

# ISSUES AND PROSPECTS OF ARTIFICIAL INTELLIGENCE APPLICATION IN LIBRARY SERVICE DELIVERY IN THE 21<sup>ST</sup> CENTURY NIGERIA

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## **Abstract**

Due to the growing presence of artificial intelligence (AI) in developed countries, this paper looks at the issues and prospect of artificial intelligence for library services in Nigeria. The paper describes the concept of artificial intelligence, investigate and analyze the various applications and components of artificial intelligence in library automation, including but not limited to collection management, cataloging, user services, data analytics, and recommendation systems, The paper examines the current landscape of library automation and the challenges faced by traditional library systems and management towards the adoption of artificial intelligence which include financial uncertainty, job loss, epileptic power supply, coast effectiveness and technological disadvantages among others. The paper concluded that the adoption of AI in libraries is setting a new level of efficient and effective library service delivery but it adoption in developing countries such as Nigeria is low due to some of the identified challenges. The paper recommended that government and library management must come together to proffer the way forward for libraries in terms of meeting up with the global and latest standard. Library staff should be exposed to training and retraining in the use of artificial intelligence in delivering library services; among others,

**Keywords:** Artificial intelligence, Library services, Robotics, Chatbot, Technology, Nigeria.

## Introduction

In the digital age libraries face evolving challenges in managing vast amounts of information, providing efficient services and ensuring a seamless user experience. Traditional library systems have been significantly transformed by the integration of automation and information technologies, one such transformative technology is artificial intelligence (AI), which has the potential to revolutionised library operations and services.

The integration of artificial intelligence in library automation offers numerous applications across various aspects of library services from optimising collection management to enhancing cataloging and metadata creation, artificial intelligence-driven solutions are reshaping traditional library workflows and it powered recommendation systems have the capacity to deliver personalised reading suggestions and improve user engagement with library resources. The potential for customisation and enhanced user experiences positions it as a compelling tool to enrich library services in the digital era.

Artificial intelligence technologies have become globally recognised as indispensable tools for improving organisational efficiency and productivity, suffice therefore to say that the technologies have strongly influenced the world of work in the 21st century in the library setting; Adebayo et al (2022) opined that the adoption of artificial intelligence can improve library services and provides access to accurate information that can drive growth and development in this information age. Artificial intelligence technologies are now being used in libraries to achieve the organic integration of readers and libraries, with this, readers interact on the same platform, track and acquire the personalised needs and information of users so that client can access information accurately. Tella, et al (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.

To this regard therefore, the paper examines the current landscape of library automation and the challenges faced by traditional library systems in managing information and in the digital age. It also analyses the various applications and components of artificial intelligence in library automation and finally assess the benefits and potential drawbacks of integrating artificial intelligence solutions into library operations. It adopted a comprehensive literature review, delving into the rich repository of scholarly works of others

Omame and Alex (2020) indicated that libraries have evolved structurally and content-wise through different eras: the ancient, medieval and modern era, in the ancient times, clay tablets and stones were used as media for transmitting information, through the medieval era of papyrus and parchments and the modern era of paper, microform and now the digital or electronic media (Gustavsson & Hedlund, 2011) libraries have acquired and maintained various forms of information resources throughout these eras so as to meet the information needs of its user communities. Similarly, a library was formally defined as a function of the physical building where books were kept for reading and other purposes. However, the definition of library today has gone beyond the physical building, it now centers on the collections and services offered. However, in its effort to satisfy the dynamic information needs of its clientele at the same time uphold its relevance in this ever-changing technological society, libraries have explored, incorporated and metamorphosed through different technological revolutions of clay tablets, stones, papyrus, parchments, paper, microforms, computers, Internet, virtual libraries, library 2.0, cloud computing etc. Furthermore, deep learning and neural network models are applied to new generation information retrieval systems in the library, the intelligent librarian can provide patrons with tailored, precise, high-quality information resources and knowledge push, including recommending books to borrow, selective dissemination of information in a particular domain, current awareness of the latest cutting-edge research hotspots, and teaching reference materials, among others. Yu, Gong, Sun and Jiang, (2019).the

combination of artificial intelligence with libraries can become a big stride in libraries' future despite the fact that Xu, Z. (2023) has identifies potential challenges and problems that libraries may face in implementing AI-related technologies.

