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Information Technology Adoption and Sustainability Performance of Manufacturing firms in Nigeria: Challenges and Prospects

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Abstract

This research explored the current state of information technology (IT) adoption in Nigerian manufacturing firms, focusing on challenges and prospects for sustainable business practices. The study assessed the level of IT adoption, identify integration challenges, and explored potential benefits for sustainable practices. Drawing on a comprehensive literature review, the research employed content analysis and adopted Rogers' Diffusion of Innovations theory to provide theoretical underpinning. The findings highlighted disparities in IT adoption among manufacturing firms, with challenges stemming from internal factors, financial constraints, infrastructure limitations, societal influences, and governmental policies. The positive impacts of IT adoption on sustainable practices are evident, including enhanced competitiveness, improved productivity, and positive economic contributions. The study recommends training programs, financial support mechanisms, infrastructure development, cultural awareness initiatives, and strengthened government support as strategies to overcome barriers and promote IT adoption in the Nigerian manufacturing sector. The findings contribute valuable insights for policymakers, industry stakeholders, and researchers seeking to enhance the sustainable performance of manufacturing firms through effective IT integration.

Keywords: Information Technology, Manufacturing Firms**,** Financial Support**, Small and Medium enterprises**

Introduction

In a world rapidly advancing in technological prowess, the intersection of Information Technology (IT) and sustainable business practices has become central for the growth of industries. Manufacturing firms in Nigeria standing at the crossroads of tradition and innovation, grappling with the decision to embrace the digital era (Emeka, Yodthong & Emmanuel, 2015). The choices made in this technological leap not only impact the individual firms but have profound implications for the sustainable future of Nigeria's manufacturing sector. Bailey (2023) highlighted the insightful perspective shared by Doris Uzoka-Anite, Nigeria's Minister of Industry, Trade, and Investment. According to Uzoka-Anite, the imperative for individuals and industries alike lies in harnessing the power of transformative technologies. In her exact words, she emphasized the need for people to strategically leverage emerging trends such as artificial intelligence, automation, robotics, and the Internet of Things (IoT). The minister believes that embracing these cutting-edge technologies is crucial for not only advancing manufacturing processes but also for enhancing efficiency and ultimately driving productivity. Uzoka-Anite envisions a future where Nigeria can solidify its standing on the global stage by adopting these innovative tools. By incorporating artificial intelligence, automation, robotics, and IoT into manufacturing practices, local industries can gain a competitive edge. The minister underscores the potential of these technologies to revolutionize production methods, streamline operations, and significantly improve overall output. This journey through the impact of Information Technology adoption on the sustainable performance of manufacturing firms in Nigeria promises to unravel challenges and prospects alike.

Nigeria, a country rich in resources and cultural diversity, has witnessed a surge in industrialization over the years. However, the manufacturing sector faces a pressing need for modernization to keep pace with global standards (Chete, Adeoti, Adeyinka & Ogundele, 2016). As the global economy tilts towards digitization, the importance of IT adoption becomes paramount. The integration of IT into manufacturing processes not only enhances efficiency and productivity but also contributes to the broader goal of sustainable

development (Irfan, Sulehri & Manickiam, 2024; Bican & Brem, 2020). Understanding this backdrop is crucial to appreciate the challenges and prospects of IT adoption in Nigerian manufacturing firms. Amidst the vast potential for growth, a critical research problem emerges: How does the adoption of Information Technology impact the sustainable performance of manufacturing firms in Nigeria? This question into the heart of a current gap in the literature, as existing studies provide limited insights into the specific challenges and prospects faced by Nigerian manufacturing firms in embracing IT solutions. The significance of this study extends beyond the confines of academic curiosity. As Nigeria aspires to diversify its economy and become a global player, the role of a technologically advanced manufacturing sector cannot be overstated. By identifying the challenges hindering IT adoption and exploring the prospects it brings, this research aims to contribute valuable insights to policymakers, industry leaders, and scholars. The study's findings may guide strategies for fostering sustainable development in the manufacturing sector, thereby influencing the overall economic landscape.

