5TH INDUSTRIAL REVOLUTION: ROLES OF ARTIFICIAL INTELLIGENCE IN ACADEMIC LIBRARIES

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Abstract

This paper is to examines 5th industrial revolution and the role of Artificial Intelligence (AI) in Academic Libraries. The paper is a reflective piece examining 5th Industrial Revolution and advancement in the context of artificial intelligence in academic libraries. The paper argued thar 5th industrial revolution has advance information service delivery by connecting cyber, virtual and physical space in contemporary academic libraries. Various studies indicated that artificial intelligence is contributing significantly to global information provision and dissemination. The paper indicated that the 5th industrial revolution and the role of Artificial Intelligence (AI) has brought about significant transformation in the way academic libraries manage and provide access to information. Literature reviewed indicated that Artificial Intelligence (AI) is one of the emerging trends and applications of computing in academic libraries. The paper also focuses on the advantages of Artificial Intelligence which enhances information services delivery. Artificial Intelligence also improves library operations and services and upgrades and heightens the relevance of academic libraries in an ever-changing digital society. The paper also discusses application of Artificial Intelligences in academic libraries in the Era of 5th Industrial Revolution. The paper also highlights the benefits of Artificial Intelligences in academic Libraries. The paper emphasizes on the challenges of integrating Artificial Intelligence (AI) in Academic Libraries. Opportunities for Artificial Intelligence (AI) in academic libraries was also discussed in the paper. The paper concluded that despite the advancements brought by the 5th industrial revolution, challenges such as privacy concerns and algorithmic biases were still pertinent in AI which must be addressed to ensure responsible AI implementation. The paper proffered way forward that there is need for academic libraries from developing countries especially Nigeria to strengthened and priorities for AI to enhance research output in the delivery of information

Keywords: Academic Libraries, Artificial Intelligence, Chatbots, Digital Technologies, Digital Preservation, Internet of Things

Introduction

The 5th Industrial revolution (AI) is making a remarkable strives with the role of digital technologies which currently influenced contemporary societies in all sectors of life; be it social, political, governance and economic development. Today, the 5th Industrial revolution has become pervasive, as it cuts across every government agency, organizations and professional bodies (UNESCO, 2024). The 5th Industrial Revolution and the role of Artificial Intelligence are currently transforming the global world. This is because the advent of artificial intelligence has revolutionized the way services are delivered for communication, information generation, access and dissemination.

AI is characterized by digital revolutions and innovations. This is because its connecting cyber, virtual and physical space with advancement in digital technology which has made communication, collaboration, information flow and work easier. For example, self-driving cars, online shopping and drone delivery services are digital technology systems that continue to solve some of the world's biggest problems faster with fewer errors and better results (Wani, & Bhat, 2023). The 5th industrial revolution also reflects and guides our way of life and thinking towards digital technology development for advancement in collection and processing of huge amount of information at an alarming rate (Okunlaya, Syed, et al, 2022).

Digital technologies such as robotic technology, artificial intelligence, cloud computing, big data, social media, smart phones, digital cameras, sensors and Internet of Things are contributing significantly in global information provision and dissemination (Anumula, et al, 2024). The emergence of 5th Industrial revolution has opened opportunities for individuals, organizations, corporate bodies and nations to develop knowledge and competencies in artificial intelligence (Senthilkumar, Jagajeevan, & Sangeetha, 2024). For instance, in order for individuals and corporate institutions to exploit the 5th industrial revolution to its fullest potential, knowledge of Artificial Intelligence is fundamental.

Globally, Artificial Intelligence (AI) is dominating research and academic discussions in recent time. Its integration has extended across numerous fields, professions, and countries. Notably, sectors like agriculture, industrialization, economy, information technology, medicine, education, military, and business, along with nations such as the United States, the United Kingdom, the European Union, and China, are at the forefront of AI integration. Despite the critical role of Artificial Intelligence (AI) across the world, literature shows disparities between the developed and the developing countries (United Nations, 2023).

