

RELEVANCE OF ARTIFICIAL INTELLIGENCE TO THE NATIONAL ECONOMY FOR SUSTAINABLE DEVELOPMENT IN NIGERIA.

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Abstract

This paper focused on pinpointing how Artificial Intelligence could promote sustainable national development in Nigeria. It stressed that embracing Artificial Intelligence has the capacity to positively impact and advance the Nigerian economy in the areas of agriculture, healthcare, education, energy, infrastructure amongst others. It highlighted how in spite of their incredible promise, AI systems have certain disadvantages which may bring risks of harm or misuse. It was suggested that to overcome the problems militating against the effectiveness of Artificial Intelligence in Nigeria, there should be sustained investment in nurturing indigenous AI talent and at the tertiary level of education, investment in research and engineering.

Keywords: Artificial Intelligence, Sustainable Development, Nigeria.

Introduction

A “4th Industrial Revolution” has been ushered in with the development of Artificial Intelligence (AI) systems and technologies. Having the potential to improve the welfare and well-being of people, Artificial Intelligence (AI) is a general-purpose technology that could contribute to positive sustainable global economic activity, increase innovation and productivity, and help respond to key global challenges. It is deployed in many sectors ranging from production, education, finance and transport to healthcare and security (OECD, 2024).

Nigeria faces various economic challenges with growing extreme poverty. According to Ogunleye (2021), in the struggle to eradicate poverty and achieve the UN Sustainable Development Goals, Artificial Intelligence (AI) has been identified as a potentially less costly and far-reaching tool. AI systems can make predictions, recommendations, or decisions influencing real or virtual environments. AI systems are designed to operate with varying levels of autonomy.

Artificial intelligence is all around us already, from self-driving cars and drones to virtual assistants and software that translate or invest. Impressive progress has been made in AI in recent years, driven by exponential increases in computing power and by the availability of vast amounts of data, from software used to discover new drugs to algorithms used to predict our cultural interests (Tucci, 2024).

While lauded for the numerous new opportunities it brings, several threats to developing countries have also been identified (Schwab, 2016). AI raises challenges for our societies and economies, notably regarding economic shifts and inequalities, competition,

transitions in the labour market, and implications for democracy and human rights (OECD, 2024)..

What is Artificial Intelligence?

Artificial intelligence is the simulation of human intelligence processes by machines, especially computer systems. Examples of AI applications include expert systems, natural language processing (NLP), speech recognition and machine vision (Craig et al., 2024). AI or AI systems are digital and/or data-driven technologies, such as those used for automated decision making, diagnosis, predicting and forecasting, and pattern recognition (OECD, 2019).

Artificial intelligence (AI) uses computers to mimic human-like intelligence for automated decision-making. These decisions might be directly implemented (e.g. in robotics) or suggested to a human decision-maker (e.g. product recommendations in online shopping). AI often incorporates machine learning (ML) – when using data-driven predictions to make better decisions – but does not have to - for short, AI can simply be described as “smart automation” (Feeny and Elson, 2019)

What is Sustainable Development?

Sustainable Development is development which meets the needs of the present without compromising the ability of future generations to meet their own needs. It is meant to ensure a better quality of life for everyone, now and for generations to come (Bryant, 2003).

Almost all developed nations have highly developed and very effective programmes of sustainable development of important infrastructure. Their citizens usually enjoy a moderately good to high standard of living. Even the poor amongst them consider themselves better off than most people in developing nations.

In Nigeria, sustainable development has to do with the development of essential societal structures that are properly maintained. Nigeria has the potential to be a developed nation, a world trailblazer and a world power. We need to however, put in place essential infrastructure common to advanced nations today, along with ensuring proper care for high levels of efficiency and effectiveness. There must be provisions in place to maintain them if they are to serve societal needs. Without an appropriate system of maintenance and stewardship of our resources and talents, a programme of sustainable development will fail (Bryant, 2003).

In September 2015, the General Assembly of the United Nations adopted the 2030 Agenda for Sustainable Development. This includes 17 Sustainable Development Goals (SDGs). The goals build on the vital principle of “leaving no one behind”, and emphasizes a holistic approach to achieving sustainable development for all. (United Nations, 2024).

The 17 Sustainable Development Goals are a call for Action by all countries – poor, rich and middle-income – to promote prosperity, while protecting the planet. They recognize that ending poverty must go hand-in-hand with strategies that build economic growth and address a range

of social needs including education, health, social protection and job opportunities, while tackling climate change and environmental protection (United Nations, 2024).

The Potential of Artificial Intelligence for Sustainable Development in Nigeria

In the Nigerian economy, AI innovations could be beneficial for the attainment of its development goals in some sectors, while the potential risks of AI can be avoided. In Oxford Insight's 2020 AI Readiness Index, which assesses how well governments are positioned to take advantage of AI transformation, Nigeria ranked 138 of 172 countries. AI technologies are gaining prominence across the developing world and, if implemented carefully, can expedite Nigeria's journey to self-reliance (Ogunleye, 2021).

