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Adoption and Impact of Artificial Intelligence on Research Support and Knowledge Management in Academic Libraries: Evidence from the Mubi Zone, Nigeria.

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ABSTRACT
Artificial intelligence (AI) has emerged as a significant driver of change in research support services and knowledge management practices within academic libraries globally transformative despite increasing interest and awareness, the institutional adoption of AI in Nigerian academic libraries remains limited. This study examined the extent of awareness, readiness, adoption, and impact of AI tools on research support and knowledge management in academic libraries in the Mubi Zone, Nigeria. investigated A descriptive survey research design was employed, involving 118 librarians and library staff drawn from Adamawa State University, Federal Polytechnic Mubi, and Federal University of Agriculture, Mubi comprising Data were collected using structured questionnaires and semi-structured interviews. Descriptive statistics were used to analyze levels of awareness, usage patterns, and infrastructural readiness, while one-way Analysis of Variance (ANOVA) was applied to test differences across institutions. The findings revealed that although librarians demonstrated a high level of awareness of AI technologies, actual adoption remained low and largely experimental. AI applications were mainly utilized for basic services such as metadata generation, virtual reference, and repository support, with limited application in advanced research analytics and predictive knowledge management. Predominantly Major challenges identified included inadequate ICT infrastructure, limited technical expertise, absence of institutional AI policies, and insufficient funding. The study concludes that AI adoption in Mubi Zone academic libraries is still at an early stage and recommends strategic investment in infrastructure, staff capacity development, and policy frameworks to enable sustainable AI integration.

Keywords: Artificial Intelligence, Academic Libraries, ICT Infrastructure, Research Support Services, Knowledge Management, Professional Development

INTRODUCTION

Background of the study

The last decade has seen an accelerating convergence of artificial intelligence (AI) and knowledge institutions. AI systems particularly machine learning (ML), natural language processing (NLP), recommender algorithms and conversational agents are being deployed to improve search and discovery, automate metadata generation and routine technical services, support research data analytics, and deliver personalized user services (Concha, Palacios Zenteno, & Tello Alfaro, 2024). Bibliometric and systematic reviews show a notable increase in AI related research in library and information science since 2020, with a surge in practical pilot projects and conceptual work after 2022 as generative models and other AI toolkits matured and became widely available (Islam, Ahmad, Aqil, & Hu 2025).

In Africa the uptake of AI in libraries is uneven but growing. Case studies across West and East Africa report pilots of chatbots, intelligent discovery layers, automated cataloguing experiments, and plagiarism detection systems; simultaneously, authors highlight chronic constraints intermittent power, limited high-speed internet, and scarce institutional funding that limit scale and sustainability (Achugbue, 2024). Within the Nigerian context, recent examinations indicate that librarians are increasingly aware of AI's potential for service improvement (cataloguing, virtual reference, metadata enrichment, and analytics), yet adoption at the institutional service level remains largely exploratory rather than systemic. Several descriptive surveys across Nigerian regions report high awareness but low availability of mature AI tools inside library production systems; common barriers reported include inadequate ICT infrastructure, limited staff training, and absence of institutional policies governing AI use (Ibrahim & Okpala, 2024).

The Mubi Zone (Adamawa State and environs) is home to tertiary institutions and agricultural research activity that depend on effective knowledge services. Although there is growing institutional interest in digital transformation at Adamawa State University and related libraries, there are no published, in depth empirical studies that specifically investigate the intersection of AI, agricultural research support, and knowledge management in the Mubi Zone's academic libraries. Local institutional reports and conference papers indicate pockets of experimentation (for example, metadata generation using ChatGPT and training workshops) but these remain fragmented in scope and documentation (Sugabsen & Amos, 2025). Consequently, the Mubi Zone represents an important and under-researched context in which to examine how AI applications might be integrated to support agricultural research and to strengthen libraries' knowledge management (KM) functions.

