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Enhancing Diversity and Inclusivity in AI-Driven Library Services in Nigeria

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ABSTRACT

Artificial intelligence is an innovation of the 21st century technology with the ability to promote service delivery and improve decision making. AI innovation within various sector drives a paradigm shift in activities. This paper examines influence of AI-powered library services in promoting diversity and inclusive education in Nigeria. The study gives an overview of AI and library service delivery, highlights the operations of AI, it explains application areas of AI components in library and information service delivery, as well as some strategies for appropriating AI for effective service delivery. The study adopts expository research approach, through literature search to gain meaningful insights to the topic hence, extant literature on the subject were reviewed to establish the findings of this study. It was concluded that artificial intelligence has contributed to a thriving library services in the 21st century. Also, by leveraging on innovativeness and creativity features of AI component, diversity and inclusivity can be promoted. Practical recommendations proffered in this study include provision of required infrastructures, promoting patrons digital literacy, formulation of policies that strengthens the adoption of AI, development and implementation of cross-sectoral AI programmes that can be used by library professionals, students, policy makers and technology firms in supporting the implementation of AI-based library and information services in Nigeria and other developing countries.

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Introduction

Library as a service organization, is saddled with the social responsibility of bridging information gaps of all people through the provision of information resources. Libraries act as a repository of knowledge where various collections and information resources for satisfying the information need and development of mankind in the society can be achieved (Echem & Okwu, 2023). Library services entail the activities and tasks rendered by librarian and information professionals to promote access to information and present all kinds of information services and resources to library users. However, library is to be regarded as an inevitable part of education and is to be counted as

important to researchers and students alike. It is the "knowledge power house" that promotes lifelong learning experience in every academic institution (Ezeabasili & Umeji, 2021)

There are different types of libraries with the goal of catering for specific needs of users. Information and library service generally are categorised based either on user services or technical services. User services are tasks that involve circulation, bibliographic instructions, government documentation, special collection and reference services that a librarian provides to the patrons whereas, technical services tasks include acquisition, cataloguing, classification, interlibrary loan, serial systems and document delivery (Meyega, 2018; Ahmed, Umar & Dewa, 2020). Service delivery in library and information centres aim at ensuring users' information needs are being adequately met through effective and efficient provision of information services (Unegbu, Ikonne & Ohwofasa, 2023).

Library services which use to be at the opening hours of the library and generally rendered only manually and physically in print format, to information seekers; is recently been transformed by the advent of technology in the libraries. Library and information services in the digital age can be described as any platform or space with sequence of classified and organization pattern of easily accessible information resources, capable of meeting users' need. The world view of integration and application of technology in the present day society has translated to change in information behaviour of library users. Therefore, for consolidation of forces, library needs to embrace new technological application for the delivery of services that will promote diversity and inclusion for all users. Consequently, technological innovations offer by the fourth industrial revolution will be relevant in achieving a seamless library/information service delivery with inclusive and equitable quality education.

Inclusive library services should involve approaches that are capable of promoting equal access by all stakeholders in a particular learning environment taking into cognizance the diverse nature of the patrons in terms of their information need, socio-economic status, gender, abilities, language, experiences and so on. Diversity is dynamic and multifaceted therefore, it is essential for todays' libraries to recognize and appreciate diversity in its patrons needs in anticipation to create an inclusive space where everyone feel valued, respected and supported that caters for patrons needs and satisfying them (Hussain, 2023; Saibakumo, 2021). Hence, the calls for diversity and inclusive library activities and service delivery practices promoted by technology innovations.

The integration of the fourth industrial revolution in libraries has made library patrons retrieve information seamlessly, almost everywhere and at any time, making service delivery faster, timely and more accurate. Most importantly, AI in libraries is a way of ensuring a better work environment, transforming library services into best services in the age of technology where frequently imbalance needs of diverse patrons will be met and facilities, collections, activities and services are adequately provided for.