This study seeks to achieve several objectives. Firstly, to assess the current level of IT adoption in Nigerian manufacturing firms. Secondly, to identify the challenges these firms face in integrating IT into their operations. Thirdly, to explore the potential prospects and benefits that IT adoption can bring to sustainable business practices in the context of the Nigerian manufacturing sector. The research hypothesizes that overcoming these challenges and embracing IT will positively impact the sustainable performance of manufacturing firms. The motivation behind this research lies in the recognition of the pivotal role that information technology can play in transforming the manufacturing landscape in Nigeria. As the country grapples with the need for economic diversification and sustainable development, leveraging technology becomes imperative. However, the challenges posed by factors such as limited infrastructure, economic disparities, and environmental concerns necessitate a nuanced exploration. The rationale for this research stems from the belief that a well-informed understanding of the challenges and prospects

associated with IT adoption in the manufacturing sector can pave the way for strategic interventions. By identifying the barriers that impede the effective utilization of IT tools and recognizing the potential benefits, stakeholders can work collaboratively to create an ecosystem where technological advancements contribute to both economic growth and environmental sustainability.

Research objectives

1. To assess the current level of information technology adoption in Nigerian manufacturing firms.
2. To identify the challenges these firms face in integrating information technology into their operations.
3. To explore the potential prospects and benefits that information technology adoption can bring to sustainable business practices in the context of the Nigerian manufacturing sector.

Literature Review

Concept of information technology

The history of information technology is marked by continuous innovation, shaping modern life. From the mid-20th century's introduction of electronic computers to the democratization of personal computers, internet proliferation, and the mobile revolution, each era brought transformative change. The World Wide Web's advent facilitated global information access, while cloud computing and artificial intelligence further revolutionized the landscape. This ongoing evolution underscored information technology's profound impact on society, enhancing productivity and connectivity, and sets the stage for an increasingly interconnected and technologically advanced future. According to Ten & Patrão (2021), information technology (IT) involves a broad range of activities related to computer-based information systems. This field involves the entire lifecycle of these

systems, from their initial design and development to their practical use and implementation. IT includes both hardware and software components, with a focus on creating, storing, processing, securing, and distributing electronic data, primarily in digital formats. The creation and maintenance of IT systems involve designing efficient and effective solutions to address various needs and challenges. This can include the development of applications, databases, and other software, as well as the design and configuration of hardware components such as computers, servers, and networking devices. Storing and processing data play a crucial role in IT, as organizations manage vast amounts of information. This includes databases that store structured data, file systems for documents and multimedia content, and other storage solutions. The processing of data involves the manipulation and analysis of information to derive meaningful insights and support decision-making processes. McInerney(2010) asserted that information technology (IT) is a dynamic and evolving field characterized by its continuous integration of hardware and software solutions to efficiently manage and process digital data. This dynamic nature reflects the constant advancements and innovations in technology, making IT a pivotal force in shaping various aspects of contemporary life. The applications of IT are pervasive, extending their influence across diverse domains, including daily life, business operations, and societal interactions. In daily life, individuals rely on IT for communication, entertainment, and access to information. In business, IT plays a crucial role in optimizing processes, facilitating communication, and supporting decision-making through data analysis. IT has become an integral part of societal interactions, influencing how people connect, share information, and collaborate. Social media platforms, online communication tools, and digital content creation are all manifestations of IT's impact on societal dynamics.

Information technology (IT) is the utilization of computers and related technologies for various purposes, including the creation, processing, storage, retrieval, and exchange of diverse forms of data and information (Moshood, Nawanir, Sorooshian, Mahmud

& Adeleke, 2024). This field is integral to modern-day operations across numerous industries and sectors. IT involves the application of hardware, software, networks, and other technological resources to streamline tasks, enhance communication, and facilitate decision-making processes. From managing databases to developing software applications, IT plays a crucial role in enabling organizations and individuals to efficiently navigate and manipulate information, fostering innovation and connectivity in today's digital age. Victoria (2020) states that Information Technology (IT) is a broad spectrum of activities centered around the processing and communication of information through electronic devices. It is an umbrella term that covers various technologies involved in handling information, ranging from sophisticated information systems and industrial automation processes to inter-organizational computer communication and personal use of computational resources. In the context of IT, she further stated that information processing is a fundamental element, involving the manipulation, storage, retrieval, and transmission of data. This can occur within complex information systems designed for businesses, where databases, software applications, and networks work collaboratively. IT is also evident in industrial settings, where automation processes leverage technology to streamline and optimize production. On a more personal level, individuals engage with IT through the use of computational resources, such as personal computers, smartphones, and other electronic devices. This personal use extends to accessing and managing information, communication through various platforms, and utilizing software applications for different purposes. Attaran (2003) defined of Information Technology (IT) as the collective capabilities offered to organizations through the integration of computers, software applications, and telecommunications. According to Attaran, these capabilities are harnessed to facilitate the delivery of data, information, and knowledge to both individuals and various organizational processes. In essence, Information Technology serves as a multifaceted toolset that enables the efficient management and dissemination of crucial information within an organizational framework. This definition highlights the dynamic and interconnected

