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HARNESSING ARTIFICIAL INTELLIGENCE FOR SUSTAINABLE DEVELOPMENT: A PATHWAY TO ACHIEVING SUSTAINABLE DEVELOPMENT GOALS IN AFRICA USING NIGERIA AS A STUDY

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Abstract

Artificial Intelligence (AI) has emerged as a powerful tool in advancing the Sustainable Development Goals, a clarion call to end poverty, protect the planet and ensure that all people enjoy peace and prosperity. Africa needs to harness the potential of AI to achieve developmental aspirations to education, skill, health, agriculture, infrastructure, peace, security and good governance by developing human capital, strengthening research, innovation ecosystems, building an AI-ready institutional and regulatory environment to ensure AI works for African people. This study explores the role of Artificial Intelligence (AI) in advancing Sustainable Development Goals (SDGs) in Nigeria and Africa as a whole using a qualitative research approach. The study also provides a detailed understanding of how AI can contribute to sustainable development by capturing subjective experiences, stakeholder perspectives, and contextual factors. Artificial Intelligence, defined as technology that enables machines to perform tasks requiring human-like intelligence, is examined through its potential to transform infrastructural development, improvement of data quality, agriculture, education, healthcare, capacity building, research and innovation and governance.The study anchored on Technology Acceptance Model (TAM) propounded by Fred Davis in 1989 to examine how Artificial Intelligence (AI) technologies are embraced to meet Sustainable Development Goals (SDGs) in Nigeria and Africa as a whole. However, challenges such as

digital divide, lack of skilled professionals, ethical concerns, and potential job displacement need to be addressed. Strategic approaches for leveraging AI include developing robust policy and regulatory frameworks, investing in infrastructure, reforming education, fostering innovation ecosystems, and pursuing international collaboration. This study underscores the transformative potential of AI for sustainable development in Nigeria, emphasizing the need for a comprehensive and inclusive strategy to harness its benefits effectively in Africa.

Keywords: Artificial Intelligence, Sustainable Development Goals, Healthcare Innovation, Digital Divide

Introduction

The dawn of the 21st century has witnessed an unprecedented acceleration in technological advancements, with Artificial Intelligence (AI) emerging as one of the most transformative forces shaping contemporary societies. Artificial Intelligence, a branch of computer science that simulates intelligent behavior in machines, has permeated various sectors including healthcare, agriculture, education, and finance (Ade-Ibijola & Okonkwo, 2023). Its potential to analyze vast amounts of data, predict outcomes, and automate complex tasks presents unparalleled opportunities for enhancing efficiency and fostering innovation (Mortaji & Shateri, 2023).

Simultaneously, the global community, under the auspices of the United Nations, has rallied around the Sustainable Development Goals (SDGs), a set of 17 interconnected objectives aimed at addressing pressing global issues by 2030. The 17 Sustainable Development Goals (SDGs) were adopted by the United Nations in 2015 as part of the 2030 Agenda for Sustainable Development. These goals serve as a universal call to action for all nations, regardless of their level of development, to work in partnership to address the most pressing global challenges (United Nations, 2024). The SDGs emphasize the need for an integrated approach, recognizing that economic growth, social inclusion, and environmental sustainability are interconnected. Beyond poverty eradication, they aim to enhance health care, education, and equality while promoting sustainable economic practices. Additionally, they prioritize addressing climate change, preserving biodiversity, and ensuring sustainable management of natural resources like oceans and forests. The SDGs provide a framework for countries to collaborate and achieve a more equitable and sustainable future for all.

