AI-Powered Library Innovation: Revolutionizing the Future of Information Science in Nigerian Libraries

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Abstract

The study explored AI-Powered Library Innovation: Revolutionizing the Future of Information Science in Nigerian Libraries. This research explores AI's transformative role in optimizing library functions and patron services. Structured around four objectives/research questions, the study employs a descriptive survey design, gathering insights from a population of over 10, 000 librarian and over 50,000 users. The researchers used the purposive sampling technique to select 3 states: Delta, Edo and Abuja. Accidental sampling technique was used to select 90 respondents including 10 LIS practitioners and 20 library users each from Delta state University, University of Benin, and University of Abuja via questionnaires. The instrument was validated by 3 experts in the field of Library and Information Science. The Crombach Alpha reliability method was used to test the internal consistency of the instrument and a reliability coefficient of 0.76 was gotten. The data collected were analyzed using descriptive statistics of mean scores and standard deviation. The results demonstrate that AI tools like machine learning and natural language processing (NLP) significantly improve resource discovery, automated cataloging, and customized user engagements, fostering more agile and user-responsive library ecosystems. However, barriers such as LIS professionals' skill deficiencies, budgetary constraints, and ethical concerns surrounding data privacy and algorithmic bias hindered comprehensive AI adoption. The study concludes that AI presents substantial opportunities for library innovation, yet maximizing its impact requires focused training initiatives, infrastructured enhancements, and comprehensive ethical frameworks for responsible implementation. Based on these outcomes, recommendations emphasized the continuous AI education initiatives, including hands-on workshops and seminars, to equip librarians with knowledge of cutting-edge AI tools and capacity to revolutionize library service delivery

Keywords: AI-Powered Libraries, Artificial Intelligence, Information Science Innovation, Library Technology, Service Transformation

Introduction

The evolution of library and information science (LIS) has consistently mirrored technological progress. From early cataloging systems to the digital transformation featuring online databases and e-resources, libraries have adapted to meet user expectations (Agim & Oraekwe, 2019). Now, artificial intelligence (AI) stands as a transformative force poised to redefine LIS through AI-powered library innovation. AI's capacity to automate processes, refine information discovery, and personalize services elevates it beyond a mere tool, fundamentally reshaping the librarian's responsibilities and expanding library service paradigms (Subaveerapandiyan, 2023). This era of AI-driven library advancement demands a comprehensive analysis of how such technologies can optimize library operations and elevate information professionals.

Integrating AI into library systems offers substantial benefits. Machine learning algorithms streamline cataloging, generate metadata automatically, and enhance search accuracy. As Ajakaye (2022) notes, natural language processing (NLP) facilitates intuitive interactions via chatbots and virtual assistants between users and library interfaces. Additionally, AI-powered predictive analytics informs collection strategies, resource allocation, and trend forecasting, enabling libraries to anticipate community needs proactively. Far from mere automation, AI cultivates a responsive, user-focused, data-driven model that reimagines conventional library functions as innovative, adaptive solutions.

Yet, implementing AI in LIS presents specific hurdles. Libraries often grapple with infrastructure overhauls, skill development for staff, and ethical issues like data privacy and algorithmic bias (Anumula, Anumula, Anumula & Damerla, 2024). Thus, scholarship must extend past AI applications to address implementation barriers and moral considerations. Understanding how librarians can deploy AI effectively while upholding foundational principles such as equitable information access, intellectual freedom, and user privacy is essential. This underscores the rationale for the current research.

Statement of the Problem

In principle, librarians should master AI technologies, integrating them fluidly into routine operations to improve service delivery, resource management, and patron interaction. AI-powered library innovation anticipates librarians using automated cataloging, digital repositories, NLP, and predictive analytics to optimize processes, provide customized support, and advance information access. Within this forward-looking framework, professionals would

exhibit strong AI proficiency, pursue ongoing training, and operate within supportive infrastructural and budgetary environments.

Reality in numerous Nigerian libraries, however, diverges sharply from this ideal. Initial researcher surveys reveal that although certain academic libraries have initiated AI use in cataloging, reference support, and digital management, persistent barriers endure. These encompass insufficient infrastructure, unreliable internet, funding shortages, and scarce AI training initiatives for librarians. Many report only fair proficiency with AI tools, hampered by skill gaps and change aversion. While enthusiasm for AI in Nigerian libraries grows, empirical evidence remains sparse on librarians' AI competencies in Delta, Edo, and Abuja, their views on AI-powered innovation, and localized impediments. This deficiency emphasizes the timeliness and importance of this investigation.