nature of IT components, emphasizing their role in enhancing the overall functioning and communication within organizations.

Sustainability performance

Akhimien and Adekunle (2023) assert that sustainable performance at a firm level involves a comprehensive approach that integrates social responsibility, economic prosperity, and environmental stewardship. It embodies the firm's commitment to fostering societal well-being by balancing the creation of economic value with the preservation of environmental integrity. This entails adopting business practices that not only drive financial growth but also contribute positively to the communities in which the firm operates, while minimizing ecological footprint and mitigating adverse environmental impacts. By embracing sustainability as a core principle, firms can strive to achieve long-term success that benefits both present and future generations, aligning economic objectives with social and environmental responsibilities. Schaltegger and Wagner (2006 cited in Sebhatu, 2008) defined sustainability performance as the comprehensive evaluation of a company's activities across various dimensions and factors that contribute to corporate sustainability. This includes not only environmental considerations but also social and economic aspects. It involves assessing how well a company manages its environmental impact, promotes social responsibility, and maintains economic viability while striving for long-term sustainability. In essence, sustainability performance evaluates the effectiveness of a company's efforts in balancing profit generation with social and environmental responsibility to meet the needs of the present without compromising the ability of future generations to meet their own needs.

In evaluating the sustainability performance of an entity, such as a company, industry, or country, Zhou and Ang (2008) state that it is a common practice to devise relevant indicators tailored for the scrutiny of analysts and decision-makers. These indicators serve as vital tools in comprehensively gauging various aspects of sustainability,

ranging from environmental stewardship and social responsibility to economic resilience. By meticulously crafting and employing these indicators, stakeholders can effectively monitor, assess, and benchmark the sustainability efforts and outcomes of the entity under review. This structured approach facilitates informed decision-making, fosters accountability, and encourages continuous improvement towards achieving long-term sustainability goals. According to Liyanage, Badurdeen and Ratnayake (2009), sustainability performance revolutionizes modern business by prioritizing long-term viability and responsible practices. It challenges traditional approaches by integrating environmental and social concerns into business strategies, fostering innovation and resilience. This shift towards sustainability ensures that businesses thrive while minimizing their impact on the planet and society, paving the way for a more equitable and sustainable future.

Manufacturing Firms

A manufacturing firm is a business entity engaged in a wide spectrum of activities related to the transformation of raw materials or minerals into finished products. These activities encompass various processes such as extraction, smelting, recovery, development, preparation, compounding, conversion, assembly, and overall production (**Law Insider, n.d.**). The scope of a manufacturing firm includes not only the physical creation of goods but also extends to facilities associated with storage, warehousing, and distribution of the manufactured products. Manufacturing firms are involved in research and development efforts aimed at discovering new substances, refining existing processes, and enhancing products. The emphasis on innovation and improvement highlights the dynamic nature of manufacturing, as companies continually strive to stay at the forefront of technological advancements and market demands. In essence, a manufacturing firm plays a pivotal role in the industrial ecosystem by contributing to the creation, advancement, and dissemination of a diverse range of products and substances.

Method

The method used is content analysis, the researchers employed a systematic and objective approach to analyze and interpret the content of various sources, which included documents, reports, interviews, or other relevant materials. The primary focus of the study is on understanding how the adoption of information technology affects the sustainable performance of manufacturing firms in Nigeria. Content analysis involved identifying patterns, themes, and trends within the collected data to draw meaningful conclusions