AI in Nigeria has the potential to provide a new frontier of economic opportunity as well as social development and inclusive and sustainable growth. AI technology can potentially have beneficial impacts on the economy by increasing labor productivity, capital efficiency, and driving growth in sectors such as agriculture, healthcare, education, infrastructure, and energy (Craig, et al. 2024).

Key sectors in which AI can provide sustainable and scalable innovations in Nigeria include:

Agriculture: AI can provide smallholder farmers with the tools to engage in high-yield, large-scale farming. It can increase the labor and capital efficiency of smallholder farmers in Nigeria, allowing sector growth to enable self-sustainability and food security. AI innovation can address supply chain issues by measuring indicators of food security (e.g., stock availability, production and consumption levels and commodities costs) on a regional or national level, encouraging "precision agriculture" and automated monitoring solutions for issues such as crop infestation, soil health or animal tracking among smallholder farmers who make up 80% of farmers in Nigeria. (Ogunleye, 2021)

AI-supported agricultural practices can increase productivity and yield across farmlands in Nigeria. These solutions include: Weather forecasting services which use high-resolution weather and remote-sensed data to provide farmers with real-time advisory services on optimal sowing and harvest periods as well as the appropriate variety of crops to plant, which could make rainfed agriculture climate change more resilient. Autonomous products including GPS-enabled tractors to plough land in a sustainable and economical manner, smart drones for aerial land surveying and dispersal of pesticides, soil sensors to provide soil health information, and livestock GPS trackers to monitor grazing patterns and the health of livestock animals (Delerce, 2016)

Healthcare: AI can be leveraged to deliver medical care in low resource environments by providing digital healthcare services for diagnosis, public health monitoring and disease management (Tucci, 2024).

Telehealth tools for diagnosis, which are mediated either by health workers or self-administered, can prevent the escalation of disease or the deterioration of health. The

digitization of health records and establishment of a national public health database can also help monitor incidences of diseases and provide early warning notifications of potential pandemics or disease outbreaks.

Globally, the healthcare sector is seeing advanced AI innovation in areas such as treatment, diagnosis, and research that is growing the revenue potential of the market and helping improve the quality of life and disease outcomes for millions of people.

AI solutions can provide clinical diagnosis using image capturing and deep learning models in the first instance before patients are able to visit a physician. (Vinuessaa. 2020)

Energy: by providing technologies for the generation, distribution, storage, and disposal of energy and power. Potential innovation in smart energy infrastructure and power grids can allow for the optimal allocation of energy resources, increasing efficient power supply and usage and reducing disruptions and unpredictability. The adoption of new and renewable technologies for energy generation and storage will also enable the country to move away from fossil fuels energy generation, which still accounts for 80% of energy generation in Nigeria. The deployment of smart utility meters can help resolve issues of leakages, inefficient or wrong billing, ineffective allocation of resources, and high costs of administration (Ogunleye, 2021)..

Education: AI has a number of potential applications in education technology. It can automate aspects of grading processes, giving educators more time for other tasks. AI tools can also assess students' performance and adapt to their individual needs, facilitating more personalized learning experiences that enable students to work at their own pace. AI tutors could also provide additional support to students, ensuring they stay on track. The technology could also change where and how students learn, perhaps altering the traditional role of educators (Craig, et al., 2024). Fully digitized learning at the primary level has not proven to be more effective long term in delivering learning outcomes but providing digitally accessible tools and resources, curriculum, and learning opportunities can ensure that kids have access to quality education that will provide them with the skills and knowledge to ultimately make a decent living (Ogunleye, 2021).

Infrastructure: AI can also be used to address some of the infrastructure issues in the country. With the current administration's focus on expanding the network of roads and railway in the country, digital and satellite data can be used to develop a picture of migration patterns and ensure smarter infrastructure investment that supports urbanization growth such as building affordable housing in areas of current and future high demand, providing adequate sanitation facilities, electrical grids, clean water supply, and public transportation services. AI technologies such as 3D modeling and modular construction can help reduce the cost of housing construction and provide cheaper housing for urban dwellers (Tucci, 2024).

Transport: AI technology can assist in the resolution of the congestion and safety issues associated with mobility and transport in Nigeria. Solutions include the collection of traffic

pattern data to provide real-time travel advisory services and provide efficient traffic flow management. Sustainable public transportation such as smart buses can also be established with digital scheduling systems and predictive traffic management, which can help mitigate congestion and overcrowding on roads.

The use of drones and other remote sensor technologies can also provide infrastructure monitoring services to ensure that energy infrastructure such as transmission wires are monitored for fault, decay or wear and tear, and to determine repair or replacement needs (Makala and Bakovic, 2020).