Artificial Intelligence provides more effective techniques to improve services such as exploration, research and recovery, accomplishments of it implementation can act as a step towards the adoption of technologies and improve the provision of information resources and services by librarians. Artificial intelligence tools and areas in which they can be applied in the library include: robotic (taking library stock, shelving, searching, and retrieving information materials from shelves, check-in and check-out); Chatbot (acquisition, descriptive cataloguing, query services, library instructions and information retrieval); natural language processing (knowledge management, book/information processing, classification of books, translation of text from native language, reading of information materials as well as information retrieval); pattern recognition (library material security, QR code of materials image, indexing and abstracting, user identification and security passwords); image processing (preservation and archiving, managing library image and video databases, record scanning and user facial recognition); text data mining (citation support and analysis, OPAC searching, metadata, reference services, social media appearance/ management and library trends). The application of artificial intelligence in librarianship is sometimes said to be inevitable; an issue in the library can be solved using two or more AI approaches as used in many spheres of life and fields of study.

### **Components Of Artificial Intelligence**

Ali, et al, (2020) among other scholars identified the following components of artificial intelligence.

**Machine Learning (ML)** this is an artificial intelligence technology that enables developed systems to train and gain new knowledge on their own without being specifically taught, data is fed into a consuming machine-learning system, which controls how the system outputs or reacts, the system may also be created repeatedly when its own output is used as

an input or data source, it can be tested and programmed on an ongoing basis. (ALA 2019). The focus is on developing computer algorithms that access and use data for training themselves, machine learning systems can play a pivot function in the provision of library information resources and services, examples of machine learning tools within AI include: Big data, Text data mining, Robotics, Pattern recognition, and Chatbot.

**Deep Learning (DL)** is a machine learning subset, the human brain inspires the algorithms and artificial neural networks which then learn from enormous amounts of data, even with a data set that is instruct-turned, very diversified and interconnected, machines solve complicated issues through deep learning, natural language processing, image processing and neural networking are examples of artificial intelligence tools used in the context of deep learning.

**Natural Language Processing (NLP):** allows computers to comprehend the primary language impressions within a question or solution. Most web search engines today such as Google, incorporates speech recognition to their system, this enables their users to speak the word or phrase they want to search and the web search engines types it into the search box via the use of natural language processing before searching and displaying the search results, the design of subject indexing, development of information retrieval systems, and bibliometrics are all examples of how it can be used as crucial components in the establishment of a digital library and also automatic translation of foreign language, it is noted that text mining techniques are used in efforts to organise vast amounts of language data (i.e., converting unstructured data to structured data) and to define concepts conveyed in textual form (e.g., sentiment and emotion analysis in speeches and comments).

**Pattern Recognition:** Pattern recognition automatically recognises patterns and consistencies in data sets. Pattern recognition is an example of machine learning, as well as other AI technologies such as data mining and knowledge discovery in databases. Pattern recognition is centered on a prior knowledge or statistical information collected from the structures. Patterns to be classified are frequently clusters of observations or

measurements that define points in a suitable multi-dimensional space. The use of the completely automated public touring test to check if the user is a robot or a human at the front end interface is an example.

### **Applications of Artificial Intelligence (AI) in Libraries**

Shanmugam (2017).indicated that artificial intelligence is the modern technology which is used to manage digital library, this systems can replicate and thus replace a human being in the library, although Li, Huang, Kurniawan and Ho (2015) believed that this invention will never replace librarians, but will center on menial and time-consuming library operations such as shelf reading and leave the librarians to engage with the patrons., corroborating this assertion, Murphy (2015) maintained that the application of robots in libraries will bring librarians and users closer together against the notion that robots will alienate librarians from their users. Some fields of artificial intelligence that are used in library management system include;

**Robotics:** Library activities involve plenty of manual work, which can be partially or fully done effectively with the help of robots. Technology has advanced libraries in many ways; robots are being used instead of humans in various library operations, especially those tasks which are hazardous and time-consuming.