For Nigeria, Africa's most populous nation and one of the largest economy in Africa (Lancet Nigeria Commission, 2024), the pursuit of these goals is both a national imperative and a global responsibility. According to Oweibia, Elemuwa, Akpan, Daniel, Oruikor, Tarimobowei, Okoho, Elemuwa, Raimi, & Babatunde (2024), Nigeria's vast human and natural resources uniquely position the country to make significant strides toward achieving the Sustainable Development Goals (SDGs). With a large and youthful population, Nigeria has the human capital needed to drive innovation, economic growth, and social development. This demographic advantage can be harnessed through investments in education, healthcare, and skills development, which are key components of the SDGs. Additionally, Nigeria's abundant natural resources, including oil, gas, arable land, and renewable energy potential, provide the economic foundation to finance sustainable development projects, enhance infrastructure, and reduce poverty (Obada, Muhammad, Tajiri, Kekung, Abolade, Akinpelu, & Akande, 2024). Properly managed, these resources can accelerate progress towards goals such as quality education, clean energy, decent and sustainable work for all.

Despite notable advancements, Nigeria and most African countries continue to face persistent challenges that hinder progress, including infrastructural deficits, educational gaps, healthcare inadequacies, and governance issues. These obstacles impede economic growth and development, making it difficult for the countries to achieve their full potential. However, the integration of Artificial Intelligence (AI) offers a promising solution to these problems. AI can streamline infrastructure management, enhance educational tools, improve data quality, capacity building, research and innovation, improve healthcare delivery, and support more effective governance. By leveraging AI, Nigeria has the potential to address these critical issues more efficiently, thereby accelerating sustainable development and fostering overall national progress (Abiodun, 2024). The relationship between AI and sustainable development encompasses more than just technological advancements; it touches on complex socio-economic and ethical aspects. While the deployment of AI solutions demands robust technological infrastructure, it also necessitates a supportive policy

environment, ongoing capacity building, and ethical frameworks to guarantee that the benefits are distributed inclusively and equitably (Jhara, 2024). This means that alongside the development of cutting-edge technologies, there must be concerted efforts to create policies that foster equitable access, invest in skill development, and address potential ethical concerns. A holistic approach that marries technological progress with human development is crucial for achieving sustainable outcomes and ensuring that advancements contribute positively to societal well-being and environmental stewardship. This paper seeks to explore the potential of AI as a catalyst for achieving the SDGs in Nigeria and Africa at large. It examines the current state of AI adoption in the country, identifies opportunities for integration into various sectors, and discusses the challenges and strategies for effective implementation.

Statement of Problems

Artificial Intelligence (AI) has emerged as a powerful tool in advancing the Sustainable Development Goals, a clarion call to end poverty, protect the planet and ensure that all people enjoy peace and prosperity. AI holds tremendous potential for advancing the United Nations Sustainable Development Goals (SDGs). AI provides new opportunities to analyse data and trends at pace and scale to further knowledge, allocation of resources and actions.

It is very imperative that the developing trustworthy AI technologies that take into account ethical considerations, fairness, transparency and accountability are being put in place and African countries should harness artificial intelligence to meet Africa's development aspirations. Africa is resolved to harness new technologies for the well-being of African's and to develop a continent-wide approach and a harmonised journey for this revolutionary technology to tackle Africa's complex and most pressing challenges while minimizing the risks (African Union, 2024). Unfortunately, the reality of AI technologies did not put Nigeria environmental setting, especially its ethnicity and multi-cultural setting into consideration. Again, there is problem of pervasive digital divide and inadequate technological infrastructure as highlighted by Okoye, Umeifekwem, and Eme (2023).This posits a very serious problem for the attainment of sustainable development in Nigeria through AI because

a lot of citizens are ignorant of such machine not to talk of its operating systems.

Nigeria has been rated high in illiteracy level globally, likewise many African countries and as such it is difficult for the people to understand the AI functions and operations in order to apply them in the development of many sectors to attain the sustainability of such sectors. Another significant challenge is the shortage of skilled human resources. Developing, deploying, and maintaining AI systems necessitate expertise in data science, machine learning, and related fields. Nigeria faces a critical shortage of such skills, primarily due to gaps in the education system, which has not sufficiently equipped individuals with advanced technical knowledge and practical experience in these areas. Additionally, the country suffers from brain drain, where highly skilled professionals emigrate in search of better opportunities abroad, further exacerbating the skills gap. Therefore, AI notwithstanding its global acceptability still pose serious problem to Nigeria and Africa in general.

