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ARTIFICIAL INTELLIGENCE AND DIGITAL LIBRARIANSHIP IN ACADEMIC LIBRARIES: OPPORTUNITIES, CHALLENGES AND FUTURE PROSPECTS: A STUDY OF ACADEMIC LIBRARIES IN IMO STATE, NIGERIA

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Abstract

This research explored the incorporation of artificial intelligence (AI) within digital librarianship in academic libraries located in Imo State, Nigeria. The study focused on identifying the opportunities and challenges linked to this integration, as well as potential developments for the future. Eight key objectives guided the research: assessing AI usage in academic libraries, highlighting its benefits, pinpointing barriers to integration, examining its future role in library services, and suggesting strategies to improve AI adoption. Using a descriptive survey methodology, the study included 175 academic librarians from Imo State. Data was gathered through a structured questionnaire, and analysis employed descriptive statistical methods such as frequency counts, percentages, means, and standard deviations. Findings revealed a moderate level of AI integration (Grand Mean = 2.64, SD = 1.01). The study underscored advantages of AI, including enhanced information accessibility, rapid data retrieval, superior reference services, automation of routine tasks, personalized information delivery, and improved staff efficiency. However, barriers like lack of funding, insufficient training, poor internet access, inadequate ICT infrastructure, unreliable power supply, and a shortage of AI-skilled professionals hinder effective AI implementation. The research also considered the future of AI in academic libraries, highlighting prospects such as operational efficiency, intelligent information retrieval, and enhanced research assistance. Respondents proposed solutions like increased funding, ongoing professional training, improved ICT infrastructure, and partnerships with technology providers. Ultimately, the study acknowledged the ongoing advancements in AI integration while emphasizing the need for significant investment in infrastructure, training, and policy development to maximize its potential benefits in digital librarianship.

Keywords: AI, digital librarianship, academic libraries, AI implementation, opportunities, challenges, future outlook, Imo State, Nigeria.

Introduction

The rapid advancement of Information and Communication Technologies has profoundly transformed the activities of academic libraries worldwide. The emergence of artificial intelligence and associated technologies such as machine learning, natural language processing, intelligent search, robotics, expert systems, and generative artificial intelligence has fundamentally changed the landscape of library and information practices. Academic libraries have adopted artificial intelligence in diverse ways, including cataloging, indexing, information retrieval, collection management, virtual reference services, plagiarism detection, and information services, resulting in increased efficiency and improved access to information resources globally (Akinola, 2023; Jatto and Tella, 2024). Artificial intelligence generally refers to computer-generated information systems that exhibit human intellectual capabilities such as reasoning, learning, solving, communicating, making decisions, and discovering patterns. The application of artificial intelligence in academic libraries enables such systems to undertake repetitive tasks while simultaneously assisting in acquiring, organizing, representing, and providing access to information and knowledge to meet users' needs. Chatbots, recommendation systems, semantic search tools, automated metadata generation systems, and digital assistants have become critical components of modern academic libraries (Bolanos et al., 2024).

Digital librarianship is another critical innovation adopted in academic libraries worldwide. It entails using digital technologies to acquire, organize, preserve, manage, and disseminate information resources digitally. Digital librarianship goes beyond digitizing information resources to providing digital resources, databases, institutional repositories, virtual reference services, and online information services to individual users and groups. Artificial intelligence and digital librarianship have combined to produce smart knowledge centers that have proven effective in supporting teaching, learning, and research compared to traditional academic libraries. (Bolanos et al., 2024). Institutions of higher learning have invested significantly in artificial intelligence to drive library services, provide access to electronic resources, automate processes, and offer virtual reference services. Artificial intelligence enables libraries to provide automated cataloging and indexing of information resources, conduct semantic searches, generate recommendation systems, detect plagiarism, and provide information resources in different formats and languages. The use of artificial intelligence in academic libraries has improved the speed and accuracy of information processing while simultaneously enhancing the quality of information services offered [4].

