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## Qualitative Study on Integration of Artificial Intelligence Technology among Tertiary Institution Libraries in Nigeria: Opportunities and Ethical Considerations

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### Abstract

*The integration of Artificial Intelligence (AI) into Nigerian academic libraries offers a transformative opportunity to modernize information access, enhance user experience, and improve operational efficiency. This paper examines the current state of AI adoption in Nigerian libraries, focusing on tools like chatbots, automated cataloging, and personalized recommendation systems that can address resource gaps and enhance accessibility. Using the Technology Acceptance Model (TAM) as a theoretical framework, it explores the interplay between perceived usefulness, ease of use, and AI adoption. The paper highlights critical barriers, including infrastructural deficits, digital illiteracy, and ethical challenges such as algorithmic bias and data privacy concerns, while exploring the potential of generative AI tools in fostering inclusive education and virtual learning environments. The conclusion emphasizes that achieving AI's full potential requires addressing infrastructural and ethical challenges, prioritizing strategic investments, and fostering collaboration across sectors. Suggestions include allocating resources to upgrade facilities, implementing tailored AI tools, and establishing localized ethical frameworks to ensure equitable access and sustainability. By aligning global best practices with local realities, this paper provides actionable insights for policymakers, library management, and stakeholders toward a sustainable and innovative AI-driven future for Nigerian academic libraries.*

**Keyword:** AI, Nigeria, Libraries, Opportunities, Ethics

### Introduction

The integration of Artificial Intelligence (AI) into academic libraries is reshaping the landscape of knowledge access, management, and dissemination. Globally, AI technologies are transforming how libraries operate, interact with users, and deliver services. Tools like automated cataloging, AI chatbots, and personalized recommendation systems are at the forefront of this transformation, offering unparalleled opportunities to enhance research efficiency, streamline information retrieval, and provide tailored user experiences. These tools leverage advanced machine learning and natural language processing (NLP) capabilities, enabling academic libraries to meet evolving user expectations and adapt to the complexities of the digital era (Sain & Hebebe, 2023; Salman, Ismaila, & Ajani, 2023). AI chatbots, for instance, facilitate real-time, human-like interactions that simplify user queries and enhance communication, while automated cataloging improves the speed and accuracy of metadata management, enabling seamless access to diverse collections. Additionally, personalized recommendation systems empower users by suggesting resources tailored to their unique research needs, fostering deeper engagement with library resources (Aydin & Karaarslan, 2023; Kim, Kim & Baek, 2024). In Nigerian academic libraries, where infrastructure and resource limitations pose unique challenges, these AI tools offer a pathway to modernize services, democratize access to information, and enhance the library's role in supporting research and education. However, these opportunities are accompanied by ethical considerations, such as data privacy, algorithmic bias, and equitable access, which necessitate a thoughtful approach to implementation. This paper examines the integration of AI into Nigerian academic libraries, exploring its potential to transform service delivery while addressing critical ethical concerns.

### Theoretical frame work

The theory guiding the integration of Artificial Intelligence (AI) into academic libraries in Nigeria is hinged on Technology Acceptance Model (TAM) developed by Davis (1986). The theory posits that the acceptance and use of a new technology are primarily determined by two key beliefs: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). In the context of Nigerian academic libraries, PU relates to how librarians and students believe AI tools such as automated cataloging, AI chatbots, or personalized recommendation systems can enhance research efficiency and information retrieval. PEOU, on the other hand, reflects how simple and user-friendly these tools are perceived to be, especially considering varying levels of digital literacy. These perceptions shape users' attitudes toward AI, which ultimately influence their willingness to adopt it. Given the infrastructural and capacity challenges facing academic

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## **Conceptual Framework on Artificial Intelligence (AI)**

