The Sustainability Question: What Can Artificial Intelligence Offer for Africa?

Olufemi Kazeem Oluoje

Independent Researcher and Technology Expert

Corresponding author: kobomarun@gmail.com

1. An overview

Africa has many difficulties, such as poverty, injustice, and environmental degradation, despite being endowed with an abundance of natural resources and a rich cultural variety. Africa's future depends on pursuing sustainability, which is a balanced approach to social development, economic progress, and environmental conservation. One intriguing way to quicken this drive is through the fast-developing field of artificial intelligence (AI), which has the potential to completely transform a number of different sectors.

Many factors have impeded our progress towards sustainability in Nigeria and Africa. Poverty, increasing urbanisation, inadequate infrastructure, and environmental deterioration are a few of them. The large population and underdeveloped economy of the continent have put tremendous strain on ecosystems and natural resources. Furthermore, the problems that already exist have been made worse by a lack of suitable infrastructure, such as clean water, sanitary facilities, and renewable electricity.

Africa can address its urgent problems and create a more sustainable and just future by utilising AI. Artificial intelligence can assist in reducing climate change, enhancing access to necessary services, streamlining resource management, and fostering equitable economic growth. However, in order to fully utilise AI, stakeholders must collaborate, develop capacity, and carefully evaluate the ethical ramifications of their actions. Investigating creative ideas is essential to move forward and create a more sustainable future. Artificial Intelligence (AI) applications are one potential direction. AI has the power to completely transform several sustainability-related fields, including resource management and climate change mitigation.

2. Can AI fast-forward Africa's push for Sustainability?

Artificial intelligence (AI) can transform agricultural methods, accelerate the switch to renewable energy sources, and completely shift how we respond to climate change. Its influence is not without difficulties, though. This opinion article examines the possible advantages and disadvantages of AI in several important domains and suggests ways to maximise its beneficial effects while reducing its hazards.

3. AI, an Effective Instrument for Forecasting Climate Change

The potential of AI to mitigate climate change impact must be addressed. The tool can analyse dataset through sophisticate

algorithms to forecast future climate trends, empowering decision-makers to allocate resources, plan for disasters, and build infrastructure. AI can also optimize energy systems, lowering pollutants and energy use. For example, supply and demand can be balanced, renewable energy sources can be integrated more successfully, and inefficiencies can be found and fixed with AI-powered smart grids. The creation and use of AI-driven climate solutions demand a large amount of processing power, which, if improperly managed, may increase greenhouse gas emissions. Energy-efficient AI hardware and algorithms must be given top priority by academics and developers to lessen this. Aligning with the potential of AI in climate modeling, researchers at the University of California, Berkeley, are using AI to develop more accurate climate models. These models were optimised in the prediction of future climate patterns and inform decision-making on climate change mitigation and adaptation (Leven, 2022).

It is therefore imperative to adopt AI towards addressing the disproportionate effects of climate change on vulnerable groups; and to guarantee fair access to AI-powered climate solutions.

4. Agriculture: The Revolution of Precision Farming

AI can revolutionise Africa's agricultural sector by making precision agricultural techniques possible and readily available. Through the use of data from sensors, drones, and satellites, AI supported farming will result in increased agricultural yields, decrease waste, and optimise resource use among farmers in Africa. The capacity of AI-powered solutions can assist in the early detection of illnesses and pests, allowing for more focused treatments and a reduction in the need for pesticides. AI can also help create crops that can withstand climate change and optimise irrigation systems to use less water (Figure 1).

Figure 1: AI Monitoring Farm Produce: A Technological Revolution
Source: AI-generated Image

Efforts are being made in some regions of Africa. In Kenya, a startup called Hello Tractor, utilises AI to analyse weather patterns, soil conditions, and historical data to predict crop yields. This enables farmers to make informed decisions about planting, harvesting, and resource allocation towards achieving improved crop yield. Beyond that, AI supported systems have been able to assist in farming, pest, weed and disease detection. In the United States, Blue River Technology has developed a robot that can identify and remove weeds from fields using computer vision and machine learning. This reduces the need for herbicides, improving crop health and environmental sustainability

However, small-scale farmers may find it difficult to invest in the infrastructure and technology needed for the widespread use of AI in agriculture. Governments and international organisations can address this by offering financial assistance and educational initiatives to farmers so they can use AI technologies.

Furthermore, it is crucial to make sure that agricultural techniques powered by AI don't worsen already-existing disparities or force rural people to relocate.

5. Green Energy: Accelerating the Transition through Technology

AI can hasten the switch to renewable energy sources by optimising the generation, distribution, and storage of energy. For instance, by anticipating weather patterns and modifying operations appropriately, artificial intelligence (AI) can increase the efficiency of solar and wind power generation. AI can also optimise energy storage devices, like batteries, to provide a consistent and reasonably priced energy supply. In energy production and management, smart grid optimization remains a key challenge. To manage this in Australia, Enerven uses AI to optimise energy distribution in the grid, reducing energy losses and improving efficiency. This helps to ensure a reliable and affordable electricity supply. In another innovative effort towards renewable energy integration in India, Power employs AI to predict solar and wind energy generation, enabling better integration of these renewable sources into the grid (Figure 2). This helps to reduce reliance on fossil fuels and mitigate climate change (Nhede, 2021).

Figure 2: Harnessing energy using the power of wind
Source:https://scienceexchange.caltech.edu/topics/sustainability/wind-energy-advantages-disadvantages

Although, more research and development work are needed to create and implement AI-powered green energy solutions. To overcome technological obstacles and save costs, governments and industry captains in developing nations should invest in AI research and innovation. The social and environmental effects of massive renewable energy projects, such as altered land usage and biodiversity loss, must also be taken into consideration.

