

Impact of Artificial Intelligence on Management of Federal University Libraries in North-Western States of Nigeria

By

¹Aliyu Muazu Dakingari & ²Babangida Umar Dangani, PhD

¹Department of Library and Information Science, Faculty of Social Sciences, Taraba State University, Jalingo, aliyumazudakingari@gmail.com

²Dept. of library and information science, Ahmadu Bello University, Zaria.
nadandani44@gmail.com

Abstract

The management of federal university libraries in Nigeria's North-Western states faces persistent challenges including outdated cataloging systems, inefficient resource management, limited real-time user support, and inadequate digital archiving mechanisms. This study examined the impact of Artificial Intelligence (AI) on library management across these institutions, focusing on five dimensions: AI-enabled cataloging and classification, automated resource management, AI-based user support systems, predictive analytics, and digital archiving. Anchored in Cognitive Science Theory and Henri Fayol's Administrative Management Theory, a descriptive survey design was adopted. The population comprised 135 librarians drawn from seven federal university libraries in the North-West geopolitical zone of Nigeria, with total population sampling employed. A researcher-developed questionnaire the Impact of Artificial Intelligence on Management Questionnaire (IAIMQ) comprising 40 items on a 4-point Likert scale was used for data collection. Face and content validity were established through expert review; reliability was confirmed via Cronbach's Alpha ($\alpha = 0.87$). Data were analyzed using mean, standard deviation, and chi-square statistics. Findings revealed that AI-enabled cataloging and classification (Grand Mean = 3.62), automated resource management (Grand Mean = 3.71), AI-based user support systems (Grand Mean = 3.58), predictive analytics (Grand Mean = 3.64), and digital archiving (Grand Mean = 3.69) all significantly impact library management efficiency, resource organization, user satisfaction, and digital preservation. The study recommends sustained investment in AI infrastructure, structured capacity-building for library professionals, and supportive national policy frameworks to facilitate AI adoption in Nigerian university libraries.

Keywords: artificial intelligence; library management; university libraries; cataloging; automated resource management

Introduction

Management is the process of coordinating resources, activities, and people to achieve organizational goals effectively and efficiently, encompassing planning, organizing, leading, and controlling tasks within available resource constraints (Drucker & Maciariello, 2020; Mintzberg, 2019). Modern management increasingly emphasizes innovation, teamwork, and data-driven decision-making to enhance productivity and sustainability. University libraries serve as pivotal

knowledge repositories underpinning teaching, learning, and research. Effective library management involves cataloging, classification, user support, resource access, and digital archiving, all aimed at enhancing service delivery and user satisfaction (Husain & Nazim, 2016). However, in the digital age, traditional library management practices face mounting challenges: limited resources, escalating user expectations, and the exponential growth of digital information (Omosekejimi & Blessing, 2019). Federal university libraries in Nigeria's North-Western states are striving to bridge the gap between resource constraints and demands for quality services.

Artificial Intelligence (AI) refers to the simulation of human intelligence by machines to perform tasks such as learning, reasoning, problem-solving, and decision-making through machine learning, natural language processing, and data analytics (Russell & Norvig, 2020). AI has emerged as a revolutionary tool in library management, facilitating intelligent cataloging, real-time user support, resource automation, and predictive analytics for data-driven decision-making. Globally, AI applications in library management have demonstrated increased efficiency, reduced operational costs, and improved user satisfaction. AI-powered cataloging systems classify resources accurately and uniformly (Smith & Anderson, 2018), while AI-based virtual assistants provide round-the-clock user support. In Nigerian federal universities, libraries face significant challenges outdated systems, inefficient resource organization, and limited digital infrastructure that hinder effective support of academic and research activities. The adoption of AI offers transformative potential to address these challenges by streamlining processes and aligning library services with international standards.

This study is therefore positioned to empirically examine, for the first time, the specific impact of five AI dimensions cataloging and classification, automated resource management, user support systems, predictive analytics, and digital archiving on the management of federal university libraries across the seven states of Nigeria's North-West geopolitical zone. By generating locally grounded evidence, the study aims to inform institutional strategies, national policies, and professional development frameworks needed to accelerate meaningful AI adoption in this context.

