

Adoption of artificial intelligence for library services at universities in Africa: are we there yet?

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As artificial intelligence (AI) technologies become increasingly prevalent in libraries, it is crucial to understand how they shape the delivery of services and influence the interactions between users and library resources. This study evaluated the extent to which AI has influenced library services in African universities. It assessed whether these institutions have fully embraced and integrated AI technologies to enhance their library services. The researcher conducted an integrative systematic review to identify and map articles published between 2020 and 2024, using specified inclusion and exclusion criteria. A total of 13 articles were included for an in-depth analysis to address the issue under investigation. The findings revealed the barriers associated with AI implementation in library services, which include a lack of awareness, financial constraints, and ethical concerns. The positive initiatives associated with AI implementation in library service include virtual assistants, improved resource discovery, efficient collection management, improved accessibility by library users, and expanded access to information. The study concluded that the adoption of AI in library services in universities in Africa has the potential to be transformative. This study proposed an integrated framework for the adoption of AI in library services.

Keywords: academic libraries, artificial intelligence, library services, universities, South Africa

1 Introduction

Various economic sectors have made strides in digital transformation, particularly in the development and implementation of artificial intelligence (AI) tools. These sectors include transport (autonomous vehicles), healthcare (use of computer-aided medical diagnosis software), banking and insurance, retail, and science. Arguably, the future and today's world of work are significantly shaped by technologies such as AI and machine learning, which are anticipated to impact economies and society (Deranty & Cobin 2022), with education being no exception. Digital transformation in the education sector involves the integration of digital technology into delivering value to learners and fundamentally changing the way they operate (Luis, Gemma, Carmen-Maria, Hugo & Jose-Luis 2020; World Bank 2020). According to Gautam (2023), libraries and education are closely linked, and libraries are an essential foundation for education, especially in universities. University libraries and universities are always interlinked and dependent, to serve educational activities and the well-designed curriculum of the university system. According to Curzon and Quinonez-Skinner (2009), a university library is attached to a higher education institution. It serves two complementary purposes, namely, to support the curriculum, as well as the research of the university faculty and students. Therefore, universities without a library have no significance and a university library without its parent institution has no origin (Gautam 2023).

AI is one of the emerging technologies of our time, as it is widely used in library services to transform service delivery in the age of information technology (Ocholla & Ocholla 2020). A study by Okunlaya, Abdulla and Alias (2022) mention that AI can foster intelligent decisions for retrieving and sharing information for learning and research. The study by Khanzode and Sarode (2020) on the importance of AI in libraries, pointed out that AI facilitates dialogues between library users and robotics, directs the library users to specific locations as per their needs, and addresses queries and the scanning system through Comprehensive Access to Printed Materials (CAPM) for academic achievement and lifelong learning of the library users. Therefore, AI complements the core mission of university libraries to provide resources and services for society's development. The importance of AI in academic libraries reinforces the need for humans to adapt it in university libraries to fit into the modern world (Khanzode & Sarode 2020). This is supported by Adejo and Misau (2021), who conducted a study in Nigeria, and posited that AI could be applied in university libraries to perform tasks to include reference services, indexing,

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acquisition, and behavioural pattern recognition. The study by Asemi and Asemi (2020) on the use of AI in university libraries identified opportunities to apply AI to improve the provision of library resources and services. The interconnected AI technologies, among other fields, are presumed to play a role in academic library reference services, technical services, indexing, acquisition, natural language processing, pattern recognition, and robotics (Adejo & Misau 2021). Finley (2019) reports on how a library in Texas has developed a teaching and technology lending programme by creating kits that members can take home and use to explore AI through a practical, hands-on approach. The study by Grant and Camp (2018) reported that many academic libraries, mostly in wealthier nations, have adopted AI to meet the many service demands of their customers, including reference and circulation services. According to Odigie (2024), these intelligent agents (IA) can answer common inquiries, assist with reference services, and even facilitate personalised recommendations based on user preferences and browsing history.

Despite the rapid AI advancements and transformative potential, its adoption for library services in universities across Africa remains limited. AI is still an emerging technology, posing challenges to how humans can work with it, particularly in light of ethical issues and security considerations (Wheatley & Hervieux 2019). Korinek and Stiglitz (2017) assert that advances in AI technologies can lead to job loss or job polarisation, financial uncertainty, emerging skills gaps, a lack of adequate infrastructure, and an irregular power supply, which still hinder the efficient adoption of AI in many universities in Africa. Similarly, AI adoption can lead to a significant rise in inequality due to automation. Adarkwah, Oluwasegu, Mekonen, Anulika, Nchekwubemchukwul, Okafor, Chineta, Muhideen and Islam (2024) mention that many academic libraries in African universities are slow to transform, hence they encounter challenges in their quest to shape university education. The World Bank (2020) asserts that developing countries may be more reluctant to adopt AI because it will lead to a higher rate of job loss. However, literature confirms a low adoption rate by university libraries in providing innovative alternative services, as this is missing in their strategic plans (Ocholla & Ocholla 2020; Saibakumo 2021; Dube & Jacobs 2022; Okunlaya, Abdulla & Alias 2022).

The level of awareness among library professionals on the use of AI for library services and processes is low. Cox, Pinfield and Rutter (2019) established that libraries in Africa are left outside the focus of technology development due to policy issues, the intelligibility of decisions, data quality, and ethical concerns. Information stakeholders are not aware of AI's contributions, particularly in relation to its opportunities and challenges (Okunlaya, Abdullah & Alias 2021). Therefore, there is a missing link between university libraries and AI incorporation in strategic plans (Wheatley & Hervieux 2019). Academic libraries lack consciousness of AI's significance, which brings about a critical gap (Wheatley & Hervieux 2019). Through this analysis, the researcher evaluated the extent to which AI has influenced library services in African universities and assessed whether these institutions have fully embraced and integrated AI technologies to enhance their library services. The objectives of the study were to: (i) understand the level to which African university librarians are aware of the adoption of AI in their library services, (ii) identify the barriers to AI implementation in African university library services, and (iii) establish positive initiatives for AI implementation in African university library services.