Rojas et al. (2022) indicated that a robot is a mechanized device that uses artificial intelligence methods to complete automated activities under direct human guidance, pre-defined instructions, or a set of generic procedures. Robot such as that in the PESIST central library in India helps in filing, sorting, and replacing books on the shelf, libraries with a huge collection now use robots for inventory purposes. The 'Robbie' robot developed by the Temasek Polytechnic library can scan more than 32000 books per day, another robot from the same library named 'Bobbie' is able to deliver materials like newspapers, magazines, brochures, and can welcome as well as direct guests and students to various locations. Robots are now being programmed to answer frequently asked questions that library patrons may have, even though robots have artificial intelligence

they cannot be as intelligent as humans as they are man-made and need a human touch to get operated. In essence, robotics involves the design and development of physical machine which combine both hardware and software to perform tasks. Robots can interact with their environment and perform physical actions that can be used in different human endeavor and environment.

**Chatbot:** (referred to as intelligent agents or digital assistants) are software applications which can converse intelligently, whether by speech, text, or possibly by embodied expression through their design, they closely emulate human conversation to communicate and interact with people. This was achieved in the artificial intelligence Turing Test, Amazon's Alexa, Google assistant and Siri are examples of modern Chatbot that are used in everyday life.

In essence, Adetayo (2023) posited that Chatbot are software programme that simulate humanlike conversation that exist solely in the digital realm interact with users through text or voice interface and it perform tasks like customer support, data collection or entertainment and which do not have a physical presence. However, the major differences between a robot and Chatbot can be represented in the table below.

### Key differences

<b>Physical presence:</b>	Robots have a physical body while Chatbot exist only in digital realm
<b>Interaction</b>	Chatbot interacts through chat or voice, while robots interacts with their environment and physical objects
<b>Purpose</b>	Chatbot focus on information exchange, while robots perform physical tasks and action.

While Chatbot and robotics are distinct, they can be combined to create advanced application like robotics arm and drone operations.

Soni (2023) posited artificial intelligence in libraries enhances the borrower experience, streamlined librarian tasks and improved resource discovery. Here are some ways it works in libraries:

**Cataloguing and classification:** artificial intelligence assists in organising and categorising library materials making them easier to find for example, natural language processing analyses titles, abstracts and descriptions to identify key words and subjects. Similarly, it helps in identifying authors, publishers, and other entity to enhance cataloguing through what refers to as “entity recognition”. Automatic classification which is to assign subject, genre and categories based on content analysis can also be performed. In essence, its application in cataloguing and classification includes;

- Automated meta data generations.
- Subject heading assignment.
- Classification system mapping (e.g. Dewey, LC)
- Authority controls ( e.g. author name normalization)
- Duplicate detection and merging.
- Collection analysis and recommendations.

By leveraging artificial intelligence, libraries can increase cataloguing efficiency and accuracy, thereby enhancing discovery and access and also improve collection management analysis which also reduces manual labour and cost.

**Virtual assistants:** AI-powered Chatbot helps patrons with queries, recommendations and research assistance, artificial intelligence as a virtual assistant in library works by:

- Chatbot: AI-powered Chatbot answer patrons’ questions by providing information and assistance.
- Knowledge Base: it accesses a vast knowledge based to provide accurate answers and information.

- Multilingual support: it assists patrons in multiple languages, breaking language barriers.
- Continuous learning: it updates its knowledge base, adapting to changing patron need and library resources
- Task Automation: it automates routine tasks, freeing librarians to focus on more complex queries
- Integration: it integrates with library systems, accessing catalogs, data bases and other resources.

In summary, by adopting artificial intelligence as virtual assistant, libraries can:

- ❖ Free up librarian time for more complex inquiries.
- ❖ Provide 24/7 assistance.
- ❖ Improve resources discovery and usage.
- ❖ Stay ahead in the digital age.
- ❖ Enhance patron experience and support.

Artificial intelligence-driven recommendation systems have shown great potential in enhancing user experience and engagement with library resources. Personalised book recommendations tailored to individual users' reading habits and preferences, have been found to increase user satisfaction and circulation rates (Sheng et al., 2022). AI-driven systems suggest books based on the readers' preferences and reading history. However, an AI book recommendation works by:

- User profiling: AI creates a reader profile based on reading history, preferences and behaviour.
- Book analysis: AI analysis book content, genre, themes and author styles.
- Machine learning algorithm: AI learns from user interaction and adapts recommendations.
- Collaborative filtering: AI identifies similar readers and recommend books based on their preferences

Ajakaye (2023) posited that artificial intelligence tools can be utilised in selecting vendors or book dealers for library materials, an intelligent system to identify a vendor or book seller can be designed based on previously successful transactions in supplying publications of a specific kind, such tools would be of particular importance in the procurement of information materials that are less routine such as conference proceedings, publications in foreign languages or other countries, and certain technical reports, among others. Artificial intelligence powered book recommendations system can:

- Suggests books based on users favorite author or genre.
- Recommends books with similar themes or topics.
- Identify new releases or lesser known books that might interest users.
- Provides personalized book lists and authors.
- Enhances discovery and exploration of new authors and genre.

