

ADOPTION OF ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN UNIVERSITY LIBRARIES IN NIGERIA: A COMPARATIVE STUDY OF SELECTED FEDERAL, STATE AND PRIVATE UNIVERSITIES

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Abstract

This study examined the adoption of Artificial Intelligence (AI) technologies in university libraries in Nigeria using a comparative quantitative approach across federal, state and private institutions. A descriptive survey research design was adopted for the study. The population comprised librarians and ICT personnel from eighteen selected universities consisting of six federal, six state and six private universities in Nigeria. A structured questionnaire was administered to 180 respondents, out of which 168 copies were returned and found usable for analysis. Data collected were analyzed using descriptive statistics (mean and standard deviation) and inferential statistics (Analysis of Variance) at 0.05 level of significance. Findings revealed that AI technologies such as RFID systems, intelligent OPAC, automated cataloguing tools and virtual reference systems are moderately adopted in Nigerian university libraries. However, adoption remains relatively low in federal and state universities compared to private institutions. Major barriers identified include inadequate funding, poor ICT infrastructure, lack of technical expertise and absence of institutional policy frameworks. The study concluded that institutional ownership significantly influences AI adoption in Nigerian university libraries. It was recommended that increased funding, professional training and development of institutional AI policies should be prioritized to enhance adoption.

Keywords: Artificial Intelligence, Academic Libraries, Technology Adoption, University Libraries, Nigeria

Introduction

Artificial Intelligence (AI) technologies are increasingly transforming academic library services globally through the automation of routine operations, improvement of information retrieval processes, and enhancement of user engagement. The emergence of AI-driven technologies such as chatbots, intelligent cataloguing systems, predictive analytics tools, recommender systems, natural language processing applications, and Radio Frequency Identification (RFID) systems has enabled libraries to improve operational efficiency and provide personalized information services tailored to the needs of diverse user communities. These technologies facilitate faster access to scholarly resources, automate classification and indexing processes, enhance digital repository management, and support data-driven decision-making in library administration.

Globally, academic libraries are integrating AI technologies into their service frameworks to remain relevant in the rapidly evolving digital information ecosystem. AI-powered systems are now being used to support reference services through virtual assistants, automate metadata generation, manage electronic resources, and enhance discovery systems for improved user experience. In addition, machine learning algorithms are increasingly applied in user behaviour analysis to support collection development decisions and predict future information needs. These developments have significantly

improved the quality, accessibility, and responsiveness of library services in technologically advanced academic environments.

In Nigeria, university libraries are gradually embracing emerging information and communication technologies (ICTs) to enhance service delivery and improve operational efficiency in response to changing information needs of users. The increasing demand for remote access to digital resources, electronic learning platforms, and research support services has necessitated the adoption of innovative technological solutions within academic libraries. Consequently, AI technologies are being explored as viable tools for automating repetitive library tasks, improving user support systems, strengthening institutional repositories, and facilitating efficient circulation management.

However, the level of adoption of AI technologies varies significantly across institutional categories due to disparities in funding structures, ICT infrastructure, administrative autonomy, policy implementation frameworks, and staff technological competence. Federal universities in Nigeria often benefit from relatively stable government funding and national policy support, while state universities may experience financial constraints that limit technological investments. Private universities, on the other hand, are typically driven by institutional competitiveness and innovation strategies, which may encourage the adoption of advanced technologies such as AI to improve service quality and institutional ranking.

Despite the growing awareness of AI technologies and their potential to revolutionize academic library services, empirical evidence on their adoption across federal, state, and private universities in Nigeria remains limited. Existing studies have largely focused on general ICT application in libraries, with minimal emphasis on AI-specific technologies and comparative institutional analysis. This gap in literature underscores the need for systematic investigation into the extent to which AI technologies have been adopted in Nigerian university libraries and the variations that may exist across different institutional ownership structures.

This study therefore investigates the level of adoption of AI technologies in selected university libraries in Nigeria, with a comparative focus on federal, state, and private universities. The findings are expected to provide empirical insights that will inform policy formulation, technological investment decisions, and capacity-building initiatives aimed at promoting effective integration of AI technologies into academic library services in Nigeria.

