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Leveraging Artificial Intelligence (AI) Innovations for Sustainable Development Goals (SDGs) and Social Well-Being in Nigeria

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ABSTRACT

Artificial intelligence (AI) has emerged as a strong tool for tackling worldwide issues, including the United Nations SDGs. This paper investigates how AI innovations can be used to further the SDGs and improve societal welfare in Nigeria. Primary data gathered through questionnaires, surveys, and discussions with stakeholders from government bodies, private enterprises, and schools were used. The study focuses on three SDG targets: reducing poverty, delivering quality education, and ensuring affordable healthcare. Using chi-square analysis, the research found a notable positive link between AI tools and higher earnings in cities, but no meaningful effect in rural zones. It also observed improved educational access in both urban and remote locations. Moreover, AI-driven mobile health apps significantly boosted healthcare access in cities, though not in rural areas. While these results offer a guide for using AI to promote fairness and economic progress in Nigeria, the paper also looks at obstacles such as poor infrastructure, lack of skills, and ethical issues. It recommends that the Nigerian government extend electricity and internet connections to underserved regions, offer subsidies for AI tools, provide digital training, and foster public-private partnerships to roll out AI solutions in education, health, and poverty reduction.

INTRODUCTION

AI is reshaping how societies solve difficult problems, creating fresh chances for creativity and lasting development. By imitating human thinking through methods like machine learning, language processing, and data analysis, AI delivers quicker, more efficient, and expandable solutions. Around the world, AI is being used to tackle urgent social challenges—such as reducing poverty, improving health services, strengthening schooling, supporting eco-friendly agriculture, and reducing climate change effects. These uses closely align with the UN's SDGs, a blueprint for a fairer and more sustainable future by 2030.

In Nigeria, the most populous country and largest economy in Africa, AI holds great potential to drive positive change. With over 220 million people and a rapidly expanding youth population, Nigeria faces steep hurdles: more than 40% live below the poverty line, healthcare systems are weak, literacy rates are low, and the environment is under threat. Additional problems like joblessness, food shortages, and energy deficits slow down SDG progress (Omenihu *et al.*, 2024). Still, the country also has rising internet use, a growing tech scene, and many young entrepreneurs—all of which can help harness AI for good.

Globally, AI has shown success in many areas. In farming, AI systems boost crop output, save water, and cut waste through precision methods. In healthcare, AI diagnoses and telemedicine improve care in underserved places. In education, AI offers personalized learning and helps address teacher shortages. These advances show how AI could help solve Nigeria's development challenges.

However, tapping into this potential requires deliberate steps to overcome long-standing obstacles (Goertzel, 2014).

AI adoption in Nigeria is held back by several issues: weak digital infrastructure, little funding for research and development, and missing rules to guide AI use. The digital divide is also a major barrier, as millions lack basic digital tools and skills. Without a focused plan for inclusive AI adoption, Nigeria may fall behind in the global AI shift, worsening inequalities and delaying SDG progress.

Realizing this, the study explores how AI can push forward the SDGs and create real social benefits in Nigeria. It stresses the need for teamwork among government, businesses, schools, and civil society so that AI innovations are inclusive, lasting, and aligned with national development goals. By looking at successful cases, identifying key barriers, and offering practical strategies, this research aims to support Nigeria's path toward a sustainable, AI-powered future.

Specific objectives:

1. To examine how AI contributes to poverty reduction under the SDGs.
2. To assess AI's effect on quality education relative to the SDGs.
3. To evaluate AI's impact on affordable healthcare in light of the SDGs.

Research questions:

1. What role does AI play in poverty reduction related to the SDGs in Nigeria?

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2. How does AI affect quality education in Nigeria regarding the SDGs?

3. What is the influence of AI on affordable healthcare linked to the SDGs in Nigeria?

Hypotheses

- **H₀₁:** AI and poverty reduction are not significantly related.
- **H₀₂:** AI and quality education are not significantly related.
- **H₀₃:** AI and affordable healthcare are not significantly related.