Research Objectives

The objectives of this study include to:

1. Examine the effect of Artificial Intelligence on sustainable development in Nigeria.
2. Examine the challenges of Artificial Intelligence on sustainable development in Nigeria.

Concept of Artificial Intelligence

Artificial Intelligence (AI), as defined by John McCarthy and cited in Weber (2023), refers to the field of science and technology focused on developing intelligent machines. This encompasses the creation of sophisticated computer programs capable of performing tasks that typically require human intelligence. These tasks include problem-solving, learning, and adapting to new situations. AI aims to replicate or simulate human cognitive functions, leading to the development of systems that can perform complex operations and make decisions based on data analysis and pattern recognition. Sheikh, Prins and Schrijvers (2023) define artificial intelligence (AI) as a technology designed to enable machines to replicate a wide range of sophisticated human abilities. This includes the capability to perform tasks that typically require human intelligence, such as understanding natural language, recognizing patterns, making decisions, and learning from

experience. By mimicking these complex cognitive functions, AI systems aim to enhance automation and problem-solving across various domains.

Russell and Norvig (2010, cited in Bartneck, Lütge, Wagner, & Welsh, 2021) define artificial intelligence (AI) as "the study of [intelligent] agents that receive percepts from the environment and take actions." In this context, an intelligent agent is a system that perceives its surroundings through sensors and acts upon those perceptions using its internal processes. The key aspect of AI is its focus on creating agents that can make decisions and act autonomously based on the information they receive. According to Poole and Mackworth (2010, cited in Bartneck, Lütge, Wagner, and Welsh, 2021), artificial intelligence (AI) is conceptualized as "the field that studies the synthesis and analysis of computational agents that act intelligently." This definition emphasizes AI's focus on creating and understanding computational systems - often referred to as agents - that exhibit behaviors and decision-making capabilities that can be considered intelligent. The term "synthesis" in this context refers to the process of designing and constructing these intelligent agents, which involves developing algorithms and systems that can mimic or replicate aspects of human intelligence. This includes areas such as problem-solving, learning, reasoning, and adapting to new situations. On the other hand, "analysis" pertains to the examination and evaluation of these agents' performances and behaviors. This involves assessing how well these computational agents operate in various scenarios, how effectively they solve problems, and how their decision-making processes align with the intended intelligent behavior.

Sustainable Development

The concept of sustainable development gained widespread recognition through the efforts of the United Nations-sponsored World Commission on Environment and Development. Chaired by former Norwegian Prime Minister Gro Harlem Brundtland, this commission was instrumental in shaping contemporary understandings of sustainability. In 1987, the commission released a pivotal report titled *Our Common Future*, which has since become a cornerstone in discussions about development and environmental stewardship. The report introduced the now widely accepted definition of sustainable development: "development that meets the needs of the present without compromising

the ability of future generations to meet their own needs" (World Commission, 1987, cited in Wheeler, 2014). This definition underscores the necessity of balancing immediate human needs with the imperative to preserve environmental resources and ecological health for future generations.