Theoretical Underpinning

The theory adopted for this study is diffusion of innovations theory developed by Rogers, E.M. in 1962. The theory provided a framework for understanding how new concepts, behaviours, technologies, or products are adopted and spread within a society. This theory posits that the adoption process is not instantaneous but occurs gradually over time. The diffusion process typically begins with innovators and early adopters, who are more open to embracing new ideas and taking risks ((Sahin, 2006). Innovators are the first individuals to adopt an innovation, often characterized by their willingness to experiment with novel concepts. Early adopters follow, representing a slightly larger group that helps bridge the gap between the innovators and the broader population. As the adoption curve progresses, the early majority and late majority come on board, constituting the bulk of the population that adopts the innovation. Finally, laggards, who are resistant to change, adopt the innovation last. Adoption, in the context of this theory, involves individuals incorporating a new idea or behavior into their lives, deviating from their previous practices. The diffusion of innovations theory emphasizes the importance of understanding the dynamics of communication channels, social systems, and individual characteristics in influencing the rate and extent of adoption within a given population.

In the context of the impact of information technology (IT) adoption on the sustainable performance of manufacturing firms in Nigeria, the diffusion of innovations theory provided insights into how the adoption process may unfold. Innovators in this context might be the pioneering manufacturing firms in Nigeria that are quick to embrace new information technologies. These firms may be at the forefront of implementing advanced manufacturing technologies, such as automation, data analytics, and digital supply chain management. Early adopters could be the manufacturing firms that follow the innovators, recognizing the potential benefits of IT adoption for enhancing efficiency, reducing costs, and improving overall sustainable performance. The early majority phase may involve a broader group of manufacturing firms in Nigeria recognizing the positive outcomes achieved by innovators and early adopters. This phase could witness a more widespread integration of IT solutions within the manufacturing processes as firms aim to remain competitive and sustainable. The late majority phase involves the more skeptical manufacturing firms in Nigeria adopting IT solutions as the benefits become increasingly apparent. This group may adopt IT practices to catch up with competitors and address the challenges posed by global market trends.

Laggards, in the context of IT adoption, could be those manufacturing firms in Nigeria that are resistant to change and slow in embracing technological advancements. They may face challenges in adapting to new IT systems, possibly due to resource constraints, lack of awareness, or traditional business practices. The diffusion process is not without challenges. Resistance to change, lack of infrastructure, and the initial costs associated with IT implementation can hinder the adoption process. Government policies and support can play a crucial role in overcoming these challenges. Successful IT adoption can lead to improved sustainable performance for manufacturing firms in Nigeria. This may include enhanced resource efficiency, reduced environmental impact, better supply chain management, and increased competitiveness in the global market.

State of information technology adoption in Nigerian manufacturing firms

Babalola, Soyemi, and George (2021) conducted a study that underscored the significant impact of information and communication technology (ICT) use on the competitiveness of manufacturing companies in Lagos state, Nigeria. The research highlighted the critical role played by ICT in enhancing operational efficiency and overall competitiveness within the manufacturing sector of the state. Despite recognizing the importance of ICT, the study brought to light a notable discrepancy in the adoption of advanced technologies among manufacturing companies in Lagos state. Specifically, the research revealed a limited utilization of sophisticated ICT tools such as Computer-Aided Design (CAD), Computer-Aided Manufacturing (CAM), Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), and Supply Chain Management (SCM). This implies a potential gap in the incorporation of cutting-edge technologies that could otherwise contribute to a substantial competitive advantage for these companies. Nigeria holds a pivotal position in Africa's ICT landscape, claiming the title of the continent's largest market. The country boasts an impressive 82% share of telecoms subscribers and contributes significantly to the regional internet usage with a 29% share. As Sub-Saharan Africa emerges as the world's fastest-growing region, anticipating a compound annual growth rate (CAGR) of 4.6%, Nigeria is poised to play a substantial role. Projections suggest an enrollment of over 167 million subscribers in the next five years, with Nigeria accounting for a substantial 55% of this growth (International Trade Administration, 2023). According to estimates from the Nigerian Communications Commission (NCC) as of June 2022, the nation demonstrates a robust ICT infrastructure. With approximately 85 million broadband subscriptions, representing a penetration rate of 44%, Nigeria showcases a strong commitment to high-speed internet access. In the voice segment, the country maintains a teledensity of 108%, reflecting a remarkable 206 million lines, underlining the widespread use of mobile communication. This data not only positions Nigeria as a leader in the African ICT landscape but also indicates a promising

trajectory for continued growth and technological advancement. The country's significant contributions to regional telecoms and internet usage, coupled with proactive measures to expand broadband access, underscore its potential as a key player in the global digital arena.