Academic libraries in developing countries such as Nigeria are still in their infancy concerning the application of artificial intelligence in library and information practices. Although most university libraries have embraced automation and electronic databases to manage and disseminate information resources, the application of artificial intelligence faces several challenges, including inadequate infrastructure, limited financial resources, insufficient technical know-how, unreliable electricity, poor internet connection, and the absence of appropriate institutional policies (Igbo et al., 2025). Although most libraries have recognized

the need to adopt artificial intelligence to improve service delivery, they lack the resources to implement the technology. However, librarians and administrators increasingly acknowledge the potential of artificial intelligence in academic libraries and are beginning to explore ways of adopting the technology to improve their services. Imo State academic libraries are essential components of the higher education system in Nigeria. Institutions such as Imo State University, Federal University of Technology Owerri, Federal Polytechnic Nekede, and Alvan Ikoku Federal University of Education rely significantly on their academic libraries for teaching and research purposes.

The use of artificial intelligence in digital librarianship offers various benefits to academic libraries in Imo State, including improved information retrieval, automated cataloging and indexing, virtual reference services, plagiarism detection, research analytics, digital preservation, informed decision-making, and personalized information services. Additionally, artificial intelligence can help academic libraries in Imo State improve their operational efficiency while simultaneously supporting collection management and development (Igbo et al., 2025). Besides improving information retrieval, artificial intelligence can help academic libraries in Imo State offer a broader range of library services, support research activities, and provide more efficient and effective information services to their users. However, the adoption of artificial intelligence in academic libraries in Imo State faces several challenges, including inadequate infrastructure, insufficient funds, the absence of appropriate institutional policies, limited technical know-how, and unreliable electricity. Other challenges include cybersecurity threats, ethical concerns, resistance to change, poor funding, and the absence of government support and relevant frameworks (Igbo et al., 2025).

In the future, artificial intelligence will continue to develop and transform academic libraries in innovative ways, such as through the use of generative artificial intelligence, chatbots, and predictive analytics. Similarly, technologies such as blockchain and cloud-based smart libraries will also revolutionize the activities of academic libraries, making them more effective in delivering information services to their users (Rabatseta et al., 2024 ; Igbo et al., 2025). However, the effective adoption of artificial intelligence requires substantial investment in digital infrastructure, continuous staff training, and the development of institutional policies regarding the use of the technology. Further, partnerships between universities, governments, and other relevant agencies are critical to enhancing digital capacities and promoting the adoption of artificial intelligence in academic libraries. Thus, the present study examines the role of artificial intelligence and digital librarianship in academic libraries in Imo State, Nigeria. Specifically, the study highlights the opportunities and challenges of adopting artificial intelligence in academic libraries and the prospects of using the technology to promote library services in the study area.

The rise in the use of artificial intelligence has revolutionized the activities of libraries worldwide. Its application has had profound implications for information retrieval, reference services, cataloging and indexing of information resources, and preserving digital information resources. Although artificial intelligence has proven beneficial to academic libraries, its adoption has been limited in most Nigerian academic libraries (Rabatseta et al., 2024 ; Igbo et al., 2025). Most institutions report facing several limitations in adopting the technology, including lack of infrastructure, insufficient funds, lack of skilled personnel, poor information

and communication technology resources, and the absence of institutional policies. Although Imo State academic libraries have adopted various digital technologies to enhance their operations, little is known about the opportunities and challenges of integrating artificial intelligence into digital librarianship in the study area. Consequently, the study will help librarians and administrators understand the opportunities and challenges of adopting artificial intelligence in academic libraries and promote quality information services.

Moreover, the development of generative AI and intelligent digital services raises new ethical, professional, and technological concerns related to data privacy, copyright, algorithmic bias, information accuracy, and staff capabilities. Without a thorough understanding of these issues, academic libraries may not fully leverage the benefits offered by AI technologies. Therefore, it is vital to investigate the opportunities, obstacles, and future outlook of artificial intelligence in digital librarianship within academic libraries in Imo State, Nigeria. The general objective of this research is to examine artificial intelligence and digital librarianship in academic libraries in Imo State, Nigeria. The s**pecific objectives include to:** a). determine the level of awareness and knowledge of AI-generated library services among academic librarians; b). assess the digital and AI competencies possessed by academic librarians; c). examine the availability of institutional and technological resources supporting AI implementation; d). examine the level of adoption of artificial intelligence in academic libraries in Imo State; e). identify the opportunities associated with AI adoption in digital librarianship; f). determine the challenges affecting AI implementation in academic libraries; g). examine the future prospects of artificial intelligence for library service delivery; h). recommend strategies for improving AI adoption in academic libraries.