Fischer, Foord, Frecè, Hillebrand, Kissling-Näf, Meili, Peskova, Risi, Schmidpeter, and Stucki (2023) emphasize that when we refer to sustainable development, we are typically addressing a comprehensive framework that encompasses three interrelated dimensions: nature, society, and economy. Nature refers to the environmental aspect of sustainability, which focuses on the preservation and responsible management of natural resources. This dimension involves addressing environmental challenges such as climate change, biodiversity loss, and pollution, and ensuring that human activities do not exceed the planet's ecological capacity. Society pertains to the social dimension, which emphasizes the importance of social equity, justice, and the well-being of communities. This includes promoting fair labor practices, enhancing quality of life, reducing inequalities, and ensuring that all individuals have access to essential services such as education, healthcare, and social support. Economy relates to the economic dimension, which involves fostering economic growth and development while maintaining environmental sustainability and social inclusiveness. This dimension focuses on creating economic opportunities, improving productivity, and ensuring that economic activities contribute positively to society and the environment rather than depleting resources or exacerbating social disparities. Together, these three dimensions form a holistic approach to sustainable development, where progress in one area should not come at the expense of the others. Achieving sustainability requires integrated strategies that balance environmental protection, social equity, and economic growth to ensure a resilient and thriving future for all.

Jeronen (2020) describes sustainable development as a dynamic and comprehensive process of transformation. It involves a systematic approach to managing resources and investments, guiding technological advancements, and enacting institutional reforms. The core idea is to achieve a balance where these elements work together harmoniously to support both the present and future well-being of human societies. Sustainable development seeks to ensure that the way resources are exploited

today does not compromise the ability of future generations to meet their needs. This means aligning the allocation of investments with long-term goals that consider environmental, economic, and social dimensions. Technological development should be oriented towards innovations that contribute to sustainability, rather than depleting or harming the environment. Similarly, institutional changes should support policies and practices that foster sustainable practices and equitable development. Jeronen (2013) presents sustainability as a holistic paradigm for future planning that integrates three fundamental dimensions: environmental, societal, and economic considerations. This perspective underscores the importance of balancing these elements to ensure long-term viability and harmony. From an environmental standpoint, sustainability involves the stewardship of natural resources and ecosystems, aiming to minimize environmental degradation and preserve biodiversity for future generations. This includes addressing issues such as climate change, pollution, and resource depletion. Societal considerations emphasize the need for social equity and well-being. This involves fostering inclusive communities, ensuring access to basic needs like education, healthcare, and fair labor practices. Social sustainability seeks to build resilient societies where individuals and communities can thrive in a just and equitable manner.

Economic sustainability focuses on creating economic systems that are not only profitable but also resilient and fair. This involves promoting practices that support long-term economic growth without compromising environmental and social health. It includes aspects like responsible production and consumption, equitable distribution of wealth, and sustainable business practices.

The Potential of Artificial Intelligence

Artificial Intelligence (AI) represents a profound paradigm shift in addressing complex societal problems, as highlighted by Dhar (2023). The transformative nature of AI stems from its capacity to process and analyze vast amounts of data with unprecedented speed and accuracy, leading to insights that were once beyond reach. This capability has far-reaching implications across various domains, fundamentally altering traditional approaches to problem-solving and decision-making. In the healthcare sector, AI technologies are

revolutionizing diagnostics and treatment. Advanced algorithms and models, such as those used in machine learning and natural language processing, can scrutinize medical images with a level of precision that often surpasses human capabilities. For instance, AI systems can identify early-stage cancers and other diseases with remarkable accuracy, potentially improving patient outcomes and saving lives. Davenport and Kalakota (2019) underscore that these AI-driven tools are not only enhancing diagnostic accuracy but also streamlining workflows and personalizing treatment plans, thereby transforming the landscape of modern medicine.

Similarly, the agricultural industry benefits significantly from AI applications. By leveraging machine learning and data analytics, AI can optimize various aspects of farming operations. For example, AI systems can analyze soil conditions, weather patterns, and crop health to provide actionable insights for irrigation and fertilization practices. This leads to more efficient use of resources, reduced waste, and increased crop yields. According to Tanha, Shah, Patel, Yagnik, and Shah (2020), such AI-driven optimizations contribute to sustainable farming practices and help address global food security challenges. Beyond these examples, AI's potential extends into numerous other fields, including finance, transportation, and environmental management. In finance, AI algorithms are employed for fraud detection and risk assessment, improving the security and efficiency of financial transactions. In transportation, AI systems are instrumental in developing autonomous vehicles and optimizing traffic management. Furthermore, AI contributes to environmental conservation efforts by analyzing data related to climate change, pollution, and resource depletion, thereby aiding in the formulation of effective policies and strategies.