Artificial intelligence pertains to the technological advancements that empower machines or devices with the capacity to engage in reasoning, planning, acquiring knowledge, resolving complex issues and being creative in their operations. It is important to know that AI can be categorized based on three types of simulation methods as symbolism intelligence mechanism –

based on logical reasoning, connectionism intelligence mechanism- based on learning algorithm and behaviourism intelligence mechanism- based on perceptual-action control and cybernetic (Idemudia & Makinde, 2022). Artificial intelligence as one of the emerging technologies that birthed vast innovation, has the ability of bringing about high productivity with reduced human-imposed challenges for a more efficient system. AI is characterized to imitate human behaviours and intelligence to ensure efficiency, effectiveness and quality library service delivery (Idemudia & Makinde, 2022).

Gradually, artificial intelligence is changing the information landscape of libraries by simplifying library functions, enhancing efficiency of librarians and promoting quality service delivery to the new generation of library patrons. Therefore, the need for artificial intelligence application in supporting library service delivery aims at two major factors such as, change in user behaviour and information landscape, increased digital revolution for technology devices with the inclusion of smart internet enabled devices and AI-enabled interfaces (Olayode, 2022). Hence, the use of AI has the potential to help libraries overcome all forms of challenges relating to access, access cost, personnel scarcity and quality of information resources and service, among others.

Furthermore, library and information services are paramount to provision of unhindered access to essential resources for intellectual freedom, cultural advancement as well as economic development. To achieve an information and knowledge based society, there should be promotion of social inclusion and diversity through library service delivery to user communities regardless of the age, gender, skills, economic status, belief or religion and culture. Hence, achieving effectiveness in library and information service delivery must be hinged on users' satisfaction through positive response to digital age.

Therefore, the need for a robust platform, such as AI, which can facilitate the inclusion of relevant and timely information services for all users cannot be overemphasized. Moreover, everybody requires information to take a decision at one point or the other. Most often, decisions taken are based on the availability of information. Likewise, the quality of information in respect to accuracy and reliability has to do with the source of the information which reflects the relevance of library and information service delivery.

Contrary to the AI potentials, libraries in Nigeria are yet to implement and adopt AI potential adequately, this might be as a result of low level of awareness, inability to demonstrate value and benefits to all the stakeholders and low level of research on AI and librarianship in Nigeria (Yusuf, Adebayo, Bello & Kayode, 2022). Therefore, this study is necessitated to enhance diversity and inclusive AI-driven library practices in Nigeria.

Aim and Objectives

The aim of this paper is to examine how AI-driven library services can foster diversity and inclusive practices within libraries in Nigeria. The study objectives are therefore to:

i. identify the prospect of AI – powered library services delivery in promoting diversity and inclusive education;

ii. examine the possible challenges affecting the promotion of diversity and inclusion in AI-driven library and information service delivery in Nigeria.

Literature Review

Artificial intelligence and library services delivery

The influx of the emerging technologies has brought a paradigm shift to the 21st century libraries. Libraries are being responsive to the technology trends and are reinventing, re-strategizing and restructuring mode of operations and practices in order to offer relevant services that will meet the need of the patrons. In line with this, many scholars attested to the role of AI as an indispensable tool of the 21st century for improving efficiency and productivity (Wood & Evans, 2018; Hussain, 2023, Cox, 2021).

The introduction of artificial intelligence in libraries has made possible for libraries to have access to devices that can perceive, understand, act and learn (Owolabi, Okorie, Yemi-Peters, Oyetola, Bello & Oladokun, 2022). Vijaykumar and Sheshadri (2019) describe AI as a useful shortcut to apply knowledge for better outcome. Hence, as libraries focus on increasing access to content through potential utilities of the library resources; using artificial intelligence will act as a tool for refining the quality of such library services. Corroborating this, Liu (2010) described AI as an intelligent agent technology, through which efforts of the librarian is reinforced and supplemented in the interest of providing better services to the patrons.