While developed countries like Britain, the United States of America, Canada, France and Germany have harnessed the integration of Artificial Intelligence to foster development, developing countries like Morocco, Liberia, South Sudan and Malawi still find it difficult to progress into a technology-driven environment, global economy and knowledge-based society (UNESCO, 2024). The benefits of AI are widely recognized, including enhanced efficiency, increased productivity, improved customer services, informed decision-making, personalized experiences, and reduced risks and errors (Owolabi et al., 2022; Oyetola et al., 2023).

Academic libraries, though slower in integrating AI, are gradually catching up (Oladokun et al., 2023). Academic libraries are pivotal contributors to the academic success of higher education, fostering intellectual growth, facilitating research endeavors, creativity, life-long learning and enhancing overall excellence by providing a diverse range of information resources and promoting information literacy (Hotsonyame 2023). Academic libraries serve as indispensable technological hubs that cater for the students, lecturers, researchers and other members' academic community for advancement in scholarship and educational excellence (Rodrigues & Mandrekar 2020). The global evolution of technological advancements has significantly reshaped and revolutionized various sectors, including academia. The integration of Artificial Intelligence (AI) technology into the educational landscape has elicited both commendation for its streamlining of traditional processes and criticism for its limitations (Gillespie et al. 2023).

Over the years, academic libraries, mirroring other sectors, have undergone substantial transformations, transitioning from manual operations to embracing cutting-edge technologies to enhance library utilization and streamline service access. Notable advancements include the transition from traditional card catalogues to Online Public Access Catalogues (OPAC), simplifying information retrieval and eliminating the need for exhaustive manual searches (Eserada & Okolo 2019). Additionally, the accessibility of library services has significantly improved, enabling remote subject assistance without physical presence (Adetayo 2023). These technological strides have been instrumental in fostering improved library utilization, particularly pertinent in the context of the fourth and fifth industrial revolutions (Oke & Fernandes 2020).

Despite proactive integration, particularly of AI, by academic libraries to reshape information service delivery and enhance paradigm shift, there remains an observable gap in comprehensive implementation (Wheatley & Hervieux 2019; Farag, Mahfouz & Alhajri 2021). While AI is being harnessed to leverage big data and data analytics for operational and service-oriented purposes, bridging this implementation gap remains crucial to fully exploit these technological advancements (Garoufallou & Gaitanou 2021; Luca, Narayan & Cox 2022). However, despite the acknowledged necessity and potential of Artificial Intelligence (AI), gaps still exist in the realization of AI in academic libraries in developing countries (Farag et al. 2021).

The idea of integrating AI into libraries has existed since at least 1985, but interest has surged in the last five years (Huang, et al., 2023). According to Li et al., (2019) in their report on the IFLA (International Federation of Library Associations and Institutions) 2017 Trend Report, AI's primary implications for libraries include speech recognition and machine translation for real-time multilingual support, complex identification of cloud services for web content, and next-generation browsers that go beyond simple keyword searches to incorporate semantic analysis. There is also significant potential for AI in academic libraries to improve user experiences, streamline operations, and enhance access to information in innovative ways (Nehra & Bansode, 2024).

Presently, numerous studies explore AI in academic libraries, focusing on AI-based services, benefits, and challenges (Aslim et al., 2023), strategies for AI adoption (Huang, et al., 2023), and the readiness of academic libraries to integrate AI into operations and services (Ajani, et al., 2022). Studies also examine librarians 'perceptions of AI technologies (Hervieux & Wheatley, 2021) and attitudes towards AI (Andrews, et al., 2021). Consequently, a thorough investigation into these opportunities and challenges is necessary. The findings and baseline insights from this study can guide academic libraries in their efforts to adopt and implement AI technologies. Additionally, this analysis provides valuable knowledge and data for governments, higher institution administrations, library managers, practitioners, and AI developers to better understand the current state of AI integration in academic libraries within the context of Nigeria.