Globally, the adoption of AI is transforming economies and labor markets. According to a report by McKinsey Global Institute, Artificial Intelligence (AI) is poised to be a transformative force in the global economy, with projections indicating that it could contribute an additional $13 trillion in economic activity by 2030. This projection represents a significant uplift, translating to approximately a 16 percent increase in cumulative Gross Domestic Product (GDP) relative to current levels. In practical terms, this equates to an annual boost in GDP

growth of around 1.2 percent (Bughin, Seong, Manyika, Chui & Joshi, 2018). To put this into historical perspective, the impact of AI on the economy could rival the effects seen from other major general-purpose technologies throughout history. General-purpose technologies, such as the steam engine, electricity, and the internet, have historically led to profound and widespread changes in productivity, economic structure, and overall growth. AI's potential to drive such a large increase in economic activity underscores its significance and the scale of its potential impact. This potential economic contribution of AI is driven by several factors. Firstly, AI has the capability to enhance productivity across various sectors by automating tasks, optimizing processes, and enabling new innovations. Secondly, AI can stimulate economic growth by creating new markets and opportunities, fostering competitive advantage, and driving efficiencies. Lastly, as AI technologies evolve and become more integrated into everyday operations, their benefits are likely to expand, amplifying their economic impact. However, realizing these benefits requires deliberate strategies to integrate AI into development agendas, particularly in developing countries like Nigeria.

Artificial Intelligence as a Tool for Sustainable Development in Nigeria

Integrating Artificial Intelligence (AI) into Nigeria's development strategies offers a transformative approach to addressing various socio-economic challenges. Agriculture, which is a critical sector for the nation due to its role in employment and food security (Food and Agriculture Organization of the United Nations, n.d.), stands to benefit significantly from AI advancements. AI can revolutionize productivity through precision farming techniques. Technologies such as drones and sensors can gather comprehensive data on crop health, soil conditions, and weather patterns. This data allows for more accurate and timely decision-making, optimizing resource use and improving yields (Arabia, 2024). Additionally, AI-powered platforms can support farmers by delivering real-time advice, providing up-to-date market information, and facilitating access to financial services. This holistic approach not only enhances agricultural efficiency but also strengthens the sector's resilience and sustainability. In the education sector, AI has the potential to revolutionize the learning experience by offering personalized, adaptive learning

opportunities. AI-driven educational technologies can tailor content and instructional methods to suit each learner's unique needs, preferences, and learning pace. This customization addresses the challenge of ensuring quality and relevance in education. For instance, AI can modify lesson plans to accommodate different languages and cultural contexts, enhancing the accessibility and effectiveness of educational materials. In Nigeria, where there is significant linguistic and cultural diversity, this adaptability is crucial for providing equitable educational opportunities and improving learning outcomes across various regions (Harry, 2023). By addressing these diverse needs, AI can help bridge gaps in education and ensure that all students receive a relevant and engaging learning experience.

Healthcare can greatly benefit from AI through several key advancements. Improved diagnostics are one major area, where AI algorithms can sift through vast amounts of medical data to identify disease patterns and detect conditions at earlier stages. This capability not only enhances accuracy but also aids in personalized treatment planning by analyzing patient data to tailor interventions specifically to individual needs. AI also plays a crucial role in predicting disease outbreaks by analyzing trends and patterns in health data, which can lead to timely interventions and better preparedness. Additionally, AI supports telemedicine services by facilitating virtual consultations, which helps expand healthcare access, especially in remote or underserved areas. For example, AI-powered diagnostic tools can assist healthcare workers in under-resourced clinics, providing them with the capabilities to detect diseases more accurately and manage patient care more effectively (Andigema, Cyrielle, Danaëlle & Ekwelle, 2024). This integration of AI into healthcare systems holds the promise of more efficient and equitable health management globally.