To address these research objectives, the researcher conducted an integrative systematic review. This paper is structured to include the background of the study, research methodology, results and data analysis, and a discussion of the key findings, guided by the Unified Theory of Acceptance and Use of Technology (UTAUT). This is followed by the presentation of a framework developed for the study and concludes with the recommendations.

2 Methodology

An integrative systematic literature review (ILR) was conducted on AI's implications for university libraries in Africa. According to Snyder (2019), an ILR is a rigorous standardised scientific method used to collect and synthesise secondary data on a specific subject matter or topic based on existing research or studies. Lubbe, Ham-Baloyi and Smit (2020) mention that an ILR allows researchers to go beyond the analysis and synthesis of primary research findings and provides new insights and summarised knowledge on a specific topic. The researcher followed the five-stage framework by Cooke, Smith and Booth (2012) in conducting the ILR for this study. Table 1 shows the outline of the stages.

Table 1: Integrated literature review stages

Stage	Explanation	Application to the current study
Problem identification	This stage provided a clear identification of the research problem, purpose of the review, and variables to set focus and clear boundaries.	The adoption of AI can lead to a significant rise in inequality due to automation. Adarkwah et al. (2024) mention that many academic libraries in African universities are slow to transform, and thus encounter challenges in their quest to shape university education.
Literature search	This stage created a well-defined and documented search strategy, including search terms, databases used, varied search strategies, and inclusion and exclusion criteria, as well as acknowledging limitations.	The researcher searched Google Scholar for relevant peer-reviewed journal articles and other documents on AI and university libraries in Africa. The main search terms were combined into a single query, with 'AI' and 'university libraries in Africa' as delimiters.
Data evaluation	The ILR approach should be guided by the types of sources used and carried out using a transparent and fully articulated quality assurance process in line with recognised and established protocols.	The researcher established the inclusion and exclusion criteria. Articles published before 2020 and after 2024 were not considered. Articles published in languages other than English, as well as duplicates, were excluded. Only studies relating to the objectives of the study and on African countries were included.
Data analysis	This stage adopted constant comparison methods, such as data reduction, display, comparison, conclusion, and verification to extract themes, patterns, and relationships that formed the basis of conclusions.	The full-text articles that met the inclusion criteria were reviewed further at this stage. This required the use of the analytical criteria, which entails synthesising and interpreting data. These articles were arranged according to the objectives of the study. The patterns were (i) awareness of AI and university libraries in Africa, (ii) barriers regarding AI and university libraries in Africa, and (iii) positive initiatives regarding AI and university libraries in Africa.
Presentation	The final stage generated conclusions linked to evidence, including the explicit identification of limitations and reflections on the review process	The synthesised extracted data were first analysed and summarised based on the research objectives. Conclusions were drawn and recommendations were presented.

3 Ethical clearance

The researcher obtained ethical permission to conduct the study from the Graduate School of Business Leadership Research Ethics Review Committee (RERC) at the University of South Africa (UNISA). The approved ethical clearance number is 2024_SBL_AC_033_EX_5489

4 Results and data analysis

A literature search on AI and African university library services was conducted through Google Scholar to address the research objectives. The results were analysed, evaluated, compared, contrasted, and discussed through the lenses of the UTAUT theory. In total, 40 studies were retrieved from Google Scholar databases and exported into the Mendeley Referencing Manager software. The strings of keywords used for the search strategy included "AI" OR "Library Services" OR "African Universities", "Awareness of AI" OR "Library Services" OR "African Universities", "Barriers of AI" OR "Library Services" OR "African Universities", "Positive Initiatives of AI" OR "Library Services" OR "African Universities", "AI" OR "Library Services" OR "African Academic Libraries". Boolean search operator "OR" was used, as supported by Grewal, Kataria and Dhewan (2016), who note that using the operator 'OR' will widen the search and retrieve more articles mentioning either subject. However, a total of 26 publications did not meet the inclusion criteria, hence 13 articles were included for in-depth analysis.

The results were grouped according to the objectives of the study, as shown in Table 2. The analysis was also arranged chronologically, from 2020 to 2024, as illustrated in Table 2. The articles ranged from 2021 to May 2024, with three articles in 2021, three in 2022, five in 2023, and two in 2024. The extracted data included the authors' names, year of publication, study's purpose, and the key findings categorised according to the study's objectives, as further shown in Table 2. Eight articles explained the awareness and adoption of AI by university libraries in Africa. The findings revealed the factors

influencing the awareness of African university librarians regarding the adoption of AI in library services. These include access to information, training, organisational support, and perceived benefits. Twelve articles discussed the barriers to AI implementation in African university library services. These challenges include a lack of awareness, financial constraints, privacy and ethical concerns, user acceptance and resistance, and cultural organisational change. Seven articles explained the positive initiatives for AI implementation in African university library services. These interventions include chatbots and virtual assistants, improved resource discovery, efficient collection management, improved accessibility by library users, and expanded access to information.