In this contemporary digital era, AI generally, is to promote library relevance, updating and expanding services, in some instances there might be need to create new service, and streamline the workflow of librarians (Oyetola, Oladokun, Maxwell & Akor, 2022). All these aimed at enhancing operational efficiency. Some of the benefits of AI to library and information service delivery include improving users experience, partnership, process mastery and digitization, collection of current descriptive metadata and in overall efficiency in library operations. However, despite these benefits of AI and the demand of the modern world, many libraries in developing countries are yet to adopt AI for effective service delivery either remotely or onsite to users (Ridge, 2019).

The various areas of artificial intelligence, which is also referred to as the components of AI enables it to cut across several other fields and supports its ability to manipulate symbols and imitate human intelligence. These components are expert system, Natural Language Processing, Robotics, Neural Network, and Pattern Recognition. All these categories of AI when employed improve users experienced by fast tracking information and its sources to be at the users' reach and meet their needs. Library patrons can be artificial intelligently helped in providing reference services when procedures of conducting successful research is rendered to inexperienced patrons. However, acquisition services, cataloging services classification, indexing, shelf reading, creating alerts when book is due, scanning on library websites, are some of the other applications that can be employed with the components of AI (Idemudia & Makinde, 2022).

Understanding AI and its operations

The primary objective of artificial intelligence is to create machine or computer systems that have the capability to exhibit, reason and replicate human intelligence. However, artificial intelligence and library automation are not to be represented as the same. Library automation is the mechanization of library routines operations while artificial intelligence is the rationale of an intelligent system that behaves and respond like librarian with or without human intervention. Therefore, to provide knowledge-based services to librarian and library users, intelligent library automation systems is to rely on the power of AI technology (Omame & Alex-Nmecha, 2020).

There are four basic principles which also serves as a common requirement guiding any artificial intelligence system. In line with Omame & Alex-Nmecha (2020) these are best described with the features such as representation, search, reasoning and learning which distinguish AI components from any other emerging technologies. The knowledge-based feature of any AI system that enables it to identify problems and form a framework for manipulating such problem is described as representation. Also, search is the aspect of AI components that deals with techniques for resolving issues on any AI systems.

Similarly, the process of reasoning in AI systems involves using problem knowledge (either deductive or inductive reasoning) to infer a range of possible solutions or to formulate the best hypothesis for an existing body of knowledge or current issues. Again, the learning feature of AI systems enable it to learn from past experiences, which allows the system to potentially reconfigure representations, update information or modify search parameters. The aforementioned principles form the foundation for how AI main components function. The sub-divisions of AI aim at using computers to enhance human intelligence in different application areas. Hence, the following are the common components of AI system used in Library management: Expert Systems (ES), Machine Learning (ML), Natural Language Processing (NLP), Robotics and Pattern Recognition (Omame & Alex-Nmecha, 2020).

Sequel to the component and the principle of AI, in a study on uses of Artificial intelligence for effective library services in Nigeria University libraries, Yusuf, Adebayo, Lateef, & Kayode. (2022) highlighted benefits of AI. Some of the benefits identified are features like simplicity of use, new standard for effective and efficient service, ability to handle complex task and the endless capabilities and capacities of AI. Furthermore the benefits can be generally discussed as promoting discoverability which can boost research productivity among users, providing accessibility to information resources such that can enhance timely services and all-round the clock service, promoting efficiency in library operations, improved service delivery through minimizing human error, reduced effort required by the librarian to perform different services.

Application of AI components in library and information service delivery

The impact of artificial intelligence and its possibility in shaping the future of library and information science for quality service delivery is affirmed through the following application of various components of AI in library and information practices:

1. Expert system: a well- developed expert system in the library is designed to stimulate human decision making by incorporating methods and techniques with specialized problem-solving expertise. It helps librarians to understand the need for improvement in productivity. It can be used to handle reference services by providing answers to users query or used for subject indexing, help managers in making decision, assist in applying cataloguing rules efficiently likewise, in acquisition, AI assists vendor with assignment in acquiring library materials, it can also function in intelligent document delivery service.

2. Natural Language processor serves as a medium of interaction; it is the ability of the machine or system to process request in form of writing or speaking. This is applied on database management systems in searching for information. Similarly, it can be used in automatic text translation or text summarization as input for processing. Also, it can be applied in indexing for information retrieval to improve precision of retrieving relevant documents, NLP can as well be applied in translation of electronic resources.

