sustain their businesses has several benefits. AI assists SMEs in decision-making by processing and analysing large amounts of information to reveal patterns, probable occurrences, and recommendations. This capability's efficiency helps SMEs effectively respond to market changes and shifting consumer trends; in other words, it strengthens their competitive advantage (Udeogu et al., 2024).

Furthermore, AI serves to be useful in increasing the variety and quality of the products that SMEs offer, and it analyses customer responses for better marketing inputs. This assists companies in satisfying consumers' demands more and thus increases consumer satisfaction and consumption. Risk management is also an area whereby AI assists in analysing possible risks and threat indicators to a firm. For instance, AI systems in business can estimate the fluctuations of the market and the financial data that allows SMEs to prepare for changes in the economic situation or customers' behaviour (Badghish & Soomro, 2024). This is key in ensuring the goals and objectives of a firm in the face of uncertainty and volatility in the business environment.

2.2 Theoretical Framework

Among these, Davis' technology acceptance model, established in 1989, is widely used to analyse how individuals adopt and use technology. As noted by Abrams et al. (2019), TAM is a popular model that defines the factors affecting the technology adoption and utilisation process and encompasses two constructs: perceived usefulness and perceived ease of use.

Perceived Usefulness (PU) is the perceived level of use of a particular system or technology and the perceived benefits that can improve a worker's performance.

Perceived Ease of Use (PEOU) refers to the extent of perceived accomplishment when interacting with the system, such as productivity and ease.

TRA is fundamental in understanding user behaviour about information systems, and TAM builds on TRA. Both PU and PEOU are central to influencing users' attitudes to technology, facilitating the behavioural intention for adopting and using the technology (Davis, 1989; Venkatesh & Davis, 2000).

Venkatesh and Davis developed the original model to add some outside variables, such as social influence and cognitive instrumental condition, which influence perceived usefulness and ease of use, to bring forth the new model called the TAM2. These additional factors further explain why some people may comprehend a system as useful and easy to use based on social aspects and the importance of the system in their working environment. Social and cognitive parameters come into the TAM2, which offers an elaborate perspective on analysing user behaviour in the domain of technology adoption.

However, the adoption of AI is still low in SMEs, especially in South-East Nigeria, as the majority of the owners and managers lack adequate information on how the technology can be implemented. Many reasons prevent businesses in this particular region from embracing Artificial Intelligence, and one of them is that they are not aware of the advantages of its implementation at all. Nevertheless, TAM makes it possible to decode why AI adoption is vital for improving the sustainability of the aforesaid organisations.

Empirical Evidence on AI Adoption in SMEs

Several authors have investigated the effects of AI on SMEs' performance. Kumar et al. (2023) discussed how AI and e-commerce positively impact SMEs' marketing performance. Using extensive literature as their source of information, the authors established that AI has helped SMEs in intelligent content creation, model predictive action, decision automation, and customer real-time monitoring. Secondly, AI assists SMEs in the effective promotion of promotional strategies, and it also helps in demand forecasting, which in return leads to the achievement of growth by SMEs through exploring new markets and customer loyalty.

In the same manner, Lian (2023) also examined the factors that impact the adoption of digital technology in green supply chain innovation of the Malaysian social enterprise. Lian applied structural equation modelling to discover that performance expectancy, effort expectancy, and cost of usage positively influenced the adoption of digital technology.

In South Africa, Amesho et al. (2022) recognised the effect of TIS on service delivery and SCA. This was critical as the students pointed out that ineffective management of technology and innovation raises various issues impacting service delivery and market competitiveness.

In Jordan, Mohammad (2022) discussed the eligibility of BI usage in SMEs by employing a TOE construct. The researchers established that technological, organisational and environmental factors impacted the adoption of BI solutions, which gave more credit to technology in improving commerce.

Yulia and Wamba (2022) discussed the existence and use of AI for business resilience to supply chain disruptions in Europe. In their study, they discovered that AI employment greatly increases business organisational adaptability by increasing unity of command, system coordination, and effective execution of tactical action plans to manage change shocks. This contributes positively to the firm's performance; the value of AI in strategic planning and management during these crises is evident.

For developing countries, Bandari (2019) also conducted a study on small firms and their application of artificial intelligence. Interacting with 391 small enterprises, the study established that AI use in customer relations, marketing and sales, prediction, stock management, financial planning, and lead generation directly affects revenue. Nevertheless, the impact on employee management and cybersecurity was relatively moderate, implying that the lucrative use of AI technology depends on the type of business sector and its associated specific tasks.

3. Research Methods

This research used a descriptive survey design and selected the southeast geo-political zone of Nigeria comprising five states: Abia, Anambra, Ebonyi, Enugu and Imo. This was due to the huge population of SMEs and the population's enthusiasm within this region towards business ventures. The study population covered all 27,546 registered SMEs the Corporate Affairs Commission (CAC) identified. Krejcie & Morgan's sample size determination formula was used to calculate the sample size and determined that 379 was required. The questionnaire was adopted for primary data collection and was structured according to the variable of interest, which experts in the area of study validated. The instrument was also subjected to reliability analysis. Another method, the test re-test, was used to determine its reliability in giving consistent results. The quantitative data analysis employed was Simple Regression Analysis, an inferential research method that was deemed suitable for determining the extent of the association between the predictor and criterion variables.