Artificial Intelligence (AI) has evolved from early theoretical explorations to a multifaceted, application-driven field. The foundational definition by McCarthy (1955), describing AI as “the science and engineering of making intelligent machines,” emphasized its engineering orientation. Nilsson (1980) extended this by identifying two goals: designing intelligent systems and understanding intelligence computationally. Similarly, Russell and Norvig (2010) defined AI as the design of rational agents capable of perceiving their environment and acting to maximize success. Modern definitions balance these perspectives with practical implications. For instance, the Association for the Advancement of Artificial Intelligence (AAAI, 2014) defined AI as systems capable of thought and behavior, bridging theoretical and practical domains. Recent interpretations, such as Zúñiga, Goyanes, and Durotoye (2023), describe AI as “the ability of non-human systems to perform tasks, solve problems, and interact logically,” emphasizing real-world applications. AI subfields, including machine learning (Ng & Leung, 2020), natural language processing (Russell & Norvig, 2022), and computer vision, showcase its interdisciplinary scope. These advancements have driven significant applications in sectors such as education, healthcare, and governance (de Lima-Santos & Ceron, 2021), demonstrating its transformative potential. Against this backdrop, this paper defines Artificial Intelligence (AI) as a multidisciplinary field combining computational theories, engineering practices, and cognitive sciences to design systems capable of perceiving, reasoning, learning, and acting rationally or humanly to solve problems and optimize tasks effectively.

## **Literature Review on Integration of Artificial Intelligence in Academic Libraries**

The integration of Artificial Intelligence (AI) into academic libraries represents a significant shift in information management, offering opportunities for innovation while posing ethical and infrastructural challenges. Studies like Atanda and Ibrahim (2023) highlight the nascent adoption of basic AI technologies, such as security systems, in Nigerian libraries. However, advanced applications like machine-learning-based cataloging, AI chatbots, and facial recognition remain limited. Similarly, Ibrahim and Okpala (2024) emphasize AI's potential to automate traditional tasks and improve user experiences but underscore the lag in adoption compared to global standards. AI introduces opportunities for enhancing library efficiency and user satisfaction. Atmika and Atmika (2024) report that AI improves material classification, recommendation systems, and information retrieval, while Zondi et al. (2024) demonstrate its ability to streamline operations and personalize services in African libraries. These benefits are particularly vital for Nigerian libraries striving to meet the demands of a digital academic environment. However, barriers to AI adoption persist. Atanda and Ibrahim (2023) identify challenges such as inadequate infrastructure, irregular power supply, and limited librarian training. Atmika and Atmika (2024) emphasize global concerns like data privacy and ethical dilemmas, while Zondi et al. (2024) note the financial and technical expertise deficits prevalent in developing countries. These studies reveal the universal nature of these challenges, though they are more pronounced in Nigeria due to resource limitations. Despite these insights, gaps remain in long-term strategies and policy frameworks for sustainable AI integration. Atanda and Ibrahim (2023) provide descriptive findings on adoption levels but lack strategic solutions, while Atmika and Atmika (2024) focus on user satisfaction without addressing infrastructural needs. Zondi et al. (2024) propose solutions without empirical support, and Ibrahim and Okpala (2024) overlook ethical concerns and digital literacy deficits. These gaps underscore the need for evidence-based approaches that balance technological advancement with readiness and governance. Integrating AI into Nigerian academic libraries offers transformative potential for improving operations and accessibility. However, realizing this potential requires addressing infrastructure deficits, skill shortages, and ethical concerns. Capacity-building initiatives, transparent AI governance, and robust collaborations between policymakers and library stakeholders are essential. By aligning technology with ethical and inclusive practices, Nigerian libraries can harness AI as a catalyst for innovation and equity, ensuring their relevance in a digital academic landscape.

## **Benefit of Generative AI tools among Tertiary Institution Libraries in Nigeria**

1. AI chatbots can promote critical thinking skills through interactive conversations that prompt students to analyze information and consider diverse viewpoints (Ilieva, Yankova, Klisarova-Belcheva, Dimitrov, Bratkov & Angelov, 2023). Ilieva (2023) further suggests that AI tools such as ChatGPT provide support in various academic tasks, such as idea generation, research, and writing, streamlining academic processes and enhancing student and academic productivity.
2. The adoption of generative AI chatbots like ChatGPT in academic libraries can also offers the potential for the enhancement of the virtual tutoring system through personalized support for students.
3. By leveraging ChatGPT as a virtual tutor, students can receive tailored explanations, translations, or verification of artifacts, thereby improving their fundamental understanding of specific topics (Singh & Mansoor, 2023)
4. The innovation potential of generative AI tools like ChatGPT presents opportunities for introducing novel teaching approaches and strategies.

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5. Integrating ChatGPT into pedagogical methods such as problem-based learning or flipped classrooms can diversify learning experiences for students and foster creativity in educational practices (Neumann et al., 2023).

