

Driving Library Service Delivery by the Instrumentality of Artificial Intelligence: A Scoping Review

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Abstract

Libraries are saddled with the responsibility of providing information resources and services to their users, considering their preference for more digital content as well as quick and unrestricted access. Artificial Intelligence (AI) has emerged as a transformative tool in driving library service delivery, offering unprecedented opportunities to enhance efficiency with great potential for providing high-quality library services through effectively handling user inquiries, providing instant assistance, and improving overall user satisfaction. The study examined the concept of artificial intelligence, artificial intelligence technologies, adoption of artificial intelligence in Nigerian libraries, application of artificial intelligence technologies in libraries, benefit of the applicability of artificial intelligence in libraries and challenges in the application of artificial intelligence in Nigerian academic libraries. It identified ethical concerns, privacy issues, budgets, librarians' attitudes, technical abilities, facilities, misuse of the technology as some of the challenges faced with the use of the technologies in libraries. It recommended that librarians strive to maintain normal human interaction with their clientele where necessary and undergo special and specific training on their proper usage to be able to leverage the opportunities they offer.

Keywords: Artificial intelligence, Library Services, Service Delivery

Introduction

The 21st century is overcome with the expansion of technological advancement, where every area of knowledge and daily life has undergone significant change in the way things are being done; the library being no exception. To maintain effective and efficient service delivery, the library like other fields is adapting to these changes by moving to the use of digital technologies. The library according to Idemudia and Makinde (2022) is no longer just a physical structure that houses information resources; it is now accessible through any platform, physical or virtual, whose primary objective is to make information materials available to various users, to enable them to meet their information needs through an organized pattern. Furthermore, the library is seen as a cloud space serving as both a physical building and a modern digital library through the use and application of emerging technologies in its workspace (Omehia et al. 2021). These technologies include mobile technologies, cloud computing, software packages, robotics, and other areas involving Artificial Intelligence (AI) such as expert systems, natural language processing, machine learning, pattern recognition, and neural networks. The different components

of AI can be deployed in carrying out the core library services such as reference services, acquisition services, cataloguing services, classification, indexing, etc.

Generally, library services comprise technical services (backstage) including collection selection, shelving, loan circulation, and information organization procedures (classification, cataloging, and subject determination). Librarians in various kinds of libraries perform this work daily which most times are repetitive, hence giving them less time for professional growth and the creation of an innovative library. This is especially true for the managerial level, where libraries need a lot of assistance with data analysis and presentation for policy and decision-making (Harisanty et al, 2024). The library being a service-oriented enterprise where information is acquired, organized, and disseminated through different mediums is forced to adopt the use of digital technologies to meet the changing needs of information seekers, especially in the digital landscape where using traditional methods is no longer sufficient. Manjunatha (2023) asserts that libraries now face new difficulties in managing enormous volumes of material, offering effective services, and guaranteeing an excellent user experience as a result of the digital era where automation and information technology integration have drastically changed traditional library systems; AI being one of such innovative technology that has the potential to completely change library services and operations in the near future.

According to Google Cloud (2024), AI is a collection of technologies that provide computers the capacity to carry out a wide range of sophisticated tasks, such as data analysis, recommendation making, speech and text comprehension, and vision. It is seen as the foundation of innovation in contemporary computing, bringing benefits to both people and companies. The core objective of any library is bringing information together with people who are seeking such, seamlessly and easily without limitation of space and time, hence the use of AI technologies will in no small measure transform the way and manner libraries carry out their services to satisfy the information needs of their users. Yusuf et al. (2022) affirmed that globally, artificial intelligence technologies are now acknowledged as essential resources for raising productivity and efficiency levels within organizations. Also, sufficient to acknowledge is, AI technologies have had a significant impact on the workplace of the twenty-first century. Its adoption within the library context can enhance services and give patrons access to reliable information which can spur growth and development as its use has the capability of helping readers and libraries integrate naturally.

Tella (2020) emphasized that although libraries in poor nations, like Nigeria are still having difficulty establishing themselves, those in developed nations have embraced and utilized AI technologies in almost every aspect of life to boost the effectiveness of their service delivery. Harisanty et al. (2024) posited that AI tools can aid libraries with jobs, boost output, and enable operations to be performed quickly and effectively. The AI applications in the library also provide users with ease, as they make it easier to access services and locate reliable sources of information. Additionally, patrons may expect prompt service from the library, which enhances their experience using its resources. The above positions highlight the importance of leveraging AI technologies to improve the overall operations of the library and how effectively they help users meet up, and be

satisfied with their information needs, which ultimately is anchored on the instrumentality of these technologies to drive the entire process effectively.