3. Pattern recognition component can help in the digitalization of printed materials, through conversion of traditional library materials to electronic format. Also, optical character recognition and neural network, bibliographic records of books can be provided for appropriate classification and retrieval of audiovisual materials

4. Machine language empowers computers to learn without explicit programming. In library and information services, it provides an array of tools to help library generate metadata which can influence efficiency in several other library routine procedures.

5. Robotics is a mechanical device, a reprogrammable, multipurpose manipulator that can perform complex under the control of human or automatically. It can come in form of reader advisory human, virtual storyteller, robotic book retrieval system which automatically retrieve information materials for users on demand using library automated catalogue (Omame & Alex-Nmecha 2020).

Challenges in Appropriation of AI- powered Library Service Delivery

Extant literature showed that there are challenges facing effective service delivery such as inadequate funding, inadequate staff training, expertise to deliver services adequately, nonchalant attitude of the library staff, absence of well-defined and uniform policies, non-compliance to technology requirement. The adoption of AI is expected to improve all these factors. However, Artificial intelligence among developing countries such as Nigeria is majorly challenged with several issues preventing its full integration.

The Chartered Institute of Library and Information Professionals (2021) and others notable scholars highlighted some of the appropriation issues to include but not limited to, lack of management support, insufficient budget and funding for libraries, in abilities to keep up with

shifts in new technology trends, copyright and intellectual property right enforcement, general data protection regulations as well as difficulties in implementing new technology. Although, the general constraint to integration of AI has been on the issue of work force polarization; there are projection of job loss especially in developing countries which World Bank (2016) claimed to have resulted to low acceptance of AI technology. Likewise, in examining the readiness of academic librarian in Nigeria, towards the adoption of robotic technologies in rendering library services, the study by Owolabi et al. (2022) showed inadequate level of readiness of academic librarians. However, another scholar established that librarians were quite aware of the benefits of AI tools for service delivery but are reluctant is supporting its adoption for the fear of being redundant or losing their jobs (Abayomi, Adeneka, Abayomi, Ajayi, & Aderonke, 2021).

Yusuf et al. (2022), corroborates on issues challenging appropriation of AI to include increase in skill gaps, in-availability of suitable infrastructure, information overload due to increase in the number of alternative sources of information, and instability in power supply. Furthermore, Omame & Alex-Nmecha (2020) also corroborates challenges of Artificial Intelligence in Libraries while identifying some other challenges like, high cost of system development, maintenance cost of AI in libraries, limited number of AI experts among the library automation vendors, inherent complexities of expert systems' development, lack of common base knowledge by the intelligence system; this can be a constrain to the overall functionality of the AI system. Another notable concern is the limitation of Natural Language to create an advanced system based on the amount of work and technical expertise. In order to achieve prospect in libraries, Echedom & Okuongha (2022) discussed some of the challenges of artificial intelligence that needs to be addressed before implementation, to include poor network services, erratic power supply, high cost of technological tools, lack of trained personnel, obsolete technologies and economic factors. Likewise, individual factor is another issue which contributes to negative perception of librarian towards new and innovative technologies; and could result to resistance to change and inadequate skill to adopt the technology. This also creates hurdles that need to be address for proper appropriation and application of Artificial intelligence in service delivery within the libraries (Hussain, 2023).

Strategies for Promoting the Use of AI in Library and Information Service Delivery

Generally, the use of AI in library and information centers can be strategically monitored and improved on. The following are extract from IFLA statement on library and artificial intelligence (IFLA, 2020):

- Since there are several ways in which AI can generate data and promote access to information and intellectual property, it is necessary to establish measures such as protection of patron's data, where AI application will not compromise user privacy.

- Also, strategies to increase transparency and carrying out regular risk assessment. Another strategy worth of considering is to base framing and formalizing of problem for AI systems on approaches to manage bias.

- Promoting AI-enabled multilingual voice translation in order to remove language barrier and increase online accessibility that support diversity.

