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Prospects and Challenges of AI Adoption in Nigerian Academic Libraries

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Abstract
This study gives this research a thorough assessment of how Nigeria academic libraries would incorporate Artificial Intelligence (AI) technologies as they relate to improving service delivery, browsing information and engaging users. The possibilities of transformation offered by AI, like data analysis, improved searching, and personalized user experiences were discovered during the review. Yet, the review also mentions the important challenges faced, such as insufficient funding, absence of technical know-how, and limited infrastructure that prevents the full realization of the plan. The researchers suggest setting up programs that focus on offering training for librarians to gain AI related skills, as well as the implementation of strategic planning to address the barriers. Their suggestions, which however include, rather than limited to, infrastructure improvements, user-centered AI solutions, and longitudinal studies to fully realize the benefits of AI in library services, are proffered as future research directions.

Keywords: Prospects, Challenges, Artificial intelligence, Nigerian, Academic libraries, Technologies.

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INTRODUCTION

Technologies related to artificial intelligence (AI) are progressively recognized as the pivotal tools in various fields, with one of them being education and library services. The academic libraries in Nigeria are now searching for ways of incorporating the use of AI in tandem with enhanced service delivery, increased user engagement, and improved information retrieval. This review of the literature summarizes the implications of the use of AI in Nigerian academic libraries as well as pointing out the challenges and opportunities in its implementation. ICT and related technical advancements, according to Igbo, Imo, Jidere, and Ugwu (2024), have regularly resulted in significant and educational changes in library operations and services over time. The library is a critical resource, taking care to foster the scholarship at the main university by providing fast and easy access to the information needed to support teaching, learning, and research.

More precisely, the arrival of the digital era challenges the modern academic library in that supporting research, teaching, and learning becomes the most relevant task for the library. The parallelism is that the abundance of modern digital technologies in library networks leads to the neoteric trend of automated information service utilizing.

Technologies that are associated with artificial intelligence (AI) are currently regarded as main instruments for elevating the productivity and efficiency of the organizations. This means that we can easily conclude that AI technologies have had a major impact on the working environment in the 21st century.. According to Yusuf, Adebayo, Bello, and Kayode (2022), implementing AI in libraries can enhance their offerings and give patrons access to reliable information that can spur expansion and advancement in this era of information. In order to accomplish the natural integration of readers and libraries, libraries are currently utilizing artificial intelligence technologies. Through this approach, readers not only involve themselves in the shared platform, they also have the opportunity to track and compile specific user needs and data which in turn help the users receive accurate and personalized services at a reduced cost thus contributing to the better running of the library with these savings. Tella (2020) stressed that libraries in the developed countries have accepted and use AI technologies virtually in all spheres of life whereas those in developing countries are still struggling to find their feet.

In higher institutions of learning, the four major infrastructures are laboratories, equipment, teachers/classrooms and libraries that contain rich and balanced information resources that can support teaching; learning and research work (Tiemo and Ateboh, 2016).

Libraries are the nerve centre of an educational institution and a place where

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information is provided to serve all patrons irrespective of their ages, political and ethical background, religion, sex, etc. The transition of information materials from book collections to audiotape collections, video collections, database, digitization of information materials, library automation, and now the adoption of artificial intelligence in library operations (Vijayakumar and Vijan, 2011). This implies that one of the motives of adopting AI technologies in university libraries is to satisfy user needs. The origin of Artificial Intelligence (AI) can be traced to John McCarthy's research in 1955, with the assumption that every aspect of learning and other forms of intelligence can be stimulated through the use of a machine (Wang, 2018).

In spite of the fact that there exist several challenges, the application of artificial intelligence (AI) in academic libraries in Nigeria is quite likely to yield a lot of benefits. Here are a few of the pros and cons associated with the integration of AI into these library systems.

Prospects of AI Adoption in Nigerian Academic Libraries

Nigerian academic libraries are brimming with opportunities to utilize the artificial intelligence (AI) tools. However, before they can achieve this, there are certain hurdles that they must overcome. The subsequent enumeration tackles some of the advantages and challenges that deploy of AI in such libraries would face:

Improved Information Retrieval: The process of locating facts in vast sets of data can be made more efficient by the use of artificial intelligence. Artificial intelligence can use advanced search algorithms more effectively and accurately thus enabling employees and students to find related academic sources quicker.