The Concept of Artificial Intelligence

Copeland (2024) defined AI as the capacity of a computer or robot to carry out actions usually associated with intelligent beings. This is commonly used to describe the endeavor of creating artificial intelligence systems that include human-like cognitive functions, like reasoning, meaning-finding, generalization, and experience-based learning. Artificial intelligence (AI) according to Irizarry-Nones et al. (2017) cited in Oname and Alex-Nmecha (2020) is the programming and development of computers to carry out tasks that need human intelligence, such as language translation, speech recognition, visual perception, decision-making, talking, and emotional reactions. It entails the use of digital programs to imitate human actions or behaviour using evolving computer technologies. Similar to the above assertion, AI applications in computers include speech recognition, natural language processing, self-driving or autonomous cars, machine learning, deep learning, and robots, according to Oname and Alex-Nmecha (2020). Everyday computing activities are already impacted by artificial intelligence because most modern computer systems and smartphones include capabilities that we may have utilized without realizing they were sophisticated devices. Operating based on perceptual recognition, as opposed to human deep cognition, computers have an advantage over humans in that they can efficiently recognize patterns at a speed and scale that humans cannot (Oname & Alex-Nmecha, 2020). Within the library context, Bello and Abdulsalam (2023) averred that artificial intelligence is a group of technological advancements that allow automated computers to act, sense, feel, learn, and carry out administrative tasks in the library to meet the day-to-day information needs of library patrons.

Artificial Intelligence Technologies

Applications of AI in libraries have the potential to completely transform the way they operate and improve the user experience. AI chatbots, intelligent libraries, robots, and other applications that help provide efficient library services are just a few of the many ways that AI technologies are used in libraries (Subaveerapandiyam, 2023). Yusuf et al (2022) identified different AI applications within the library system such as descriptive cataloguing, technical services, and collection development; subject indexing, reference services, database searching, and document delivery. These are very important areas in which the use of various AI technologies can boost the overall service delivery while meeting the library's objective. Xu, Z. (2023) conducted a research study on the application of artificial intelligence (AI) in the library sector while investigating its significant role in libraries-related industries. It identified six key technologies AI technologies that are very useful and will highly impact the development reforms in the library; OCR, data mining, natural language processing, face recognition, knowledge mapping, and machine learning.

Optical Character Recognition (OCR): This is a technology that enables computers to recognize printed or handwritten text from an image or document. According to Leviner (2023), libraries

utilize OCR technology to turn printed documents into digital text files, which can greatly improve the accessibility of educational resources for students with disabilities. Additionally, it can be used to digitize library books, making them easier for users to find and access.

Data Mining: The process of sifting through massive data sets to find links and patterns that may be used to address business problems through data analysis is known as data mining. Businesses can forecast future trends and make more educated business decisions by utilizing data mining techniques and technologies. Discovering more about a user base, predicting results, identifying fraud or security problems, describing a target data collection, and identifying bottlenecks and dependencies are just a few uses for data mining (Gillis et al., 2024). The library could use this AI technology to closely monitor the records of their users to detect anomalies with their records in terms of registration or default in the return of library materials.

Natural Language Processing (NLP): This branch of AI enables computers to comprehend, generate, and alter human language. For instance, the core technology behind virtual assistants like Alexa, Cortana, Siri, and the Oracle Digital Assistant (ODA) can query the data using natural language text or speech. These virtual assistants can understand user requests and respond to our questions in natural language thanks to natural language processing (NLP) (Chen, 2021). This is a quick fix for responding promptly to user queries, especially in the reference section where users may want quick answers to some of their inquiries.

Face Recognition: Every year, face recognition technology advances in speed and accuracy. This implies that it may soon be applied to improve the convenience of our daily lives. The Library access control system based on facial recognition is better than the standard library access control system. An example is the Touchless face-based access control and attendance system powered by artificial intelligence technologies (Jampani, 2021). This technology is very essential for the protection of library resources and equipment, as it will easily help to identify the different users of the library.

Knowledge Mapping: The knowledge map presents contents in various ways and offers a straightforward, visual layout with direct access to the library resources. The knowledge map may help users reduce their intrinsic cognitive load, minimize their extraneous load, or promote their germane load. It can also help librarians prepare teaching materials or provide guidance for management (Liu, 2020).

Machine Learning: This is the computer's capacity to learn on its own from prior experiences and to handle complicated tasks without the need for explicit human programming to create predictions. Some examples of machine learning models are supervised learning, unsupervised learning, reinforcement learning, deep learning, and deep reinforcement (Wehle, 2017; Daimari et al., 2021). This will in no small measure help librarians to avoid repeated tasks or operations; eg in the classification of materials, machine learning technology would help in the area of bibliographic search to avoid duplicating efforts.