Research Questions

The study sought to answer the following questions:

1. What Types of Artificial Intelligence (AI) technologies are adopted in selected university libraries in Nigeria?
2. What is the level of AI adoption in federal, state, and private university libraries in Nigeria?

3. What is the level of librarians' readiness towards the adoption of AI technologies in selected university libraries in Nigeria?
4. What challenges affect the adoption of AI technologies in university libraries in Nigeria?
5. Does institutional ownership significantly influence the adoption of AI technologies in university libraries in Nigeria?

Research Hypothesis

H_0 : There is no significant difference in AI adoption among federal, state and private university libraries in Nigeria.

Review of Related Literature

AI Technologies Adopted in University Libraries

Artificial Intelligence (AI) has transformed academic libraries by automating routine operations and enhancing information discovery, user engagement, and knowledge management. Common AI technologies currently adopted in university libraries include Radio Frequency Identification (RFID) systems, AI-powered chatbots, intelligent Online Public Access Catalogues (OPACs), automated cataloguing and metadata generation tools, recommender systems, machine learning applications, natural language processing (NLP), speech recognition technologies, and predictive analytics. These technologies improve circulation management, information retrieval, digital repository management, and virtual

reference services while increasing operational efficiency and user satisfaction (Cox, 2022; Shahzad et al., 2023). Recent evidence from Nigerian academic libraries indicates that RFID systems, AI-enabled catalogue search tools, and chatbot-assisted reference services are the most commonly implemented AI applications, although their deployment remains at an emerging stage.

Level of AI Adoption in Federal, State and Private University Libraries

The extent of AI adoption differs considerably across higher education institutions due to variations in financial resources, institutional priorities, technological infrastructure, and administrative support. International studies report that universities with stronger ICT ecosystems and strategic digital transformation policies demonstrate higher levels of AI integration than institutions with limited technological capacity (Dwivedi et al., 2023). Within Nigeria, private universities generally exhibit higher adoption levels because of greater managerial flexibility, competitive positioning, and investment in digital innovation, whereas many federal and state universities continue to rely primarily on conventional library automation systems. Existing empirical studies consistently show that AI implementation in Nigerian university libraries remains moderate, with significant disparities across institutional ownership categories.

Librarians' Readiness towards AI Adoption

Successful implementation of AI depends largely on librarians' readiness, which encompasses awareness, technical competence, positive attitudes, digital literacy, and willingness to acquire new skills. As AI increasingly complements traditional library services, librarians are expected to possess competencies in AI tools, data management, digital ethics, and information technologies. Studies have shown that librarians generally recognize the potential benefits of AI but often express concerns regarding insufficient training and inadequate technical expertise. Continuous professional development, institutional support, and AI literacy programmes have therefore been identified as essential prerequisites for successful adoption (Cox, 2022; Shahzad et al., 2024). In Nigeria, librarians demonstrate growing awareness of AI technologies such as ChatGPT and Gemini, although professional application in library services remains relatively limited.

Challenges Affecting AI Adoption in University Libraries

Despite the growing recognition of AI's benefits, several barriers continue to impede its implementation in university libraries. The most frequently reported challenges include inadequate funding, poor ICT infrastructure, unreliable electricity supply, limited internet connectivity, shortage of AI-skilled personnel, resistance to organizational change, concerns over data privacy and security, and the absence of institutional AI policies. In developing countries, these challenges are further compounded by limited investment in emerging technologies and insufficient government support for digital transformation. Nigerian studies similarly identify financial constraints, inadequate technological infrastructure, and

lack of institutional commitment as the major obstacles to AI adoption in university libraries.

Institutional Ownership and AI Adoption

Institutional ownership has emerged as an important determinant of technology adoption in higher education. Organizational characteristics-including governance structure, funding mechanisms, leadership commitment, and strategic priorities-influence the extent to which institutions invest in emerging technologies. Private universities generally possess greater operational autonomy and flexibility in adopting innovative technologies than public universities, while federal universities often benefit from larger government interventions but may experience bureaucratic delays. State universities frequently face greater financial limitations that constrain technological investments. Comparative studies therefore suggest that institutional ownership significantly influences AI adoption through differences in resource availability, organizational culture, and strategic planning, resulting in varying levels of AI implementation across university libraries.