Author(s) and publication year	Purpose of the study	Study design/method used	Key findings		
			Awareness and adoption of AI at university libraries in Africa	Barriers associated with AI implementation in library services	The benefits associated with AI implementation in library services
Abayomi, Adenekan, Abayomi, Ajayi and Aderonke 2021	The study investigated the awareness and perception of AI in the management of university libraries in Nigeria.	Survey	The findings of the study revealed that academic librarians are aware of the existence of AI usage in university libraries and that the fear of job loss is the major constraint which they face in the adoption of the technologies.	Fear of job loss is the major constraint which university librarians face in the adoption of the technologies.	
Echedom and Okuonghae 2021	This paper focused on the opportunities and challenges associated with transforming academic library operations with AI. In the quest to render fast, effective, and efficient services, academic libraries have adopted different technologies in the past. AI technology is the latest among the technologies currently being introduced in libraries.	Literature review		Technologies like the AI expert system always require large amounts of data to function effectively. This becomes a major limitation, where there is insufficient data or low data volumes.	AI holds a lot of prospects for the improvement of information service delivery in African university libraries.
Saibakumo 2021	The study established the librarians' level of awareness of the new technology-based services offered in academics in developed countries.	Descriptive Survey	Amongst librarians from Nigeria, there was a high level (74%) of awareness of the various emerging technologies and their significance for academic libraries. On the contrary, the level of adoption is below the expected trend (47%), as noticed in developing countries.	Although emerging technologies received an overwhelming reception based on readiness, their full implementation by regulatory and funding bodies, including parent institutions, is constrained by underfunding, among other challenges.	
Ajani, Tella, Salawu and Abdullahi 2022	The study examined the perspectives of librarians on the awareness and readiness of academic libraries to integrate AI for library operations and services in Nigeria.	Qualitative	Nigerian university libraries are aware of the integration of AI systems in libraries and how it is now being adopted and used in many academic libraries around the globe. The findings also reveal that librarians have mixed feelings about the readiness of academic libraries to integrate AI systems into library operations and services.	The challenges reported on are that academic libraries in Nigeria may likely face the problem of funding, inadequate experts, limited power supply, and a limited budget to procure the technology and training personnel that will be in charge of the system maintenance.	Based on the librarians' perceptions, the results imply that the integration of AI in library operations and services will take the library to the next level by reducing human errors due to repetitiveness in library tasks.

Dube and Jacobs 2022	This paper aimed to determine the extent to which academic libraries and information services were extended due to the emergence of Covid-19 in the Gauteng Province of South Africa.	Mixed methodology, using both questionnaires and interviews		Use of technology related to
				AI, such as the BOTsa, which is a chatbot, aimed to assist users in receiving speedy responses to library-related inquiries.
Mwilongo and Mwageni 2022	The study surveyed and examined empirical literature on the assumptions of the future application of AI in Tanzanian academic libraries.	Review of Literature		AI has created fears about employment opportunities for workers and library staff, in particular. Library staff are mismatched with the AI in academic libraries due to the lack of awareness, inadequate qualifications, and limited infrastructure in academic libraries.
				AI brings the world together, in which people work and network in the integral function of providing library resources and services to library users. AI is an enabler for academic libraries to create library spaces, store, process, preserve, conserve, access, and retrieve library resources and services timely with fewer costs. Furthermore, AI lessens the inadequacy of funds to purchase printed materials in academic libraries, the lack of digital devices, and limited spaces in libraries. AI has transformed the complex attitude and behaviours of library staff and users.
Emiri 2023	The study investigated how librarians working in the various university libraries in Southern Nigeria adopted and used AI.	Survey	Librarians are aware but they have not fully adopted AI tools in library services.	Challenges include considerable disruption brought by AI to conventional library services, a lack of skills and the need for training prior to adoption, erratic power supply, and a lack of suitable infrastructure for adoption, among other problems.
Enakrire and Oladokun 2023	This study reported on the gap analysis of AI as an enabler of future library services.	Document analysis of literature	Many librarians perceive AI and are aware of it, but they are not adopting.	
Subaveerapandyan, Sunanthini and Amees 2023	This study investigated the knowledge and perception of AI among library and information science professionals in Zambia.	Survey		The library and information science professionals were concerned about AI replacing the librarians' roles and the barriers to adopting AI technologies in Zambian libraries.
				The library and information science professionals had a favourable and encouraging outlook with regard to AI steering committee.
Tunmibi and Okuonghae 2023	The study investigated the influence of technological readiness on the adoption of AI technology.	Survey		Workers need to learn new AI skills in the use of technology applications.

Yakubu, Yagana and Umar 2023	The study investigated the librarians' intention to use AI for effective library service delivery.	Quantitative method	Librarians are aware and show great intention to use AI in their library service delivery.		
Abba 2024	This paper investigated the level of adoption of AI to support library service delivery in university libraries in Africa.	Qualitative		A lack of funds to acquire the AI tools, training of librarians, and the lack of full knowledge of AI, were the most mentioned challenges associated with its adoption in the libraries.	Few university libraries in Africa have adopted AI technologies, such as chatbot, ChatGPT, LibKey from ThirdIron, robots, RFID technology, and Grammarly.
Odiege 2024	The study explored the awareness, use, and challenges faced in the integration of AI.	Qualitative	Findings reveal that while reference librarians demonstrate a substantial awareness of AI tools, such as ChatGPT and Gemini, their utilisation remains primarily for personal use rather than professional service delivery within libraries.	Challenges such as training, infrastructure, poor internet access, a lack of technological skills, insufficient funding, and poor digitisation policies, were reported.	AI in university libraries in Africa offers several benefits, including improved efficiency, accuracy, and user experience in library cataloguing, management, and operations. AI can also support reference services, information retrieval, cataloguing and classification, and collection management.

5 Findings and discussions

The ILR was discussed in light of the UTAUT variables. According to Soares, Hoga, Peduzzi, Sangaleti, Yonekura and Silva (2017), the advantage of ILR is that it integrates different methodologies, such as qualitative and quantitative research studies, as well as other forms of valuable information, aiming to go beyond merely analysing and synthesising accumulated knowledge and primary research results, thereby allowing for theory generation and the classification of constructs.

