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ASSESSING THE ROLE OF ARTIFICIAL INTELLIGENCE (AI) IN PROMOTING SUSTAINABLE HOSPITALITY PRACTICE AND ECO-TOURISM DEVELOPMENT IN NIGERIA

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Abstract
This paper examined the role of Artificial Intelligence (AI) in fostering sustainable hospitality practices and eco-tourism development in Nigeria. This study applied the descriptive survey research design. Data was collected from the field using structured online questionnaires distributed through Google Forms and WhatsApp platform from 384 respondents. Data were analysed using descriptive statistics and inferential statistics such as Pearson correlation and regression analysis. The findings indicated that AI application leads to increased operational efficiency, effective energy regulation, enhanced customer satisfaction, environmental protection, and sustainable marketing of tourism in Nigeria. The research also reveals that there is a significant positive relationship between AI adoption and the development of sustainable hospitality and eco-tourism in Nigeria ($r= 0.842$, $p < 0.05$). Poor infrastructure, high implementation cost, and insufficient technical manpower were found as some of the challenges in the adoption of AI in the country's tourism and hospitality sector. Therefore, to effectively promote sustainable hospitality practice and eco-tourism in Nigeria through AI, appropriate policy frameworks and technological infrastructure should be developed and strengthened.

Keywords: Artificiality, Intelligence, Sustainability, Hospitality, Technology.

Introduction

Hospitality and tourism industry serve as a backbone of growth to global economy, generation of employment opportunities, cultural exchange and sustainable development. Nonetheless, the proliferation of tourism development has led to a growing array of environmental challenges such as the rising of carbon footprints from travelling, energy consumption, waste generation, loss of biodiversity, land use degradation and destruction of natural habitats. The rise in these challenges led to increasing focus on sustainability hospitality and eco-tourism as crucial approaches to balancing economic development and environmental preservation. Artificial Intelligence (AI) a transformative innovative technology is poised to play a critical role in achieving sustainability in hospitality and tourism industries by enhancing operational efficiencies, improving the customer journey, boosting environmental management, and fostering a smarter and more responsible tourism ecosystem. Advanced technologies like machine learning, predictive analytics, robotic, smart sensors and Internet of Things (IoT) have the potential to revolutionize hotel and tourism operations, driving energy and waste reduction, supporting smart destination management and advancing sustainable tourism globally (Ivanov & Webster, 2021). Leading nations in Europe and North America, the United States, the United Kingdom, Japan, Germany, and Singapore, have made substantial strides in incorporating AI into their sustainable hospitality operations and eco-tourism development initiatives. These advanced economies are implementing AI-enabled solutions in areas of smart energy management, automated customer services, predictive maintenance, environment management systems, and sophisticated digital tourism marketing. Many international hotel chains are actively leveraging AI technologies to optimize energy and water consumption, understand and predict customer preferences, minimize operational waste and achieve sustainable operational goals. Initiatives like Singapore's Smart Nation strategy and Japan’s focus on robot-powered hospitality reflect the progressive deployment of AI technologies to drive efficiency and sustainability in their tourism sectors. In contrast, the adoption of AI in developing economies is hampered by several key obstacles including: inadequate digital infrastructure, significant investment requirements, insufficient policy support, limited technical capabilities and shortage of expertise in AI technologies. Although some developing countries such as India, Brazil and Indonesia have initiatives for digitalizing tourism operations and hospitality services, progress is frequently hampered by high technology costs and insufficient infrastructure (Buhalis & Leung, 2022). In Africa, a growing number of countries including Kenya, Ghana, South Africa and Rwanda have initiated measures to embrace digital tourism tools and smart technologies for better management of natural heritage tourism, destinations marketing and eco-tourism sustainability.