Cognitive Science Theory, rooted in the interdisciplinary contributions of Herbert Simon, Allen Newell, Noam Chomsky, and John McCarthy in the 1950s and 1960s, seeks to understand how humans acquire, process, store, and apply knowledge. It combines insights from psychology, neuroscience, linguistics, philosophy, anthropology, and computer science to model human cognitive processes (Nilsson, 2019). This theory is directly applicable to AI-enabled library systems, as AI mimics cognitive processes learning, reasoning, and decision-making — to automate cataloging, resource management, user support, predictive analytics, and digital archiving (Floridi & Chiriatti, 2020).

Henri Fayol's Administrative Management Theory identifies five primary functions of management planning, organizing, commanding (leading), coordinating, and controlling and proposes 14 principles emphasizing clarity of roles, effective communication, and balanced authority (Robbins, DeCenzo, & Coulter, 2017). Applied to university library management: planning guides collection development and technology upgrades; organizing ensures proper resource allocation; leading motivates library staff toward quality service delivery; coordinating

integrates acquisitions, cataloging, and user support; and controlling enables performance monitoring and service improvement. Fayol's framework underscores how AI technologies can be systematically integrated into each management function to enhance library operational efficiency.

Statement of the Problem

Libraries in federal universities within Nigeria's North-Western states are burdened with persistent operational inefficiencies: outdated cataloging systems, inadequate resource management, absence of real-time user support, and insufficient digital archiving mechanisms. These challenges are compounded by limited funding, inadequate ICT infrastructure, and a shortage of technical expertise, collectively undermining librarians' capacity to meet users' evolving information needs.

While AI technologies including intelligent cataloging, automated resource management, AI-based user support, and predictive analytics have demonstrated transformative impacts on library management globally, their adoption in Nigerian university libraries remains minimal. The extent to which these technologies can meaningfully impact library management in the North-Western states context remains empirically underexplored. Without adequate research and evidence-based implementation, libraries in this region risk widening the gap between local practices and global standards, with adverse consequences for educational and research quality. This study therefore investigates the impact of AI on library management across these institutions.

Objectives of the Study

The main purpose of this study is to examine the impact of Artificial Intelligence on the management of federal university libraries in the North-Western states of Nigeria. Specifically, the study seeks to examine the impact of:

1. AI-enabled cataloging and classification on management of federal university libraries in North-Western states, Nigeria.
2. AI automated resource management on management of federal university libraries in North-Western states, Nigeria.
3. AI-based user support systems on management of federal university libraries in North-Western states, Nigeria.
4. AI predictive analytics on management of federal university libraries in North-Western states, Nigeria.
5. AI digital archiving on management of federal university libraries in North-Western states, Nigeria.

Research Methodology

A descriptive survey research design was adopted. The population of the study comprised 135 librarians from seven federal university libraries in the North-Western states of Nigeria. Total population sampling was adopted because the population is of manageable size and possesses the uncommon characteristic of direct responsibility for AI-enabled library management. This

technique ensures comprehensive data coverage and eliminates sampling error (Sekaran & Bougie, 2013). Data were collected using a researcher-developed instrument titled the "Impact of Artificial Intelligence on Management Questionnaire" (IAIMQ). Face and content validity were established through expert review by three specialists: two from Library and Information Science and one from Measurement and Evaluation, Faculty of Education, Taraba State University, Jalingo. Reliability was established through a pilot test conducted with 20 library staff from Taraba State University, Jalingo and Federal University Wukari. The Cronbach's Alpha method yielded a reliability coefficient of 0.87, indicating high internal consistency. Data were analyzed using mean and standard deviation to answer the research questions. A criterion mean of 2.50 and above was adopted as the threshold for agreement (i.e., AI has impact), while a mean below 2.50 indicates disagreement (i.e., no impact). Chi-square (χ^2) statistics were used to test the null hypotheses at the 0.05 significance level. All analyses were conducted using IBM SPSS Version 21.