Research Methodology

This study adopted a descriptive survey research design using a quantitative cross-sectional approach to investigate the adoption of Artificial Intelligence (AI) technologies in university libraries in Nigeria. The design was considered appropriate because it enabled

the collection of standardized data from a relatively large number of respondents at a single point in time, thereby facilitating objective measurement and comparison of AI adoption, librarians' readiness, and implementation challenges across different categories of universities. The quantitative approach also allowed the use of descriptive and inferential statistics to answer the research questions and test the study hypothesis.

The population comprised librarians and Information and Communication Technology (ICT) personnel working in selected university libraries across Nigeria. Eighteen universities were purposively selected to ensure representation of the three major ownership categories: Bayero University Kano, University of Maiduguri, Federal University of Technology Owerri, University of Port Harcourt, University of Abuja, and University of Ibadan (Federal Universities); Rivers State University, Imo State University, Kano State University of Science and Technology, Kogi State University, Lagos State University, and Kashim Ibrahim University (State Universities); and Covenant University, American University of Nigeria, Nile University of Nigeria, Igbinedion University, Skyline University Nigeria, and Wigwe University (Private Universities). Ten librarians and ICT personnel were purposively selected from each institution, giving a total sample size of 180 respondents.

Data were collected using a researcher-developed structured questionnaire titled the Artificial Intelligence Adoption Questionnaire (AIAQ). The instrument comprised four sections covering respondents' demographic information, AI technologies adopted, librarians' readiness towards AI adoption, and challenges affecting AI implementation.

Responses were measured on a five-point Likert scale. The questionnaire was validated by experts in Library and Information Science and Information and Communication Technology, while its reliability was established through a pilot study involving 15 respondents from universities outside the study area, producing a Cronbach's Alpha coefficient of 0.84, which indicated high internal consistency.

The questionnaire was administered through both physical and electronic means to maximize participation and response rate. Data collected were analyzed using descriptive statistics (frequency, mean, and standard deviation) to answer the research questions, while Analysis of Variance (ANOVA) was employed to test the hypothesis at the 0.05 level of significance. Ethical principles of informed consent, voluntary participation, anonymity, and confidentiality were strictly observed throughout the study to ensure the credibility and integrity of the research process.

Results

RQ1: What Types of Artificial Intelligence (AI) technologies are adopted in selected university libraries in Nigeria?

AI Technology	M	SD
RFID Circulation Systems	2.89	0.74
AI-powered Chatbots	2.63	0.81
Intelligent OPAC	2.71	0.76
Automated Cataloguing Tools	2.55	0.84
Machine Learning Analytics	2.34	0.92
Virtual Reference Systems	2.68	0.79

The table presents the mean (M) and standard deviation (SD) scores for the Artificial Intelligence (AI) technologies adopted in selected university libraries in Nigeria. Among the technologies examined, RFID circulation systems recorded the highest mean score (M = 2.89, SD = 0.74), indicating that they are the most commonly adopted AI-related technology. Intelligent OPAC (M = 2.71, SD = 0.76), virtual reference systems (M = 2.68, SD = 0.79), AI-powered chatbots (M = 2.63, SD = 0.81), and automated cataloguing tools (M = 2.55, SD = 0.84) also showed moderate levels of adoption, while machine learning analytics recorded the lowest mean score (M = 2.34, SD = 0.92), suggesting minimal implementation.

In summary, the findings indicate that university libraries in Nigeria have made greater progress in adopting basic AI technologies that support library automation than advanced AI applications. The relatively moderate mean scores across most technologies suggest that AI adoption is still at a developmental stage, with variations among institutions likely influenced by differences in funding, ICT infrastructure, technical expertise, and institutional support.

RQ2: What is the level of AI adoption in federal, state, and private university libraries in Nigeria?

INSTITUTION TYPE	N	M	SD
FEDERAL UNIVERSITIES	56	2.47	0.68
STATE UNIVERSITIES	54	2.33	0.71
PRIVATE UNIVERSITIES	58	2.84	0.65

The table presents the mean (M) and standard deviation (SD) scores for the level of AI adoption across federal, state, and private university libraries in Nigeria. Private universities recorded the highest level of AI adoption ($M = 2.84$, $SD = 0.65$), indicating greater integration of AI technologies and relatively consistent adoption across the institutions studied. Federal universities showed a moderate level of adoption ($M = 2.47$, $SD = 0.68$), while state universities recorded the lowest mean score ($M = 2.33$, $SD = 0.71$), reflecting comparatively limited implementation of AI technologies.