### **Challenges to AI Implementation among Tertiary Institution Libraries in Nigeria**

AI deployment in Nigerian academic libraries faces multifaceted challenges:

1. High Costs: Limited funding restricts access to advanced AI technologies (Omole & Adeyemi, 2024).
2. Skills Gap: A lack of training among library staff hinders operational efficiency (Mansoor & Rahman, 2022).
3. Digital Literacy Deficiency: Both users and personnel struggle with AI tools, reducing effectiveness (Afolabi & Olayinka, 2021).
4. Algorithmic Bias: Bias in AI systems risks perpetuating inequalities (Taylor et al., 2023).
5. Institutional Resistance: Bureaucratic inertia and the absence of AI governance frameworks exacerbate these issues.

Compared to developed contexts, where AI implementation is often supported by proactive policy environments, Nigerian libraries require systemic reforms to address these gaps.

### **Ethical Frameworks and Considerations for AI among Tertiary Institution Libraries in Nigeria**

The integration of Artificial Intelligence (AI) into academic libraries has unlocked transformative potentials, ranging from enhanced service delivery to improved user engagement. However, alongside these opportunities come significant ethical challenges. Globally, ethical frameworks for AI emphasize core principles such as data privacy, transparency, accountability, and bias mitigation (Taylor et al., 2023). While these principles provide a robust foundation, their direct application to Nigerian academic libraries requires contextualization to address unique local challenges, including low digital literacy, inadequate data protection frameworks, and systemic infrastructural gaps (Afolabi & Olayinka, 2021). The tension between global ethical ideals and local realities underscores the necessity of collaborative efforts among technologists, librarians, and policymakers. For instance, while Western standards like the General Data Protection Regulation (GDPR) offer valuable guidelines, their wholesale adoption in Nigeria risks overlooking critical socio-cultural and technological nuances. To ensure both innovation and user rights are upheld, ethical policies must be adapted to local contexts. This approach promotes sustainable implementation that balances international best practices with the specific needs of Nigerian academic libraries.

### **Integrating Artificial Intelligence among tertiary institution Libraries for Equitable Access and Innovation**

Artificial Intelligence (AI) adoption in Nigerian academic libraries continues to trail behind global advancements due to infrastructural limitations and financial constraints. While some institutions have made strides by experimenting with AI in areas like cataloging and virtual reference services (Okeke et al., 2022), such efforts are often sporadic and predominantly concentrated in private universities (Omole & Adeyemi, 2024). Public academic libraries face even greater challenges, including constrained budgets and a lack of adequately trained personnel (Afolabi & Olayinka, 2021). Globally, the focus on scalable AI frameworks and robust training programs highlights the gap in Nigeria's approach, necessitating a strategic focus on investments and capacity-building to achieve equitable and sustainable AI integration across the sector.

Ethical Considerations in AI-driven Library Services among tertiary institutions in Nigeria

AI's ethical dimensions extend across multiple domains, each demanding careful scrutiny to ensure alignment with institutional values and user rights.

1. Ethics and AI Systems: The ethical deployment of AI hinges on principles of fairness, accountability, and inclusivity. While global frameworks outline these principles, the Nigerian context often lacks comprehensive guidelines to enforce them. Advocating for transparent and equitable AI practices within Nigerian libraries is critical to safeguarding user rights and ensuring institutional accountability (Guszcza et al., 2022).
2. Data Privacy and Protection: Effective data governance is central to mitigating risks associated with AI systems. Localized frameworks inspired by international standards such as GDPR must be developed to address Nigeria's unique regulatory environment (Adams & Martin, 2023). Additionally, the absence of robust national data protection legislation underscores the urgency for systemic reforms to complement institutional efforts.
3. Intellectual Property (IP) Concerns: AI's ability to generate content introduces complex questions about ownership and copyright. Nigerian libraries must navigate the intersection of AI and intellectual property law by establishing clear policies on ownership rights and copyright compliance for AI-generated content (Khan & Ali, 2024).
4. Algorithmic Bias and Transparency: Algorithmic biases present a significant risk to equitable access to library services. Left unchecked, these biases can exacerbate existing disparities, undermining the democratic ethos of libraries (O'Neil, 2021). To foster trust and inclusivity, Nigerian academic libraries must prioritize transparent AI design and conduct periodic audits to identify and mitigate biases (Miller & Miller, 2022).