Problem statement

Research, particularly in data-intensive fields such as agriculture, increasingly relies on efficient access to scholarly information, advanced discovery tools, data curation services, and well-managed institutional repositories. Academic libraries are strategically positioned to support these needs through the adoption of AI-driven solutions. However, in many Nigerian academic libraries, including those in the Mubi Zone, the integration of AI into library workflows remains limited.

Existing studies suggest a disconnect between librarians' awareness of AI technologies and their actual institutional deployment. Constraints such as inadequate infrastructure, limited technical competencies, lack of formal AI policies, and insufficient funding continue to hinder sustainable adoption. In the absence of empirical evidence specific to the Mubi Zone, library administrators and policymakers lack the contextual insights needed to make informed decisions regarding AI

investments. This study therefore investigates the extent, nature, and impact of AI adoption on research support and knowledge management in academic libraries within the Mubi Zone, Nigeria.

Research Objectives

1. To assess the awareness, readiness, and current use of AI tools among librarians and library staff in academic libraries within the Mubi Zone.
2. To evaluate the contribution and influence of AI applications on research support services and knowledge management practices.
3. To identify the major barriers and enabling factors affecting AI integration and propose strategies for sustainable adoption in academic libraries.

Research Questions

1. What is the level of awareness, readiness, and usage of AI tools among librarians and library staff in the Mubi Zone?
2. How do AI applications contribute to research support services and influence knowledge management practices in the sampled libraries?
3. What barriers and enabling factors affect AI adoption, and what strategies can support sustainable AI integration in academic libraries?

Hypotheses:

H_{01}: There is no significant relationship between librarians' AI awareness/readiness and the adoption of AI tools in academic libraries.

H_{02}: AI adoption has no significant effect on research support services and knowledge management practices in the Mubi Zone academic libraries.

REVIEW OF RELATED LITERATURE

Conceptual Foundations

Artificial intelligence (AI) in academic libraries refers to technologies capable of performing tasks that traditionally require human cognition, such as reasoning, problem-solving, and language processing (Akinola, 2023). Common applications include chatbots for virtual reference, machine learning-based recommendation systems, robotic automation, and AI-powered metadata generation (Bashorun, Tella, & Ajani, 2024). By automating routine tasks and enabling advanced search and discovery, AI tools help libraries improve service efficiency and offer personalized support to users. These technologies are particularly relevant for enhancing research support and knowledge management (KM), as they allow libraries to transition from static repositories to proactive knowledge organizations.

Academic libraries provide research support services that encompass literature retrieval, reference assistance, data curation, bibliometric analyses, and management of institutional repositories. AI applications can significantly augment these services by providing faster, more accurate, and tailored support. For example, chatbots can serve as first-line reference points, machine learning algorithms can predict research trends or recommend relevant resources, and AI-enabled analytics can help librarians track patterns in research outputs (Orubebe, Braide, & Oladokun, 2021). These capabilities make AI a strategic tool in supporting the research needs of scholars, particularly in data-intensive fields such as agriculture.

Knowledge management in libraries involves systematic strategies to acquire, organize, store, and disseminate both explicit and tacit knowledge (Krishnamurthy & Arali, 2025). AI supports KM by enabling intelligent document clustering, automated metadata generation, predictive analysis of

research needs, and maintenance of digital repositories. These processes ensure that knowledge is not only preserved but also readily accessible and effectively utilized by researchers. In this way, AI contributes to the libraries' mission of facilitating knowledge creation, sharing, and preservation.

The integration of AI in research support and KM is interconnected. AI tools enhance research services by automating routine tasks, which generates enriched data that can feed into knowledge management systems. For instance, usage patterns collected from AI-driven reference services can help libraries identify knowledge gaps, refine resource organization, and optimize retrieval systems. However, AI adoption also introduces challenges, including data privacy concerns, potential algorithmic bias, and the need for adequate infrastructure and training (Akinola, 2023). These factors must be considered to ensure effective, ethical, and sustainable implementation of AI in libraries.