4. Data Analysis

SMEs in southeast Nigeria use various aspects of machine learning to improve their operational efficiency.

Table 4.1
Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.842	.817	.815	3.27657

a. **Predictors:** (Constant), MACHINE LEARNING

Table 4.2

ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	2795.185	1	2795.185	258.853	.000
Residual	634.154	60	11.736		
Total	**3429.339**	61			

Dependent Variable: **OPERATIONAL EFFICIENCY**

Predictors: (Constant), **MACHINE LEARNING**

Coefficients

Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.
	B	Std. Error	Beta	
(Constant)	3.653	1.088		3.461
MACHINE LEARNING	0.861	0.058	0.706	16.230

Dependent Variable: **OPERATIONAL EFFICIENCY**

Table 4.1 presents the values of R and R^2. This correlation analysis aims to determine the degree of association between the independent variable, Machine Learning, and the dependent variable, Operational Efficiency, using the coefficient of determination, R2 value (0.842). The value of 0.817, called the coefficient of determination, also confirmed the percentage of variance in operational efficiency caused by the application of machine learning. Consequently, the two variables are closely related and represented by the high R-value.
Thus, the analysis with the help of machine learning explains 81.7% of the variance of operational efficiency, confirming the high value of R^2. The machine learning coefficient, as

shown above, shows a coefficient of 0.842, indicating that it has a positive and significant relationship with operational efficiency. This is confirmed by the t value of 16.230. The following P = 0.0022 <0.05; therefore, the null hypothesis is rejected since it is statistically significant. Therefore, the null hypothesis is rejected, while the research supports the belief that machine learning improves the operational efficiency of SMEs in South-East Nigeria.

This result means that the effectiveness of the presented machine learning technologies is linked exclusively to the increase in functioning speed. Consequently, artificial intelligence adoption instigates radicalization within the processes of SMEs or small and medium enterprises. To a certain extent, it is possible to apply the potential of AI tools to a mass scale and implement corresponding innovations in terms of industry standards.

5. Discussion of Findings

The hypothesis tested indicated that the application of machine learning has a positive effect on the operation effectiveness of SMEs in South Eastern Nigeria. Machine learning plays a tangible role in improving the SME business because it helps to complete some of the clerical tasks, allocate resources efficiently, and also assists in correct decision-making based on the analytical data available. One key benefit of utilising machine learning is dealing with massive data to find patterns useful for decision-making. It enhances the probability for MSEs to make decisions that respond to prevailing market forces, improving their capacity to respond to market forces (Oldemeyer, Jede, & Teuteberg, 2024). Informed decision-making is therefore paramount in an organisation's growth, sustainability and competitiveness.

These findings align with Smith's (2024) premise that using digital technologies, such as machine learning, enhances employee productivity and efficiency in decision-making. Thus, the study can also confirm the findings of Kumar, Pandey, Pujari, and Arora's study (2023), which revealed that the use of AI inevitably promotes company growth in several aspects like smart content generation, value propositions, accurate forecasting, decision-making support systems, strategic customer understanding, and stepped-up product/service development. In all, the above factors positively impact the operations of SMEs in several ways.

6. Conclusion

AI has become the revolution whose absence can spell the difference between businesses' sustainability and failure. It has numerous advantages for SMEs that endeavour to boost performance with the intention of maintaining it incessantly. Overall, operational performance enhancement, identification of manufacturing bottlenecks, decision support, innovation, better customer relations, resource utilisation, and risk management are the areas in which AI is of great value to SMEs to succeed in such a dynamic and extremely competitive environment. The adoption of AI has the potential to aid SMEs in future-proofing their operations through improved efficiency and adaptability. Implementing AI is no longer a luxury but a necessity for companies to survive in the fast-progressing global economy.

7. Limitations

Inferential statistical techniques also limit other potential statistical analysis approaches to the study. Furthermore, it was restricted to SMEs resident in the South-East geopolitical zone of Nigeria as opposed to all the SMEs in Nigeria. Such a geographical limitation may influence the control and generalizability of the results.

8. Suggestions

Thus, policymakers and industry executives must create environments conducive to the effective use of AI, particularly by SMEs that may not have had prior experience with it. Strategies should include:

- Challenges faced when implementing the incentives for deployment of artificial intelligence in order to reduce costs.
- Help learners gain greater access to training programmes to increase the training on AI.
- The ecosystem that needs to be created should encourage the release of innovative ideas while strictly addressing data privacy issues.

In addition, partnerships between various governmental organisations, educational facilities, and industry players should assist SMEs in coping with the challenge by implementing AI successfully. In this context, the organisational culture for innovation and sustainability in SMEs aims to increase the efficiency of organisation performance and contribute towards sustainability goals of the environment and economy (Nguyen, Pham, & Hoang, 2024).

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