In Nigeria, tourism and hospitality development has gained significant momentum as part of the country's approach to diversifying the economy from oil dependence. The nation possesses an extensive range of eco-tourism potential, including its diverse cultural heritage, numerous wildlife reserves, scenic coastlines, forest reserves and vast natural resources, all of which are conducive to the development of sustainable tourism. Initiatives by the Nigerian Tourism Development Authority (NTDA) and the formation of a Federal Ministry of Art, Culture, Tourism and Creative Economy reflect the growing government interest in

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sustainable tourism and the digital transformation of the industry. However, challenges persist within Nigeria's hospitality and tourism sector, including inefficient energy use, high implementation costs, lack of technical expertise, insufficient policy guidance, lack of proper waste management systems, inadequate infrastructure, and the low adoption of advanced technologies. Although some businesses have started adopting digital solutions like online booking systems and CRM software, the uptake of advanced AI applications in sustainable hospitality management and eco-tourism is still minimal. However, there is a conspicuous absence of empirical studies focusing specifically on the role of artificial intelligence in driving sustainable hospitality practice and eco-tourism development within Nigeria. Most studies have predominantly addressed tourism marketing, customer engagement, and hospitality management, with limited attention paid to the impacts of AI on environmental sustainability and eco-tourism advancement in the Nigerian context. Hence, this paper fills the gap by exploring the role of AI in facilitating sustainable hospitality operations and enhancing eco-tourism development in Nigeria.

Empirical Review

Recently, the literature has expressed more emphasis on the importance of artificial intelligence (AI) for sustainable growth and operational efficiency in hospitality and tourism industry across nations. Uzoamaka, Eneh and Anyahara, (2025) studied the effect of artificial intelligence on the sustainable growth and operational efficiency of small and medium scale enterprises (SMEs) in South-East Nigeria through a descriptive survey design and simple regression analysis. Among the variables tested, the effect of machine learning, an element of AI, showed significant effect on the operational efficiency and sustainability of SMEs ($p<.005$). The researchers enjoined advocacies and policies that focus on integration and adoption of AI. Similarly, data analysis by Kekeocha and Ejiogu (2025) with respect to the link between AI and the sustainable hospitality business in Owerri, Imo State, Nigeria through a descriptive survey design, revealed AI had significant positive relationship with the variables of environmental sustainability and social sustainability of hospitality firms ($r= .882$; $p< 0.05$ and $r= .801$; $p< 0.05$). The result indicated that even as the industry improve AI concepts such as chatbots and robot services, the sustainable performance of hospitality industry gradually increases. Concerning future eco-tourism development, Bhaskar (2025) assessed the contribution of AI and information technology to sustainable eco-tourism and applied secondary data collected from global tourism development projects and Indian eco-tourism programmes as the basis of research. Results found that the inclusion of modern Information and Communication Technologies, such as AI, GIS, IoT, blockchain, and big data analytics in eco-tourism practice led to sustainable strategies in eco destinations, nature conservation, resource optimization, and enhancement of visitor experience, and in turn will accelerate the achievement of SDGs. Also, Alnaqeeb, Almasoodi, Alshammari and Ghanayem, (2025) investigated the efficiency of AI-powered eco-tourism recommendation system in Iraq, by interviewing 398 tourism-related practitioners through quantitative survey and found that the system led to significant gain in environmental sustainability, economic development and tourism management.

In addition, other studies identified various AI technologies and implementation challenges that hinder sustainable tourism development. Zhang and Deng (2024), in their systematic

review of 29 high-quality publications, revealed that AI methodologies including AI, IoT, augmented reality (AR), virtual reality(VR), and data analytics significantly enhance sustainable ecotourism activity, ecosystem and environmental management, and multi-stakeholder cooperation. However, the authors emphasized the need for lucrative alliances among government, local communities, and tourism stakeholders for successful execution. Similarly, Ndlovu, Sifolo and Tshipala, (2026) in their bibliometric review of AI and sustainability in small and medium tourism enterprises (SMTEs) identified main challenges as poor ICT infrastructure, the high implementing cost, deficient technical capacity, and AI systems designed for larger tourism enterprises. In other study, Okonkwo, E., Ndu-Anunobi and Umeokafor, (2024) investigated the prospects of AI usage for attaining SDGs in Nigeria and Africa with the framework of the Technology Acceptance Model (TAM). The authors affirmed the capacity of AI for sustainable development promotion but reported digital divide, weak policy infrastructure, and dearth of professional experts as key obstacles to AI utilization. The study recommended strategic policies, increased investment in digital infrastructure, and partnerships for sustainable innovations. Similarly, Yakubu (2024) reported weak infrastructure, poor ICT skills, and ethical issues as significant challenges to effective AI implementation in Nigeria though AI promising of sustainable economy and societal wellbeing.