Agwu (2016), in his study titled "ICT Diffusion, Adoption, and Strategic Importance in Nigerian SMEs," emphasized the limited and not widespread adoption of Information and Communication Technology (ICT) among Nigerian Small and Medium-sized Enterprises (SMEs). Despite recognizing the numerous benefits that ICT brings to businesses, including improvements in processes, enhanced service delivery, and increased profit maximization, the study highlighted a significant gap in the adoption of these technologies within the SME sector in Nigeria. This observation underscores the challenges or barriers that SMEs in the country face in fully embracing and integrating ICT into their operational frameworks. Agwu's work serves as a crucial insight into the existing disparities between the potential advantages of ICT and its actual implementation in the context of Nigerian SMEs. Ade-Ibijola & Okonkwo (2023) highlighted a growing trend in the adoption of Artificial Intelligence (AI) across various aspects of human activity within the current African society. The emphasis on AI's increasing popularity underscores its potential to influence and shape diverse facets of life on the continent. However, despite this rising trend, the scholars noted that the actual adoption and utilization of these modern technologies in the African context are currently hindered by low levels of implementation. This disparity is attributed to a range of emerging challenges that act as barriers to the widespread integration of Artificial Intelligence.

Nigeria, classified as a developing nation, exhibits a relatively sluggish pace in the application and utilization of Information and Communication Technology (ICT) within its organizations, especially when compared to its counterparts across the African continent. This observation aligns with the research findings of Kolawole, Adeigbe, and Hilary (2014). According to their conclusions, a significant portion of organizations in

Nigeria falls under the category of Non-Intensive ICT users. Non-Intensive ICT users, as defined by the study, are organizations that possess fundamental ICT infrastructure such as computers, local area networks (LANs), wide area networks (WANs), as well as mobile and landline phones. However, these organizations face a constraint in their capacity to afford more advanced ICT resources, particularly internet connectivity and Very Small Aperture Terminal (VSAT) technology. The absence of internet and VSAT access in these organizations restricts their ability to connect with the broader global network, limiting their potential for external communication, research, and collaboration. This scenario underscores the existing challenges and financial barriers that impede the widespread integration of advanced ICT solutions in Nigerian organizations.

Challenges facing firms in integrating information technology into their operations in Nigeria

Kapurubandara and Lawson (2006) conducted a comprehensive categorization of the barriers hindering the adoption of Information and Communication Technology (ICT) by Small and Medium Enterprises (SMEs) in developing countries. Their classification highlighted both internal and external factors that play pivotal roles in shaping the landscape of ICT adoption within these business entities. Factors considered as internal barriers are personal attributes, attitudes, and perceptions of business owners and managers can significantly influence the decision to adopt ICT. Factors such as technological literacy, openness to change, and risk tolerance may act as internal barriers. Secondly, the inherent characteristics of SMEs, including their size, structure, and existing organizational culture, can pose challenges to the smooth integration of ICT. Resistance to change within the organization and the lack of a conducive environment for technological incorporation are examples of firm-related barriers. Thirdly, financial considerations, encompassing the initial investment costs and concerns regarding the expected return on investment, form crucial internal barriers. SMEs, often operating with limited resources, may find it

challenging to justify and allocate funds for ICT adoption. On the hand, the internal factors include the availability and quality of technological infrastructure, such as reliable internet connectivity and power supply, are external factors that directly impact ICT adoption. Inadequate infrastructure can impede the effective implementation of technological solutions. Societal and cultural aspects play a significant role in influencing ICT adoption. Attitudes towards technology, prevailing norms, and societal expectations can either facilitate or hinder the integration of ICT within SMEs. The external environment, including political stability, legal frameworks, and regulatory policies, can shape the feasibility and ease of ICT adoption. Uncertain political climates or stringent regulations may act as barriers for SMEs looking to embrace new technologies.