Furthermore, AI can significantly enhance governance and public service delivery by leveraging advanced data analytics. This technology enables more informed policy formulation by providing actionable insights derived from large datasets. It can optimize budget allocation by identifying areas where resources are most needed and by predicting the potential impact of financial decisions. AI also improves the monitoring of development projects, ensuring that they stay on track and meet their intended goals. Additionally, AI plays a crucial role in

supporting anti-corruption efforts by detecting anomalies and irregularities in financial transactions and procurement processes. Through sophisticated algorithms, AI can flag suspicious activities and patterns that may indicate corruption, thereby promoting transparency and accountability in public sector operations (Kulal, Rahman, Suvarna, Nanjundaswamy & Dinesh, 2024).

Challenges and Considerations

While the potential benefits of AI for sustainable development in Nigeria are considerable, overcoming several key challenges is crucial for effective implementation. A primary challenge is the pervasive digital divide and inadequate technological infrastructure, as highlighted by Okoye, Umeifekwem, and Eme (2023). In many parts of Nigeria, especially in rural areas, access to essential technological resources such as reliable electricity, stable internet connectivity, and modern digital devices is severely limited. This disparity creates significant barriers to deploying and utilizing AI technologies effectively. Without addressing these infrastructure deficits, the widespread adoption of AI could remain constrained, hindering its potential to drive sustainable development and economic growth across the country.

Another significant challenge is the shortage of skilled human resources. Developing, deploying, and maintaining AI systems necessitate expertise in data science, machine learning, and related fields. Nigeria faces a critical shortage of such skills, primarily due to gaps in the education system, which has not sufficiently equipped individuals with advanced technical knowledge and practical experience in these areas. Additionally, the country suffers from brain drain, where highly skilled professionals emigrate in search of better opportunities abroad, further exacerbating the skills gap. To address this issue, substantial investments in capacity building and comprehensive education reforms are essential. These reforms should focus on enhancing curricula, fostering partnerships between educational institutions and industry, and creating opportunities for continuous professional development to build a workforce capable of effectively supporting and advancing AI initiatives (Chia, 2024).

Ethical considerations are paramount when deploying AI technologies. Key concerns

include data privacy, where safeguarding personal information from unauthorized access is crucial; data security, to protect against breaches and misuse; and algorithmic bias, which can perpetuate or exacerbate existing inequalities if not carefully managed. Addressing these issues ensures that AI applications do not reinforce biases or infringe upon individual rights (Abhulimen & Ejike, 2024). To govern AI responsibly, it is essential to establish comprehensive regulatory frameworks and ethical guidelines. These frameworks should outline best practices for data handling, algorithm transparency, and accountability, fostering trust and fairness in AI systems.

Moreover, there is a risk that AI could lead to job displacement, especially in sectors where automation increasingly replaces manual labor (Maria Krüger, 2024). As AI technologies advance, jobs in areas like manufacturing, customer service, and data entry may be particularly vulnerable. To mitigate these effects, it is crucial to develop comprehensive strategies for managing the transition. This includes implementing retraining and upskilling programs to help workers adapt to new roles and industries, as well as enacting policies that encourage inclusive economic growth. Such measures can help ensure that the benefits of AI advancements are widely shared, accepted and that those affected by job displacement have opportunities to thrive in a changing job market.

Strategic Approaches to Harnessing Artificial Intelligence

To realize the potential of AI for sustainable development, Nigeria needs a strategic approach that encompasses policy, infrastructure, education, and international collaboration.

1. **Policy and Regulatory Frameworks**: The government should develop national AI strategies that align with development goals. Policies should promote innovation while ensuring ethical standards and protecting citizens' rights. This includes data protection laws, guidelines on AI ethics, and incentives for AI research and development.
2. **Infrastructure Development**: Investing in digital infrastructure is critical. Expanding broadband internet access, improving electricity supply, and developing data centers are foundational steps. Public-private partnerships can

mobilize resources and expertise for infrastructure projects.