Traffic Control: AI-based intelligent traffic control systems with signalized pedestrian crossings, lane monitoring, and accident heat maps can help reduce the occurrence and severity of accidents. (Flir, 2020).

The Risks and Disadvantages of Artificial Intelligence.

USAID's 2018 report: 'Reflecting the Past, Shaping the Future: Making AI Work for International Development', outlines the promise of Machine Learning (ML) and Artificial Intelligence (AI) and gives reasons for caution as we engage with and integrate AI-based systems into development programming. (Jolley, et al. 2018)

Since machines always learn using data from the past, when existing patterns of oppression, exclusion or bias are embedded in data used to train ML models, these inequities will be reflected in what the models learn.

In addition, seemingly straightforward design choices — for example, how to evaluate a model's accuracy — can reflect the biases of a model's designer.

AI systems are often opaque, meaning that their ultimate decision processes are difficult for people to explain or understand, which can further undermine accountability and erode trust.

Craig, et al. (2024) and Vinuessa (2020) highlighted several disadvantages of using AI which include:

Legal issues. AI raises complex questions around privacy and legal liability, particularly amid an evolving AI regulation landscape that differs across regions. Using AI to analyze and make decisions based on personal data has serious privacy implications,

Environmental impact. The data centers and network infrastructures that underpin the operations of AI models consume large amounts of energy and water. Consequently, training and running AI models has a significant impact on the climate.

Security vulnerabilities. AI systems are susceptible to a wide range of cyberthreats,

Job displacement. AI can lead to job loss if organizations replace human workers with machines -- a growing area of concern as the capabilities of AI models become more sophisticated and companies increasingly look to automate workflows using AI.

Difficulty with generalization. AI models often excel at the specific tasks for which they were trained but struggle when asked to address novel scenarios. This lack of flexibility can limit AI's usefulness, as new tasks might require the development of an entirely new model.

Algorithmic bias. AI and machine learning algorithms reflect the biases present in their training data -- and when AI systems are deployed at scale, the biases scale, too.

Talent gap. Compounding the problem of technical complexity, there is a significant shortage of professionals trained in AI and machine learning compared with the growing need for such skills.

Technical complexity. Developing, operating and troubleshooting AI systems, especially in real-world production environments, requires a great deal of technical know-how.

High costs. Developing AI can be very expensive. Building an AI model requires a substantial upfront investment in infrastructure, computational resources and software to train the model and store its training data. After initial training, there are further ongoing costs associated with model inference and retraining.

Challenges of AI utilization in Nigeria.

First, there are limitations around data availability. High-volume and high-quality digital data can be hard to come by in developing countries, Nigeria inclusive, meaning that model developers may need to make do with data that are outdated, biased or drawn from a different context. Additionally, with a rapidly-evolving field like AI, it is virtually impossible for regulatory protections to keep up with emergent risks (Ogunleye, 2021).

Difficulties in developing and deploying local AI solutions are driven by a poor public education system with little emphasis on technical and entrepreneurial skills; the absence of an adequate data ecosystem; and low broadband penetration in the country, despite the high rate of mobile phone penetration.

Data collection and digital storage in Nigeria is poor and cloud computing remains hampered by poor internet service provision, unreliable power supply.

Suggestions

To resolve these issues the Nigerian Government should:

1. Invest heavily in the education system by embedding ICT infrastructure into primary and secondary education to encourage digital literacy and an interest in STEM disciplines from an early age.
2. There should also be investment at the tertiary level in research and engineering laboratories that can create solutions to pressing social and economic issues.
3. Expand the broadband network through partnerships with local and international companies able to provide low-cost access across the country. •
4. Improve the employability of the young labor force by providing work-based training opportunities.

5. There is the need for a sustained investment in nurturing indigenous AI talent. We must involve technology users, owners and regulators in the design process, consulting them early and often.
6. We also need to promote algorithmic literacy in Nigeria, and work to cultivate an indigenous AI workforce that can build and deploy responsible solutions to local problems.

Conclusion

AI offers unique promise. Some AI advocates even claim that the impact of AI will be as profound as electricity or fire that it will revolutionize nearly every field of human activity. With AI potentially speeding up global progress towards the achievement of the SDGs, countries that are unable or unwilling to take advantage of the opportunities may find themselves falling even further behind, thereby exacerbating global inequality. Various surveys of global readiness for AI innovations have found African countries, particularly those in sub-Saharan Africa, to be mostly not ready to take advantage of the technology revolution for economic growth and development. AI has the potential to build prosperity and support a country's journey to self-reliance, or to entrench exclusion and dependency; Nigeria must take up the challenge to harness the great potential artificial intelligence has to offer to advance its national economy for sustainable development.

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