- Personalizing individual online experiences especially on social media platforms and for search engine use. Ensuring AI on such platforms guide choices, organizes and ranks the information an individual can access or is exposed to.

- Libraries as an inclusive space can specialize in information literacy. To ensure that AI is of benefits to the society at large, this can be done through campaigns and training on understanding how algorithm influence information flow on different platforms.

Theoretical framework

To expand the scope of this study, the theoretical framework approach is considered. Hence, the study is anchored on Technology Organisation Environment Framework (TOE) and Library Quality Model (LibQual). Technology Organisation Environment Framework as propanded by Tornatzky and Fleischer (1990), the framework has served as a tool for understanding the relationship that exists between technology, organization and environment. Technology is described by the characteristics, functionality, complexity, compatibility within the existing system and the ease of use. Organization refers to the internal context in which the technology is used, it includes factors such as organization's size organizational culture, organizational structure and resources. Environment describes the external context in which the organization operates, and it includes factors such as market conditions, regulatory requirements, norms, both social and cultural norms. TOE gives a clear understand on the external and internal factors that can contribute to technological adoption. It explains the three elements according to how organization see the need for technology, search for the technology and finally how it is being adopted in the organization. TOE framework is considered appropriate for this study in the adoption of Artificial intelligence for enhancing service delivery from an organization-based perspective (libraries) rather than individual based; where behavioural factors should be of a concern.

LibQual is another model that is used to anchor the service delivery aspect of this study. Library Quality model was co-developed by researchers in ARL and Texas A&M University (1999). Library Quality model addresses the actions and services of a library. It serves as a tool for ascertaining service excellence. LibQual considers three dimensions that can influence quality service delivery in the library. The first is affect of service followed by information control and the last is library as place. The human aspect of quality library service is affect of service. It relates to how patrons interact with library staff or information professionals in terms of care and competence rendered. Information control measures the service quality from a context-based perspective, where scope of content offered, the chosen formats and the convenience are considered. Also, with library as a place, examines the physical characteristics of the library as it relates to workspace conveniences, conduciveness for patron's use. LibQual is considered appropriate for this study mainly because it fosters a culture of excellence and gives room for

continuous improvement in service delivery. LibQual is based on the expectation confirmation and disconfirmation theory which explains that users develop a certain level of expectation on services provided by the library before taking advantage of such service. Once the user takes advantage of the service, the quality of the service can then be rated using levels such as minimum acceptable level of service, desired level of service and perceived level of service (Mallya & Payini, 2019). Incorporating the ideas in these two theories will help to ascertain the possibility and necessity of AI-powered library services for diversity and inclusiveness.

Methodology

This study adopts descriptive method of expository research approach where extant literatures and theories were reviewed to gain meaningful insights of the topic on Artificial intelligence and library, the benefits, application, challenges and strategies to promote AI in service delivery. Conceptual review and theoretical framework was established from the literatures reviewed upon which the analyses were made and used to furnish the discussions in the study.

Discussion

In any library or information centers, information professional's goal is to ensure that users have access to information, this is ensured by setting up an environment that is secured and welcoming. This knowledge is prioritized in libraries which serves as foundational value for libraries that promotes diversity, inclusivity and innovation in its service delivery to its user communities. Libraries have evolved structurally and content-wise as a result of technological eras and have metamorphosed through the revolutions. Hence, fourth industrial revolution is an emerging technology of the 21st century and have innovatively presented Artificial intelligence with the benefits of optimal service delivery of library and information resources. Artificial intelligence is therefore presented as a groundbreaking technology of this century and the justification for its application in library and information centers involves maximizing, time, space, effort and efficiency for improved users' experience.

Libraries have been able to incorporate technology in promoting diversity and inclusion through its various collection of information resources made accessible to various categories of users in form of library and information services; packaged to meet diverse users' information needs. According to Amaechi, Enweani & Eke (2018) study on 21st century challenges to library and information services delivery; it was recorded that 92.4% of the respondents supported transformed library and information services delivery which in essence through the technological innovations, promoted efficient and effective service delivery in the library. Likewise, in another study from public libraries in South-South Nigeria, it is evident that ICT have a significant and positive influence on library and information service delivery as a result of which application of ICT competence is considered necessary for relevant library and information services (Unegbu, et al. 2023).