Overall, the findings reveal that AI adoption varies across institutional ownership, with private universities leading, followed by federal universities, while state universities lag behind. The observed differences are likely influenced by variations in funding, ICT infrastructure, administrative flexibility, and institutional commitment to technological innovation, suggesting that institutional ownership plays an important role in the adoption of AI technologies in Nigerian university libraries.

RQ3: What is the Level of Librarians' Readiness Towards the Adoption of AI

Technologies in Selected University Libraries in Nigeria?

INDICATOR	M	SD
Willingness to Learn Ai Tools	3.12	0.66
Basic Ai Awareness	2.95	0.70
Technical Skills in Ai	2.41	0.85
Institutional Support	2.38	0.8

INDICATOR	M	SD
		9

The table presents the mean (M) and standard deviation (SD) scores for indicators of librarians' readiness towards the adoption of AI technologies in selected university libraries in Nigeria. Willingness to learn AI tools recorded the highest mean score (M = 3.12, SD = 0.66), indicating that librarians generally have a positive attitude towards acquiring AI-related knowledge and skills. This was followed by basic AI awareness (M = 2.95, SD = 0.70), suggesting that respondents possess a moderate understanding of AI technologies and their applications in library services. However, technical skills in AI (M = 2.41, SD = 0.85) and institutional support (M = 2.38, SD = 0.89) recorded relatively lower mean scores, reflecting limited practical competencies and inadequate organizational support for AI implementation.

Conclusively, the findings reveal that while librarians are willing to embrace AI technologies and possess basic awareness of their potential, their readiness is constrained by insufficient technical skills and weak institutional support. This suggests that successful AI adoption will require sustained investment in staff training, capacity building, and institutional policies that promote AI integration in university libraries.

RQ4: What Challenges Affect the Adoption of AI Technologies in University Libraries in Nigeria?

Challenge	M	SD
Inadequate Funding	3.18	0.61
Poor ICT Infrastructure	3.05	0.68
Lack of AI Expertise	2.97	0.72
Absence of Policy Framework	2.88	0.75
Data Privacy Concerns	2.69	0.79

The table presents the mean (M) and standard deviation (SD) scores for the major challenges affecting the adoption of AI technologies in university libraries in Nigeria. Inadequate funding recorded the highest mean score ($M = 3.18$, $SD = 0.61$), identifying it as the most significant barrier to AI adoption. This was followed by poor ICT infrastructure ($M = 3.05$, $SD = 0.68$), lack of AI expertise ($M = 2.97$, $SD = 0.72$), and the absence of policy frameworks ($M = 2.88$, $SD = 0.75$), indicating that financial, technological, human capacity, and policy-related issues all constrain AI implementation. Although data privacy concerns recorded the lowest mean score ($M = 2.69$, $SD = 0.79$), respondents still regarded them as a notable challenge.

In summary, the findings reveal that inadequate funding and poor ICT infrastructure are the most critical obstacles to AI adoption in Nigerian university libraries, while insufficient AI expertise, weak policy frameworks, and data privacy concerns also hinder effective implementation. These results underscore the need for greater investment in digital infrastructure, staff capacity building, and institutional policies to facilitate sustainable AI integration in academic libraries.

Hypothesis Testing

A one-way Analysis of Variance was conducted to determine whether institutional ownership influences AI adoption.

Source	SS	df	MS	F	p
Between Groups	6.842	2	3.421	4.26	0.016
Within Groups	132.641	165	0.804		

Since $p = 0.016 < 0.05$, the null hypothesis was rejected.

Discussion of Findings

The findings of this study revealed that Artificial Intelligence (AI) adoption in Nigerian university libraries remains largely at a developmental or exploratory stage despite increasing awareness among professional librarians. This suggests that awareness alone does not necessarily translate into institutional implementation, particularly within resource constrained environments. This outcome aligns with the observations of Cox, Pinfield, and Rutter (2019), who reported that while academic libraries globally demonstrate growing interest in AI technologies, actual implementation remains slow due to institutional readiness challenges such as financial limitations, inadequate infrastructure, and lack of technical expertise.

