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ENHANCING CLIMATE RESILIENCE THROUGH THE USE OF ARTIFICIAL INTELLIGENCE FOR SUSTAINABLE DEVELOPMENT IN NIGERIA

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ABSTRACT

The greatest technological changes in our 21st Century are predicted to be brought about by Artificial Intelligence (AI). AI has impacted various sectors, such as health care, telecommunication, business, agriculture, education, and urban development in a profound way. Through literature review and participant observation, this study identifies how climate resilience can be enhanced in Nigeria through the innovative use of Artificial Intelligence. This study enumerates the developmental, psychological, socio-economic and therapeutic benefits of the use of AI and further recommends more research in this novel field for enhancing climate resilience in Nigeria. It concludes with a clarion call to the Nigerian government to go the extra mile to help her citizens appreciate and maximize the opportunities in the use of artificial intelligence for enhancing climate resilience in Nigeria.

KEYWORDS: Artificial Intelligence, Climate Resilience, Computer Science, Sustainable Development.

INTRODUCTION

Green entrepreneurial opportunities abound in climate change adaptation, mitigation and resilience strategies for achieving sustainable development in Nigeria (Anabaraonye., Okafor & Eriobu, 2019). Climate change poses a significant challenge in achieving sustainable development as it affects the education, health, environmental and socio-economic sectors in Nigeria in a profound way (Anabaraonye., Okafor & Eriobu, 2019). Climate change has been described as an existential threat to good health and well being both for humans, animals and plants. Globally, it affects the social and environmental determinants of health: clean air, safe drinking water, sufficient food and secure shelter (Lu, 2016; PAHO, 2013). Researchers have recently identified the impacts of climate change on biodiversity in Nigeria (Anabaraonye., Amaechi, Okolo., Adeniyi.& Nwobu, 2022).The impacts of climate change which include drought, flooding, environmental degradation, land pollution, erosion, etc. also affect soil fertility in Nigeria in a profound way (Anabaraonye, Okafor,, Ewa, & Anukwonke, 2021).The renewable energy industry in

Nigeria which is one of the green entrepreneurial opportunities available for Nigerian youths will play a vital role in enhancing climate resilience for sustainable development in Nigeria (ADB, 2014). Nigeria is amply endowed with RE sources and is environment-friendly in nature, but the RE capacities are grossly under-utilized, particularly from biomass to wind energy and solar energy (Sambo, 2009). The Nigerian Government have a vital role to play in finding solutions to the environmental issues that we face today through the renewable energy industry which can be enhanced through the innovative use of artificial intelligence(Manso & Behmiri, 2013). In recent past, Nigeria has witnessed unprecedented climatic challenges such as floods, droughts, erosion, bio-diversity loss, etc. which negatively affects the environment, education, good health and well being, and socio-economic development (Akpodiogaga, & Odjugo, 2010). It is worthy to note that Nigeria has the capacity to lead the market in the renewable energy industry and products in Africa as it adopts the disruptive innovation in the use of artificial intelligence in her operations BluePrint (2015). In 2011, the International Energy Agency asserted that "the development of affordable, inexhaustible and clean solar energy technologies will have huge longer-term benefits" (IEA, 2011)." This study identifies the need to adopt the use of artificial intelligence for enhancing climate resilience in Nigeria thereby achieving the United Nations' Sustainable Development Goals (13).

METHODOLOGY

This paper aimed to examine the use of artificial intelligence for enhancing climate resilience in Nigeria through literature review and participant observation. The literature review includes journal articles, magazines, book chapters and encyclopedia available online and in libraries. The main purpose of this research work was to survey theoretical backgrounds and previous studies on the above subject matter and the current progress with the use of artificial intelligence (AI) for enhancing climate resilience in Nigeria.