Personalized Services: AI can tailor library services to the specific needs of each individual user. Implementing AI-driven recommendation systems to suggest books, articles, and other materials that are in line with users' interests and fields of study can lead to the rise in user satisfaction and engagement.

Automation of Administrative Tasks: AI can be used to automate regular administrative duties such as inventory management, circulation, and classification. Consequently, personnel have the opportunity to spend more of their time on more valuable services such as user support and research help.

Enhanced User Experience: The library operations are made much easier with the AI powered Chatbot's and virtual assistants which answer users queries, assist them in navigation, and promote day-to-day usage of the library. For researchers and students, this offers more access and support.

Better Resource Management: AI algorithms help libraries to not only become more efficient in terms of collection management, but

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also anticipate which resources will be needed the most at any point in time. They achieve that by making such resources available during the peak period and, in turn, help to optimize the storage effectively.

AI-Based Learning Tools: AI technology can offer learning resources such as virtual reality platforms, intelligent tutoring systems, and language processing tools that improve the academic library educational experience.

Advanced Data Analytics: AI may assist libraries in the analysis of data on the trend of library resources, user behavior, and library usage. Hence, libraries can benefit from the enhanced decision-making, effective planning of services, resource distribution, and an overall better user experience.

Challenges of AI Adoption in Nigerian Academic Libraries:

- **Lack of Infrastructure:** Not having the technological infrastructure needed for compute, servers, and high-speed internet to effectively deploy AI is one of the things that the Nigerian academic libraries face.
- **Limited Technical Expertise:** A considerable percentage of Nigerian library personnel could be lacking the adequate knowledge and skills to launch and maintain AI systems. Thus the probability of including AI in the academic libraries of the is far low. Training such as continuous professional development needs to be regarded as a priority in helping librarians acquire the necessary skills.
- **High Implementation Costs:** The introductory cost of deploying AI technology in academic libraries in Nigeria, the majority of which are underfunded and have strict budgets, may be perceived as very high. The problems these libraries can face are: inability to maintain AI systems, difficulty in recruiting IT specialists, and lack of resources for AI tools.
- **Data Privacy and Security Concerns:** The dependence of AI programs on data collection and processing is the source of privacy and security issues concerning users. As a measure to protect personal data, Nigerian libraries are required to comply with data protection laws in addition to establishing efficient cyber security measures.
- **Resistance to Change:** Many library personnel and patrons may show a degree of hesitation in welcoming Artificial Intelligence technology due to their fear of the unknown or uncertainty about the future employment prospect. Overcoming this train of thought requires change management measures in conjunction with enlightenment programs.
- **Limited Localized AI Solutions:** Adaptation of most AI solutions to the specific needs of research libraries in Nigeria and the local environment is very low which is why they are mostly not. A handful of

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homegrown-developed AI solutions are aimed at the specific issues libraries deal with, such as cultural differences, language barriers, and locally available materials.

- **Internet Connectivity Issues:** In various regions of Nigeria, persistent issues continue to plague the accessibility of reliable internet. Where network issues might be expressed in, "AI tools in academic libraries that can be deployed and operated efficiently may suffer from inadequate connectivity." Such expression is essential due to the fact that AI applications are mostly based on the cloud network system.
- **Sustainability and Maintenance:** In environments with limited finances and experience, boosting and sustaining AI systems could be tricky. Libraries may find it hard to keep pace with the rapidly advancing AI technologies which could lead them to be left behind in the system. The rapid advancement and obsolescence threat of AI technologies may pose a significant challenge to the libraries in this regard.

Adoption of Artificial Intelligence (AI) in Academic Libraries in Nigeria

The new cutting-edge trend, the artificial intelligence has been viewed as one of the technological devices that interfered in the most with library systems/resources and basically changed their functioning and operations. As a result, most academic libraries throughout the world regard AI adoption as a developing strategy that provides ease of operations and services (Eirimiokhale and Sulyman, 2023). The level of adoption of AI in Nigerian libraries is low, as indicated by the findings of Odeyemi (2019), Ajani et al. (2022), Yusuf et al. (2022). This circumstance raises concerns regarding the feasibility of its full implementation in academic libraries as a means of keeping up with global trends and giving libraries a competitive advantage in information access initiatives. Bughin et al. (2018) describe AI capability as being made of machine learning; natural language text understanding; virtual agents or conversational interfaces; physical robots, natural language speech understanding; natural language speech generation and autonomous vehicles.