5.1 Theory

A theoretical framework, according to Passey (2020), “arises from outcomes beyond a single study, based on one or more theories.” It is thus important to have a theoretical framework in the research process to select a topic, develop research questions, and conceptualise the literature review and research design, including the analysis. In this study, the researcher adopted the UTAUT theory developed by Venkatesh, Morris, Davis, and Davis (2003), which is commonly used in AI-related research. These include studies by James, Heather and Jung Won (2021), who investigated UTAUT as a model for understanding the intention to adopt AI and related technologies among librarians; Bokhan and Myeong (2023), who analysed AI adoption behaviour by applying an extended UTAUT framework in urban cities; and Sougato and Biplab (2024), who conducted a study on the application of UTAUT on adopting AI in passenger car sales. Therefore, UTAUT is believed to be more useful to underpin the use of AI as it predicts behavioural patterns in academic settings (Han & Conti 2020).

5.2 UTAUT variables and constructs and the use of AI in university library settings

According to Venkatesh et al. (2003), UTAUT has four concepts, namely, performance expectancy (PE), effort expectancy (EE), social influence (SE), and facilitating conditions for behavioural intention and use behaviour. There are four moderator variables, namely, gender, age, experience, and voluntariness (Venkatesh et al. 2003). These authors define EE as the level of ease in adopting the use of a system. In the context of this study, the ease of being aware and the adoption of AI and related technologies for library services by African universities was explored. PE is the extent to which users believe that technology use will help them to satisfy their job-related needs (Venkatesh et al. 2003). This study established that university library employees believe that AI-enabled technologies are of benefit in enhancing their job performance at the library. The findings confirm that the UTAUT can partially predict the likelihood of AI and related technologies adoption intentions among librarians, particularly highlighting the importance of PE (Dwivedi, Rana, Jeyaraj & Williams 2019). This

is supported by Mwilongo and Mwageni (2022), who state that the application of the UTAUT theory into the library settings is based on the acceptance and use of AI by the library staff and users.

Social influence is defined as how the users' perception of technology is influenced by their social environment (Venkatesh et al. 2003). In the model, it has been proposed that social influence on user behaviour could result from compliance, especially during the initial use of technology (Venkatesh et al. 2003). In this research, the environment for social influence comprised library personnel and users, and how they influence the use of AI-enabled tools in university libraries. According to Venkatesh et al. (2003), facilitating conditions are the extent to which the user believes that adequate support and resources are available for using technology in organisations. Facilitating conditions determine behavioural intentions towards the use of technologies and innovations (Slade, Dwivedi, Piercy & Williams 2015).

5.3 Awareness and adoption of AI by university libraries in Africa

Studies show that some librarians are uncertain about the future of AI in research libraries, as well as the roles of libraries and librarians in AI (Odigie 2024)). In Nigeria, librarians are aware of the integration of AI systems in libraries globally, but they have mixed feelings about the readiness of academic libraries to adopt AI (Ajani et al. 2022). Students in Nigeria are aware of the usage of AI in library operations and recognise the need for basic computer skills in this era (Abayomi et al. 2021). Another study by Emiri (2023) highlighted that library leaders, practitioners, and scientists in academic libraries in Africa have a favourable outlook on AI and are ready to implement AI initiatives. Odigie (2024) revealed that while reference librarians demonstrate a substantial awareness of AI tools such as ChatGPT and Gemini, their utilisation remains primarily for personal use rather than professional service delivery within libraries. Factors such as AI awareness, acceptance, value perception, application experience, leadership attention, innovation atmosphere, and competitive pressure, influence a library's readiness to adopt AI (Odigie 2024). Enakrire and Oladokun (2023), in their study, found that the perception of librarians towards AI in the context of library services is a complex and evolving phenomenon. While some librarians view AI as a potential tool to enhance efficiency and user experience, others harbour concerns about its impact on job roles, user privacy, and the quality of human interaction within libraries. Regardless, many librarians perceive AI as a promising avenue to streamline routine tasks and improve the delivery of services (Enakrire & Oladokun 2023). This was also supported by Ajani et al. (2022), who revealed that Nigerian academic libraries are aware of the integration of AI systems in libraries and how it is now being adopted and used in many academic libraries around the globe. The findings also reveal that librarians have mixed feelings about the readiness of academic libraries in integrating AI systems into library operations and services. Based on the librarians' perceptions, the results imply that the integration of AI in library operations and services will take the library to the next level by reducing human errors due to repetitiveness in library task, and if care is not taken, the AI system might take its job role.

The adoption of AI in library services across the African continent is very much in its infancy (Odigie 2024). A recent study by Emiri (2023) investigated AI adoption among librarians in Southern Nigeria's university libraries and found that AI technologies have not been fully adopted. AI technologies such as robots, chatbots, face recognition, touch recognition, Radio Frequency Identification (RFID) technologies, humanoids, AI classification tools, machine-readable catalogues, and AI smart features are still lacking in Southern Nigeria's university libraries. Yakubu, Yagana and Umar (2023) investigated the librarians' intentions to use AI for effective library service delivery in Nigerian university libraries and found that the librarians have shown a strong intention to use AI in their libraries. In Nigeria, Ajani et al. (2022) reported that only the University of Lagos has adopted AI for use in some library services and operations, adding that the library professionals' awareness of the use of AI in library services and operations is still low.

5.4 Barriers associated with AI implementation in library services

According to Abba (2024), a lack of funds to acquire AI tools, the training of librarians, and the lack of full knowledge of AI were the most mentioned challenges associated with AI adoption in libraries. Abayomi et al. (2021) discovered that university librarians are aware of the existence and use of AI in university libraries and that the fear of job loss is the major constraint which they face in adopting these technologies, despite knowing that these innovative technologies will enable more efficient user satisfaction. A study by Ajani et al. (2022) reported that university libraries in Nigeria may likely face the problem of funding, inadequate experts, limited power supply, and limited budget to procure the technology and training personnel that will be in charge of the system maintenance. This was supported by Odigie (2024), who pointed out that the shift from traditional library systems to more dynamic, digitised platforms came with challenges, such as poor internet access, the lack of technological skills and infrastructure, insufficient funding, and poor digitisation policies. Moreover, Africa is still limited in terms of generative AI technology-integrated library services. These findings concur with those of a study by Subaveerapandiyani et al. (2023) in Zambia, in which library and information professionals expressed concern over AI replacing librarian roles in the delivery of library services. Supporting this, Enakrire and Oladokun (2023) found that some

librarians fear that as AI systems take over routine tasks, there may be a decrease in the demand for traditional librarian roles. Another critical concern relates to user privacy and data security.