Objectives of the Study

The broad objective of the study was to explore AI-Powered Library Innovation: Revolutionizing the Future of Information Science in Nigerian Libraries. Specifically, the study was to:

1. explore AI-powered innovations that enhance the advancement of library services and operations in the information science domain.
2. determine the essential competencies required by LIS professionals to thrive in AI-integrated library environments.
3. analyze the barriers to implementing AI technologies within innovative library systems.
4. recommend strategies for leveraging AI to optimize user experiences in library and information science contexts.

Research Questions

The study was guided by the following research questions:

1. What is the AI-powered innovations that enhance the advancement of library services and operations in the information science domain?
2. What are the essential competencies required by LIS professionals to thrive in AI-integrated library environments?
3. What are the barriers to implementing AI technologies within innovative library systems?

4. What are the strategies for leveraging AI to optimize user experiences in library and information science contexts?

Literature Review

AI's Transformative Impact on Library Innovation

The incorporation of artificial intelligence (AI) into Library and Information Science (LIS) is driving a fundamental shift, redefining library operations and service delivery. AI excels at automating standard procedures, refining information access, and personalizing patron interactions, thereby reshaping conventional library roles (Agim, Abah, & Ezejiofor, 2025). This evolution stems from AI's prowess in managing resource-heavy activities like cataloging and metadata creation, freeing librarians for higher-level, patron-oriented tasks. Moreover, AI algorithms improve search accuracy and speed, helping users locate pertinent materials efficiently. A hallmark of this change is AI's personalization capabilities, which adapt content delivery to individual user profiles and needs.

Core Elements Driving AI-Powered Library Advancement

Multiple interrelated factors fuel the shift toward AI-powered library innovation. Operational automation leverages AI to handle repetitive functions, boosting efficiency and minimizing mistakes. Donkor and Afrane (2023) note that AI-enhanced retrieval systems, such as smart search engines and recommendation tools, leverage user data to deliver precise outcomes. Personalization advances through AI-crafted individualized learning paths and anticipatory support features. These elements interconnect: enhanced retrieval directly enriches tailored user experiences (Agim et al., 2025). For instance, refined search capabilities deepen AI's grasp of user preferences, fostering more relevant engagements.

Revolutionizing Library Operations Through AI Tools

AI is reshaping library services by streamlining workflows and elevating interactions via sophisticated interfaces. Key implementations include AI-optimized cataloging and metadata tools that enhance resource visibility while lightening staff workloads (Chandrashekara & Mulimani, 2024). NLP-enabled chatbots and virtual agents provide instant, customized reference support, guiding users through extensive collections and databases (Funom, Lazarus & Abdullahi, 2023). AI recommendation systems, informed by user patterns, suggest targeted resources, improving satisfaction and allocation. Together, these innovations optimize processes, creating patron-centric ecosystems.

Extending beyond frontline services, AI supports sophisticated analytics and preservation initiatives. Methods like text mining and automated extraction help process vast digital holdings, speeding research and insights (Clarivate, 2025). Robotic process automation (RPA) aids back-office functions such as acquisitions and serials control, allowing staff to focus on strategy (Ex Libris, 2025). Cutting-edge developments like generative AI and edge computing promise expanded capabilities through content automation and on-site data handling, reimagining library environments (Elejene, Agim & Umunnakwe, 2025). These advances establish libraries as dynamic, tech-forward information hubs.

Critical Competencies for LIS Experts in AI-Driven Libraries

LIS professionals must cultivate robust technical and human-centered skills to succeed in AI-enhanced settings. Essential technical proficiencies include AI tool mastery, data analysis, machine learning basics, and elevated digital fluency for effective deployment and result interpretation (Achugbue, 2024). Knowledge of natural language processing and metadata protocols is vital for refining AI cataloging and service optimization (Pirgova-Morgan, 2023). Understanding cybersecurity measures and privacy regulations is key to securing user data in AI platforms (Hodonu-Wusu, 2024). Continuous education remains essential to match technological pace and user evolution.