Results

Demographic Profile of Respondents

Table 1: Demographic Characteristics of Respondents (N = 135)

Variable/Category	Frequency (f)	Percentage (%)
Sex		
Male	72	53.3
Female	63	46.7
Qualification		
ND/Technician Certificate	18	13.3
HND/B.Sc/B.LIS	67	49.6
Postgraduate (MLS/Ph.D)	50	37.1
Years of Experience		
Less than 5 years	38	28.1
5–10 years	54	40.0
More than 10 years	43	31.9
Total	135	100.0

Source: Field Survey, 2024/2025.

Table 2 presents the demographic profile of respondents. Male librarians constituted the majority (53.3%). The modal qualification was HND/B.Sc/B.LIS (49.6%), followed by postgraduate qualifications (37.1%), indicating a well-educated workforce. Respondents with 5–10 years of

experience constituted the largest group (40.0%), suggesting a productive mid-career workforce with meaningful exposure to both traditional and emerging library management approaches.

Objective 1: Impact of AI-Enabled Cataloging and Classification

Table 2: Mean Ratings on Impact of AI-Enabled Cataloging and Classification on Library Management (N = 135)

S/N	Item Statement	Mean	Std Dev	Decision
1	AI-enabled systems improve the accuracy of subject classification of library resources.	3.74	0.61	Agreed
2	AI automates the assignment of metadata to new materials, reducing manual workload.	3.68	0.64	Agreed
3	AI assists in standardizing cataloging formats to ensure consistency across records.	3.59	0.71	Agreed
4	AI-enabled classification enhances the retrieval speed of library resources for users.	3.71	0.58	Agreed
5	AI helps identify and correct duplicate and erroneous catalog records efficiently.	3.52	0.77	Agreed
6	AI tools facilitate easier updating and maintenance of classification systems.	3.61	0.69	Agreed
7	AI-enabled cataloging supports effective resource sharing and inter-library collaboration.	3.55	0.74	Agreed
8	Librarians receive adequate training to effectively utilize AI in cataloging tasks.	3.55	0.78	Agreed
Grand Mean		3.62	0.69	Agreed

Source: Field Survey, 2024/2025. Decision rule: Mean \geq 2.50 = Agreed; Mean $<$ 2.50 = Disagreed.

Table 3: Hypothesis Test Result — $\chi^2(\text{calc}) = 21.34, df = 3, p = 0.001 < 0.05. H_0$ Rejected.

Table 3 shows that all eight items on AI-enabled cataloging and classification recorded means above the criterion mark of 2.50, ranging from 3.52 to 3.74. The grand mean of 3.62 (SD = 0.69) indicates that respondents agreed that AI-enabled cataloging and classification significantly impacts library management. The highest-rated item was the improvement of subject classification accuracy (M = 3.74), confirming that AI's primary perceived value in cataloging lies in precision enhancement. The chi-square result ($\chi^2 = 21.34, p = 0.001$) confirms statistical significance, leading to the rejection of H_0 .

Objective 2: Impact of AI Automated Resource Management

Table 3: Mean Ratings on Impact of AI Automated Resource Management on Library Management (N = 135)

S/N	Item Statement	Mean	Std Dev	Decision
9	Automated AI systems effectively track the borrowing and return of library resources.	3.78	0.57	Agreed
10	Automated resource management optimizes acquisition of new materials based on user demand.	3.71	0.62	Agreed
11	Automated systems provide timely and accurate inventory reports for management decisions.	3.69	0.66	Agreed
12	Overdue reminders and notifications are efficiently handled by automated library systems.	3.75	0.60	Agreed
13	Automated resource allocation ensures equitable access to limited library resources.	3.65	0.70	Agreed
14	AI-powered recommendations assist in purchasing resources aligned with users' needs.	3.72	0.63	Agreed
15	Automated systems reduce the workload of librarians in managing resource circulation.	3.76	0.58	Agreed
16	The integration of automated resource management improves overall user satisfaction.	3.69	0.67	Agreed
Grand Mean		3.71	0.63	Agreed

Source: Field Survey, 2024/2025.

Table 4: Hypothesis Test Result — $\chi^2(\text{calc}) = 24.18, df = 3, p = 0.000 < 0.05. H_{02}$ Rejected.