AI systems often require access to user data to provide personalised recommendations and services (Enakrire & Oladokun 2023). Librarians are cautious about how user data is collected, stored, and used by AI algorithms, fearing breaches of privacy and potential misuse of sensitive information. Similarly, the World Bank (2020) maintained that developing countries may be more affected by the adoption of AI because it will lead to a high job loss rate. Enakrire and Oladokun (2023) identified several factors that work against the adoption of AI in library operations, especially in developing countries. These are poor maintenance ethics, inadequately trained staff, high costs, network issues, a lack of adequate facilities, an epileptic power supply, and technological issues. Ajani et al. (2022) reported that the adoption of AI in academic libraries is setting a new standard for efficient and effective library service delivery, although adoption in developing countries such as Nigeria remains low due to challenges such as financial uncertainty, job loss, and technological disadvantages, among others. Echedom and Okuonghae (2021) reported that technologies like the AI expert system always require large amounts of data to function effectively. This becomes a major limitation where there is insufficient data or low data volumes. Tunmibi and Okuonghae (2023) mentioned that another area of concern with the use of AI is the burden of workers to learn new skills in the use of applications and technology. Odiege (2024) concurred, stating challenges such as training, infrastructure, poor internet access, the lack of technological skills, insufficient funding, and poor digitisation policies.

A study by Abba (2024) highlighted that the cost of designing AI technologies has been the biggest challenge, followed by the difficulty of getting librarians to understand how to use the technology so they can teach students. While both options carry significant risks, we chose the latter due to financial constraints and the support and maintenance that we hoped to receive internally. The third most mentioned challenge was the lack of full knowledge of AI (Abba 2024). This is supported by a study by Ajani et al. (2022), who reported that university libraries in Nigeria may likely face the problem of funding, inadequate experts, limited power supply, and a limited budget to procure the technology and training personnel that will be in charge of the system maintenance. Emiri (2023) also mentions several challenges, including the considerable disruption that AI brings to conventional library services, a lack of skills and the need for training before adoption, erratic power supply, and a lack of suitable infrastructure for adoption, among others.

5.5 Positive initiatives associated with AI implementation in library services

The study by Abba (2024) found that only a few university libraries in Africa have adopted AI technologies, including chatbots, ChatGPT, LibKey from ThirdIron, robots, RFID technology, and Grammarly. These AI technologies, according to Abba (2024), are used to render various library services, such as answering directional and ready reference questions posed by library users, serving as a knowledge base for cataloguing information on library materials, functioning as self-check machines for books, acting as a marketing tool for the library, serving as a tool for statistics evaluation and recommendations, and assisting in the charging and discharging of library materials. A study by Dube and Jacobs (2022) revealed that an AI technology called BOTsa, a new library service chatbot, was officially launched in January 2020 in Botswana, at the onset of the Covid-19 pandemic. This library chatbot helps to answer basic library-related inquiries automatically. Dube and Jacobs further mentioned that library-related inquiries that cannot be resolved through chatbots are redirected to the academic librarians' e-mail addresses for attention. Therefore, it is recommended that this chatbot be adopted in all academic libraries, given that academic librarians are working from home and have varying rosters, rotations, and shifts. This will relieve academic librarians from handling numerous library inquiries, allowing them to focus on other library services that cannot be automated (Dube & Jacobs 2022).

Odiege (2024) mentioned that AI can also support reference services, information retrieval, cataloguing and classification, and collection management. The results of the research by Mwilongo and Mwageni, (2022) revealed that AI brings the world together, in which people work and network in the integral function of providing library resources and services to library users. The authors further mentioned that AI is an enabler for academic libraries to create library spaces, store, process, preserve, conserve, access, and retrieve library resources and services timely with fewer costs. Furthermore, AI helps to mitigate the inadequacy of funds for purchasing printed materials in academic libraries, as well as the lack of digital devices and limited spaces in libraries. AI has transformed the complex attitudes and behaviours of library staff and users (Mwilongo & Magweni 2022). Odiege (2024) revealed that the adoption of AI in university libraries in Africa offers several benefits, including improved efficiency, accuracy, and enhanced user experience in library cataloguing, management, and operations. Similarly, AI technology enhances library data management, provides personalised recommendations based on user preferences and reading habits, and helps to identify customers' interests (Odiege 2024). In the same vein, based on the librarians' perceptions, the result of a study by Ajani et al. (2022) implies that the integration of AI in library operations and services will take the library to the next level by reducing human errors due to repetitiveness in library tasks, and if care is not taken, AI system might take their job role.