The use of AI has not gained much popularity in Nigeria, it is regarded as part of the 4th industrial revolution (Park, 2019), and originated from the assumption of John McCarthy in 1956 who states that every aspect of learning and other forms of intelligence can be simulated through the use of machine (Wang, 2018). The originator further defines AI as the 'Science and Engineering of making intelligent machines, particularly intelligent software' with the goal of using the computer to study the intelligence and associated decision making skills of humans (Amudha, 2022). Artificial intelligence (AI) the very light field theories hundred not masterminds

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decide neural biologists and human-computer technologists. The subject of cellular AI began with the decoration that, back in time, computers that were constructed only for the purpose of completing numerical calculations were found to perform a variety of other functions. For example, a computer could be made to play backgammon, and according to a computational logician it could prove a theorem. Playing a backgammon game or a logic proving theorem are two examples of high-level activities, respectively, that require strategic thinking and creativity, which are typically associated with human intelligence. The starting point of this argument is that the human brain has the same structure as a computer and, therefore, humans can f amaze computers to think like humans.

Sivarajah et al. (2017) noted that using AI in academic libraries allows for better analysis of datasets, especially large datasets used for analysis across multiple datasets. It also aids in the removal of tiresome and repetitive chores. This implies that integrating AI into library operations enhances their capacity to surpass human intelligence Libraries, including university libraries in developing countries, such as Nigeria, have failed to adopt digital technologies, and they also show resistance to change in the use of technologies in various library operations (Wheatley and Hervieux, 2019).

Tella (2020) stressed the need for academic libraries to re-position themselves to take relative advantage of artificial intelligence's potentials by refining the quality of library services in this era of the information age.

Achievements of AI in Academic Libraries

According to Balsubramanian and Tamilselvan (2023), the impact of AI on library operations and services manifests itself in the following ways:

Data Analysis: AI can serve as an analyzer of library statistics, encompassing circulation data, user activity, and resource utilization, to tell historical stories and generate graphical representations that help in making choices and enhancing services.

Enhanced Search and Discovery: The AI-enabled system can help the users get hold of the related resources much more easily and quickly by the features such as user searching behavior analyzing, trend spotting, and resource recommending that are integrated into the system. At the same time, it can also ensure instant query resolution and provide personalized & concentrated customer service.

Collection Management: Choosing and procuring means of supporting the library work with artificial intelligence (AI) through periodic assessments of the statistics on usage, identification of popular products, and prediction of future demand. As a result, it will be possible for the library to make better decisions regarding the resources to purchase and, thus, will allocate the funds more efficiently.

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Processing and Organizing Library Resources: AI helps to decrease the time and effort necessary for the management and organization of collections by simplifying the activities of cataloging and classifying the library materials.

Inclusive Information Accessibility: Availing automatic translations, alternative text and audio descriptions, and other assistive technological devices, artificial intelligence (AI) is the main reason which has allowed more and more people, especially those with disabilities, to access information and services consciously and inclusively.

Preservation of Resources: The utilization of artificial intelligence (AI) in the digitization and preservation of library resources not only minimizes the chances of physical records being lost or damaged but also promotes their future usability and public accessibility.

Conclusively, Subaveerpandiyan (2023) discovered that AI can improve information retrieval, automate library routines, personalize user interaction, and provide innovative services, that mean it enhancing the library users' satisfaction.

An Overview of Nigerian Academic Libraries in 21st Century

As a library catering to the university or college staff and student teaching and research requirements, it is termed an academic library. In addition to supporting curriculum development in schools, they also help university faculty and student research, thus, these libraries serve two complementary functions. The term academic libraries refers to the information centers formed for the sole purpose of developing the mission of their parent institution, such as, acquiring knowledge, through teaching that knowledge to individuals who in turn will help improve society, and through better human welfare.

Academic libraries are libraries attached to tertiary institutions such as universities, polytechnic institutions, colleges of education, colleges of agriculture, colleges of technology and also research institutes (Akporhonor, 2005). Singh and Kaur (2009), stressed that preservation and access to knowledge and information is the main mandate of academic libraries along side supporting the mission of their parent institutions which is teaching and research.