Virtual Assistants: These help users with several tasks, like scheduling, making and receiving phone calls, and giving directions when they're on the road. These devices require a lot of data and learn from human input to improve their ability to predict user needs and behavior. The most well-known virtual assistants on the market right now are Apple's Siri, Google Assistant, and Amazon Alexa. Since virtual assistants adapt to each user's particular behavior and learn from it to improve over time, they are more personalized than chatbots and conversational agents (Copeland, 2024).

Adoption of Artificial Intelligence in Nigerian Libraries

Information technology advancements enable people to work more efficiently and produce higher-quality work. Given that libraries are information sources that hold a variety of intellectual property and user data in sufficiently big amounts, AI is likely to be used as libraries process much digital content from numerous sources. In addition to handling user and social media data, libraries are dealing with an increasing amount of transaction data that needs to be processed and analyzed using specialized programs to be used for decision-making, service enhancement, resource quality improvement, and other purposes. (Harisanty et al, 2023). Artificial intelligence's impact on academics, business, and culture is still expanding, with libraries not exempted. While many organizations worry that AI might disrupt their operations, libraries through the use of this new set of technologies will be able to improve their outreach, streamline daily work, and much more according to LaFountain (2023).

The library patrons of the twenty-first century have evolved into digital users who frequently expect autonomous usage of digital library materials. In addition, the library has expanded the range of services it offers to offer a wealth of answers to issues facing humanity. Users across a range of categories have consistently recognized and appreciated the importance of libraries in providing information that helps them solve issues that come up regularly as conventional library practices lack the enablement to meet these demands. It has been proposed that collections can be improved to make them more beneficial to users by utilizing artificial intelligence (Cordell, 2020). Grant and Camp (2018) noted that many academic libraries particularly in developed countries have accepted AI for numerous library operations such as circulation and reference services in the US Library of Congress. However, in Nigeria, Yusuf et al. (2022) noted that the University of Lagos is the only institution that has introduced the use of AI in library services and operations. Mupaikwa (2025) concluded that AI is being used in all aspects of the library's housekeeping operations, including strategic decision-making levels. Unfortunately, there hasn't been much use of these technologies—especially in developing nations—with the majority of projects remaining in the experimental stage.

Application of Artificial Intelligence Technologies in Libraries

Even though the application of AI is not intended to replace librarians as a whole, several librarianship activities have been replaced by information technology, sometimes even dominating work in libraries. The use of AI has so far helped librarians carry out their activities by dealing easily with a lot of work within a limited amount of time. Therefore, the application of AI provides

librarians the ability to serve users optimally without leaving their jobs as information managers (Rudiansyah, 2023). He further observed that AI technology such as robots and smart machines helps humans work, especially in data processing. They help librarians especially with routine tasks such as circulation, shelving, processing, and registration of new members leading to high-level productivity and library development. In the same vein, Subaveerapandiyan (2023) asserted that AI application in libraries holds immense potential for revolutionizing library operations and enhancing user experiences.

The application of AI technologies in librarianship has in no small measure influenced the way and manner in which librarians offer their services to library patrons in the 21st century. Idemudia & Makinde (2022) opined that robotics has a lot of potential for providing high-quality library services because, for instance, chatbots can lighten the strain on librarians, particularly reference librarians. Expert systems, which are knowledge-based machines capable of making prompt, well-informed decisions like that of a person, could have saved the library time and money. Also, AI-powered chatbots according to Subaveerapandiyan (2023) can effectively handle user inquiries and provide instant assistance, improving overall user satisfaction. Intelligent libraries equipped with AI technologies can streamline cataloguing, classification, and recommendation processes, enabling efficient information access for patrons. Commenting on the effectiveness of AI in library service provision, Adetayo (2023) states that ChatGPT has become a valuable tool for academic libraries, providing rapid and accurate responses to user inquiries, and offering convenience and accessibility outside traditional library hours. ChatGPT's advanced language processing capabilities enable it to generate human-like and contextually relevant responses, making it an effective virtual assistant. Academic libraries can utilize ChatGPT for reference services, selective dissemination of information, and collection development.

According to the study by Harisanty et al. (2023), other areas where AI can be applied in libraries include administrative functions like staffing, technical functions like cataloguing, and informational functions like reference and information literacy. The creation and management of collections, circulation, and user services, library processing, reference services, library administration, and library customization are the main areas in which Das & Islam (2021) identified the application of AI in libraries. Automated library retrieval systems, usage monitoring, checkout times, patron services, security, inventory capacity, and smart shelves have all improved due to the use of AI in these fields.