Theoretical Perspectives

The objective of a theoretical framework in any study is to define a broad framework within which a researcher may work. The framework also enhances clarity of the research and helps the researcher to get through the research faster. There are numerous theories related to the diffusion, gratification, implementation, and adoption of information and communication technology (ICT) systems. These frameworks have been widely employed by scholars to explain how technology spreads across societies and how individuals, organizations, and communities respond to its adoption. Among these, the Technology Acceptance Model (TAM), developed by Davis (1989), remains the most popular and frequently cited. TAM is designed to predict and explain individual behavioral intentions to accept or reject the use of information technology, with its core constructs being perceived usefulness and perceived ease of use.

Due to its broad applicability and reliability, TAM has been validated and extended through various studies, resulting in several derivatives over time. Other notable theories of behavioral intention include Fishbein and Ajzen's (1975) Theory of Reasoned Action (TRA), which links beliefs, attitudes, norms, intentions, and behaviors, as well as Ajzen's (1991) Theory of Planned Behavior, which emphasizes cognitive self-regulation. Venkatesh et al.'s (2003) Unified Theory of Acceptance and Use of Technology (UTAUT) also plays a key role in explaining user intentions toward ICT adoption, focusing on constructs such as performance expectancy, effort expectancy, social influence, and facilitating conditions.

UTAUT is further moderated by variables like gender, age, experience, and voluntariness. In terms of organizational and community adoption of technology, Roger's Diffusion of Innovation (DOI) Theory (1983) is one of the most widely used models. DOI explains how communication channels and opinion leaders influence the spread of new technologies and ideas at both individual and organizational levels. Other key theories include the Technology-Organization-Environment (TOE) framework by Tornatzky and Fleischer (1990), the Institutional Theory by Scott and Christensen (1996) and Scott (2001), Concern Based Adoption Model (CBAM) by Fuller (1969) and Technology Readiness Index (TRI) by Parasuraman (2000) as well as the model by Lacovou et al. (1995), among others. Previous research has often combined these theories with other frameworks to better understand technology adoption in organizations.

Given that artificial intelligence (AI) is being adopted across various professions, communities, and countries, in this study, Diffusion of Information (DOI) propounded by Rogers (1996) was be adopted as a guide. The comprehensiveness of the DOI compared to other theories and models has allowed researchers to comprehend how innovations diffuse among sets of people from different dimensions. it is clear that integration of AI in academic libraries in Nigeria would be better understood from multiple perspectives, incorporating insights from theory, practice, and scholarly discourse to provide a holistic understanding of the phenomenon.

Methodology

This paper used literature review as methodology. The purpose of adopting literature review is to convey to the readers the knowledge and ideas that have been established, gaps identified as well as strengths and weaknesses of previous studies. The literature review according to Jacobs and Walker (2014) is to show the readers the extent of previous studies and the connection of current and to fill the gap between previous and current studies. The use of literature review is to illustrate how the topic under investigation was previously studied as well as identify the gaps in previous research discover and articulate relationships (similarities and contradictions) between previous research and the current study (Creswell 2014). Therefore, this paper identified relevant literature on the 5th industrial revolution and the role of Artificial Intelligence in academic libraries with the view to closing gaps identified by the literature for effective information service delivery.

Literature Review

The Concept Artificial Intelligence in Academic Libraries

Despite the growing scholarly interest in the integration AI across various fields, professions, and occupations, perspectives on its implementation still vary among academics, governments, and communities (Kelly, Kaye, & Oviedo-Trespalacios, 2023). As with many complex, interdisciplinary, and multidimensional applied concepts, there is no universally accepted definition of "artificial intelligence." However, as Collins, Dennehy, Conboy, and Mikalef (2021) pointed out, this lack of consensus is not necessarily problematic. That said, efforts to provide a general definition of AI have been made by scholars and within reference works. For instance, the Online Dictionary of Library and Information Science (ODLIS) (2002) defines AI as "mechanical and electronic devices and applications designed to closely mimic the human ability to learn, reason, and make decisions," noting its use in voice recognition, expert systems, natural language processing, and robotics.