The research will add to the increasing information available on the use of AI in library and information science, specifically in academic libraries in Nigeria. The results will offer real-world proof for university officials, policymakers, librarians, scholars, and government bodies on how AI is currently being used in academic libraries in Imo State. It will also aid library administrators in recognizing areas where skills need to be improved, identifying gaps in infrastructure, and proposing policies needed for a successful integration of AI. Additionally, the outcomes will be a resource for upcoming researchers interested in AI, digital library management, digital changes, and new technologies in academic libraries.

Methodology

Imo State is among the five states located in the South-East region of Nigeria. It was established on 3 February 1976, carved out of the former East Central State, with Owerri as its capital. Positioned between latitudes 4°45′N and 7°15′N and longitudes 6°50′E and 7°25′E, the state is bordered by Anambra State to the north, Abia State to the east, Rivers State to the south, and Delta State to the west. Covering an area of about 5,530 square kilometers (NBS, 2024). Imo State experiences a tropical climate with distinct wet and dry seasons, ideal for agriculture and human habitation. Imo State is renowned as a key educational hub in Nigeria, boasting numerous public and private higher education institutions such as universities, polytechnics, colleges of education, and health sciences colleges. The state accommodates various higher education establishments such as Imo State University, Federal University of Technology Owerri, Federal Polytechnic Nekede, Alvan Ikoku Federal University of Education, and other recognized tertiary institutions that have well-established academic libraries. These academic

establishments house libraries that cater to the information needs of students, scholars, and faculty members. Given the concentration of higher education facilities (Federal Ministry of Education, 2024). Imo State presents a conducive environment for exploring the integration of artificial intelligence and digital library management in academic libraries. The growing focus on digital innovation, electronic resources, and tech-driven library services in these institutions offers a platform to study the implementation, challenges, opportunities, and future outlook of AI among academic librarians. This research utilized a descriptive survey methodology to gather information from academic librarians in Imo State, Nigeria about their views on integrating artificial intelligence into digital librarianship. The study population included professional and para-professional librarians in academic libraries in Imo State. A total of 175 academic librarians were surveyed using a census approach. The data collection tool was a structured questionnaire named "Artificial Intelligence and Digital Librarianship Questionnaire (AIDLQ)."The questionnaire had two sections: one for demographic details and the other for exploring AI adoption levels, challenges, opportunities, future prospects, and strategies for enhancing AI integration in academic libraries. The questionnaire used a four-point Likert scale and multiple-response items. The questionnaire's validity was confirmed through face and content validation by experts, and its reliability was ensured via a pilot study using the Cronbach's Alpha method. All 175 distributed questionnaires were completed and returned, resulting in a 100% response rate. Descriptive statistics were employed to analyze the data, with frequencies and percentages utilized for multiple-response items and mean and standard deviation for Likert-scale items. A mean score of 2.50 was the threshold for decision-making, with scores above indicating agreement and scores below indicating disagreement.

Result and Discussions

Level of Awareness and Knowledge of AI-Generated Library Services among Academic Librarians

The data in Table 1 reveals that academic librarians generally have a strong level of familiarity and expertise in AI-powered library services, with an average score of 2.97 (standard deviation = 0.93), surpassing the benchmark score of 2.50. Participants mostly agreed that they are knowledgeable about AI tools like ChatGPT, Gemini, and Copilot for library services (Average = 3.16, SD = 0.94), followed by awareness of AI-based library services (Average = 3.14, SD = 0.89). The aspect rated the lowest was the adequacy of information received through professional training (Average = 2.68, SD = 1.00), indicating that although awareness is generally high, formal training opportunities are somewhat limited. In essence, the results suggest that academic librarians have a solid grasp of AI-generated library services but could benefit from additional professional development to enhance their skills. Awareness and understanding of Artificial Intelligence (AI)-generated library services have grown in importance for academic librarians due to the swift incorporation of AI technologies into library functions and services. AI-generated library services involve utilizing intelligent computer systems capable of carrying out tasks like information retrieval, reference services, cataloging, indexing, classification, collection development, plagiarism detection, metadata creation, and tailored user support with minimal human involvement. The increasing utilization of AI tools such as ChatGPT, Gemini, Copilot, intelligent discovery systems, and machine learning applications has revolutionized how academic libraries provide information services and aid