It transforms book recommendations making them more personalised, accurate and engaging. The significance of AI in library is multi-faceted

- Improve discovery: artificial intelligence driven search engines and recommendations systems facilitate resource discovery, making it easier for patrons to find relevant materials.
- Increase efficiency: AI automates routine tasks freeing librarian to focus on complex and creative tasks.
- Accessibility and inclusion: AI-powered tools enhanced accessibility for patron with disability and provide personalized support.
- Preservation and conservation: AI aid in digital preservation, restoring and maintaining library collections.
- Research support: artificial intelligence assist researcher in finding relevant sources, analyzing data and identifying patterns.

### Potential constraints in using AI in libraries and information centers

Artificial intelligence systems may have technical limitations such as complexity, uncertainty, or vulnerability. For example, it's based natural language processing system may have difficulties understanding the context, nuance or ambiguity of human language or an artificial intelligence-based security system and also may be susceptible to hacking or manipulation, librarians like many professionals in various fields, encounter both opportunities and challenges with the integration of this services into their work. Here are some of the key issues that librarians may face with artificial intelligence services, particularly concerning ethics and accuracy:

**Algorithmic bias:** artificial intelligence systems can inherit biases present in the data used to train them; librarians may need to be cautious about the potential biases in the datasets that power its tools, especially regarding information retrieval. If the training data contains biases, the system may perpetuate and amplify those biases, leading to biased search results.

**Ethical use of AI:** librarians are responsible for ensuring that artificial intelligence services are ethically deployed and aligned with professional and ethical standards. (Harper et al.2021) ensuring its ethical practices requires clear guidelines and policies that prioritised user rights and promote responsible development and deployment.

**User education:** librarians may face the challenge of educating users about the limitations and capabilities of artificial intelligence services.

**Limited understanding of AI:** some librarians may have limited understanding of these technologies, which can pose a challenge in effectively integrating these tools into library services.

**Resource allocation:** Implementing and maintaining the services may require additional resources, including financial investments, training programs, and ongoing support.

**Digital divide:** The use of artificial intelligence services in libraries may exacerbate existing digital divides if certain user groups lack access to technology or have limited digital literacy skills. Librarians need to be mindful of inclusivity and work towards providing equitable access to the services.

**Phobia of losing job:** Abayomi et al. (2021) academic librarians were aware of the use of artificial intelligence in library operations; still they were concerned about the potential loss of their jobs due to its adoption.

## Conclusion

In conclusion, the adoption of artificial intelligence in libraries is setting a new level of efficiency and effective library service delivery but its adoption in developing countries such as Nigeria is low due to some of the identified challenges

## Recommendations

**Fairness and equity:** librarians must ensure that artificial intelligence services are designed and deployed with fairness and equity in mind.

**Address Algorithmic Bias:** libraries should actively address algorithmic bias in AI-driven services by regular review and auditing algorithms to identify and mitigate biases that could impact users' experiences.

**Transparency:** librarians should advocate for transparency in algorithms and decision making processes, understanding how the systems work is crucial for identifying and addressing potential biases, including race-related ones.

**Community engagement:** librarians can engage with their communities to understand their perspectives and concerns related to artificial intelligence and racial bias.

**Education and awareness:** librarians play a role in educating both staff and users about the potential biases in the systems and how they can impact different racial and ethnic groups.

**Collaborate with AI Experts:** Lung and Wang (2023) found that lack of familiarity with the technologies leads to a fear of the unknown therefore; Libraries/librarians can collaborate with experts and researchers to gain insights into best practices and stay updated with the latest developments relevant to library automation.

By implementing these recommendations, libraries can effectively harness the power of artificial intelligence to automate processes, enhance user experiences, and ensure the responsible and ethical use of the technologies. Embracing artificial intelligence driven automation will enable libraries to adapt and thrive in the evolving digital landscape, ultimately benefiting their users and communities.