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Ethical considerations are foundational to the successful integration of AI in academic libraries. For Nigerian libraries, the challenge lies in balancing the adoption of global best practices with the development of locally relevant solutions. Addressing ethical issues such as privacy, data security, intellectual property, and algorithmic bias requires collaborative efforts across sectors. By crafting localized ethical frameworks and implementing targeted reforms, Nigerian academic libraries can leverage AI technologies responsibly, ensuring both innovation and inclusivity in service delivery.

### **Prospects of AI among Tertiary Institution Libraries in Nigeria**

Despite challenges, AI holds transformative potential:

1. Enhanced Information Retrieval: AI-driven tools offer personalized, context-aware search capabilities, improving academic productivity (Jiang & Zhang, 2021).
2. Automation of Library Processes: Tasks like cataloging and indexing can be streamlined, allowing librarians to focus on value-added activities (Smith, 2021).
3. Digital Preservation: AI aids in safeguarding digital and physical archives, ensuring the longevity of academic resources (Afolabi & Olayinka, 2021).
4. Improved User Engagement: AI-powered chatbots and assistive technologies enhance accessibility and user satisfaction, addressing diverse needs (Taylor et al., 2023).

By comparing these benefits with global successes, Nigerian libraries can adopt AI strategically, aligning innovation with ethical imperatives. The integration of AI into Nigerian academic libraries presents a dual-edged sword of opportunity and challenge. Bridging the digital divide requires not only financial investment but also a robust ethical and policy framework. By critically engaging with global standards and adapting them to local contexts, Nigerian libraries can harness AI's potential while safeguarding user rights.

### **Transformative Artificial Intelligence (AI) Tools among Tertiary Institution Libraries in Nigeria**

The advent of Artificial Intelligence has significantly altered how service is being rendered in libraries across the world. Below are some of the Transformative Artificial Intelligence (AI) Tools that are used in Academic Libraries:

1. Automated Cataloging: Automated cataloging systems harness the power of AI to improve the efficiency and accuracy of metadata generation and management. These systems use machine learning algorithms to classify and index materials, reducing manual effort and ensuring the processing of new acquisitions but also enhances the discoverability of resources by students and researchers (Salman et al., 2023).

In the Nigerian context, automated cataloging can address challenges related to inadequate staffing and outdated cataloging practices. By deploying AI-driven solutions, libraries can streamline workflows, reduce backlogs, and improve access to both physical and digital collections. Such innovations align with global best practices, ensuring that Nigerian academic libraries remain competitive and relevant in the digital age (Hussain, 2022).

2. AI Chatbots: AI chatbots are revolutionizing user interactions in libraries by providing 24/7 assistance and personalized responses to inquiries. These tools, powered by NLP and machine learning, enable libraries to address a wide range of user needs, from locating materials to troubleshooting access issues (Aydin & Karaarslan, 2023). For Nigerian academic libraries, where staff availability may be limited, AI chatbots represent a cost-effective solution to improve user engagement and satisfaction. They can bridge communication gaps, especially in hybrid and digital learning environments, by offering timely support to remote users. Moreover, as chatbots become more sophisticated, their integration can enhance the overall library experience, making information more accessible and user-friendly (Kim et al., 2024).
3. Personalized Recommendation Systems: Personalized recommendation systems use AI algorithms to analyze user behavior and preferences, suggesting resources that align with individual research interests. These systems draw from vast datasets, including borrowing history, search patterns, and academic trends, to provide highly relevant recommendations (Sain & Hebebe, 2023). In Nigerian academic libraries, personalized recommendation systems can play a pivotal role in addressing the challenges of information overload. By curating content that aligns with user needs, these systems empower students and researchers to discover new materials and deepen their engagement with library resources. Furthermore, these tools support the library's mission to foster academic excellence by making research processes more efficient and enjoyable.

### **Applications of AI Technology among Tertiary Institution Libraries in Nigeria**

AI has prominent applications that are utilized in the library Galibtech (2024), Oseji, et al. (2021) highlighted Applications of Ai in libraries, they include the following:

1. Information retrieval: AI-powered search engines can increase the discoverability of library resources by understanding user queries, analyzing content, and providing relevant recommendations.