A study by Abba (2024) revealed responses from various university libraries on the positive initiatives for AI implementation in African university library services. Responses from the North West University (NWU) in South Africa revealed that the NWU Library has adopted AI technologies in library service delivery. The responding librarian reported that the physical robot and chatbot is under construction and will be used as library assistants. This robot will respond to basic questions from patrons, serve as a marketing tool for the library and the institution as a whole, and provide online support to the patrons 24/7. Responses from the University of the Free State in South Africa revealed that all the library branches have adopted AI for tagging books and AI language tools such as Grammarly. According to the responding librarian, *"We are currently implementing RFID technology, the first phase was tagging books in all our libraries, that is done and we are now in the process of rolling out RFID technology fully."* Responses from the University of the Witwatersrand in South Africa revealed that they have adopted a chatbot to answer general library queries. In the words of the responding librarian at the University of Pretoria, South Africa, the library uses robots for several services. According to the librarian, the robot, named Libby, has over 60 sensors, cameras, and software integration, which it uses to receive commands or requests. The robot can perform a range of services, which include repetitive tasks such as responding to users' queries, assisting in the charging and discharging of library materials, as well as entertaining library users. Beyond carrying out repetitive tasks, the robot can process survey data since it is able to connect to the online cloud through WIFI (Abba 2024). At the University of Lagos, the study by Abba (2024) found that the library has adopted AI technology, including robots, for client services. In the words of the responding librarian, the client services robots were acquired to assist librarians in library operations, such as answering directional and ready reference questions posed by library users.

The library users can interact with the robot using its voice recognition feature. Beyond answering reference queries, the robot also serves as a knowledge base for cataloguing information on library materials, hence library users can query the robot to determine the availability or otherwise of a particular information resource in the library. In addition, the robot at the University of Lagos library can take user statistics, and thus providing the library management with accurate or near-accurate user data for planning and decision-making (Abba 2024).

6 Contribution

Based on the challenges discussed in this paper, it seems almost impossible to adopt AI technologies in university libraries. Nevertheless, the proposed framework provides suggestions on the possible solutions for university libraries in Africa to adopt AI. The proposed framework, as shown in Figure 1, has four pillars, which include AI literacy, AI policy initiators, AI awareness, and AI access, which are all interlinked.

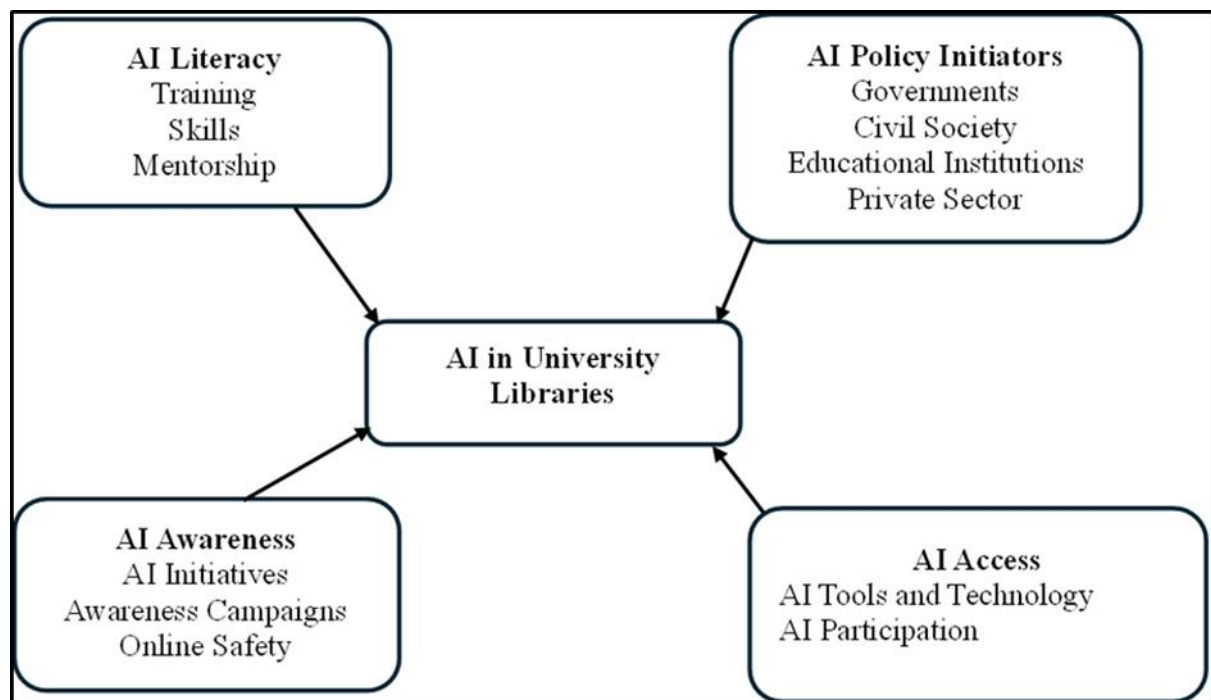


Figure 1: Framework for AI adoption by University of Libraries in Africa (Synthesised by the researcher)

6.1 AI Literacy

University library staff should remain relevant in the fourth industrial revolution (4IR) by acquiring skills aligned with modern technologies. AI literacy ensures that both library staff and users possess the necessary skills to live, learn, work, and

effectively use AI tools and technologies. As shown in Figure 1, AI training, skills, and mentorship is needed in the adoption by library personnel and users. Therefore, it is essential to educate both the students and teachers on the use of digital tools in education. AI technologies should be customised for specific ages and regions.

6.2 AI Policy Initiators

Different stakeholders should find ways to address the AI crisis by implementing strategies that seem challenging to implement (Nkomo & Matli 2022). As illustrated in Figure 1, governments should show their commitment to 21st-century education by developing and fully implementing national policies that support modern teaching and learning. This includes understanding ICT in education policy, curriculum and assessment, pedagogy, AI skills application, organisation and administration, and library policy. Governments should collaborate with non-profit and international organisations, such as the United Nations Children's Fund (UNICEF), the United Nations Children's Fund (UNICEF), and the United Nations Educational, Scientific and Cultural Organisation (UNESCO) to align their goals with digital transformation and educational advancement, regardless of location.

6.3 AI Awareness

Library management should educate academic librarians that the adoption of AI in the library does not translate to the loss of jobs. Both library personnel and users need to be aware of the knowledge, skills, and attitudes required for them to use AI tools and technologies effectively. As shown in Figure 1, library personnel and users should be aware of the AI tools and technologies to effectively adopt them technologies in library services.