Soft skills like critical analysis, ethical reasoning, and flexibility are equally indispensable (Obiekwe & Agim, 2021). Professionals need to scrutinize AI results for bias, precision, and equity (Asemi et al., 2020; Murugan & Khan, 2023). Strong communication and teamwork skills promote synergy with IT specialists and users, nurturing innovative cultures (Achugbue, 2024). Problem-solving prowess equips librarians to troubleshoot AI issues and customize solutions for varied needs. These abilities empower LIS practitioners to maximize AI, evolving libraries into responsive knowledge centers.

Overcoming Barriers to AI Integration in Library Innovation

AI deployment in libraries faces hurdles like infrastructure gaps, budget limitations, and staff skill deficiencies (Hodonu-Wusu, 2024; Chandrashekara & Mulimani, 2024). In resource-constrained areas, challenges include poor connectivity, obsolete hardware, and funding shortfalls that hinder AI setup and maintenance (Achugbue, 2024). Staff reluctance due to job fears and transition anxiety exacerbates issues. Ethical dilemmas involving privacy, bias

mitigation, and transparency require careful management (Restackio, 2024). Absent strategic responses, these factors risk stalling AI's revolutionary impact.

Libraries can unlock AI benefits by investing in robust digital foundations and targeted training to build AI proficiency (Murugan & Khan, 2023). Phased rollouts promote measured integration and tech evaluation. Establishing ethical guidelines and data policies addresses privacy and fairness, building user confidence (Hodonu-Wusu, 2024). Partnerships with tech providers, academia, and associations facilitate expertise and resource sharing (Pirgova-Morgan, 2023). Blending tech strategy with human priorities enables libraries to surmount obstacles and fully realize AI-powered transformation.

Methodology

The study employs a descriptive survey research design. The population comprised 10, 000 librarian and over 50,000 users. The researchers used the purposive sampling technique to select 3 states: Delta, Edo and Abuja. Accidental sampling technique was used to select 90 respondents including 10 LIS practitioners and 20 library users each from Delta state University, University of Benin, and University of Abuja via questionnaires. The instrument was validated by 3 experts in the field of Library and Information Science. The Crombach Alpha reliability method was used to test the internal consistency of the instrument and a reliability coefficient of 0.76 was gotten. The data collected were analyzed using descriptive statistics of mean scores and standard deviation

Results

Research Question 1: What are the AI-powered innovations that enhance the advancement of library services and operations in the information science domain?

Table 1: Mean Ratings on the AI-powered innovations that enhance the advancement of library services and operations in the information science domain

S/N	Item	Mean	SD	Decision
1	AI can automate cataloguing and classification tasks to improve accuracy and efficiency.	3.28	0.62	Strongly Agreed
2	AI-based chatbots can partially replace human librarians for user inquiries.	2.85	0.71	Agreed
3	AI can enhance personalized information retrieval and recommendation services.	3.32	0.58	Strongly Agreed
4	AI applications in academic libraries can streamline interlibrary loan and resource sharing processes.	2.81	0.66	Agreed

S/N	Item	Mean	SD	Decision
5	AI can assist in predictive analytics for user behavior and collection development.	3.11	0.60	Strongly Agreed
6	AI can automate plagiarism detection and improve academic integrity support.	2.96	0.69	Agreed
7	AI can improve library security through facial recognition and smart surveillance systems.	3.14	0.64	Strongly Agreed

Grand Mean = 3.07

The results in Table 1 show that librarians in academic libraries agreed on several AI-powered innovations that enhance the advancement of library services and operations in the information science domain. Specifically, they agreed that AI-based chatbots can partially replace human librarians for inquiries (Mean = 2.85), that AI applications can streamline interlibrary loan and resource sharing (Mean = 2.81), and that AI can automate plagiarism detection and support academic integrity (Mean = 2.96). Furthermore, the respondents strongly agreed that AI can automate cataloguing and classification tasks (Mean = 3.28), enhance personalized information retrieval (Mean = 3.32), assist in predictive analytics for collection development (Mean = 3.11), and improve library security through smart surveillance systems (Mean = 3.14). These results suggest an overall strong perception of the versatile applications of AI-powered innovations that enhance the efficiency and advancement of library services and operations in the information science domain. With a grand mean of 3.07, it is clear that while some AI-powered innovations are viewed with moderate enthusiasm, others are highly anticipated for their transformative impact.