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2. Digital Archives and Preservation: Artificial intelligence algorithms can help with the digitization and preservation of these fragile objects, ensuring that rare manuscripts and historical records are available to future generations.
3. Virtual assistants: AI chatbots can provide users with immediate assistance by answering their questions, pointing them in the direction of the appropriate library books, and offering customized recommendations.
4. Collection Development: Artificial intelligence (AI) algorithms can analyze user preferences and usage patterns to offer insightful information for collection development decisions. This aids libraries in acquiring the most pertinent and sought-after materials.
5. Data analytics: Artificial intelligence (AI) powered analytics tools can help libraries make data-driven decisions and optimize their use of resources by giving them insights into user behavior, usage patterns, and resource allocation.
6. Accessibility: Artificial intelligence (AI) technology can improve accessibility for users with disabilities by providing text-to-speech, image recognition, and other assistive capabilities.
7. Content Curation: AI algorithms are able to highlight popular topics, recommend articles that are relevant, and provide customized reading lists based on the interests and preferences of the user.

### **Future of AI generative tools among Tertiary Institution Libraries in Nigeria**

The future potential and application are strengthened by its effects on students' learning experience, outcomes, and performance (Wu Yu, 2024). Generative AI tools such as chatbots, powered by artificial intelligence (AI) algorithms, have the potential to provide personalized support to students, offering instant responses to queries related to course information, schedules, assignments, and academic resources (Rathore, 2023). Grassini (2023) added that the integration of AI applications like ChatGPT in educational settings such as academic library can significantly enhance the learning experience for students and increase academic research engagement and publication 24/7. With their 24/7 accessibility, generative AI chatbots can ensure that students and academics have access to assistance at any time, catering to the needs of distance learning and those with varying schedules and learning needs and expectations. (Chukwuere & Handoko, 2024).

The integration of AI in Nigerian academic libraries presents immense potential to revolutionize service delivery, democratize access to information, and support academic research. However, achieving these outcomes requires addressing critical challenges such as infrastructure inadequacies, skill shortages, and ethical concerns. This study emphasizes the transformative power of AI tools like automated cataloging, chatbots, and personalized recommendation systems while acknowledging the need for localized solutions tailored to Nigeria's unique socioeconomic context. To maximize the benefits of AI integration, stakeholders must prioritize strategic investments in technology, foster collaboration across sectors, and establish robust ethical and regulatory frameworks. By adopting an inclusive and context-sensitive approach, Nigerian academic libraries can bridge the digital divide, ensure equitable access, and position themselves as key drivers of innovation in the academic landscape.

### **Conclusion**

The integration of AI in Nigerian academic libraries presents immense potential to revolutionize service delivery, democratize access to information, and support academic research. However, achieving these outcomes requires addressing critical challenges such as infrastructure inadequacies, skill shortages, and ethical concerns. This paper emphasizes the transformative power of AI tools like automated cataloging, chatbots, and personalized recommendation systems while acknowledging the need for localized solutions tailored to Nigeria's unique socioeconomic context. To maximize the benefits of AI integration, stakeholders must prioritize strategic investments in technology, foster collaboration across sectors, and establish robust ethical and regulatory frameworks. By adopting an inclusive and context-sensitive approach, Nigerian academic libraries can bridge the digital divide, ensure equitable access, and position themselves as key drivers of innovation in the academic landscape.

### **Suggestions**

The following suggestions are out forward for the integration of AI into academic libraries in Nigeria:

1. The government should allocate resources to upgrade library facilities, improve internet connectivity, and ensure reliable power supply, alongside targeted training programs to enhance librarians' expertise in AI technologies.
2. There is the need to implement AI tools like chatbots and automated cataloging systems as initial phases to evaluate their effectiveness, ensuring a smoother transition to more complex applications such as machine learning-based cataloging and recommendation systems.
3. There is the need to establish a context-specific guidelines that address data privacy, algorithmic bias, intellectual property, and user rights, drawing from international standards but tailored to Nigeria's unique environment.
4. There is the need to encourage partnerships among policymakers, academic institutions, technology providers, and library management to create a unified strategy for funding, implementation, and innovation.



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5. Design AI initiatives that are accessible to users of varying digital literacy levels and socioeconomic backgrounds, ensuring equitable access and the long-term sustainability of technological advancements in Nigerian academic libraries.

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