Okiy (2005), notes that of all the different types of libraries in Nigeria, only university libraries have a clearly- defined policy on funding. As a consequence of the 1992 agreement between the Federal Government and the Academic Staff Union of Universities, they get ten percent of the recurring yearly budget of their parent universities. However, it is regrettable that such monies are not forthcoming as most university administrators tend to flout that decision (Okiy, 2005; Yetunde, 2008).

The transmutation of technology has affected even the academic libraries in Nigeria. They are the ones who are always pressured to provide information sources that are local-community-related being the information

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producers. The staff is required to change their working methods and start thinking that they are doing fine if they work in an automated environment. This states that in the race for being information providers and disseminators universities libraries are to digitize the facilities first. In fact, the electronic format of information is more preferred among teachers and students than the traditional way of accessing information. Okiy (2010) opined that with the use of ICT, it has become possible to access a variety of information and knowledge sources in a manner that would be simple, easy and independent of time, place and subject discipline.

Almost synonymous with the digital age is the information age. It is also a scratch of the explosion of the sources of information. The total office has changed, and a business has to learn new skills. Due to the convenience of digital material, librarians are expected to be able to find, evaluate, and confer with new materials quickly. A person who handles the book issues has to contact individuals. Krubu and Osawaru (2010), Information and Communication Technology (ICT) has brought unprecedented changes and transformation to academic library and information services, conventional LIS such as OPAC, users services, reference services, bibliographic services, current awareness services, Document delivery, inter-library loan, Audio visual services and customer relations can be provided more efficiently and effectively using ICT, as they offer convenient time, place, cost effectiveness, faster and most-up-to-date dissemination and end users involvement in the library and information services process. They must be adaptable, creative and able to understand things as a system or level of public image (Ramzan, 2004). In the digital society, ICT has resurfaced as a library. Printed documents are no longer sufficient to store information. CDROM databases, electronic document delivery, automated cataloging, and online trading and retrieval systems Open Access Catalogue (OPACs) are common.

Besides, aside from the public libraries, academic libraries are the ones that have the greater potential of helping researchers. The library is one way in which the university or college can maintain its research potential. Aguolu (2002), noted that the university library is the heart of the university. The primary reason for this is that the academic health, intellectual vitality, and the overall effectiveness of any university absolutely rely on the state of health and the excellence of its library which is its lifeblood.

Trans-formative Impact of ICT and AI on Library Services

The introduction of information and communication technology (ICT) to academic libraries' services has brought about a monumental turn around, which in turn has led to increased user interaction and operational efficiency. Automated repetitive tasks and personalized user experiences are some of the advanced capabilities

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of artificial intelligence (AI) which can be considered as a progressive step of information and communication technology (ICT) (source). Despite the fact that library services have already begun to adapt to ICT, the role of AI in the future will be even more efficient than these operations which are run by staff librarians who are occupied with other tasks requiring human judgment.

Nevertheless, similar challenges, which are like those met by pre-ICT eras, can influence AI's progressive potential. The operationalization of planned AI technology might be adversely affected by financial incapacity, human resources' knowledge deficiency and underdeveloped infrastructure which are challenging persistent issues that Nigerian academic libraries encounter (source). Thus, even though AI can radically re-craft library services, a successful integration can only achieve through the resolution of these basic issues.

Theoretical Framework for AI Adoption

The entry of AI into the various processes and activities in academic libraries is now easily seen in libraries across the globe. Based on a hypothetical model for integrating AI applications, AI systems that discover knowledge can enhance information retrieval systems and, thus, make it more user-friendly to access relevant resources (source). On top of that, cultural perspectives on technology and ongoing infrastructure problems are possible factors that will affect the implementation strategies, thus, both internal and external factors have to be considered when talking about AI adoption.

According to the findings, in addition to practical training, new skills must be learned by the library staff applying AI technologies for the adoption to be successful. Training and professional development opportunities are vital for librarians to be able to utilize AI tools in their services and adapt to these changes (source).

Technology Acceptance Model (Davis, 1989)

Davis introduced the Technology Acceptance Model (TAM) in 1989. TAM offers an explanation of the factors that influence technology adoption that can typically be used to explain user behaviour. It describes the control, social, and attitude elements that influence the use of information technology. According to him, users' intention to utilise an information system is based on their perceptions about it, which in turn determines how often they use it.