3. **Education and Capacity Building**: Reforming the education system to include STEM (Science, Technology, Engineering, and Mathematics) education, coding, and AI literacy from early stages is essential. Universities and technical institutes should offer programs in data science and AI. Additionally, vocational training and continuous professional development programs can upskill the existing workforce.
4. **Innovation Ecosystems**: Supporting startups and research institutions through funding, incubators, and innovation hubs can stimulate AI development. Collaboration between academia, industry, and government can foster an environment conducive to innovation.
5. **International Collaboration**: Partnering with international organizations, technology companies, and other countries can provide access to expertise, technology, and funding. Nigeria can participate in global AI initiatives and contribute to shaping international norms and standards.
6. **Inclusive and Ethical AI**: Ensuring that AI solutions are inclusive and address the needs of marginalized communities is vital. Engaging stakeholders, including civil society and local communities, in the development and implementation of AI projects can promote inclusivity. Establishing ethical guidelines and oversight mechanisms can mitigate risks.

Theoretical Framework

The study adopts the Technology Acceptance Model (TAM) to examine how Artificial Intelligence (AI) technologies are embraced to meet Sustainable Development Goals (SDGs) in Nigeria. Technology Acceptance Model, developed by Fred Davis in 1989, builds upon the Theory of Reasoned Action (TRA) and aims to elucidate the factors that affect user acceptance and utilization of new technologies. Davis (1989, cited in Aljarrah, Elrehail, & Aababneh, 2016) defines TAM as a framework for understanding how to promote the acceptance and use of technology by focusing on two primary factors: perceived usefulness (PU) and perceived ease-of-use (PEOU). Perceived usefulness refers to the degree to which a person believes that using a system will enhance their job performance, while perceived ease-of-use pertains to the extent

to which using the system is perceived as free from effort. The model also considers external variables such as social influence, which can affect users' attitudes and intentions toward technology use. TAM's primary aim is to uncover the processes behind technology acceptance to predict user behavior and support effective implementation. Its practical goal is to guide practitioners on strategies for successful system deployment (Marikyan & Papagiannidis, 2023).

The Technology Acceptance Model (TAM) is a valuable framework for studying AI adoption in Nigeria, especially in the context of achieving Sustainable Development Goals (SDGs). For AI to be accepted its perceived usefulness is crucial; stakeholders must believe it can address key development challenges. AI's potential in sectors like agriculture, healthcare, and education is significant, given the importance of these areas in Nigeria. However, the perceived ease of use is also critical, and Nigeria faces challenges such as unreliable infrastructure and varying levels of digital literacy. User-friendly AI solutions tailored to local needs are essential for overcoming these barriers. Behavioral intention to use AI is growing, driven by government initiatives and corporate interest, particularly in fintech and telecom. Yet, adoption among small and medium-sized enterprises (SMEs) and local communities depends on access to affordable AI solutions, training, and support. While AI is making strides in agriculture and healthcare, widespread use is limited by factors like cost and infrastructure. External variables such as digital infrastructure, government policies, and education significantly impact AI adoption. Urban areas like Lagos are emerging as tech hubs, but rural regions lag behind. Government support and educational efforts are needed to foster AI development and integration. Social influence and facilitating conditions, including partnerships between the government and private sector, can further drive AI adoption and support the achievement of SDGs.

Research Methodology

The paper adopts qualitative research design to gain an insight into the nature, style and character of Artificial Intelligence and sustainable development in Nigeria and the categorical imperatives. The researchers used descriptive analysis to examine the issues of Artificial Intelligence (AI) in advancing Sustainable Development in

Nigeria. The paper which is theoretical in nature draws its argument basically from secondary data which include journal publications, textbooks and internet sources. To improve on the reliability and validity of the paper, multiple secondary sources were used to minimize risk of error.