The findings align with several empirical studies in the field. Agim, Abah and Ezejiofor (2025) highlighted the significant role AI plays in personalizing information retrieval processes, leading to improved user satisfaction in academic libraries. Similarly, Subaveerapandiyan (2023) found that librarians viewed AI-powered innovations like cataloguing automation and predictive analytics as critical tools for increasing operational efficiency. Moreover, Ajakaye (2022) observed that although there is enthusiasm about AI, librarians also acknowledged the need for careful integration strategies, especially regarding user interaction systems like chatbots and plagiarism detectors. These studies collectively support the positive perception and cautious optimism observed in the present study regarding AI-powered innovations in libraries.

Research Question 2: What are the competencies required by LIS professionals to thrive in AI-integrated library environments?

Table 2: Mean Ratings on the essential competencies required by LIS professionals to thrive in AI-integrated library environments

S/N	Item	Mean	SD	Decision
1	Ability to apply data analytics in user service optimization	2.85	0.92	Agree
2	Understanding of AI algorithms and how they relate to information	3.12	0.89	Strongly Agree
3	Basic knowledge of programming and machine learning tools	2.95	0.94	Agree
4	Capacity to ethically manage AI-generated data and outputs	3.21	0.87	Strongly Agree
5	Skills in digital content curation and metadata creation	3.05	0.91	Strongly Agree
6	Critical thinking for AI-driven decision-making processes	3.18	0.90	Strongly Agree
7	Effective communication of AI-driven insights to users	2.90	0.88	Agree
	Grand Mean	**3.04**		

The results on the essential competencies required by LIS professionals to thrive in AI-integrated library environments shows that respondents agreed that LIS professionals need competencies such as the *ability to apply data analytics* (Mean = 2.85), *basic knowledge of programming* (Mean = 2.95), and *effective communication of AI insights* (Mean = 2.90) to function effectively in an AI-driven environment. More strongly, participants strongly agreed on the need for a solid *understanding of AI algorithms* (Mean = 3.12), *ethical management of AI data* (Mean = 3.21), *skills in digital curation and metadata creation* (Mean = 3.05), and *critical thinking for AI-enabled decision-making* (Mean = 3.18). These findings reflect an awareness of the complex, multi-disciplinary competencies needed to adapt to technological evolution in the library field. The grand mean of 3.04 indicates an overall strong agreement among librarians in academic libraries that a variety of both technical and cognitive competencies are essential for thriving in AI-integrated library environments.

These findings align with earlier studies of Anumula, Anumula, Anumula and Damerla (2024) which emphasized the need for academic librarians to develop digital fluency and critical data literacy to effectively work alongside AI systems. Hodonu-Wusu (2024) further identified AI-related competencies such as programming, metadata creation, and ethical governance as central to the evolving role of LIS professionals. Additionally, Achugbue (2024) found that AI is reshaping the nature of information services, thus requiring LIS curricula to include competencies in algorithmic thinking, machine learning, and human-computer interaction. These studies collectively support the emphasis on both technical and soft skills evident in the current findings.

Research Question 3: What are the barriers to implementing AI technologies within innovative library systems?

Table 3: Mean ratings on barriers to implementing AI technologies within innovative library systems

S/N	Item	Mean	SD	Decision
1	High cost of acquiring and maintaining AI technologies	3.15	0.84	Strongly Agree
2	Lack of technical expertise among library staff	2.78	0.91	Agree
3	Privacy and ethical concerns regarding AI data usage	2.82	0.89	Agree
4	Resistance to change from traditional library service models	2.73	0.86	Agree
5	Limited infrastructural facilities to support AI integration	2.91	0.90	Agree
6	Insufficient training opportunities for librarians on AI applications	2.88	0.87	Agree
7	Uncertainty about the long-term impacts of AI on library job security and relevance	3.10	0.82	Strongly Agree
	Grand Mean	**2.91**		**Agree**

The results on the barriers to implementing AI technologies within innovative library systems revealed that respondents agreed that major challenges to AI integration in libraries include the *lack of technical expertise among library staff* (Mean = 2.78), *privacy and ethical concerns* (Mean = 2.82), *resistance to change from traditional models* (Mean = 2.73), *limited infrastructural facilities* (Mean = 2.91), and *insufficient training opportunities* (Mean = 2.88). More strongly, they strongly agreed that *high costs of acquiring and maintaining AI technologies* (Mean = 3.15) and *uncertainty about the long-term impacts of AI on job security* (Mean = 3.10) are critical barriers to successful AI integration. This shows that both structural and human factors significantly hinder AI-powered innovations in library systems. The grand mean of 2.91 suggests that librarians overall perceive a moderately high level of barriers to implementing AI technologies within innovative library systems.