Ogbari, Atolagbe, Adeboye & Uzuegbunam (2017) discussed the challenges faced by technology-based firms (TBFs) and how these challenges can affect their growth. The study categorizes these challenges into three main groups: internal challenges, external challenges, and challenges related to external linkages. The scholars identifies several internal challenges that TBFs face. These include: The methods and styles used by an organization in applying its founding strategy, focusing on innovativeness, risk-taking propensity, and proactiveness. The level of an organization's internal technological know-how, encompassing knowledge, patents, production processes, and other technologically based factors. Also, technology-based firms often face difficulties in obtaining financial resources due to factors like lack of expertise in the sector, unavailability of collateral security, and the high-risk nature of the technology sector. External challenges, according to Ogbari et al., (2017), include factors in the broader business environment that affect TBFs. These factors involve: Technology-based firms encounter competition from other firms. Keeping up with rapid technological changes is crucial for TBFs. The market for technology-based products can be unpredictable, posing challenges for these firms. The role of external linkages, such as partnerships and sponsorships, is discussed as a source of challenges. This involves: Collaborative relationships with other enterprises, venture

capitalists, universities, and research institutes are explored. These partnerships provide resources, knowledge, and support. Sponsorships from external parties, including government bodies, enhance the legitimacy and prestige of TBFs, providing financial support and access to scarce resources.

Sadiq, Hack-Polay, Fuller & Rahman (2022) outline challenges hindering IT adoption in developing countries, specifically Nigeria. They identify three categories: Technological-related barriers, Organisational Barriers, and Environmental Barriers. Technological-related barriers for Small and Medium Enterprises (SMEs) in developing countries include high implementation costs (hardware, software, internet setup, and maintenance), limited resources, a perceived low return on investment, and security concerns like hacking and fraud. The quality of internet service, including speed and stability, is crucial, while funding constraints pose a significant challenge. Organisational Barriers faced by SMEs involve resource limitations (both financial and infrastructural), limited ICT knowledge and skills among employees, resistance to change, time constraints for implementation, perceived technology complexity, and inadequate skills development through training. Environmental barriers to effective ICT incorporation in small businesses include insufficient government support, especially in less developed countries like Nigeria. Weak legal and regulatory policies, particularly for cross-border transactions in business-to-customer interactions, present barriers. Low consumer usage of advanced ICTs due to poor internet access and weak ICT infrastructure in developing countries, as well as cultural barriers, further complicate the implementation and usage of advanced ICTs, particularly in SMEs. Addressing these challenges is essential for the successful integration of ICTs in small business operations.

The positive impacts of adopting information technology on sustainable business practices in the Nigerian manufacturing sector

Idoko (2023) highlighted the revolutionary impact of new technologies on manufacturing management worldwide, emphasizing their role in enhancing efficiency, productivity, and product quality. These advancements not only facilitate faster innovation and development but also have far-reaching implications for global manufacturing practices. In the context of Nigeria, embracing new technologies in manufacturing can usher in a host of advantages. Firstly, it can significantly enhance the competitiveness of the country's manufacturing sector on the global stage. The integration of advanced technologies enables Nigerian manufacturers to produce goods more efficiently and with higher quality, positioning them favorably in international markets. Moreover, the adoption of new technologies in manufacturing has the potential to generate employment opportunities. As industries become more automated and technologically advanced, there is a growing demand for skilled workers in areas such as robotics, artificial intelligence, and data analysis. This not only addresses unemployment concerns but also contributes to the development of a skilled workforce in the country. Additionally, the use of cutting-edge technologies facilitates improved decision-making processes within the manufacturing sector. Data-driven insights and real-time analytics empower manufacturers to make informed choices, optimize operations, and respond swiftly to market changes. This, in turn, leads to more effective resource utilization and strategic planning. In the broader economic context, the integration of new technologies into Nigeria's manufacturing sector is crucial for maintaining alignment with global standards. As international markets evolve and demand higher standards of efficiency and innovation, staying technologically competitive is essential for sustained growth and economic development.

Oluwafemi (2015) asserted that the impact of Information and Communication Technology (ICT) on productivity within the Small and Medium-sized Enterprises (SME) sector in Nigeria is substantial. The study emphasized that the integration of ICT in SME operations has a transformative effect on processes, resulting in increased productivity and

ultimately, enhanced profitability. Stakeholders within the SME industry acknowledge that the adoption of ICT brings about significant changes, streamlining operations and fostering a more efficient business environment. The research highlights that the introduction of ICT not only boosts productivity but also opens up new opportunities for SMEs. By leveraging information and communication technologies, SMEs can effectively manage inventories, enhance the tradability of their services, and tap into previously inaccessible markets. Moreover, the study underscores that ICT plays a pivotal role in improving the core business functions of SMEs throughout their entire business process.