UNDERSTANDING ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) is the ability of a digital computer to perform tasks commonly associated with intelligent beings (Britannica, 2024). Artificial intelligence (AI) can also be defined as the development, deployment, and maintenance of computational systems that can replicate certain types of human intelligence (Rouse, 2024). Artificial intelligence (AI) has become a global revolution in the last decade. Almost every sector in the developed countries of the world has utilized artificial intelligence to deepen their technological efficiency as well as escalate progress and development which in turn entrenches their global relevance (Nwoye, 2023)**.** The utilization of artificial intelligence (AI) to enhance climate resilience for sustainable development in Nigeria is an urgent priority. AI holds the potential to bring about transformative advancements in environmental data monitoring, resource management optimization, and the enhancement of climate resilience strategies (UNDP, 2024). Artificial intelligence can further be defined as using computers to do most of what humans would ordinarily do (Robeiro, 2021). Rebeiro (2021) also defines AI as the field of computer science that enables machines to perform tasks requiring human-like intelligence. It involves creating intelligent agents that can sense, comprehend, learn, and act in a way that extends human capabilities (Robeiro, 2021; Nils, 2010). Nils (2010) opines that Artificial intelligence is that activity devoted to making machines intelligent, and intelligence is that quality that enables an entity to function appropriately and with foresight in its environment (Nils,2010; Tehrani, 2023). There is therefore need to explore the innovative use of AI in green entrepreneurship education towards enhancing climate resilience in Nigeria (Anabaraonye, Okon, Ewa, Adeniyi. & Nwobu, 2022).

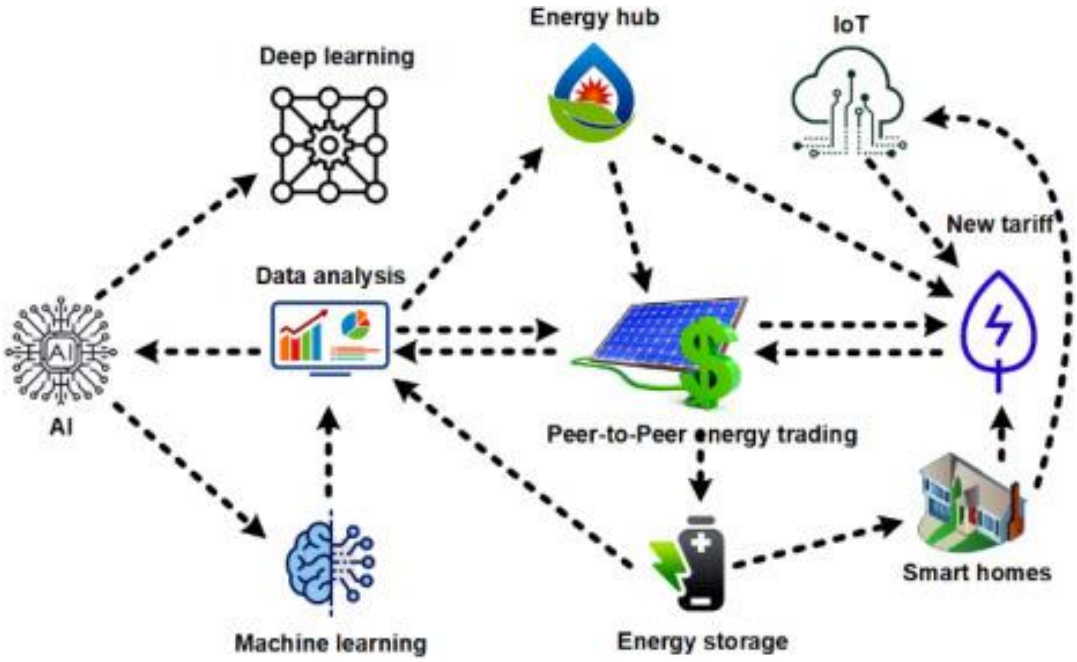


FIG. 1: Energetics Systems and Artificial Intelligence: Applications of Industry 4.0
(Source: Ahmad et al., 2022)

In the pursuit of addressing the climate crisis, data becomes an indispensable tool for tracking climate progress, anticipating environmental challenges, and directing resources effectively. When leveraged correctly, data acts as a catalyst for driving climate action (UNDP, 2024). Today's AI often uses machine learning in conjunction with other computational techniques and technologies. A hybrid approach allows for robust AI systems (Rouse, 2024). Artificial Intelligence technology is streamlining business operations and increasing efficiency across various sectors but it is also requiring employees to upgrade their skills and adapt to new roles and responsibilities within the workplace. As routine tasks become automated, the workforce is expected to shift towards more analytical, creative, and supervisory roles that AI technology cannot fulfill. The hope is that the transition will not only enhance employee productivity, it will also allow employees to focus on strategic and creative tasks that add greater value to the business (Rouse, 2024).