Benefits of the Applicability of Artificial Intelligence in Libraries

Many well-known service delivery companies, like Google, IBM, Amazon, and Netflix, among others, have integrated various AI features to enhance their provision of goods and services. Even major industries in the health, education, weather, business, and agriculture sectors, as well as government, and non-government organizations, are demonstrating interest in, and are using these technologies to streamline and balance workloads, boost and accelerate productivity, decrease interpersonal communication, and most importantly lead the digital world in a smart and

sophisticated manner (Bello & Abdulsalam, 2023). Libraries have joined the bandwagon in the adoption and application of various AI technologies in a bid to drive their service delivery to meet the dynamic needs of their users and satisfy them. Das and Islam (2021) asserted that on the whole, AI offers numerous strengths and opportunities for libraries, including improved information retrieval, personalized recommendations, and task automation.

According to Abdulsalam and Bello (2023), AI has enabled libraries to provide solutions for urgent problems like classifying and acquiring library materials, as well as shelving books and other materials. Consequently, library services can be provided in more efficient and well-structured ways to increase patron satisfaction. Dawa (2021) posits that AI enhances the effectiveness of library operations, including content selection and procurement, technical services, circulation, reference, serial management, and more. Additionally, technology improves the efficient provision of library services by removing human error from library operations and lessens the physical strain that librarians endure while performing their everyday duties. Also, in academic libraries, AI can boost research productivity among faculty members by making research more discoverable as it provides for constant and timely accessibility, and reduced space occupied by print materials through the introduction of digitization. Furthermore, in the discussion on the impact of the application of AI to library operations, Kai-jun et al. (2019) asserted that by improving the accuracy and effectiveness of information retrieval through sophisticated search algorithms and natural language processing, the incorporation of AI holds the potential to greatly enhance library services. Personalized library resource recommendations based on user preferences and behavior analysis can also be made with its help. Additionally, AI can automate repetitive processes like inventory control and cataloguing, freeing up librarians to focus on more complex and valuable endeavors.

Challenges in the application of Artificial Intelligence in Nigerian academic libraries.

Many AI-based technologies are offered to libraries to help with routine and complex tasks, but not many libraries have partially or fully adopted AI. Rudiansyah (2023) identified several concerns in libraries' adoption of AI which include issues related to leadership policies, budgets, human resources, and facilities. Despite the potentials associated with the application and use of AI technologies for driving library service delivery, Adetayo (2023) noted that challenges exist with the use of AI for library operations which include but are not limited to the potential loss of library employment, misuse of the technology, inaccurate query responses, and limited comprehension compared to human librarians.

In a study conducted by Subaveerapandiyan (2023), the implementation of AI in libraries also poses certain challenges and considerations that include ethical concerns, privacy issues, and the need to ensure equitable access to information which are important factors that must be carefully addressed to consolidate the gains of its application. Libraries must balance the benefits of AI technologies and the preservation of human-centred values, ensuring that they complement and enhance the work of librarians, rather than replace them. Hussain (2023) concluded that while

AI is a powerful technology that can improve library services, various obstacles, including a budget, librarian attitudes, and technical abilities, may prevent its effective application. While discussing artificial intelligence in libraries, Oname and Alex-Nmecha (2020) averred that AI systems are generally not in operational use in most libraries in Nigeria and developing countries. Attributing the limitations to lack of technical know-how among library staff, lack of adequate funding due to a tight budget, high system development and maintenance cost, erratic power supply, inherent complexities of expert/artificial intelligence systems' development, limited natural language capabilities, intelligent systems lack that common base of human knowledge, level of effort and technical expertise, and a limited amount of artificial intelligence experts among library automation vendors.

Conclusion and Recommendations

It is no longer news that the change in the information landscape in the twenty-first century occasioned by the proliferation of information and communication technology and other digital technologies has brought about a drastic change in the way and manner library users expect to be provided information. Libraries and librarians are forced to adapt to the new trend by adopting the use of technologies such as artificial intelligence in their day-to-day operations. The introduction of AI to library operations has had a transformative effect on libraries, acting as a transformative tool in driving library services. The application of AI offers unquantifiable opportunities capable of enhancing the level of effectiveness and efficiency with which librarians carry out their operations in making information resources and services accessible to users in a manner that will satisfy their information needs. The use of chatbots, automated systems, data analytics, and other AI technologies have helped libraries to streamline their operations, save time, and free librarians to concentrate on a more high-valued aspect of their responsibilities. Leveraging on the attendant advantages attributed to the application of AI in service delivery in libraries, they can easily cater to the diverse information needs of their users while ensuring that accessibility is quick and unrestricted. However, the use of AI technologies for library service delivery is not without its challenges such as ethical concerns, privacy issues, budgets, librarians' attitudes, technical abilities, facilities, misuse of the technology, inaccurate query responses, and limited comprehension of human queries among others. It is recommended that librarians strive to remain resolute in ensuring they maintain normal human interaction with their clientele where necessary and not leave for robots what ought to be done by humans. Also, librarians should be trained especially on the use of different AI technologies to be able to fully leverage the opportunities they offer.

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