Theoretical Frameworks

Two theoretical models are commonly used to understand technology adoption in library contexts. The Technology Acceptance Model (TAM) suggests that perceived usefulness and perceived ease of use influence users' attitudes and intentions to adopt technology (Davis, 1989). In libraries, if AI tools are perceived as highly beneficial for research support or KM, librarians are more likely to embrace them. Conversely, if they are viewed as difficult to use, adoption may be hindered (Kotso, Gbaje, & Yabanet, 2025).

The Diffusion of Innovation (DOI) theory explains how new technologies spread through social systems over time. In academic libraries, AI adoption depends on factors such as relative advantage over existing methods, compatibility with current workflows, trial ability through pilot programs, and observable benefits. Early adopters and innovators play a key role in demonstrating the value of AI, influencing wider acceptance among library staff (Igbo, Imo, Jidere, & Ugwu, 2025).

Empirical Review

Empirical evidence on AI integration in Nigerian academic libraries reveals varying levels of awareness, competency, and adoption. In a foundational study, Orubebe, Braide, and Oladokun (2021) surveyed 39 librarians across academic institutions in Rivers State, Nigeria, to assess their knowledge and readiness regarding AI technology. Their findings indicated that while many librarians held a basic understanding of AI and recognized its potential to enhance tasks such as predicting user search trends and managing data, they were deeply concerned about the lack of infrastructure (e.g., computing resources) and training opportunities. The study also surfaced anxieties about job displacement, signaling that librarians' perceptions of AI were influenced not only by technical utility but also by professional risk.

Building on the theme of readiness, Kotso, Gbaje, and Yabanet (2025) conducted a nationwide survey of 73 academic librarians to evaluate their AI literacy and attitudes toward adoption. Using constructs drawn from the Technology Acceptance Model (TAM), the authors found that perceived usefulness of AI strongly predicted positive attitudes (correlation coefficient $r = 0.713$), whereas perceived ease of use had a weaker but still positive correlation ($r = 0.183$). Significantly, while most respondents were familiar with basic AI tools such as plagiarism detection and search engines, awareness of more advanced applications like predictive analytics and AI-powered cataloguing remained low. The authors argue for structured, institutional training to bolster librarians' AI competencies and ultimately drive meaningful adoption.

In exploring situational awareness, Okuonghae and Tunmibi (2025) surveyed 107 librarians from 18 universities across Edo and Delta States. Their results showed a high level of situation awareness across the sample: librarians were generally knowledgeable about AI technologies, understood their functions (perception), comprehended how these could apply to library services (comprehension), and could project possible future uses (projection). Importantly, participants

recognized AI's relevance for information discovery and access, but also flagged limitations, particularly in infrastructure and consistent institutional support. This study underscores that high awareness does not automatically translate into adoption structural factors remain critical.

A broader, cross-continental perspective is offered by Abba (2025), who investigated AI adoption in 102 university libraries across English-speaking African countries. Through qualitative methods and content analysis, Abba found that only a limited number of libraries had embraced AI tools notably chatbots (including ChatGPT), robots, and RFID systems. These tools were being used for ready reference, self-checkout, cataloguing support, and statistical evaluation. The major obstacles to adoption were identified as lack of funding, insufficient training of librarians, and limited institutional understanding of AI. Abba recommends creating formal AI policies, investing in capacity building, and promoting strategic planning for sustainable AI integration.

Focusing on student readiness, Owolabi et al. (2022) surveyed 320 final-year polytechnic students across five Nigerian institutions to assess their awareness of AI in library settings. The study revealed that students are generally aware of AI in libraries, often gaining exposure during orientation programs; however, they cited unstable power supply as a significant barrier to future AI use. The authors call for library management to consider alternative power solutions and for academic curricula to include practical ICT and AI training to support future usage.