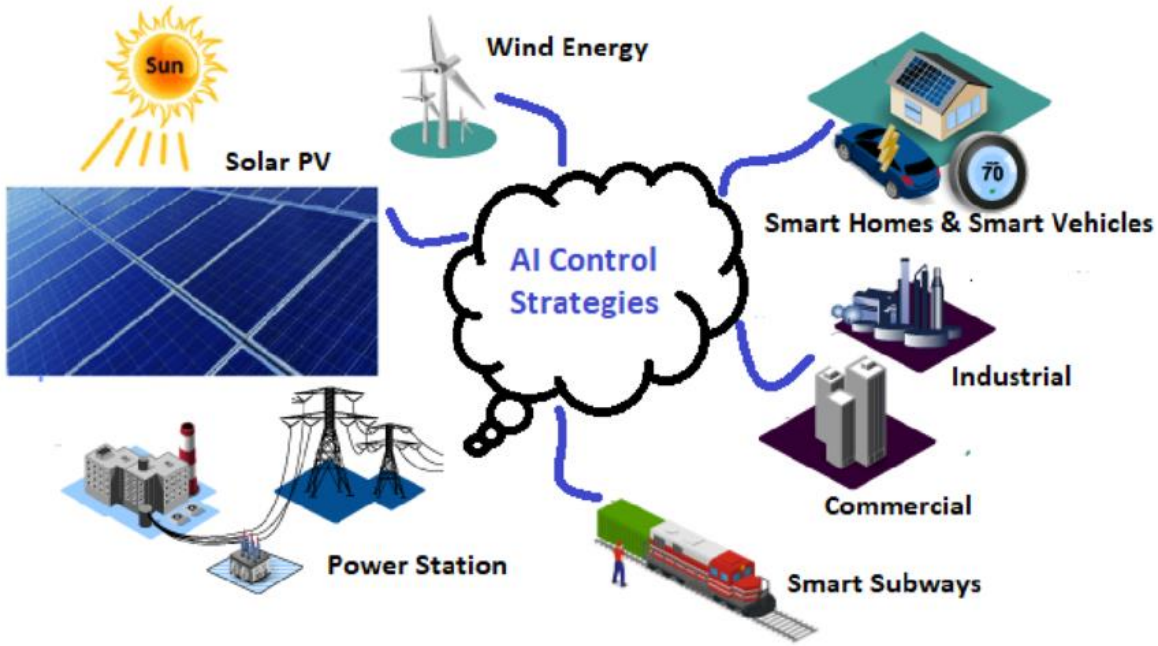


FIG. 2: Smart Grid AI Control Schemes (Source: Thanduxolo et al., 2023)

The global outcry on extinction of species, global warming and the green house effect demands that countries and nations of the world must identify alternatives to their excessive burning of fossil fuels, deforestation, plastic pollution, etc. towards enhancing climate resilience which can be achieved by the use of artificial intelligence.

ENHANCING CLIMATE RESILIENCE THROUGH ARTIFICIAL INTELLIGENCE (AI) IN NIGERIA

In the face of climate change and environmental degradation in Nigeria, It is therefore important to leverage on the ease provided by artificial intelligence to promote environmental sustainability and enhance climate resilience in Nigeria. To maximize the use of artificial intelligence (AI) for sustainable development in Nigeria, Let us consider the following strategies:

1. **Develop AI talent:** Invest in education and training programs that focus on AI, data science, and related fields to build a skilled workforce.

2. **Infrastructure development:** Establish reliable data centers, cloud services, and high-speed internet connectivity to support AI applications.

3. **Data collection and management:** Develop data collection frameworks and data management systems to ensure data quality, accessibility, and privacy.

4. **AI research and development**: Encourage research in AI applications relevant to Nigeria's sustainable development challenges.

5. **Public-private partnerships:** Foster collaborations between government, industry, and academia to leverage resources, expertise, and funding.