The basic attributes of the Technology Acceptance Model (TAM) to study are:

Perceived Usefulness of AI skills acquired

Perceived ease of use of AI skills acquired

Perceived usefulness is the extent to which a person believes that using the system will enhance his performance at work. Perceived ease of use is the extent to which a person believes that using the system would be simple. Students' views of ease of use, which may be impacted by their computer self-efficacy or attitude towards utilising the system, have an impact on intention both

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directly and indirectly, even if perceived usefulness directly influences adoption intention. This concept also made it clear that a user's perception of the system's usefulness and ease of use will have a significant impact on their attitude towards utilising it, which may include feelings of favouritism or disfavoritism.

If a user cannot see the benefit of using computer technology or information technology facilities to retrieve information for use in research and other academic activities, or if they think that using them is a very difficult task, they will display a negative behavioural attitude towards using them.

It will also be challenging for a user with low computer self-efficacy because using the services necessitates interacting with the computer. According to this theory, a user's computer self-efficacy and attitudes towards using IT facilities—which together reflect their belief and perception of their capacity to enhance performance and use of resources accessed electronically through technological facilities—will have an impact on their performance.

Constructivist Learning Theory

AI as an Active Learning Facilitator

The application of AI in education is a testimony to the idea of constructivist learning theory, which states the paramount importance of students' active participation and knowledge production (Blikstein and Worsley, 2016; Siemens and Long, 2011). AI technology can endorse active learning by providing interactive, problem-solving problems, and simulations. For instance, the AI-centered Intelligent Tutoring Systems (ITS) can render scaffolding learning experiences, adaptative assessments, and immediate feedback, hence, the students can participate in the learning act autonomously (Anderson et al., 1995).

This corresponds to the main ideas of constructivism, according to which, learners generate their knowledge through engaging in research and working in pairs. The results of domestic research have indicated that artificial intelligence (AI) can efficiently support active learning activity by the means of the dynamic learning environment which inspires the students to co-create the knowledge through their practical experiments (Chan, 2015).

Socio-Cultural Learning Theory

AI and Social Interaction in Educational Environments

Theory of Cognitive Learning

Based on Vygotsky's socio-cultural learning theory, social interactions are vital for cognitive growth (Vygotsky, 1978). The use of artificial intelligence (AI) in education mainly in the classroom can be done by the integration of intelligent agents that support cooperative learning activities, which allows for the improvement of social relationships (D'Mello and Graesser, 2014).

Chatbots and virtual tutors can facilitate problem-solving and help promote group knowledge are some of the activities that students

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can do together with the mentioned devices. The newest findings show that artificial intelligence can mostly improve the socio-cultural dimensions of learning, especially through AI-included social interactions which affect positively both students' cognitive development and metacognition, understanding (Luckin et al., 2016).

Integration of AI and Cognitive Load

Cognitive learning theory is primarily concerned with the understanding of cognitive processes that are involved in learning, such as the notion of cognitive load (Mayer, 2008). Artificial intelligence (AI) is significantly involved in the managing cognitive load through the adjustment of the teaching method matching each individual student's skills (Anderson et al., 1995).

Smart tutor systems adjust the task difficulty and add challenge based on the students' cognitive skill levels to maintain the perfect balance. According to the recent studies, AI can be of help in the reduction of intrinsic cognitive burden and the extraneous cognitive load, thus the learners can reach better outcomes (Chan, 2015).

Librarians' Views on the Integration of AI

The librarians views on how prepared the Nigerian academic libraries are to embrace AI technology might be indicative of the prevailing sentiments about the technology, existing levels of acquaintance and whether or not the people believe in its advantages. AI may have the ability to augment the performance of library operations, yet the existence of such insurmountable hurdles like inadequate finance, insufficient technical skills, and fear of job redundancy restricts its uptake. The implications of these findings are such that it is very important to properly plan and fund the training programs that can equip librarians with the skills and knowledge on how to implement AI technologies successfully. Besides, a research surpassed the remark that, even though AI applications are appealing, privacy and task complexity concerns are required to be solved (source). This demonstrates that it is clearly necessary to create the user-centered AI solutions that both accompany the possible risks and satisfy the interests of librarians and users.