In the research conducted by Lawal and Magini (2021), their findings shed light on the complex dynamics between information technology (IT) and sustainability in the context of small and medium-scale enterprises (SMEs). According to their study, the relationship between information technology and the sustainability of SME growth was deemed insignificant. This implies that, contrary to expectations, the adoption and integration of information technology alone did not have a substantial positive impact on the overall sustainability of SMEs. On the other hand, the research highlighted a contrasting result concerning technology innovation. The study revealed a significant positive relationship between technology innovation and the sustainability of SME growth. This suggests that SMEs that actively engage in technological innovation initiatives are more likely to experience positive outcomes in terms of sustained growth.

The research conducted by Odohoedi, Williams & Akpan (2023) underscored the pivotal role played by modern production innovations and emerging management philosophies in advancing business sustainability. The study empirically establishes a positive correlation between the adoption of technologies such as enterprise resource planning, business intelligence tools, artificial intelligence, and robotic manufacturing and improvements in the environmental, social, and governance dimensions of companies. In the realm of manufacturing, the study identifies the degree of mechanization, technological advancement, and the innovation ecosystem as critical elements contributing to sustainable

development. The analysis further reveals a strong interconnection between capital per unit of labor factor and the level of digital technology integration in the manufacturing sector. Moreover, the study highlights the significance of innovation ecosystems, representing communities that support innovation processes, in enhancing productivity and fostering positive changes in business sustainability. It asserts that innovation is a linchpin for business success, playing a pivotal role in wealth creation, socio-economic development, and enhancing societal well-being, all while mitigating environmental risks. The research emphasized that effective management innovation can rapidly amplify productivity and profitability, ultimately raising the standard of living for employees and augmenting shareholder wealth. In essence, the findings underscore the multifaceted benefits of embracing technological advancements and fostering innovative management practices for businesses aiming to thrive in a sustainable manner.

Discussion and Conclusion

The review of related literatures has shown that overcoming challenges and embracing Information Technology (IT) will have a positive impact on the sustainable performance of manufacturing firms in Nigeria. This assertion finds validation in the overwhelming positive results arising from the incorporation of new technologies, especially Information and Communication Technology (ICT) and technological innovation, within the manufacturing domain discussed by scholars. The studies underscored how these advancements contributed positively to manufacturing efficiency, productivity, competitiveness, and sustainability, drawing examples from both the broader manufacturing sector and Small and Medium Enterprises (SMEs) in Nigeria. The literature reviewed offers compelling implications that bolster the research broad objective, highlighting that the adoption of new technologies in manufacturing is not merely a modernization effort but a strategic move with profound implications for competitiveness and sustainability. One notable implication is the substantial enhancement of

manufacturing competitiveness and sustainability through the optimization of efficiency and product quality. Additionally, the positive impact of ICT on SMEs, according to Oluwafemi (2015) and Idoko (2023), align seamlessly with the research major objective. Oluwafemi and Idoko emphasized how overcoming challenges and embracing IT can catalyze increased productivity and profitability, thereby supporting the notion that technological integration can indeed translate into tangible benefits for manufacturing firms. Furthermore, the detailed findings derived from Lawal and Magini (2021) research contributed valuable insights to the discussion. Their research suggests that mere adoption of IT may not suffice; instead, active engagement in technological innovation initiatives emerges as a crucial factor for sustained growth in SMEs. This implies that the research hypothesis should not be viewed simplistically, but rather, it should encompass a holistic understanding of the multifaceted nature of technology integration, emphasizing the importance of ongoing innovation efforts.

Recommendations

Based on the findings of this study, it was recommended:

i. Governments should improve infrastructure for reliable internet and address power supply issues, alongside awareness programmess addressing societal and cultural factors influencing SMEs' ICT adoption.

ii. Implement training programmes for business owners and managers to enhance technological literacy and openness to change, while also strengthening government support for SMEs through policies, subsidies, and regulatory frameworks facilitating ICT adoption, including addressing legal and regulatory barriers for cross-border transactions.

iii. Establish funding programmes tailored to the unique challenges faced by technology-based firms and strengthen government support for SMEs through

policies, subsidies, and regulatory frameworks. Address legal and regulatory barriers, particularly for cross-border transactions, to facilitate ICT adoption.

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