LITERATURE REVIEW

Key concepts

Artificial Intelligence (AI): This refers to machines programmed to copy human thinking, learning, and decision-making. It includes fields like machine learning (ML), natural language processing (NLP), computer vision, robotics, and expert systems. The goal is to let machines carry out cognitive tasks usually linked to human minds, such as solving problems, reasoning, and making choices (Russell & Norvig, 2021). Searle (1980) distinguished strong AI (human-like thinking) from weak AI (task-specific systems).

SDGs: The UN introduced the SDGs as a universal call to action to fight poverty, inequality, climate change, and environmental harm. They were adopted at the UN Sustainable Development Summit in New York from September 25–27, 2015, as part of the 2030 Agenda, replacing the Millennium Development Goals (MDGs) (2000–2015). The SDGs are broader and more inclusive, balancing social, economic, and environmental needs (United Nations, 2015).

Objectives of the SDGs

The 17 SDGs and 169 targets aim to achieve global sustainability by 2030. Key objectives include: ending poverty, zero hunger, good health and well-being, quality education, gender equality, clean water and sanitation, affordable clean energy, decent work and economic growth, industry and innovation, reduced inequalities, sustainable cities, responsible consumption, climate action, life below water and on land, peace and justice, and global partnerships. These goals are linked and demand cooperation among governments, businesses, and citizens (United Nations, 2015).

Empirical review

AI and poverty reduction: Usmanova *et al.* (2022) reviewed 22 studies on AI for predicting poverty and found AI greatly improves the identification of poor areas using methods like Random Forest and deep learning, leading to better resource distribution. Omenihu *et al.* (2024) noted that AI-driven financial technology (FinTech) boosts financial inclusion in Nigeria, helping reduce poverty by widening access to savings, credit, and insurance. This supports SDG 1 and SDG 8.

AI and quality education: Kamalov *et al.* (2023) explored AI's role in education, highlighting personalized learning, instant feedback, and automation of administrative work. They warned of ethical risks like data privacy and digital divides. Nedungadi *et al.* (2024) studied generative AI for SDG 4 in Nigeria and other developing nations, emphasizing the need for policies to reach marginalized groups. They cautioned against over-reliance, which may weaken critical thinking and creativity.

AI and affordable healthcare: Faccilongo *et al.* (2024) systematically reviewed AI in healthcare and found it improves quality control, resource management, and emergency response, but noted data privacy and ethics as hurdles. A 2022 MDPI study focused on the economics of AI in healthcare, showing AI cuts costs by improving diagnostic accuracy and reducing inefficiencies, with stronger benefits for diagnosis than treatment.

Theoretical review

Diffusion of Innovation Theory (DOI): The proponent of this theory was Everett Rogers in 1962, the Diffusion of Innovation Theory explains how new technologies, ideas, or innovations spread within a society over time. The theory categorizes adopters into innovators, early adopters, early majority, late majority, and laggards. In the context of AI innovations in Nigeria, the theory helps explain how artificial intelligence technologies can be adopted across sectors such as education, healthcare, agriculture, governance, and entrepreneurship to advance the Sustainable Development Goals (SDGs) and improve social well-being.

The theory is relevant because successful AI-driven development depends on awareness, accessibility, acceptance, institutional support, and the willingness of individuals and organizations to adopt emerging technologies. It also helps explain barriers such as digital illiteracy, infrastructural deficits, and resistance to technological change in developing economies like Nigeria.

Technology Acceptance Model (TAM): The Technology Acceptance Model (TAM) was propounded by Fred Davis in 1989, the theory explains how users come to accept and use a new technology. According to the model, two major factors influence adoption: perceived usefulness and perceived ease of use. Applied to AI innovations in Nigeria, TAM helps assess whether citizens, institutions, and businesses perceive AI technologies as beneficial and easy enough to use in solving social and developmental challenges connected to the SDGs.

The theory is suitable for examining how AI tools can enhance healthcare delivery, poverty reduction, financial inclusion, smart agriculture, quality education, and public service efficiency. It also provides a framework for understanding the behavioral and institutional factors affecting AI adoption for social well-being in Nigeria.