Table 4 reveals that automated resource management recorded the highest grand mean among all five dimensions (Grand Mean = 3.71, SD = 0.63). All items exceeded the criterion mark, ranging from 3.65 to 3.78. The highest mean was recorded for the tracking of borrowing and return of resources (M = 3.78), confirming that resource circulation automation is the most immediately valued function among respondents. The chi-square result ($\chi^2 = 24.18, p = 0.000$) confirms statistical significance, leading to rejection of H_{02} . This finding underscores the operational importance of circulation automation in environments where manual tracking has historically produced errors and inefficiencies.

Objective 3: Impact of AI-Based User Support Systems

Table 4: Mean Ratings on Impact of AI-Based User Support Systems on Library Management (N = 135)

S/N	Item Statement	Mean	Std Dev	Decision
17	AI-based virtual assistants efficiently provide real-time answers to user queries.	3.61	0.70	Agreed
18	AI chatbots effectively guide users in locating library materials.	3.55	0.74	Agreed
19	AI systems recommend relevant resources based on users' research interests.	3.63	0.67	Agreed
20	AI-based user support systems enhance user satisfaction through 24/7 assistance.	3.67	0.65	Agreed
21	AI platforms simplify the process of accessing digital library archives.	3.52	0.78	Agreed
22	AI tools reduce librarian workload by handling routine inquiries efficiently.	3.60	0.71	Agreed
23	AI-powered systems handle multilingual queries to support diverse user needs.	3.49	0.81	Agreed
24	AI-based user support systems improve the overall operational efficiency of library services.	3.60	0.72	Agreed
Grand Mean		3.58	0.72	Agreed

Source: Field Survey, 2024/2025.

Table 5: Hypothesis Test Result $\chi^2(\text{calc}) = 18.92, df = 3, p = 0.003 < 0.05. H_{03}$ Rejected.

Table 5 presents findings on AI-based user support systems, recording a grand mean of 3.58 (SD = 0.72). All items exceeded the 2.50 criterion, with means ranging from 3.49 to 3.67. The highest mean was for 24/7 user assistance capability (M = 3.67), reflecting respondents' recognition of continuous service availability as a key benefit. The multilingual query handling item recorded the lowest mean (M = 3.49), suggesting that language diversity support is less advanced or less experienced in current library systems in the study area. The chi-square result ($\chi^2 = 18.92, p = 0.003$) confirms statistical significance and H_{03} is rejected.

Objective 4: Impact of AI Predictive Analytics

Table 5: Mean Ratings on Impact of AI Predictive Analytics on Library Management (N = 135)

S/N	Item Statement	Mean	Std Dev	Decision
25	Predictive analytics effectively forecasts user demand for specific library resources.	3.66	0.67	Agreed

S/N	Item Statement	Mean	Std Dev	Decision
26	Predictive analytics aids in determining priority areas for resource acquisition.	3.71	0.62	Agreed
27	Predictive analytics helps identify underutilized resources for better reallocation.	3.62	0.69	Agreed
28	Predictive analytics tools assist in planning future infrastructure and space requirements.	3.58	0.73	Agreed
29	Predictive analytics is used to identify patterns in resource borrowing and usage trends.	3.65	0.66	Agreed
30	Predictive analytics supports preservation of rare materials by prioritizing digital archiving.	3.60	0.71	Agreed
31	Predictive analytics improves decision-making by providing insights into emerging research topics.	3.68	0.64	Agreed
32	Predictive analytics ensures efficient resource distribution to meet user needs effectively.	3.64	0.68	Agreed
Grand Mean		3.64	0.68	Agreed

Source: Field Survey, 2024/2025.

Table 6: Hypothesis Test Result $\chi^2(\text{calc}) = 20.57, df = 3, p = 0.001 < 0.05. H_{04}$ Rejected.

Table 6 shows that predictive analytics recorded a grand mean of 3.64 (SD = 0.68), with all items exceeding the criterion mark. Resource acquisition prioritization (M = 3.71) and research topic insight generation (M = 3.68) were the highest-rated items, indicating that respondents value predictive analytics most for strategic collection development and evidence-based decision-making. Infrastructure planning recorded the lowest mean (M = 3.58), suggesting this application is less developed or less familiar in the study context. The chi-square result ($\chi^2 = 20.57, p = 0.001$) is significant, leading to rejection of H_{04} .