Finally, Olaseinde (2025) explored librarians' perceptions of AI adoption in Nigerian academic libraries through a structured questionnaire administered to librarians across several institutions. Findings indicate that many librarians do not yet fully appreciate the transformative potential of AI, pointing to a deficit in awareness and formal training. The study suggests that continuous professional development is necessary to close the gap between AI potential and practical implementation, and encourages institutional leadership to support AI adoption through training, policy, and resource allocation.

Synthesis and Research Gaps

The literature consistently shows a growing awareness of AI among librarians in Nigeria and Africa, yet adoption remains limited due to infrastructural, financial, and human resource constraints. TAM and DOI frameworks illustrate that perceived usefulness and relative advantage influence adoption, but compatibility and institutional support are equally crucial. A clear research gap exists for region-specific empirical studies, particularly in the Mubi Zone, which has received limited scholarly attention. Additionally, most studies focus on general library services, with few examining AI's role in research support for domain-specific areas such as agricultural research or its integration into KM systems. Addressing these gaps will provide actionable insights for sustainable AI adoption in academic libraries.

RESEARCH METHODOLOGY

Research Design

This study adopted a descriptive survey design, which is widely recognized as appropriate for examining attitudes, perceptions, and practices in educational and library contexts (Creswell & Creswell, 2018). The descriptive survey method allows the researcher to collect quantitative and qualitative data from respondents to assess AI integration in agricultural research support and knowledge management in academic libraries. This design enables the identification of patterns, trends, and relationships between variables such as AI competency, library infrastructure, and knowledge management practices.

Population of the Study

The study population comprised librarians and library staff from three academic institutions in the Mubi Zone, Nigeria:

- ✓ Adamawa State University (ADSU), Mubi – 54 librarians
- ✓ Federal Polytechnic, Mubi (FPM) – 41 librarians
- ✓ Federal University of Agriculture, Mubi (FUAM) – 23 librarians

The total population was 118 librarians, encompassing professional librarians, para-professionals, and library support staff involved in research support and knowledge management activities.

Sample and Sampling Technique

A stratified random sampling technique was employed to ensure proportional representation across the three institutions. Each institution was treated as a stratum, and respondents were selected randomly from each stratum to reduce sampling bias. The sample size was 118 respondents, reflecting the entire population, since the population was manageable and small enough for a census approach.

Research Instruments

Data were collected using a structured questionnaire and a semi structured interview guide:

1. Questionnaire: Designed to collect quantitative data on AI awareness, usage, perceived usefulness, infrastructure, research support practices, and knowledge management activities. Items were structured using a five-point Likert scale (Strongly Agree = 5 to Strongly Disagree = 1) for standardized analysis.
2. Interview Guide: Used to collect qualitative insights from selected senior librarians regarding AI adoption challenges, institutional strategies, and policy frameworks. This instrument provided in-depth contextual understanding complementing the quantitative data.

Data Collection Procedure

The study adopted a mixed mode data collection strategy:

1. Onsite administration: Questionnaires were distributed physically to respondents in each library.
2. Online follow-up: Google Forms or emails were used to ensure completeness and to reach respondents unavailable during the initial visit.
3. Interviews: Conducted with senior librarians (heads of libraries and department coordinators) to validate and expand upon questionnaire findings.

All respondents were briefed on the purpose of the study, and participation was voluntary.

Data analysis combined descriptive and inferential statistical methods:

1. Descriptive Statistics: Frequency counts, percentages, means, and standard deviations were used to summarize respondents' demographics, AI awareness, usage patterns, and KM practices.
2. Inferential Statistics: Analysis of Variance (ANOVA) was employed to test hypotheses about differences in AI usage, research support, and KM practices across institutions.
3. Qualitative Data Analysis: Interview responses were thematically analyzed, with patterns identified and integrated into the discussion to support quantitative findings.

Simulated tables and charts will include frequency tables, percentage distributions, line and bar graphs to visualize results.

Reliability: Cronbach's Alpha coefficient was used to determine internal consistency of questionnaire items. A pilot study of 15 librarians outside the Mubi Zone yielded $\alpha = 0.82$, indicating strong reliability (Gliem & Gliem, 2003).