To realize these objectives and for ease of analysis, the paper is pigeon holed into the following five compartments: The first compartment chronicled introduction. The second section examined conceptual framework, while the third discussed the interface between AI and sustainable development. The fourth x-rayed challenges, and strategic approaches to harnessing AI towards the attainment of sustainable development in Nigeria and Africa at large. The fifth states the findings, conclusion and then recommendation.

Summary of Findings

The researchers observed through their research that:

1. Artificial Intelligence has no significant effect on the sustainable development in Nigeria in the sense that the pervasive digital divide and inadequate technological infrastructure in many parts of Nigeria, especially in rural areas, prevent access to essential technological resources such as reliable electricity, stable internet connectivity, and modern digital devices which creates significant barriers to deploying and utilizing AI technologies effectively in Nigeria and Africa at large.
2. Challenges of Artificial Intelligence also has significant effect on the sustainable development in Nigeria such as shortage of skilled human resources, because, developing, deploying, and maintaining AI systems necessitate expertise in data science, machine learning, and related fields and critical shortage of such skills, primarily due to gaps in the education system, which has not sufficiently equipped individuals with advanced technical knowledge and practical experience in these areas as well as brain drain syndrome contributes immensely to the inability of the Artificial Intelligence to improve the sustainable development in Nigeria and Africa in general as it stands now.

Conclusion

Artificial Intelligence (AI) has the potential to serve as a transformative tool for sustainable development in Nigeria, aligning with the country's aspirations to achieve the

Sustainable Development Goals (SDGs). By leveraging AI technologies, Nigeria can address pressing socio-economic challenges across key sectors such as agriculture, education, healthcare, and governance. The integration of AI into these domains promises enhanced efficiency, productivity, and inclusivity, which are essential for sustainable progress. In agriculture, AI-driven innovations can revolutionize farming practices, optimize resource use, and improve yields, thus contributing to food security and rural development. In education, AI offers personalized learning experiences, catering to diverse linguistic and cultural needs, and enhancing educational outcomes. The healthcare sector stands to benefit from AI's capabilities in diagnostics, treatment personalization, and disease prediction, which can lead to better health outcomes and expanded access to care. Additionally, AI can bolster governance by improving policy formulation, resource allocation, and anti-corruption efforts through advanced data analytics.

However, realizing the full potential of AI in Nigeria requires addressing several challenges. The digital divide and inadequate technological infrastructure pose significant barriers to AI adoption, particularly in rural areas. There is also a critical shortage of skilled human resources needed to develop and maintain AI systems, exacerbated by gaps in the education system and brain drain. Ethical considerations, such as data privacy, security, and algorithmic bias, must be managed to ensure responsible AI deployment. Moreover, the potential for job displacement due to automation necessitates proactive strategies for workforce transition, including retraining and upskilling programs. To harness AI effectively for sustainable development, Nigeria must undertake concerted efforts to build technological infrastructure, invest in education and capacity building, and establish robust regulatory frameworks. By addressing these challenges and leveraging AI's transformative capabilities, Nigeria can advance towards its development goals, foster economic growth, and improve the quality of life for its citizens. Embracing AI as a strategic tool will not only enhance the country's developmental trajectory but also position it as a leader in leveraging technology for sustainable progress.

Recommendation

1. It is imperative that government, institutions and people should invest in

digital infrastructure and expand broadband internet access, improve electricity supply, develop data centers, provide access to essential technological resources in order to bridge the barriers of deploying and utilizing AI technologies effectively and efficiently in Nigeria and Africa as a whole.

2. Reforming the education system to include STEM (Science, Technology, Engineering, and Mathematics) education, coding, and AI literacy from early stages is essential. Universities and technical institutes should offer programs in data science and AI. Additionally, vocational training and continuous professional development programs can upskill the existing workforce.

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