Methodology

The paper adopted a cross-sectional survey research method, which was used to investigate the role of artificial intelligence in fostering sustainable hospitality practices as well as the development of ecotourism in Nigeria. Stakeholders in Nigeria hospitality and tourism industry/sector such as hotel managers, tourism operators, ecotourism administrators, information and communication technology personnel and others were targeted for participation in the study. Nigeria was the study area and country of focus because of the rapid digital economy being experienced, the enormous ecotourism potentials as well as the rapid interest in sustainable tourism development. Data for the study were obtained from primary and secondary sources. Primary data were obtained through the administration of structured questionnaire in five point Likert-scale online via Google forms platform, WhatsApp and Email links to target respondents that have the requisite industry knowledge and experience. Secondary data were obtained through literature review, journal publications, newspapers, textbooks, proceedings of seminars and conferences, government publications, tourism studies report, institutional publications on artificial intelligence, tourism hospitality sustainability as well as ecotourism development. The 2026 Nigeria population estimates as projected by the National Population Commission (NPC) was used as the population frame for the study. Tthe sample size was determined using the Cochran's (1977) formula at 95% confidence level and 5 % sampling error, which yielded a sample size of 384 respondents. Purposive and snow ball sampling techniques were adopted in targeting respondents who are experts and to enable respondents enhance further response among hospitality and tourism stakeholders. Data generated was analyzed using the descriptive statistical tools such as frequency distribution and percentage and inferential statistical tools with the help of Statistical Package for Social Sciences (SPSS 27). Pearson Product Moment Correlation and Simple Linear Regression were used to test the hypothesis that adoption of artificial

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intelligence (AI) has significant influence on sustainable hospitality and eco-tourism development in Nigeria.

Results

Information provided in Table 1, revealed respondent's perception on AI application in sustainable hospitality practices as it pertains to eco-tourism development in Nigeria. Findings perceived AI positively in the hospitality and tourism industry. For instance, the data showed that 45.6% strongly agreed and 38.3% agreed that AI improves energy efficiency in hospitality business operations while 42.4% strongly agreed and 39.3% agreed that AI enabled systems and applications aid in reducing waste generation in hotels and other hospitality tourism facilities. The finding also inferred that 48.7% strongly agreed and 33.6% agreed while 54.4% strongly agreed and 30.5% agreed that AI enhances sustainable resource management/consumption effectively and efficiently in the hospitality and tourism enterprises while 50.8% strongly agreed and 29.1% agreed that AI enabled customer service system improves efficiency in delivering hotel and tourism agencies services. Moreover, it was also discovered that 44.5% strongly agreed and 35.7% agreed while 52.3% strongly agreed and 28.4% agreed that AI enables eco-tourism destination management and development in Nigeria and improves tourists experience and satisfaction respectively. Furthermore, the data identified the respondents agreement regarding AI serving as a tool for environmental monitoring and preserving and application of intelligent digital marketing in creating awareness of eco-tourism destination locations in Nigeria such that 49.7% strongly agreed and 32.6% agreed, 57.6% strongly agreed and 25.3% agreed respectively. However, the data revealed the challenges that impede adoption of AI technologies in the hospitality industry such as 60.7% strongly agreed and 24.7% agreed that poor technological infrastructure, 56.5% strongly agreed and 27.3% agreed that lack of technical skilled persons/knowledge and lack of advanced technology (financial constraint) can hinder application of AI with respondents stating that 53.4% strongly agreed and 29.4% agreed. Equally, there is high support for policy promotion and digital investments in Nigeria such that 64.3% strongly agreed and 22.7% agreed that the Nigerian government can be more supportive and infrastructural development can improve AI adoption for sustainable tourism development in Nigeria.