AI also refers to the development of computer systems capable of performing tasks that typically require human intelligence, such as learning, reasoning, problem- solving, and understanding natural language. In the context of academic libraries, AI technologies are being leveraged to address longstanding challenges and to unlock new opportunities for libraries to deliver more personalized, efficient, and responsive services to their users (Ajani, Tella, Salawu, & Ajani, 2022). Various scholars have attempted to clarify the concept of AI. For example, Kelly, Kaye, and Oviedo-Trespalacios (2023) proposed a synthesized definition in their systematic review on AI acceptance, describing it as "an unnatural object or entity that possesses the ability and capacity to meet or exceed the requirements of the task it is assigned when considering cultural and demographic circumstances."

The interpretation and application of AI in academic libraries, however, have only recently begun to gain attention. Kramer (2022), referencing Hervieux and Wheatley (2022) in their book The Rise of AI: Implications and Applications of Artificial Intelligence in Academic Libraries, defines AI as "the development of machines to accomplish tasks and reproduce thought processes that are normally seen in humans; this simulation of intelligent behavior is distinct from other forms of automation because it requires the computer to use human reasoning or thinking to perform tasks" (p. 70).

Within the field of library and information science, Asemi and Asemi (2018) define AI as the use of computers and their associated products and services to perform various tasks and deliver services within libraries. Integration of artificial intelligence in library system encompasses descriptive cataloguing, subject indexing, reference services, technical services, collection development, information retrieval system, and information management and information service delivery. These have gone beyond Natural Language Processing (NLP), and knowledge-based services. With the advancement in artificial intelligence programming, creating a smart library is not only a possibility but a matter of time. However, many academic libraries in Nigeria are still lagging behind in integrating Artificial Intelligence (AI) to provides library services due to poor facilities, poor knowledge and competencies and poor digital skills

The 5th Industrial Revolution and Role of Artificial Intelligence (AI) among Librarians in Academic Libraries

The 5th industrial revolution has brought significant transformation with AI in academic libraries to addresses effectiveness of information resource, improves information retrieval, streamlines knowledge organization, personalizes user services, thereby significantly improving library services (Barsha & Munshi 2023). With the advancement in Artificial Intelligence (AI) academic libraries have not demonstrated interaction and communication, exchange ideas and knowledge via email, teleconferencing and chatting to advance information service delivery. However, evidence from literature indicated that not all academic librarians have knowledge of digital competencies to make effective use of digital resources and other related technologies to provide

The justified that artificial intelligence played an important role in assisting academic libraries to develop new thinking and creativity toward digital technologies to support academic activities to achieve functional research, interactions and learning process (Ali, Naeem & Bhatti 2020). However, many academic libraries in developing countries especially in Nigeria still find it difficult to transform digital technologies to advance the library services to meet the dynamic and fast changing information needs of the users (Kaushal & Yadav 2022).

The 5th industrial revolution is contributing to ease societal problems with fast and ease. Artificial intelligence is desirable and currently contributing significantly in global information provision and dissemination as well as changing the information landscape in our society. Wider access: AI can meet simultaneous access requests for a document by easily creating multiple instances or copies of the requested document. It can also meet the requirements of a larger population of users easily. Improved information sharing through the appropriate metadata and information exchange protocols, the digital libraries can easily share information with other similar digital libraries and provide enhanced access to users.

The diverse capabilities of AI, ranging from natural language processing to classifying books to enriching metadata, are redefining traditional library operations (Cox & Mazumdar 2022). By using modern technologies such as natural language processing and machine learning algorithms to automate the indexing and accurate classification of library collections, AI also enables the creation of customized recommendation systems that significantly improve the discoverability and accessibility of resources for library patrons (Suryawanshi 2024). The impact of AI goes beyond mere automation; it frees librarians from mundane tasks, as chatbots serve as a simple platform to reach out to target users such as students and researchers and can help them access the library's databases, allowing librarians to focus on more complex tasks (Aithal & Aithal 2023).