6. AI in Built-Environment: Real Estate, Development Forecast and Spatial Growth

The built environment is only one of the many industries that artificial intelligence (AI) is quickly changing. AI has the potential to completely transform real estate, development forecasts, and spatial expansion in Africa. Stakeholders can enhance decision-making, boost productivity, and promote sustainable urban development by utilising AI's capabilities. In property and real estate financing and development, AI has been adopted in property valuation, and analytics. The potential of AI in property valuation is in its capability to precisely estimate a property's worth based on a wide range of criteria, such as size, amenities, location, and market trends.

Appraisers, investors, and property owners may all benefit from this when making judgements. Further, the intelligent tool can also be adopted in the predictive analytics of the real estate market by providing a future forecast of rental rates, occupancy rates, and property values by analysing past data. Developers may use this information to optimise their portfolios and find successful investment options.

In achieving developmental forecast and spatial growth management, urban planning and built-environment professionals must begin to look beyond the traditional approach in developmental planning (see: Yigitcanlar et al., 2020; Sanchez et al., 2023; Ge et al., 2024**).** AI is capable of analysing massive information to spot trends and patterns in population density, infrastructure development, and urban expansion. Decisions on urban development may be made with this knowledge in mind, and cities can create more resilient and sustainable communities. Beyond this, the tool remains critical to infrastructure planning**.**

Efficient and sustainable transportation networks, electricity grids, and other vital infrastructure planners will all benefit from AI's assistance in its planning and optimisation. Artificial Intelligence (AI) will assist in pinpointing regions in need of more infrastructure and enhancing current systems by examining traffic patterns, energy usage, and population expansion. Likewise, improved smart city planning will be achieved through the integration of AI technology. Artificial Intelligence (AI) is capable of facilitating the creation of smart cities, which employ technology to enhance the standard of living for both companies and citizens. AI-powered solutions can improve public safety, control waste, and streamline traffic flow and management (Audu et al., 2021; Reza & Hassan, 2023; Deep & Verma, 2023; Alahi et al., 2023). Through green building techniques, maximising land usage, and minimising environmental effect, artificial intelligence supports sustainable urban development. Beyond this, the tool can assist in achieving more resilient and sustainable communities by analysing data on pollution, resource usage, and climate change.

7. The Concluding Thought: Wake up Africa, Technology can help achieve sustainability

It is time for Africa to awaken. The world is changing quickly, and we have to change with it, or else we risk falling behind. Once considered a luxury, technology in the 21st century has been classed an essential component of living experience. It provides us with an effective instrument to deal with our urgent problems and create a more sustainable future.

Technology can assist us in achieving our objectives, from maximising agriculture to enhancing healthcare, from using renewable energy to reducing climate change. It can uplift our people, generate employment, and enhance our standard of living. However, we have to approach it with an open mind, long-term planning, and investment in innovation and creative technologies.

References

Alahi, M. E. E., Sukkuea, A., Tina, F. W., Nag, A., Kurdthongmee, W., Suwannarat, K., & Mukhopadhyay, S. C. (2023). Integration of IoT-enabled technologies and artificial intelligence (AI) for smart city scenario: recent advancements and future trends. *Sensors*, *23*(11), 5206.

Audu, A.A., Iyiola, O.F., Popoola, A.A., Adeleye, B.M., Medayese, S., Mosima, C. and Blamah, N. (2021). The application of geographic information system as an intelligent system towards emergency responses in road traffic accident in Ibadan', Journal of Transport and Supply Chain Management, 15(0), a546. https://doi.org/10.4102/jtscm.v15i0.546

Deep, G., & Verma, J. (2023). Embracing the future: AI and ML transforming urban environments in smart cities. *J. Artif. Intell*, *5*, 57-73.

Ge, M., Feng, Z. and Meng, Q., 2024. Urban Planning and Green Building Technologies Based on Artificial Intelligence: Principles, Applications, and Global Case Study Analysis. *Preprints* 2024, 2024081108. https://doi.org/10.20944/preprints202408.1108.v1

Reza, M. and Hassan, M., 2023. AI-Driven solutions for enhanced waste management and recycling in urban areas. *International Journal of Sustainable Infrastructure for Cities and Societies*, *8*(2), pp.1-13.

Leven, R. (June 2, 2022). New UC Berkeley initiative uses AI research to solve climate problems. Available at: https://cdss.berkeley.edu/news/new-uc-berkeley-initiative-uses-ai-research-solve-climate-problems

Nhede, N. (October 19, 2021). Tata Power expands rollout of AI-enabled energy forecasting. Available at: https://www.smart-energy.com/industry-sectors/energy-grid-management/tata-power-expands-rollout-of-ai-enabled-energy-forecasting/

Sanchez, T.W., Shumway, H., Gordner, T. and Lim, T., 2023. The prospects of artificial intelligence in urban planning. *International Journal of Urban Sciences*, *27*(2), pp.179-194.

Leveraging AI for Precision Agriculture. Hello Tractor | Growing Together retrieved from https://hellotractor.com/

Yigitcanlar, T., Kankanamge, N., Regona, M., Ruiz Maldonado, A., Rowan, B., Ryu, A., Desouza, K.C., Corchado, J.M., Mehmood, R. and Li, R.Y.M., 2020. Artificial intelligence technologies and related urban planning and development concepts: How are they perceived and utilized in Australia?. *Journal of Open Innovation: Technology, Market, and Complexity*, *6*(4), p.187.