6.4 AI Access

To embrace AI adoption in library services by university libraries, there is a need for AI access. As shown in Figure 1, AI access encompasses the tools and technologies that libraries need to integrate into their services. Library staff and users require adequate infrastructure, software, and connectivity to utilise digital technologies. Both library personnel and users should have access to AI tools and technologies to facilitate AI adoption in the library.

7 Conclusion

University libraries in Africa are yet to fully utilise the potential of AI in their operations. To improve university education, academic libraries should utilise existing and emerging technologies to innovate their services. The study recommends that training should be organised for librarians to boost their skills in the use of AI for service delivery. The university and library management should be committed to provide the needed support towards the adoption of AI by making available the needed infrastructure to ensure swift AI implementation.

References

- Abba, T. 2024. Use of artificial intelligence technologies in rendering library services: An empirical evidence from university libraries in Africa. *African Journal of Library, Archives and Information Science*, 34(1).
- Abayomi, O.K.N., Adenekan, A., Abayomi, O., Ajayi, T.A. and Aderonke, O.A. 2021. Awareness and perception of the artificial intelligence in the management of university libraries in Nigeria. *Journal of Inter-Library Loan, Document Delivery & Electronic Reserve*, 9(1-2): 13-28. [Online]. <https://doi.org/10.1080/1072303X.2021.1918602>. (7 April 2025).
- Adarkwah, M., Oluwasegu, A.E., Mekonen, O.Y.K., Anulika, A.G., Nchekwubemchukwul, S., Okafor, M.U., Chineta, M., Muhideen, S. and Islam, A. 2024. Exploring the transformative journey of academic libraries in Africa before and after COVID-19 and in the Generative AI Era. *The Journal of Academic Librarianship*, 50(4).
- Adejo, A.A. and Misau, A.Y. 2021. Application of artificial intelligence in academic libraries in Nigeria. *Library Philosophy and Practice* (E-journal). [Online]. <https://digitalcommons.unl.edu/libphilprac/6639>. (6 June 2024).
- Ajani, Y.A., Tella, I.A., Salawu, K.Y. and Abdullahi, F. 2022. Perspectives of librarians on awareness and readiness of academic libraries to integrate artificial intelligence for library operations and services in Nigeria. *Internet Reference Services Quarterly*, 26(4): 213-230. [Online]. <https://doi.org/10.1080/10875301.2022.2086196>. (7 April 2025).
- Asemi, A. and Asemi, A. 2018. Artificial intelligence (AI) application in library systems in Iran: A Taxonomy study. *Library Philosophy and Practice* (e-journal). [Online]. <https://digitalcommons.unl.edu/libphilprac/184>. (16 May 2024).
- Bokhan, S.A.A. and Myeong, S. 2023. An analysis of artificial intelligence adoption behaviour applying extended UTAUT framework in urban cities: The context of collectivistic culture. *Engineering Proceedings*, 56(1): 289-300. [Online]. <https://doi.org/10.3390/ASEC2>. (7 April 2025).
- Cooke, A., Smith, D. and Booth, A. 2012. Beyond PICO: The SPIDER tool for qualitative evidence synthesis. *Qualitative Health Research*, 22(10): 1435-1443.