By using AI systems based on radio frequency identification (RFID), libraries optimize the location of resources and work intelligently, enabling autonomous functions (Chhetri & Thakur 2019; Okunlaya, et al., 2022). For users, AI simplifies the search for relevant research materials by using generative AI to streamline search procedures and save valuable time (IFLA 2023a). Librarians are freed from repetitive tasks and can spend their time getting to know and serve their clientele better (Chakarova & Trabert 2017) Innovation through AI extends further, transforming library operations such as self-checkout systems and enabling 24- hour services (IFLA 2023b).

The tireless nature of AI systems ensures continuous library operation, freeing librarians from round-the-clock responsibilities (Omame & Alex-Nmecha 2020). AI-driven virtual reference assistants like Pixel or chatbots constructed using Hypertext Pre-processor (PHP) prove instrumental in delivering consistent and efficient 24/7 services, catering for users' need for instant and personalised information (Gujral, Shivarama & Choukimath 2019; Omame & Alex- Nmecha 2020). Libraries in developed countries, such as the University of Oklahoma Library in North America, Monash University Library in Australia, and San Jose State University Library in North America, are already successfully using these AI chatbots (De Sarkar 2023). However, in developing countries such as India, there are obstacles such as a lack of financial support and infrastructure that hinder the adoption of chatbots in libraries (Kaushal & Yadav 2022).

In an era characterized by information overload, the role of AI in academic libraries becomes indispensable (Hussain 2023). AI technology's ability to analyze extensive metadata associated with scientific collections elevates indexing, reference services and information retrieval (Allal 2022). Ultimately, the integration of AI not only ensures accessibility and availability of library resources, but also equips library staff to adeptly navigate and harness AI's capabilities to address user inquiries (Abayomi et al. 2021)

Application of Artificial Intelligences in Academic Libraries in the Era of 5th Industrial Revolution

Artificial Intelligence (AI) holds immense potential to transform academic libraries by offering innovative solutions for information management, user engagement, and operational efficiency. Ajikaye (2022) provided the artificial intelligence applications in academic libraries as follow's"

1. ***Digital Preservation:*** AI assists in digital preservation efforts by automating processes like content identification, OCR (optical character recognition), and content restoration. This ensures the long-term accessibility and integrity of digital collections.
2. ***Virtual Assistants and Chatbots:*** academic libraries are deploying Al-driven virtual assistants and chatbots to provide instant support to users, answer reference inquiries, assist with circulation services, and offer _serialized recommendations based on user preferences.
3. ***User Analytics and Personalization:*** AI technologies analyze user data to gain insights into user behavior and preferences. This information is then used to personalize services, recommend relevant resources, and enhance overall user satisfaction.
4. ***Information Retrieval:*** academic libraries use artificial intelligence to provide powered search engines and utilize machine learning algorithms to improve the accuracy and relevance of search results. These systems can understand user intent, analyze patterns in search behavior, and adapt over time to deliver more precise information retrieval experiences.
5. ***Cataloging and Metadata Management:*** AI automates cataloging processes by automatically assigning metadata tags, classifications, and keywords to digital resources. This streamlines the organization of library collections and ensures consistency in metadata standards for easy, effective and efficient information search strategy.

6. ***Automation of Routine Tasks:*** AI automates repetitive tasks such as inventory management, interlibrary loan processing, and collection maintenance. By freeing up staff from mundane tasks, libraries can optimize resource allocation and focus on more strategic initiatives.