6. **Inclusive and accessible AI:** Ensure AI solutions are designed to be inclusive, accessible, and affordable for marginalized communities.

7. **Ethics and governance:** Establish guidelines and regulations for AI development and deployment, prioritizing transparency, accountability, and human rights.

8. **Intersectoral collaboration:** Engage stakeholders from various sectors (health, education, agriculture, etc.) to identify areas where AI can drive sustainable development impact.

9. **AI literacy and awareness:** Promote AI knowledge and awareness among policymakers, business leaders, and the general public.

10. **Monitoring and evaluation:** Establish frameworks to track the impact and effectiveness of AI interventions in achieving sustainable development goals.

11 **Address digital divide**: Implement initiatives to bridge the digital divide, ensuring equal access to AI technologies and benefits.

12. **Leverage existing initiatives**: Build upon existing sustainable development initiatives and incorporate AI to amplify their impact.

By implementing these strategies, Nigeria can harness the potential of AI to drive sustainable development, promote economic growth, and improve the lives of its citizens.

Furthermore, Artificial intelligence (AI) can play a significant role in enhancing climate resilience in Nigeria by:

1. **Predictive Analytics:** AI can analyze historical climate data to predict future climate-related disasters, enabling early warning systems and proactive measures.

2. **Climate Modeling:** AI can help create high-resolution climate models to simulate the impacts of climate change on Nigeria informing adaptation strategies.

3. **Agricultural Optimization:** AI can optimize agricultural practices such as crop selection and irrigation management to enhance food security under climate change.

4. **Disaster Response:** AI-powered chatbots can facilitate rapid disaster response and provide critical information to affected communities.

5. **Energy Efficiency:** AI can optimize energy consumption in buildings and industries, reducing greenhouse gas emissions and promoting sustainable development.

6. **Environmental Monitoring:** AI-powered sensors can monitor environmental parameters, detecting early signs of climate-related changes and triggering swift action.

7. **Climate-Informed Decision Making:** AI can provide data-driven insights for climate-resilient infrastructure development, urban planning, and policy making.

8. **Education and Awareness:** AI-powered platforms can disseminate climate change information, promoting awareness and behavior change among Nigerians.

9. **Climate Change Research:** AI can accelerate climate change research by analyzing large datasets, identifying patterns, and providing new insights.

10. **International Collaboration:** AI can facilitate global climate collaboration by connecting Nigerian researchers, policymakers, and practitioners with international experts.

By leveraging these AI applications, Nigeria can enhance its climate resilience, protecting vulnerable communities and promoting sustainable development.

RECOMMENDATIONS

1. The Government of Nigeria at Local, State and Federal level must take steps to invest in capacity building of its work force in AI technology.
2. AI technology/education should be entrenched at all levels of Education in the country.
3. Private sector investors must scale up investments in emerging technology by keying into AI evolutions.
4. Civil society and non-governmental organizations should increase advocacy on environmental protection and utilization through the use of AI.
5. Environmental education which can be advanced through artificial intelligence will go a long way in enhancing climate resilience in Nigeria (Onnoghen, Ojong., Omang, Obibessong & Asor,2020)

CONCLUSION

As the impacts of climate change is felt in a profound way in Nigeria's economic sector (Onnoghen, Orji, Olisah & Anabaraonye, 2024), Green entrepreneurship education which can also be advanced through artificial intelligence will go a long way in enhancing climate resilience in Nigeria (Onnoghen, Onwuzurike, & Anabaraonye, 2024). There is great need for more research towards exploring effective utilization of AI for enhancing climate resilience in Nigeria. Researchers and Scholars need to engage in the exploration of cutting-edge AI applications for climate action, formulation of policy frameworks, and collaborative endeavors, all with the overarching goal of mitigating the impacts of climate change and promoting long-term environmental sustainability and protection, good health and sustainable economic growth in Nigeria. Multilateral Organizations such as the World Bank Group and African Development Bank (ADB) should help to promote the innovative use of AI for enhancing climate resilience in Nigeria. They should also engage in green financing towards encouraging and enabling more research in this novel field of AI technological advancement in Nigeria (Anabaraonye, Ezuma, Emone, Olisah & Ewa, 2023).

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