- Cox, A.M., Pinfield, S. and Rutter, S. 2019. The intelligent library: Thought leaders' views on the likely impact of artificial intelligence on academic libraries. *Library High Technology*, 37(3):418-435. [Online]. <https://doi.org/10.1108/LHT-08-2018-0105> (7 April 2025).
- Curzon, S. and Quinonez-Skinner, J. 2009. Encyclopaedia of Library and Information Sciences. *Academic Libraries*. DOI: 10.1081/E-ELIS3-120044525
- Echedom, A.U. and Okuonghae, O. 2021. Transforming academic library operations in Africa with artificial intelligence: Opportunities and challenges: A Review Paper. *New Review of Academic Librarianship*, 27(2): 1-11. DOI: 10.1080/13614533.2021.1906715.
- Emiri, O.T. 2023. Adoption and utilisation of artificial intelligence by adoption and utilisation of artificial intelligence by librarians in university libraries in southern Nigeria librarians in university libraries in Southern Nigeria. *Library Philosophy and Practice* (e-journal). [Online]. <https://digitalcommons.unl.edu/libphilprac/7570>. (7 April 2025).
- Enakrire, R.T. and Oladokun, B.D. 2024. Artificial intelligence as enabler of future library services: how prepared are librarians in African university libraries. *Library High Technological News*, 41(3):1-5.
- Deranty, J.P. and Corbin, T. 2022. Artificial intelligence and work: a critical review of recent research from the social sciences. *AI & Society*, 1-17.
- Dwivedi, Y.K., Rana, N.P., Jeyaraj, A., Clement, M. and Williams, M.D. 2019. Re-examining the unified theory of acceptance and use of technology (UTAUT): Towards a revised theoretical model. *Information Systems Frontiers*, 21(3): 719-734.
- Dube, T.V. and Jacobs, L. 2023. Academic library services extension during the COVID-19 pandemic: considerations in higher education institutions in the Gauteng Province, South Africa. *Library Management*, 44(1/2): 17-39. [Online]. <https://doi.org/10.1108/LM-04-2022-0039> (7 April 2025).
- Gautam, S. 2023. Symbiotic Relation between a Library and an Academic Institution. *An International Journal of Nepal Library Association*, 2(1): 209-215. DOI: 10.3126/access.v2i01.59000.
- Grant, C. and Camp, T. 2018. Calling artificial intelligence in libraries via a national project registry. University Oklahoma, CNI Fall Project Briefing. [Online]. https://www.cni.org/wp-content/uploads/2019/01/CNI_Scaling_Grant. (16 May 2024).
- Grewal, A., Kataria, H. and Dhewan, I. 2016. Literature search for research planning and identification of research problem. *Indian Journal of Anaesthesia*, 60(9): 635-639. DOI: 10.4103/0019-5049.190618
- Finley, T. 2019. The democratization of artificial intelligence: One library's approach. *Information Technology & Libraries*, 38(1): 8-13.
- Han, J. and Conti, D. 2020. The use of UTAUT and post-acceptance models to investigate the attitude towards a telepresence robot in an educational setting. *Robotics*, 9(2): 34 - 49.
- James, E.A., Heather, W. and Jung Won, Y. 2021. UTAUT as a model for understanding the intention to adopt ai and related technologies among librarians. *The Journal of Academic Librarianship*, 47(6). [Online]. <https://doi.org/10.1016/j.acalib.2021.102437>. (7 April 2025).
- Khanzode, K.C.A. and Sarode, R.D. 2020. Advantages and disadvantages of artificial intelligence and machine learning: A literature review. *International Journal of Library & Information Science*, 9(1): 3-10.
- Korinek, A. and Stiglitz, J. 2017. Artificial intelligence and its implications for income distribution and unemployment. NBER Working Paper. National Bureau of Economic Research.
- Luis, E.D., Gemma, F.C., Carmen-Maria, H.L., Hugo, G. and Jose-Luis, A.C. 2020. Analyzing the impact of COVID-19 on education professionals. Toward a paradigm shift: ICT and neuroeducation as a binomial of action. *Sustainability MDPI*, 12(14):1-10.
- Lubbe, W., Ham-Baloyi, W. and Smit, K. 2020. The integrative literature review as a research method: A demonstration review of research on neurodevelopmental supportive care in preterm infants. *Journal of Neonatal Nursing*, 26(6): 308-315.
- Mwilongo, K. and Mwageni, R. 2022. Assumptions of the future application of artificial intelligence in Tanzanian academic libraries: A review of literature. Proceedings of the 4th COTUL Scientific Conference.
- Nkomo, S. and Matli, W. 2022. Emergency remote education in Southern African schools: Digital transformation bridging the gap in the COVID-19 era. *International Journal of Educational Development in Africa*, 7(1): 1-17.
- Ocholla, D.N. and Ocholla, L. 2020. Readiness of academic libraries in South Africa to research, teaching and learning support in the Fourth Industrial Revolution. *Library Management*, 41(6): 335-368.
- Odiege, I.O. 2024. Exploring the awareness, use and challenges facing the integration of artificial intelligence in library services by librarians in university libraries in North-Central, Nigeria. *Journal of Library and Information Science*, 26(1): 212-219.
- Okunlaya, R.O., Abdullah, N.S. and Alias R.A. 2022. Artificial intelligence (AI) library services innovative conceptual framework for the digital transformation of university education. *Library High Technology*, 40(6).
- Passey, D. 2020. Theories, theoretical and conceptual frameworks, models and constructs: Limiting research outcomes through misconceptions and misunderstandings. *Studies in Technology Enhanced Learning*, 1(1): 1-15.
- Saibakumo, W.T. 2021. Awareness and acceptance of emerging technologies for extended information service delivery in academic libraries in Nigeria. *Library Philosophy and Practice* (e-journal), 5266. [Online]. <https://digitalcommons.unl.edu/libphilprac/5266>. (16 May 2024).

- Slade, E.L., Dwivedi, Y.K., Piercy, N.C. and Williams, M.D. 2015. Modeling consumers' adoption intentions of remote mobile payments in the United Kingdom: Extending UTAUT with innovativeness, risk, and trust. *Psychology and Marketing*, 32(8): 860-873. [Online]. <https://doi.org/10.1002/mar.20823>. (8 April 2025).
- Soares, C.B., Hoga, L.A.K., Peduzzi, M., Sangaleti, C., Yonekura, T. and Silva, D.R.A.D. 2014. Integrative review: concepts and methods used in nursing. *Revista da Escola de Enfermagem da USP*, 48(2): 335-345. DOI: 10.1590/S0080-623420140000200020.
- Sougato, D. and Biplab, D. 2024. Application of UTAUT on adopting Artificial Intelligence Powered Lead Management System (AI-LMS) in passenger car sales. *Technological Forecasting and Social Change*, 201. [Online]. <https://doi.org/10.1016/j.techfore.2024.123241>. (7 April 2025).
- Subaveerapandiyar, A., Sunanthini, C. and Amees, M.A. 2023. Study on the knowledge and perception artificial intelligence. *IFLA Journal*, 49(3): 503-51. [Online]. <https://doi.org/10.1177/03400352231180230>. (7 April 2025).
- Snyder, H. 2019. Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, 104: 333-339.
- Tunmibi, S. and Okuonghae, N. 2023. Technological readiness as predictor of artificial intelligence technology adoption among librarians in Nigeria. *Library Philosophy and Practice* (e-journal), 7(24).
- Venkatesh, V., Morris, M., Davis, G. and Davis, F. 2003. User acceptance of information technology: Towards a unified view. *MIS Quarterly*, 27(3): 425-478.
- Wheatley, A. and Hervieux, S. 2019. Artificial intelligence in academic libraries: An environmental scan. *Information Services and Use*, 39(7): 1-10.
- World Bank. 2020. *Remote learning response to COVID-19 knowledge pack with a focus on least developed countries (LDCs) and fragility, conflict and violence (FCV)*. The World Bank, pp.1-26.
- Yakubu, A.S., Yagana, A.A. and Umar, S.Y. 2023. Investigating librarians' intention to use artificial intelligence for effective library service delivery: A partial least square structural equation modeling-based approach. *Dutse Journal of Pure and Applied Sciences*, 9(1): 1-15.