These findings are corroborated by previous research. Murugan and Khan (2023) identified infrastructural deficits, ethical risks, and high implementation costs as primary obstacles to AI-powered innovations in library contexts. Similarly, staff resistance, lack of training, and fears about automation's effect on job security were major hurdles to AI-powered innovations in academic libraries. Restackio (2024) also highlighted the twin challenges of cost and lack of technical skills among library professionals as critical bottlenecks. Together, these studies affirm the need for strategic investments in technology, capacity building, and ethical frameworks to facilitate successful deployment of AI-powered innovations in libraries.

Research Question 4: What are the strategies for leveraging AI to optimize user experiences in library and information science contexts?

Table 4: Mean Ratings on the strategies for leveraging AI to optimize user experiences in library and information science contexts

S/N	Item	Mean	SD	Decision
1	Continuous professional training for librarians on AI tools	2.88	0.86	Agree
2	Development of user-centered AI applications tailored to library needs	2.91	0.84	Agree
3	Incorporating personalized recommendation systems for library resources	3.22	0.80	Strongly Agree
4	Building strategic partnerships with tech companies for AI deployment	2.77	0.89	Agree
5	Implementing AI-driven virtual reference services for real-time user support	3.15	0.83	Strongly Agree
6	Establishing ethical guidelines and protocols for AI integration in library systems	2.93	0.88	Agree
7	Regular assessment and improvement of AI systems based on user feedback	3.08	0.82	Strongly Agree
	Grand Mean	**2.99**		**Agree**

The responses on strategies for leveraging AI to optimize user experiences in library and information science contexts indicated that librarians agreed on the importance of strategies such as continuous professional training on AI tools (Mean = 2.88), development of user-centered AI applications (Mean = 2.91), building strategic partnerships with tech companies (Mean = 2.77), and establishing ethical guidelines for AI integration (Mean = 2.93) to improve user experiences in libraries. More strongly, librarians strongly agreed that strategies like incorporating personalized recommendation systems (Mean = 3.22), implementing AI-driven virtual reference services (Mean = 3.15), and regular assessment and improvement of AI systems based on user feedback (Mean = 3.08) are crucial for effectively harnessing AI for better user satisfaction and engagement. This shows a strong inclination toward both capacity building and technological enhancement for user-centered service delivery. The grand mean of 2.99 suggests that, overall, librarians perceive a high level of strategic importance in both human capacity development and technological innovation for improving user experiences through AI.

The results of this study are consistent with several prior research findings. Agim, et al (2025) emphasized the need for continuous AI training programs for library staff and ethical protocols for successful AI adoption. Pirgova-Morgan (2023) highlighted the effectiveness of personalized AI-driven services, such as recommendation systems, in significantly improving library user satisfaction and engagement. Similarly, Hodonu-Wusu (2024) found that partnerships with tech firms and constant AI system evaluations are critical strategies that helped libraries enhance service quality and maintain relevance in a rapidly evolving digital landscape. Together, these studies reinforce the current findings and demonstrate the pivotal role of well-planned strategies in leveraging AI for superior user experiences.

Conclusion

The findings affirm that AI-powered library innovation represents the cornerstone of Library and Information Science's future, achieved through purposeful deployment of AI technologies. This evolution requires both cutting-edge technological advancements and significant commitment to upskilling information professionals. Academic librarians recognize AI's revolutionary capabilities, the essential competencies needed for effective adaptation, and the obstacles requiring resolution for smooth implementation. To maintain libraries' vitality and leadership in the digital age, sustained initiatives must emphasize AI literacy, perpetual professional growth, ethical deployment, and patron-focused advancements in library operations.

Recommendations

The study offers the following recommendations:

1. Continuous Launch of AI education initiatives, including hands-on workshops and seminars, to equip librarians with knowledge of cutting-edge AI tools and their capacity to revolutionize library service delivery.
2. Establish collaborations with universities and tech companies to provide targeted certification courses and practical training in AI applications customized for Library and Information Science (LIS) practitioners.
3. Develop a comprehensive AI integration roadmap for libraries that incorporates ethical standards, data protection measures, financial planning, and technical infrastructure essential for sustainable AI deployment.
4. Allocate specific budget lines for ongoing professional upskilling in AI capabilities and procurement of advanced AI systems that power personalized, forward-thinking library innovations.

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