## References

- Abayomi, O. Adenekan, F. Abayomi, A., Olateju, Ajayi, T. A., & Aderonke, O. (2020). Awareness and Perception of the Artificial Intelligence in the Management of University Libraries in Nigeria. *Journal of Interlibrary Loan, Document Delivery & Electronic Reserve*, 29(1-2), 13-28. <https://doi.org/10.1080/1072303X.2021.1918602>
- Adebayo, O A; Bello, L A; Yusuf, T I; and Kayode, J O, (2022). "Adoption of artificial intelligence for effective library service delivery in academic libraries in Nigeria" *Library Philosophy and Practice (e-journal)*. 6804. <https://digitalcommons.unl.edu/libphilprac/6804> Retrieved July 2024
- Adetayo, A. J. (2023). Artificial intelligence Chatbot in academic libraries: The rise of ChatGPT. *Library Hi Tech News*, 40(3), 18-21. <https://doi.org/10.1108/LHTN-01-2023-0007>
- Agrawal, A., & Bhatia, S. (2017). Role of Artificial Intelligence in Library and Information Science. *International Journal of library science and research*, 7(3), 36-44.

- Ali, M. Y., Naeem, S. B., & Bhatti, R. (2020). Artificial intelligence tools and perspectives of university librarians: *An overview. Business Information review, 37(3), 1–9. doi:10.1177/0266382120952016*
- American library association (ALA). (2021). Libraries: An American Value. Retrieved from <https://www.ala.org/tools/libraries-transform/libraries-american-value>.
- American Library Association. (2019). *Artificial Intelligence. Retrieved October 12, 2019 from http://www.ala.org/tools/future/trends/artificialintelligence*
- Soni, D, N. (2023) the role of artificial intelligence in Information and Library Science: Opportunities and Ethical Considerations:
- Gustavsson, J., & Hedlund, M. (2011). The art of writing & speaking. Retrieved July 15, 2019 from: <https://www.svet.lu.se/sites/svet.lu.se/en/files/art-of-writingspeaking-2011.pdf>
- Harper, S. et al. (2021). From deskilling to deskilled: Automation and the future of library labor. *Library Trends, 69(2), 152-182*
- Lund, B.D. and Wang, T. (2023), "Chatting about ChatGPT: how may AI and GPT impact academia and libraries?" *Library Hi Tech News, Vol. 40 No. 3, doi 10.2139/ssrn.4333415*
- Murphy, D. (2015). Robotics and the human touch in libraries and museums. Retrieved May 12, 2019 from: <https://slis.simmons.edu/blogs/unbound/2015/04/06/robotics-and-the-human-touch-in-libraries-and-museums/>
- Omame, I. M., & Alex-Nmecha, J. C. (2020). *'Artificial intelligence in libraries: managing and adapting library Information Services for future users. IGI Global. doi:10.4018/978-1-7998-1116-9.ch008*
- Rojas, M., Hermosilla, G., Yunge, D., & Farias, G. (2022). An Easy to Use Deep reinforcement learning library for AI mobile robots in Isaac Sim.

*Applied Sciences*, 12(17), Article 17. <https://doi.org/10.3390/app12178429>

Shanmugam, A. P. & Sridevi, P. C (2017). *Artificial intelligence and its applications In Libraries. In E- Resources Management. Retrieved April 7, 2019 from:https://www.researchgate.net/publication/327831852\_Artificial\_Intelligence\_and\_its\_applications\_in\_Libraries*

Makri, S., et al. (2022). User perspectives on AI-powered library services: A qualitative study. *Journal of the Association for Information Science and Technology*, 73(1), 78-91.

Tella, A .Salawu, Ajani, Y. A., K. Y., & Abdullahi, F. (2022). "Perspectives of Librarians on Awareness and Readiness of Academic Libraries to Integrate artificial intelligence for Library Operations and Services in Nigeria"  
*InternereferenceServicQuarterly*<https://doi.org/10.1080/10875301.2022.2086196>

Yu, K., Gong, R., Sun, L., & Jiang, C. (2019). "The application of artificial intelligence in smart library." *International Conference of Organisational Innovation (ICOI 2019).advances in Economics, Business and Management Research," 100, 708-713. 10.2991/icoi-19.2019.124*

Xu, Z. (2023). "Research on the application of artificial intelligence in the library sector" *Third International Conference on Artificial Intelligence and Computer Engineering (ICAICE 2022)*, <https://doi.org/10.1117/12.2671477>.