Objective 5: Impact of AI Digital Archiving

Table 6: Mean Ratings on Impact of AI Digital Archiving on Library Management (N = 135)

S/N	Item Statement	Mean	Std Dev	Decision
33	AI systems ensure efficient digitization of physical materials for long-term preservation.	3.73	0.60	Agreed
34	AI-based digital archiving enhances the discoverability of archived resources.	3.70	0.63	Agreed

S/N	Item Statement	Mean	Std Dev	Decision
35	AI tools identify and prioritize critical materials for digital preservation.	3.65	0.68	Agreed
36	AI-driven predictive analytics supports planning for digital storage capacity.	3.62	0.70	Agreed
37	AI technology facilitates creation of high-quality digital replicas of rare documents.	3.75	0.59	Agreed
38	AI systems enhance remote access to archived materials for library users.	3.71	0.62	Agreed
39	AI-enabled archiving systems improve the accuracy of metadata for digital resources.	3.68	0.65	Agreed
40	AI tools assist in monitoring and mitigating risks to digital preservation such as data corruption.	3.66	0.67	Agreed
Grand Mean		3.69	0.64	Agreed

Source: Field Survey, 2024/2025.

Table 7: Hypothesis Test Result $\chi^2(\text{calc}) = 22.83, df = 3, p = 0.001 < 0.05. H_0s$ Rejected.

Table 7 reveals that digital archiving recorded a grand mean of 3.69 (SD = 0.64), the second-highest among all five dimensions. The creation of high-quality digital replicas of rare documents (M = 3.75) and efficient digitization of physical materials (M = 3.73) were the highest-rated items, reflecting respondents' acute awareness of the value of AI in preserving institutional heritage and rare materials a particularly salient concern in libraries holding unique historical records. All hypotheses tests were significant ($\chi^2 = 22.83, p = 0.001$), leading to rejection of H_0s .

Table 7: Summary of Grand Means across all Five AI Dimensions

S/N	AI Dimension	Grand Mean	Std Dev	Decision
1	AI-Enabled Cataloging and Classification	3.62	0.69	Agreed
2	AI Automated Resource Management	3.71	0.63	Agreed
3	AI-Based User Support Systems	3.58	0.72	Agreed
4	AI Predictive Analytics	3.64	0.68	Agreed

S/N	AI Dimension	Grand Mean	Std Dev	Decision
5	AI Digital Archiving	3.69	0.64	Agreed
Overall Grand Mean		3.65	0.67	Agreed

Source: Field Survey, 2024/2025.

Table 8 presents a consolidated summary of grand means across all five AI dimensions. All dimensions recorded means above the 2.50 criterion, with an overall grand mean of 3.65 (SD = 0.67), confirming that AI significantly impacts library management across all measured dimensions. Automated resource management recorded the highest mean (3.71), followed by digital archiving (3.69), predictive analytics (3.64), cataloging and classification (3.62), and user support systems (3.58). The consistent pattern of agreement across all five dimensions with all means falling between 3.58 and 3.71 indicates a remarkably uniform and strongly positive perception of AI's impact on library management among librarians in the North-Western states.

Discussion of Findings

The finding that AI-enabled cataloging and classification significantly impacts library management (Grand Mean = 3.62, $\chi^2 = 21.34$, $p = 0.001$) is consistent with the existing literature. Oluwaseun and Omolara (2022) found that AI reduced manual labor and enhanced accuracy in cataloging in Nigerian university libraries, while Smith and Lee (2019) demonstrated that AI chatbots enhanced metadata management efficiency. The high mean for subject classification accuracy (M = 3.74) corroborates Gnanasekar and Rajkumar's (2018) finding that AI systems can identify patterns in large datasets to classify resources under appropriate categories automatically. These results confirm that Nigerian academic librarians in the North-West recognize and experience the utility of AI in addressing the cataloging inconsistencies and inefficiencies that have long characterized manual cataloging systems.