On the contrary, Hussain (2023), identified from the librarian angle some peculiar challenges affecting appropriation of AI technology into library and information services delivery to include negative perception and workload polarisation, skill gaps. However, other challenges as related to technical know-how involve expertise and maintenance of the system. The issues of policies, regulations and funds was also addressed as importance issues hindering effective appropriation of AI in service delivery (Yusuf et al. 2022, CILIP, 2021, Omame & Alex-Nmecha, 2020). Furthermore, while some of these challenges can still be managed, issues like erratic power supply, networking facilities, trained personnel, economic factors and technological tools are to be considered adequate before implementing AI-powered library and information service delivery, failure of which efficient service delivery cannot be achieved (Echedom & Okuongha 2022).

Moreover, library activities are automated, and the impact of emerging technologies is gradually evolving in 21st century libraries. Artificial intelligence can now perform tasks such as shelf reading and shelf arrangement, reference services, circulation activities that involve registration, cataloguing and classification, charging and discharging of materials and generating library statistics. All these are possible through the power of Artificial intelligence particularly speech recognition, neural network, natural language processing for promoting fast, efficient, effective and up-to-date library and information service delivery.

Summary and Conclusion

In the 21st century, for libraries to thrive, Libraries and information professionals should understand the unrelenting trends in technology and as a result innovate service and the service delivery to comply with the changing information seeking behavior of the users too. The best way to promote diversity and inclusive library and information service is by leveraging on innovativeness and creativity features of the emerging technologies. Artificial intelligence has contributed to promoting effective and efficient library and information service delivery. The application of expert system and the other components of AI demonstrate the unique feature of representation, recognition and learning of an intelligent system in library routine procedures such as circulation, cataloguing, classification, shelf reading, generating library statistics for informed decision and efficient service delivery. Despite the benefits of artificial intelligence in library and information service delivery, there are yet some issues facing the appropriation of its application are not limited to such that relates to expertise, maintenance, cost and funding, economic factor, technological tools, detailed policies, ethical standards and regulations, as well as privacy considerations.

In conclusion, Artificial intelligence is one of the emerging technologies of the fourth industrial revolution that maximize library service and service delivery at low cost when implemented. Libraries are vital agents of innovative technology and as such, for libraries to continue to thrive in the knowledge economy, adequate considerations for appropriation of AI into library service delivery is a necessity.

Recommendations

In today's technology age, for quality service delivery and to promote diversity and inclusion in AI-powered library services in Nigeria, the following recommendations are made to the government, library associations and libraries, librarians as well as library users:

1. Governments and intergovernmental organisations should ensure that libraries are included in development and implementation of cross-sectoral AI programs and strategies. Policies and regulations of AI that addresses both the strength and weaknesses in library services should be formulated and efforts that support innovation and public interest goal should be included through the library legislation. Likewise, government should ensure the provision of required infrastructures, library networks and technologies that can help the adoption and use of AI technologies in libraries.
2. Library associations are to function as forum for the exchange of best practices on ethical use of AI technologies in libraries. Library association should serve as intermediary between AI researchers and developers and influence them to create applications that meets library ethical and privacy standards and that meet specific needs of libraries and library patrons. Also, it is recommended that library association should support library professionals to understand the impact of AI and its intersection with privacy and ethical principles. However, library associations should ensure that library training providers design adequate capacity building package, sufficient to provide necessary digital skill set and competencies to its staff.
3. Libraries should help their patrons develop digital literacy that gives better understanding of how AI and algorithm works and corresponding privacy and ethical issues. Libraries is to ensure procurement of necessary technology that meets ethical, privacy and accessibility requirement are available in the libraries. It is also recommended that libraries safeguard the right of the users and ensure that use of AI technologies in the library is subjected to clear ethical standard.
4. Library patrons are to cooperate and understand the ethical standard necessary for appropriation of AI in an information environment.

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