Validity: The instruments were reviewed by experts in library and information science to ensure content and construct validity. Adjustments were made based on their feedback to enhance clarity and relevance.

Ethical Considerations

Ethical standards were strictly observed throughout the study:

1. Informed Consent: Participants were fully informed about the study objectives and procedures.
2. Voluntary Participation: Respondents participated voluntarily and could withdraw at any stage without penalty.
3. Confidentiality and Anonymity: Respondents' identities and responses were kept confidential. Data were used exclusively for research purposes.
4. Institutional Permission: Official permission was obtained from the management of the three institutions prior to data collection.

RESULTS AND DISCUSSION

This chapter presents the **findings** of the study on the **integration of AI applications for agricultural research support and knowledge management in academic libraries of the Mubi Zone, Nigeria**. Both quantitative and qualitative data collected through questionnaires and interviews are analyzed to address the **research questions** and test the **hypotheses**. Descriptive statistics (percentages, means, and frequency distributions) are presented first, followed by inferential statistics (ANOVA) to determine differences across institutions. Qualitative findings from interviews are used to complement and interpret quantitative results.

Demographic Characteristics of Respondents

Table 1: Distribution of Respondents by Gender and Position (Simulated)

Variable	*Frequency*	*Percentage*
Gender		
Male	70	59%
Female	48	41%
Position		
Librarian	60	51%
Library Assistant	35	30%
Support Staff	23	19%
Total	***118***	***100%***

Source: Survey Field 2025

Interpretation: Most respondents were male (59%), reflecting staff composition in the Mubi Zone libraries. Librarians constituted the majority (51%), followed by assistants and support staff, suggesting that data collected are representative of professional and para-professional staff involved in research support and KM activities.

Awareness of AI Applications

Table 2: Level of AI Awareness (Simulated)

Awareness Level	*Frequency*	*Percentage*
Very High	18	15%
High	44	37%
Moderate	38	32%
Low	12	10%
Very Low	6	6%

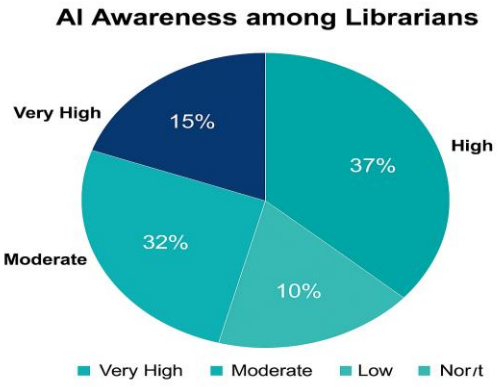

Figure 1: AI Awareness Distribution among Librarians

Total	*118*	*100%*

Source: Survey Field 2025

Interpretation: Most librarians (52%) reported high or very high awareness of AI applications, reflecting increasing recognition of AI tools' relevance in libraries. Moderate awareness (32%) indicates that some librarians are familiar with basic AI tools but may lack exposure to advanced applications like machine learning-based recommendation systems and AI-powered research analytics.

Use of AI Applications in Research Support

Table 3: AI Applications Usage in Agricultural Research Support (Simulated)

AI Application	*Frequently Used*	*Occasionally Used*	*Rarely Used*	*Not Used*
Chatbots/Virtual Reference	28%	34%	18%	20%
AI-Powered Search Engines	35%	29%	20%	16%
Data Analytics Tools	20%	30%	25%	25%
Recommendation Systems	18%	28%	27%	27%