Automated resource management emerged as the dimension with the highest grand mean (3.71), a finding consistent with Afolabi (2022), who documented significant improvements in resource acquisition, cataloging, and retrieval through automated systems in South-West Nigerian university libraries. The highest-rated item automated tracking of borrowing and return (M = 3.78) aligns with Kumar and Singh's (2021) documentation that ARM facilitates real-time inventory tracking in university libraries. The slightly lower mean for resource allocation equity (M = 3.65) may reflect respondents' awareness that while automated systems improve efficiency, ensuring equitable access across all user groups requires deliberate governance beyond the algorithm. These findings collectively validate the ARM literature's argument that automation reduces human error and optimizes resource utilization (Xu et al., 2019; Chen & Zhang, 2020).

The significant impact of AI-based user support systems (Grand Mean = 3.58, $\chi^2 = 18.92$, $p = 0.003$) corroborates findings by Smith and Johnson (2023) and Okafor and Adeyemi (2021). The highest mean for 24/7 assistance (M = 3.67) confirms Yang et al.'s (2018) documentation that AI systems provide round-the-clock support, a particularly valuable feature in university libraries

where student demand extends beyond regular operational hours. The relatively lower mean for multilingual query handling ($M = 3.49$) is consistent with Ibrahim et al.'s (2018) finding that limited local language support remains a documented barrier to AI user support adoption in developing-country contexts, including the multilingual environment of North-Western Nigeria.

The significant impact of AI predictive analytics (Grand Mean = 3.64, $\chi^2 = 20.57$, $p = 0.001$) aligns with Brown and Lee (2023), who found that predictive analytics improved resource allocation efficiency and reduced acquisition costs in US university libraries. The strong rating for acquisition prioritization ($M = 3.71$) reflects Zhao and Wang's (2020) documentation that libraries leveraging predictive analytics are better positioned to anticipate user demand and make strategic collection decisions. Okeke and Chukwu's (2018) finding that predictive analytics enhanced decision-making accuracy in Nigerian university libraries provides the closest comparable Nigerian context, and the current study's findings offer expanded empirical confirmation across the North-West geopolitical zone specifically.

AI digital archiving recorded the second-highest grand mean (3.69), consistent with Zhang and Liu (2021) and Okoro and Adeyemi (2020). The particularly high mean for creating digital replicas of rare documents ($M = 3.75$) is especially significant in the North-West geopolitical zone context, where many federal university libraries house unique cultural, historical, and academic heritage materials that are vulnerable to physical deterioration. This finding validates Brown et al.'s (2020) documentation that AI enables scalable solutions for archiving, ensuring efficient management of resources and long-term digital preservation. The strong remote access enhancement rating ($M = 3.71$) further confirms that respondents value AI's capacity to extend the geographic reach of archival resources beyond the physical library.

Conclusion

This study has established, through empirical evidence drawn from 135 librarians across seven federal university libraries in Nigeria's North-Western states, that Artificial Intelligence significantly impacts library management across all five examined dimensions. All five null hypotheses were rejected at the 0.05 significance level, confirming that AI-enabled cataloging and classification, automated resource management, AI-based user support systems, predictive analytics, and digital archiving each make a statistically significant positive contribution to library management effectiveness. The overall grand mean of 3.65 across all dimensions indicates a strongly positive and consistent perception of AI's transformative potential among library professionals in the study area.

Recommendations

Based on the findings of this study, the following recommendations are advanced:

- i. Federal and state governments should substantially increase budgetary allocations to AI infrastructure in federal university libraries, including procurement of AI-enabled library management systems, reliable hardware, and high-speed internet connectivity — the foundational prerequisites for meaningful AI adoption.

- ii. The National Universities Commission (NUC) should incorporate AI competency standards into minimum standards for university libraries and enforce compliance as a condition of institutional accreditation, ensuring baseline AI readiness across all federal institutions.
- iii. University managements should develop and fund structured, role-differentiated AI capacity-building programs for library staff, addressing the specific competency gaps in AI-enabled cataloging, automated systems management, predictive analytics, and digital archiving operations.
- iv. The Librarians' Registration Council of Nigeria (LRCN) should develop mandatory continuing professional development (CPD) frameworks specifying minimum annual AI and digital library training hours as a condition of continued professional registration for academic librarians.
- v. University libraries should constitute AI adoption committees, comprising library professionals, ICT staff, and university management representatives, to develop institution-specific AI roadmaps, oversee implementation, and evaluate outcomes systematically.

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