The comparatively higher adoption level observed in private universities further reinforces the structural influence of funding models on technological innovation. Private

universities often possess greater administrative autonomy and flexible budgetary frameworks, which enhance their capacity to invest in emerging digital technologies such as AI-enabled cataloguing systems, predictive analytics tools, and automated user-service platforms. Similar findings were reported by Asemi et al (2021), who noted that institutional financial strength and managerial support significantly determine the extent to which libraries adopt intelligent information systems for service delivery and decision-making processes.

Furthermore, although librarians demonstrated generally positive attitudes toward AI adoption, effective implementation was hindered by limited technical competence and inadequate institutional support systems. This finding supports the assertion of Fang, et al (2025) that human capacity remains a critical determinant in the successful integration of intelligent systems within academic information environments. The authors emphasized that without sufficient digital literacy, professional training, and organizational backing, technological innovations risk becoming underutilized or misapplied within library operations.

Insights from practitioner communities also reveal that administrative enthusiasm for AI implementation often exceeds the practical readiness of library personnel, thereby creating resistance or ambivalence toward adoption. For instance, discussions among academic librarians indicate that institutional leadership may promote AI integration without providing adequate ethical training or technical support, leading to concerns about

job displacement, quality of service delivery, and over-reliance on automated tools in scholarly environments. This highlights the importance of aligning technological initiatives with staff development programmes and participatory implementation strategies to ensure sustainable adoption.

Taken together, these findings suggest that AI adoption in Nigerian university libraries is shaped not only by technological availability but also by institutional funding structures, workforce preparedness, and organizational policy support. Consequently, meaningful integration of AI into academic library systems will require coordinated investments in infrastructure development, professional capacity building, and strategic policy formulation to bridge the gap between awareness and practical implementation.

Recommendations

1. **Increase funding for AI infrastructure in university libraries:** Government agencies, university management, and intervention bodies such as TETFund should allocate dedicated funds for the acquisition and maintenance of AI technologies, including RFID systems, AI-powered cataloguing tools, chatbots, intelligent discovery systems, and the supporting hardware and software required for their effective operation.
2. **Provide continuous professional training on AI technologies:** Universities should organize regular workshops, seminars, certification programmes, and hands-

on training to equip librarians and ICT personnel with the knowledge and practical skills needed to effectively deploy, manage, and utilize AI technologies in library operations and service delivery.

3. **Develop institutional AI implementation policies:** University administrations should formulate clear policies and strategic frameworks that guide the planning, procurement, ethical use, governance, security, and evaluation of AI technologies. Such policies will promote standardization, responsible AI adoption, and long-term sustainability.
4. **Invest in robust ICT infrastructure:** University management should strengthen the technological environment by providing reliable internet connectivity, stable electricity supply, modern computer systems, cloud-based platforms, and secure network infrastructure to support the successful implementation and continuous operation of AI applications.
5. **Promote collaboration with technology experts and industry partners:** University libraries should establish partnerships with ICT firms, AI solution providers, research institutions, professional library associations, and academic departments to facilitate technology transfer, staff capacity building, joint research, system customization, and access to emerging AI innovations.

These recommendations are practical, achievable within existing university governance structures, and directly address the major barriers to AI adoption identified in the study.

Conclusion

The findings of this study indicate that Artificial Intelligence (AI) technologies are moderately adopted in Nigerian university libraries, reflecting a gradual shift toward digitally enhanced service delivery. While tools such as RFID systems, intelligent OPACs, and virtual reference platforms are being implemented in some institutions, the overall level of integration remains at a developmental stage. This suggests that although awareness and interest in AI are growing among librarians, full-scale adoption of advanced AI applications has not yet been achieved across many universities.

The study further reveals that institutional ownership significantly influences the level of AI adoption, with private universities leading in implementation compared to federal and state institutions. This disparity may be linked to differences in funding capacity, administrative flexibility, infrastructure, and strategic priorities. The findings therefore underscore the importance of sustained investment, supportive governance structures, and professional capacity development in strengthening AI integration within Nigerian university libraries.

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