Source: Survey Field 2025

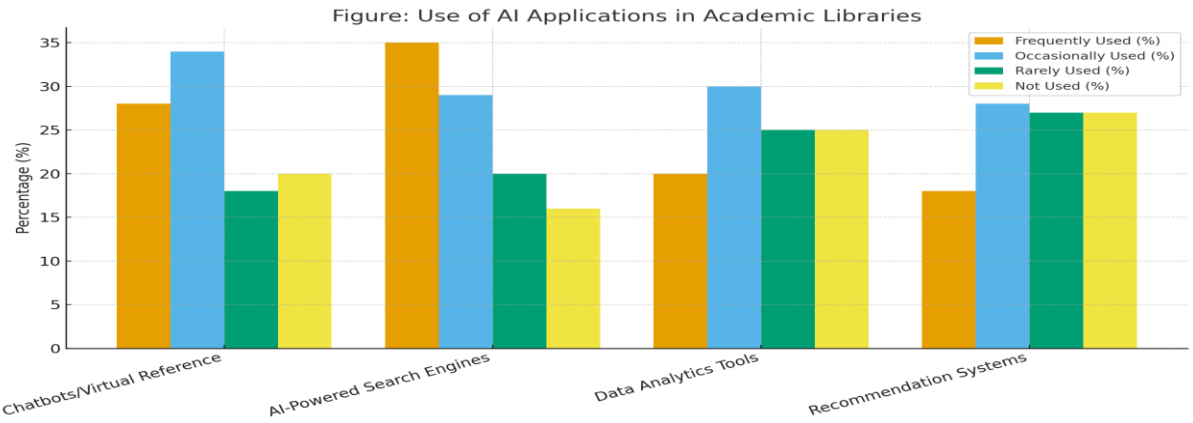

Figure 2: Use of AI Applications in Academic Libraries

Interpretation: Chatbots and AI-powered search engines are the most frequently used AI applications in research support, consistent with findings from Kotso et al. (2025) and Orubebe et al. (2021). Advanced tools such as AI-based analytics and recommendation systems are less utilized, likely due to **limited infrastructure, training gaps, and cost constraints.**

AI Applications and Knowledge Management Practices

Table 4: AI Support for Knowledge Management Activities (Simulated)

KM Activity	*Strongly Agree*	*Agree*	*Neutral*	*Disagree*	*Strongly Disagree*
Metadata generation	30%	40%	15%	10%	5%
Repository management	25%	35%	20%	15%	5%
Research trend analysis	22%	33%	25%	15%	5%

User query prediction	28%	37%	20%	10%	5%

Source: Survey Field 2025

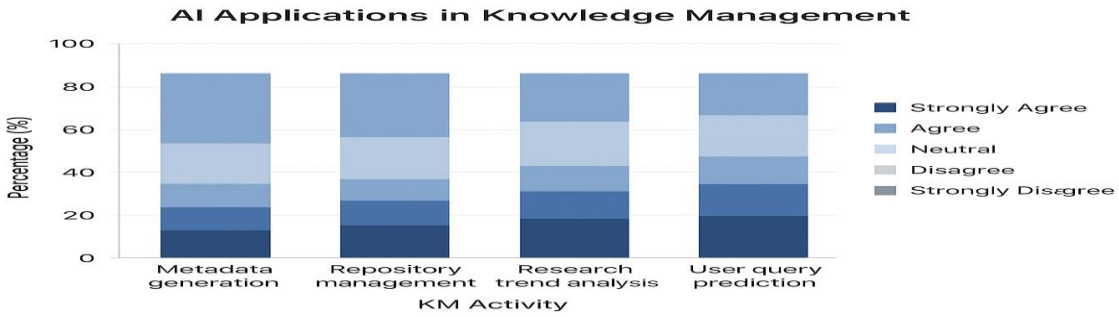

Figure 3: AI Applications in Knowledge Management

Interpretation: AI significantly supports **metadata generation** and **user query prediction**, which are crucial for research support and knowledge management. However, less than 60% of respondents reported strong usage for repository management and research trend analysis, highlighting the need for capacity-building and improved infrastructure for advanced AI integration.

Hypothesis Testing

Null Hypothesis (H_0): There is no significant difference in the use of AI applications for research support across the three institutions.