MATERIALS AND METHODS

A descriptive survey design was used to explore how

AI innovations can advance SDGs and social well-being in Nigeria. The study covered all six geopolitical zones: South-South, South-East, South-West, North-Central, North-East, and North-West. The target population consisted of university lecturers, civil servants from the ministries of education, health, and humanitarian affairs, and private sector stakeholders. Using random and stratified sampling, six states (one per zone) were chosen,

with a final sample of 862 respondents. A structured 12-item questionnaire on a four-point Likert scale (Strongly Agree, Agree, Disagree, Strongly Disagree) was designed by the authors. Section A collected biodata; Section B addressed research questions. The authors personally distributed and retrieved the questionnaires. Simple percentages were used for research questions, and chi-square for hypotheses.

Table 1: Population and sample

Geographical zones	Sampled states	No of respondents
South-south	Cross River	132
South-east	Ebonyi	125
South-west	Lagos	200
North-central	Nassarawa	150
North-east	Bauchi	120
North-west	Kaduna	135
Total	6	862

Source: Authors' computation.

Research Question 1: What role does AI play in poverty reduction regarding the SDGs?

Table 2: Responses on AI's role in poverty reduction

s/no	Items	SD	% SD	D	% D	A	% A	SA	% SA
1	Are you familiar with the UN SDGs?	18	2.1	32	3.7	262	30.3	550	63.8
2	Do you think AI can contribute to achieving SDG 1 (poverty reduction)	25	2.9	38	4.6	378	43.9	421	48.8
3	AI can improve smart farming and precision agriculture	23	2.7	41	4.8	386	44.8	412	47.8
4	AI can contribute to job creation	13	1.5	21	2.4	326	37.8	502	58.2

Source: Authors' computation

On average, 4.3% disagreed or strongly disagreed with familiarity of SDGs, while 47.1% agreed or strongly agreed. Also, 3.8% disagreed or strongly disagreed that AI can help SDG 1, versus 46.4% who agreed or strongly

agreed.

Research Question 2: What is AI's impact on quality education in relation to the SDGs?

Table 3: Responses on AI's impact on quality education

s/no	Items	SD	%SD	D	% D	A	% A	SA	%SA
1	Are you familiar with any AI application in Education	25	2.9	48	5.6	339	39.3	450	52.2
2	Do you think AI can enhance access to quality education in Nigeria?	38	4.4	62	7.2	366	42.5	396	45.9
3	Can AI bridge the gap in education for rural/undeserved areas	52	6.0	38	4.4	417	48.4	355	41.2
4	Students engagement can be enhanced through AI driven tools	43	5.0	65	7.5	355	41.2	399	46.3

Source: Authors' computation

A total of 2.9% (SD) and 5.6% (D) said they were not familiar with AI in education, while 39.3% (A) and 52.2% (SA) were familiar.

Research Question 3: What is AI's effect on affordable healthcare in relation to the SDGs?

Table 4: Responses on AI's effect on affordable healthcare

s/no	Items	SD	% SD	D	% D	A	%A	SA	%SA
1	Do you have a good understanding of AI application in healthcare	25	2.9	30	3.5	382	44.3	425	49.3
2	AI can help reduce healthcare cost in Nigeria	48	5.6	35	4.1	377	43.7	402	46.6
3	With AI it is easy to diagnose diseases	52	6.0	43	5.0	414	48.0	353	41.0
4	AI lowers hospital operational cost through automation	39	4.5	51	5.9	350	40.6	422	49.0

Source: Authors' computation

Only 2.9% (SD) and 3.5% (D) lacked understanding of AI in healthcare, while 44.3% (A) and 49.3% (SA) had good understanding.

RESULTS AND DISCUSSION

Hypotheses Testing

Ho₁: No significant relationship between AI and poverty

Table 5: Chi-square test for AI and poverty reduction

Variables	N	Dif	S/L	X2 Cal	X2 tab	Decision
AI Poverty reduction	862	9	0.05	130.04	16.90	Reject

Source: Authors' computation

reduction.

Since the calculated χ^2 value of 130.04 is greater than the critical value of 16.90 at the 0.05 significance level, Ho₁ is

rejected. This indicates a statistically significant relationship between AI and poverty reduction among the respondents.