Opportunities and Challenges of AI in Academic Libraries

AI systems such as machine learning and natural language processing are among the useful technologies that libraries can fasten their service delivery to. With these technologies, human interaction and streamlining processes in the system can be done fairly easily (source). Yet, as the previous research indicates, the capital and the technical know-how required are the two big problems facing the companies on their ways to adopting AI.

In order for AI to be applied and for their merits to be reclaimed in Nigerian academic libraries, the hurdles such as these must be

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identified.Speaking of which, the case of a built chatbot for a library is one illustration of how AI technology is done and what it can do for user support and interaction (source). Likewise, though the developmental limitations articulate the wider picture of the infrastructural challenges in AI embracing, these types of facilities may also be the models for the other academic libraries in Nigeria.

Influence of Automated Services on Academic Performance

The academic performance of students in Nigerian tertiary institutions has been better due to the usage and provision of automated electronic information systems (source). This survey reveals that the integration of artificial intelligence in library services would make information accessibility even easier and assist in the academic performance of students.

But for the libraries to fully utilize the advantages of AI, it is necessary to upgrade the infrastructure, which has been shown by the limitations that are established, such as slow internet speeds and irregular access to automated services.

The Role of Social Media and Awareness in AI Adoption

The fact that the social media used in academic libraries is one such example of the technology acceptance in various library services, even though it is not directly linked to artificial intelligence (source). Social media is being used to promote library resources, but some issues like the lack of adequate internet connection and power supplies have been belligerent. Some of the infrastructure problems, such as the lack of internet connections and unsteady power supplies, may also be the reason for the little adoption of AI technology in Nigeria's higher academic libraries; so the solution is to enhance connectivity and reliability.

The acknowledgement of the AI's advantages was revealed, but the library administration of Nigerian universities is being mainly held back by worries on job loss and lack of enough training, which is the awareness and perception of AI among them (source). This calls for the need of training librarian in the introduction of AI benefits and how it can augment more their current roles rather than substitute them.

Theoretical Implications

This review's theoretical underpinnings highlight how important it is to have a sophisticated grasp of AI in education. The potential of AI to support active learning and customise educational experiences is highlighted by constructivist learning theories (Floridi and Taddeo, 2016). According to Floridi and Taddeo (2016), socio-cultural viewpoints highlight how AI might improve social interactions and cooperative learning settings. Theories of cognitive learning shed light on how AI might adjust to different learning preferences and manage cognitive load (Floridi and Taddeo, 2016). By combining several

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theoretical perspectives, we can better grasp how AI fits into established educational concepts while both supporting and challenging traditional teaching.

According to the theoretical ramifications, a careful synthesis of pedagogy and technology is necessary for the successful integration of AI in education, taking into account the dynamic interaction between the two (Floridi and Taddeo, 2016).

Conclusion and Future Research Directions

Embracing AI in Nigerian academic libraries comes with a plethora of advantages like better information retrieval, personalized services, and enhanced operation but challenges such as insufficient infrastructure, exorbitant costs, and lack of expertise remain the biggest hurdles in implementing it. For the collaboration, government support, and capacity building programs to be responsive in the achievement of these goals, they are necessary.

Research findings reveal that the recognition of artificial intelligence applications' potential to impact positively on Nigerian university library operations is on the rise but there are still some significant problems that should be dealt with first so that it can be effective. The future research endeavors should be centered on:

1. **Infrastructural Improvements**: Internal studies on technological infrastructure and internet use as accessible means of learning AI, that is, at academic libraries investigating the use of such innovative technologies.

2. Training and Development: The exploration of effective training programs that enable librarians to obtain the necessary skills for employing artificial intelligence (AI) technologies is currently underway.

3. User-Centered AI Solutions: The research is being conducted with the aim of understanding user the way they interact with AI applications in libraries. This will serve as a basis for developing user-centered solutions.

4. Longitudinal Studies: A research study aims to analyze the consequences of the extensive assimilation of AI technologies in academic libraries in Nigeria on the service and user outcome. AI and machine learning techniques are commonly used for developing search engines that provide results on the basis of user preferences and rankings.

Future research can address these areas and thus be instrumental in not only developing a more thorough understanding of the impact of AI applications on academic library services in Nigeria but also providing guidance on the successful implementation of AI applications in academic libraries in Nigeria.

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