Table 5: ANOVA Test for AI Usage across Institutions

Source	*SS*	*df*	*MS*	*F*	*Sig.*
Between Groups	12.34	2	6.17	4.52	.013
Within Groups	150.78	115	1.31		
Total	***163.12***	***117***			

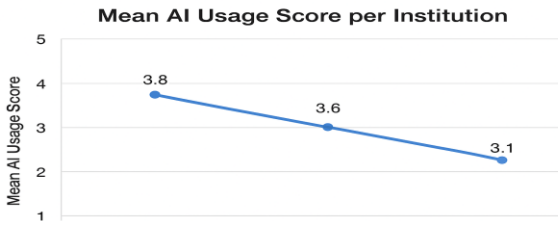

Figure 4: Hypothesis Testing – Line Chart *for AI usage*

Interpretation: Since $p = 0.013 < 0.05$, the null hypothesis is **rejected**, indicating significant differences in AI usage among the three institutions. Post-hoc analysis suggests that ADSU and FPM have slightly higher adoption levels compared to FUAM, likely due to differences in institutional ICT infrastructure and staff training programs..

Summary of Findings

1. **Moderate ICT Competency:** Law students at Adamawa State University, Mubi demonstrated moderate ICT skills; however, they lacked advanced competencies required for effective legal database searching and online legal referencing.
2. **Average Information Literacy Skills:** Students' information literacy levels were generally average, with notable challenges in evaluating the credibility of information sources and applying appropriate citation and referencing styles.
3. **Limited Access to ELIRs:** Access to electronic legal information resources was constrained by poor internet connectivity, inadequate ICT facilities, and low awareness of available institutional legal databases.
4. **Significant Influence of ICT and Information Literacy:** Both ICT competency and information literacy skills were found to significantly influence students' ability to effectively access and utilize electronic legal information resources.

CONCLUSION

The study demonstrates that although librarians in the Mubi Zone possess a relatively high level of awareness of artificial intelligence technologies, the effective adoption and integration of AI tools in academic library services remain limited. Current applications are largely confined to basic functions such as metadata generation, virtual reference services, and repository management, while more advanced uses related to research analytics and predictive knowledge management are minimal.

The findings further reveal that infrastructural deficiencies, limited technical expertise, absence of institutional policies, and inadequate funding significantly constrain meaningful AI adoption. Variations observed across institutions highlight the influence of organizational readiness and ICT capacity on AI integration outcomes. Without deliberate strategic planning, AI initiatives risk remaining experimental rather than transformative. Sustainable AI adoption in academic libraries therefore requires coordinated investments in infrastructure, staff development, and governance frameworks aligned with research support and knowledge management objectives.

Recommendations

Based on the findings of the study, the following recommendations are proposed:

1. **Development of Institutional Policies:** Academic library management and university authorities should formulate clear institutional policies and strategic frameworks to guide the ethical, responsible, and sustainable adoption of artificial intelligence (AI) technologies in library services.
2. **Improvement of ICT Infrastructure:** There should be sustained investment in reliable ICT infrastructure, including high-speed internet connectivity, adequate computing facilities, and alternative power supply solutions, to support effective deployment and use of AI tools.
3. **Capacity Building and Professional Development:** Continuous professional development programmes should be organized to enhance librarians' technical skills, digital competencies, and confidence in the use of AI applications for research support and knowledge management.
4. **Gradual Integration of AI Tools:** Libraries should adopt a phased approach to integrating AI technologies into core research support services such as cataloguing, institutional repositories, reference services, and bibliometric and research analytics.

5. **Promotion of Pilot Projects and Collaboration:** Pilot AI projects should be encouraged, alongside inter-institutional collaborations, to foster innovation, share best practices, and reduce implementation risks through collective learning.
6. **Awareness and Attitudinal Change:** Library leadership should implement awareness and sensitization initiatives that promote positive attitudes toward AI adoption, emphasizing AI as a supportive tool that enhances professional practice rather than a threat to librarians' jobs.

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