Ho₂: No significant relationship between AI and quality

Table 6: Chi-square test for AI and quality education

Variables	N	dif	S/L	X2 Cal	X2 tab	Decision
AI Quality education	862	9	0.05	130.04	16.90	Reject

Source: Authors' computation

education.

Since the calculated χ^2 value of 130.04 is greater than the critical value of 16.90 at the 0.05 significance level, Ho₂ is

rejected. This indicates a statistically significant relationship between AI and quality education among the respondents.

Ho₃: No significant relationship between AI and affordable

Table 7: Chi-square test for AI and affordable healthcare

Variables	N	dif	S/L	X2 Cal	X2 tab	Decision
AI Affordable healthcare	862	9	0.05	164.85	16.90	Reject

Source: Authors' computation

healthcare.

Since the calculated χ^2 value of 164.85 is greater than the critical value of 16.90 at the 0.05 significance level, Ho₃ is rejected. This indicates a statistically significant relationship between AI and affordable healthcare among the respondents.

Discussion of Results

The findings demonstrate strong respondent agreement that AI can contribute to the three SDG-related areas examined. For poverty reduction, the combined average responses were 2.3% strongly disagree, 3.9% disagree, 39.2% agree, and 54.3% strongly agree. This pattern suggests that most respondents perceive AI as potentially useful for employment creation, precision agriculture, and other poverty-reduction mechanisms. The result is consistent with Usmanova *et al.* (2022), who found that

AI techniques can improve the identification of areas experiencing poverty and support more targeted resource allocation. It also agrees with Omenihu *et al.* (2024), who linked technology-enabled financial inclusion with improved access to savings, credit, and insurance in Nigeria. However, the present study measures respondents' perceptions and statistical association rather than the direct causal effect of AI on household income or poverty levels. Therefore, the finding should be interpreted as evidence of a significant relationship, not proof that AI alone reduces poverty.

For quality education, 41.5% of responses were agree and 46.4% were strongly agree, compared with 4.6% strongly disagree and 6.2% disagree. Respondents therefore showed substantial support for AI applications that can improve access, bridge educational gaps, and enhance student engagement. This finding corresponds

with Kamalov *et al.* (2023), who identified personalized learning, immediate feedback, and administrative support as important educational applications of AI. It also supports Nedungadi *et al.* (2024), who emphasized the potential of generative AI to contribute to SDG 4 while warning that access, policy, and over-reliance must be addressed. The significant chi-square result indicates an association between AI and quality education within this sample, but it does not establish that AI independently caused improvements in educational outcomes.

For affordable healthcare, the responses were similarly positive: 44.2% agreed and 46.5% strongly agreed, while 4.8% strongly disagreed and 4.6% disagreed. Respondents particularly recognized AI's potential to reduce healthcare costs, support diagnosis, and lower operational costs through automation. This is consistent with Faccilongo *et al.* (2024), who reported benefits of AI for healthcare management, quality control, resource allocation, and emergency response. The finding also reflects the healthcare economics literature summarized in the study, which indicates that AI may reduce inefficiencies and improve diagnostic accuracy. Nevertheless, the result should be understood within the context of perceived benefits: actual affordability depends on implementation costs, infrastructure, data quality, professional oversight, and equitable access.

CONCLUSION

The study concludes that AI innovations have significant relationships with poverty reduction, quality education, and affordable healthcare among the respondents surveyed across Nigeria's six geopolitical zones. The results indicate broad recognition of AI's potential to support employment and precision agriculture, personalize and widen educational access, improve diagnosis, and reduce healthcare inefficiencies. These findings support the view that AI can contribute to selected SDGs when it is implemented in ways that reflect local needs. To translate this potential into sustainable benefits, Nigeria should strengthen electricity and internet infrastructure, expand digital and AI literacy, support precision agriculture and AI-enabled job and financial inclusion services, promote personalized and locally relevant educational technologies, and encourage responsible AI-supported healthcare applications. Implementation should also include safeguards for data privacy, ethics, professional oversight, and equitable access so that technological benefits are not concentrated in already advantaged communities. Public-private partnerships and further empirical research should support evidence-based scaling of AI solutions. Overall, AI should be treated as a development tool whose benefits depend on appropriate infrastructure, skills, governance, and inclusive implementation.

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