Table 1 Artificial Intelligence, Sustainable Hospitality Practices, and Eco-Tourism Development in Nigeria

Variables/Indicators	SA	A	U	D	SD	Total Frequency
AI improves energy efficiency in hospitality operations	175 (45.6%)	147 (38.3%)	32 (8.3%)	18 (4.7%)	12 (3.1%)	384 (100%)
AI reduces waste generation in hotels and tourism facilities	163 (42.4%)	151 (39.3%)	34 (8.9%)	24 (6.3%)	12 (3.1%)	384 (100%)
AI enhances sustainable resource management in hospitality operations	187 (48.7%)	129 (33.6%)	38 (9.9%)	18 (4.7%)	12 (3.1%)	384 (100%)

AI-based customer service improves operational efficiency	209 (54.4%)	117 (30.5%)	28 (7.3%)	17 (4.4%)	13 (3.4%)	384 (100%)
AI improves eco-tourism destination management	171 (44.5%)	137 (35.7%)	40 (10.4%)	23 (6.0%)	13 (3.4%)	384 (100%)
AI enhances tourists' experiences and satisfaction	201 (52.3%)	109 (28.4%)	36 (9.4%)	22 (5.7%)	16 (4.2%)	384 (100%)
AI contributes to environmental monitoring and conservation	191 (49.7%)	125 (32.6%)	35 (9.1%)	21 (5.5%)	12 (3.1%)	384 (100%)
AI-powered digital marketing increases eco-tourism awareness	221 (57.6%)	97 (25.3%)	30 (7.8%)	20 (5.2%)	16 (4.1%)	384 (100%)
Poor infrastructure limits AI adoption in hospitality sector	233 (60.7%)	95 (24.7%)	24 (6.3%)	18 (4.7%)	14 (3.6%)	384 (100%)
High implementation cost hinders AI integration	217 (56.5%)	105 (27.3%)	26 (6.8%)	20 (5.2%)	16 (4.2%)	384 (100%)
Inadequate technical expertise affects AI usage	205 (53.4%)	113 (29.4%)	31 (8.1%)	19 (4.9%)	16 (4.2%)	384 (100%)
Government support and digital investment can improve AI adoption	247 (64.3%)	87 (22.7%)	22 (5.7%)	16 (4.2%)	12 (3.1%)	384 (100%)

Source: Researcher's fieldwork, (2026)

Pearson Product Moment Correlation (PPMC) and Simple Linear Regression analyses were conducted to determine the extent to which the adoption of artificial intelligence affects sustainable hospitality and eco-tourism development in Nigeria. From the results, a strong positive and significant relation exists between adoption of artificial intelligence and sustainable hospitality and eco-tourism development ($r = 0.842$, $p<0.05$). Based on the regression result; strong coefficient correlation was obtained $R = 0.842$, and the determination coefficient $R = 0.709$. On the ANOVA, $F(1,382)=941.563$, $p=0.000$, which means that the model of regression was significant. Also, regression coefficient analysis result indicates that artificial intelligence adoption positively and significantly affect the sustainable hospitality and eco-tourism development (= 0.842, $t=30.684$, $p<0.05$). Therefore, rejection of the null hypothesis (artificial intelligence adoption has no significant impact on sustainable hospitality and eco-tourism development in Nigeria) and acceptance of alternative hypothesis are established based on these results. Hence, the implementation of artificial intelligence (e.g., smart automation systems for customer service, smart operating tools, e-marketing, environment monitoring, etc.) will undoubtedly boost sustainability and operational efficiency, increase customer satisfaction and enhance the visibility of the eco-tourism development in Nigeria tourism and hospitality industry are made from the analyses.

Table 2: Correlation Analysis Showing Relationship Between Artificial Intelligence Adoption and Sustainable Hospitality Practices/Eco-Tourism Development

Variables	Mean	Std. Deviation	N	r	Sig. (2-tailed)

Artificial Intelligence Adoption	4.31	0.74	384	0.842	0.000
Sustainable Hospitality Practices and Eco-Tourism Development	4.18	0.69	384		

Source: Researcher's fieldwork, (2026)

Table 2: Model Summary for Simple Linear Regression Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.842a	0.709	0.707	0.418

Source: Researcher's fieldwork, (2026)

Table 3: ANOVA Result for Regression Model

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	164.327	1	164.327	941.563	0.000b
Residual	66.671	382	0.175		
Total	230.998	383			

Source: Researcher's fieldwork, (2026)