Benefits of Artificial Intelligence in Academic Libraries

Artificial Intelligence is installed in machines or computers to reduce human casualties in wars, hazardous work environments, car accidents, plane crash, fire explosion or disasters as a result of human error. Furthermore, artificial intelligence facilitates human work with greater speed, efficiency and effectiveness in work environments such as the library. According to Anumula, et al., (2024), artificial intelligence and expert systems are used in classification, cataloging and indexing of library materials. Via the use of optical character recognition and neural network, the system is able to obtain the bibliographic records of books and classify them accordingly. Thus, Artificial Intelligence holds great potentials for library and information service.

The benefits of Artificial Intelligence in academic libraries as summarized by Asim, et al., (2023) are as follows:

1. ***Improved Efficiency***: AI streamlines workflows, reduces manual effort, and optimizes resource allocation, leading to improved operational efficiency within libraries. According to Ex Libris (2019), artificial intelligence in libraries can make research more discoverable which can boost research productivity among faculty members,

2. ***Bridge in Time:*** Round the clock accessibility to information resources and services just in time.

3. ***Bridge in Space:*** The space occupied by piles of books, journals, bound newspapers and other information materials has been reduced by the introduction of digitization, electronic copies and use of robotic cranes that stores and retrieve books from a compact off-site storage location.

4. ***Maximization of Efficiency:*** This refers to efficiency in library operations: selection and acquisition of materials, technical services, circulation services, references services, serial management etc.

5. ***Enhanced User Experience:*** AI-driven personalized services enhance user satisfaction by delivering tailored recommendations and responsive support.

6. ***Data-Driven Decision Making:*** AI analytics provide valuable insights into user needs and behaviors, enabling libraries to make informed decisions about resource acquisition and service improvements.

7. ***Maximization of effectiveness***: AI enhances effectiveness in form of improves services delivery and elimination of human errors in library operations.

8. ***Minimization of Effort***: The effort expended by librarians in technical services, circulation services, references services, serial management etc, can been minimized by the use of artificial intelligence systems in libraries. 7. Enhanced and immersive user experience in library services delivery.

9. ***Innovation and Adaptation:*** AI fosters innovation in LIS by enabling libraries to adopt emerging technologies and respond effectively to changing information demands. AI-powered information retrieval refers to the use of Artificial Intelligence (AI) technologies to enhance the process of accessing and retrieving information from vast collections of data, particularly within the context of academic library

Challenges of Integrating Artificial Intelligence (AI) in Academic Libraries in 5th Industrial Revolution

The literature reveals the major challenges as follows:

1. Lack of technical know-how to use and operate artificial intelligence systems among the library staff.

2. Lack of adequate funding to develop or procure artificial intelligence systems in libraries. Since the budgets for hardware and software are frequently tight, there’s always constrain to the type of system the library can purchase or develop.

3. High system development and maintenance cost of artificial intelligence systems in libraries. 4. Erratic power supply to power artificial intelligence systems in libraries especially in developing countries.

5. Inherent complexities of expert/artificial intelligence systems’ development.

6. Limited natural language capabilities.

7. Intelligent systems lack that common base of human knowledge, severely constraining the types of functions that they can perform.

8. Level of effort and technical expertise needed to create artificial intelligence systems in libraries. The level and nature of effort that must be invested to develop an intelligent library system is directly proportional to the power and complexity of the system. This implies that, the more intelligent the system is, the more the effort that must be invested therein. Currently, the required skilled personnel with expensive development tools or techniques, needed to develop sophisticated intelligent system in libraries is lacking or costly, hence, the lack of such systems in libraries.

9. Limited amount of artificial intelligence experts among library automation vendors. The field of artificial intelligence is complex and thus, requires a specialized knowledge in that aspect far beyond the development of conventional library automation systems.

Consequently, this will require hiring new personnel in that area before any significant, widespread work can be done in the area of artificial intelligence systems in libraries. T

Opportunities for Artificial Intelligence (AI) in academic libraries

The integration of AI within library system is crucial for increased efficiency in library services. In the contemporary era, academic libraries are positioned to educate library users about modern technologies, ensuring users are well-informed about new technologies and conducting regular orientation programmes to foster appreciation and utilization of these technologies (Kaushal & Yadav 2022; Srikanth & Kumar 2023). Embracing this responsibility by stakeholders enhances effective integration of AI in libraries. While budget considerations are vital for sustaining resources and services, the cost presents a significant obstacle to AI integration in libraries (Lo 2023; Srikanth & Kumar 2023).