Table 4: Coefficients of Regression Analysis

Model	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (Beta)	t	Sig.
(Constant)	0.781	0.118		6.619	0.000
Artificial Intelligence Adoption	0.791	0.026	0.842	30.684	0.000

Source: Researcher's fieldwork, (2026)

Discussion

The findings of this study revealed the influence of artificial intelligence (AI) on sustainable hospitality practice and eco-tourism development in Nigeria. The descriptive analysis of results indicated that majority of the respondents strongly agree that AI influences energy efficiency, waste management, sustainable resource utilization, customer service delivery, environmental monitoring, eco-tourism destination management, and digital tourism marketing in Nigeria. Also, majority of respondents strongly agree that the customer service system integrated with AI could improve operating efficiency in hospitality business and the application of AI in digital marketing could significantly improve destination awareness in Nigeria for eco-tourism purposes. However, the negative influences in implementing AI into Nigerian hospitality and tourism businesses include insufficient infrastructure, high implementation costs and lack of technical experts. The result of inferential analysis using Pearson Product Moment Correlation showed there is a strong positive and statistically significant relationship between AI adoption and sustainable hospitality practice and eco-tourism development in Nigeria ($r=0.842$; $p<0.05$), and the result of regression analysis demonstrated that AI adoption can explain seventy-zero point nine percent (70.9%) variation of sustainable hospitality practice and eco-tourism development ($R = 0.709$), ANOVA result of the regression model indicates that it is statistically significant ($F=941.563$, $p<0.05$). As a result, the null hypothesis that AI adoption has no statistically significant effect on sustainable hospitality practice and eco-tourism development in Nigeria was rejected, and the

alternative hypothesis was accepted. The results are in line with Uzoamaka et al. (2025), which confirms that machine learning positively impacts on operational efficiency and sustainability among Nigerian SMEs in south-east and with Kekeocha & Ejiogu (2025), who concludes that there is a significant positive relationship between AI adoption and environmental sustainability in hospitality business operations in Owerri, Imo state. This findings is also in consensus with Bhaskar (2025) and Alnaqeeb et al. (2025) which confirms that AI technologies lead to improvements in destination management, guest experience, environment conservation, and sustainable tourism development. The identified implementation factors, namely infrastructure, costs and expertise is in line with the finding of Ndlovu et al. (2026), Okonkwo et al. (2024) and Yakubu (2024), which confirmed that insufficient digital infrastructure, limited support policies and limited human capital are crucial barriers in deploying AI technology in Nigeria and developing countries in general.

Conclusion

AI plays a very crucial role in developing sustainable hospitality practice and eco-tourism development in Nigeria. The study reveals that AI technologies make important contribution towards operational efficiency, energy efficiency management, waste management system, sustainable resource utilization, conservation, customer satisfaction and tourism digital marketing in hospitality and tourism industry. This study further establishes that AI adoption has a strong positive and statistically significant relationship toward sustainable hospitality practice and eco-tourism development, thus the null hypothesis is rejected and alternative hypothesis is accepted. While recognizing the benefit of AI technologies, it identifies insufficient infrastructure, high costs of implementation and lack of technical expert and weak institutional support as critical constraints limiting the adoption of AI in hospitality and tourism industries in Nigeria.

Recommendations

1. Federal Government of Nigeria should improve and develop digital infrastructure as well as electricity supply in hospitality and tourism destinations in order to enable the effective application of AI and sustainable tourism development in the destinations.
2. The Nigerian hospitality and tourism operators should readily embrace and utilize AI technologies such as the intelligent customer service system, energy management devices as well as digital marketing tools in order to develop operating efficiency and environmental sustainability.
3. The appropriate governmental agencies as well as the tourism stakeholders should establish and conduct continuous trainings and capacity development programs for workers in the hospitality and tourism industry in order to acquire technical knowledge of the application of AI.
4. The Financial institutions and development agencies should make readily available affordable credit facilities, grants as well as tax holidays and incentives to hospitality and tourism businesses to ameliorate the high costs associated with implementation and maintenance of AI technologies.
5. Environmental agencies, tourism regulatory bodies as well as private technology organizations should engage in collaborative efforts to the implementation of the AI-

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powered environmental monitoring and eco-tourism development systems in the prominent tourism destinations in Nigeria.

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