The pursuit of enhanced technology, services and user experiences necessitates libraries to seek additional funding, prompting the need for strategic investments (Onwueme & Nyemezu 2017). Practical solutions for developing countries to implement AI in library services include partnerships and infrastructure investments (Barsha & Munshi 2023). To address this financial challenge, libraries can explore diverse funding opportunities, such as technology grants and establishing partnerships with technology companies. Collaborative endeavors of this nature may present the prospect of reduced or cost-free access to AI tools in exchange for data sharing and cooperation (Lo 2023). Ajani et al. (2022) advocate that funding should ideally originate from government sources or the parent institutions of academic libraries, to prevent the misallocation of funds.

Moreover, the integration of alternative power sources incorporating green technology concepts is essential to enhance AI integration and library usage. Library management plays a pivotal role in ensuring a consistent power supply using alternative sources such as solar energy and generators (Owolabi et al. 2022). Ajani et al. (2022) highlight the challenges developing countries face related to technologies such as electricity supply and recommend that academic libraries tackle this issue by deploying alternative power generation systems like solar energy and biofuels. By collectively addressing challenges associated with AI implementation, such as finance, power and training, there would be a substantial increase in its overall efficacy within academic libraries.

Conclusion

The paper review literature on the 5th industrial revolution and the role of artificial intelligence in academic libraries. Literature identified that AI provides improves relevant research materials, enhance search strategy, promote streamline search procedures and save valuable time with AI in academic libraries. The 5th industrial revolution and the role of AI in academic libraries is a revolutionary change that is redefining the landscape of library services with unprecedented levels of efficiency.

This adoption holds immense potential to improve accessibility, accuracy, and personalized user experience. However, the realization of these promising prospects faces significant challenges; especially in underdeveloped countries where infrastructure, financial resources, expertise, and constant power supply are limited, posing major obstacles to the implementation of AI. To advance the integration of AI into academic library services, a comprehensive approach that considers both the potential and the obstacles is essential.

Addressing these challenges requires a concerted effort to bridge the technology gap and ensure that libraries in developing countries are not left behind. Strategic alliances and partnerships between libraries, technology experts, policy makers and funding agencies can serve as a catalyst for progress. Crucially, the focus should be on knowledge sharing and capacity-building initiatives to equip library professionals with the skills they need to use AI effectively.

In addition, developing adaptable and scalable AI models tailored to different resource environments is critical to promoting inclusivity and equitable access to technological advances. By fostering a collaborative ecosystem and prioritizing adaptable strategies, the integration of AI into academic libraries becomes an achievable reality that enriches global scholarly work and ensures equitable access to transformative technological innovations in libraries worldwide.

Way Forward

Based on the gaps established from the literature review, the following suggestions on the way forward were made:

1. There is need for technical know-how to use and operate artificial intelligence systems among the library staff.
2. There is need for adequate funding to develop or procure artificial intelligence systems in libraries. Since the budgets for hardware and software
3. There is need for high system development and maintenance of low cost of artificial intelligence systems in libraries.
4. There is need to improve power supply to power artificial intelligence systems in libraries especially in developing countries
5. There is the need for employ capable expert in artificial intelligence systems' development for academic library services.
6. There is the need for enhance natural language capabilities in Artificial intelligence capabilities
7. There is the need for intelligent systems in common base of human knowledge that can perform various functions in the library
8. There is also the need for academic libraries to improve on the AI to enhance search strategy to transform library services as well as widen coverage of AI in effective information service delivery
9. There is need for academic libraries in Nigeria to strategize in the integration of AI to mitigate the challenges of digital transformation and innovations

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