teaching, learning, and research (Asemi et al., 2021; Cox et al., 2023). Awareness of AI-generated library services encompasses librarians' knowledge of the presence, abilities, and potential uses of AI technologies within library settings. Knowledge, on the other hand, goes beyond awareness to encompass an understanding of how these technologies operate, their real-world applications, ethical considerations, advantages, and constraints. Librarians in academia who possess a high degree of AI awareness and knowledge are better equipped to embrace innovative technologies, enhance service provision, boost user satisfaction, and back digital scholarship initiatives (Okorie & Ekere, 2024). Recent research indicates that awareness of AI applications among academic librarians is steadily rising, primarily due to professional development programs, conferences, online training, and increased exposure to AI-driven digital tools. However, the depth of knowledge varies significantly among institutions, particularly in developing nations where insufficient ICT infrastructure, limited funding, inadequate training opportunities, and resistance to technological changes persist as barriers to effective AI implementation (Boateng and Agyemang, 2023; IFLA, 2024). Consequently, many librarians are aware of AI technologies but lack the practical skills necessary for their effective use. Moreover, AI literacy has become a crucial skill for academic librarians in the digital age. Librarians need ongoing education and capacity-building initiatives to acquire the technical and ethical knowledge required to responsibly integrate AI into library services. Enhanced awareness and knowledge will empower librarians to maximize the benefits of AI while addressing concerns related to data privacy, algorithmic bias, copyright, and information ethics (UNESCO, 2023). Therefore, evaluating the level of awareness and knowledge of AI-generated library services among academic librarians is essential for pinpointing competency gaps and creating suitable training programs that will enhance AI readiness and digital transformation in academic libraries.

Table 1: Level of Awareness and Knowledge of AI-Generated Library Services among Academic Librarians

S/N	Item	Mean	SD
1	I am aware of AI-generated library services used in academic libraries.	3.14	0.89
2	I understand the functions of AI tools in library service delivery.	3.00	0.91
3	I have adequate knowledge of AI applications in cataloguing, indexing and classification.	2.93	0.93
4	I can identify different AI-powered library technologies.	2.88	0.90
5	I am familiar with AI tools such as ChatGPT, Gemini and Copilot for library services.	3.16	0.94
6	I understand the ethical issues associated with AI-generated library services.	2.90	0.92

S/N	Item	Mean	SD
7	I know how AI can improve reference and information services.	3.06	0.91
8	I have received adequate information about AI technologies through professional training.	2.68	1.00

Digital and AI Competencies Possessed by Academic Librarians

The data presented in Table 2 shows that academic librarians have different levels of digital and AI skills. The most frequently mentioned skill was basic computer and ICT knowledge, reported by 168 participants (96.0%). Following this, online database searching and retrieval was cited by 161 respondents (92.0%), and the use of AI chatbots like ChatGPT, Gemini, and Copilot by 149 individuals (85.1%). Other competencies such as digital reference services (82.9%), electronic cataloguing and metadata management (78.9%), and digital information literacy instruction (76.0%) were also widely acknowledged. However, more advanced AI skills were less prevalent. Only 35.4% of the respondents felt confident in machine learning or data analytics applications, while 26.9% claimed to have programming or scripting abilities for library automation. These results indicate that although academic librarians have adequate digital skills and basic AI competencies, there is a need for capacity building in advanced AI, programming, and intelligent automation. Academic librarians in the digital age need digital skills and competencies in Artificial Intelligence (AI). Digital skills include knowledge, expertise, and attitudes about using digital technologies to create, organize, communicate, and problem-solve information. At the same time, AI competencies are knowledge, expertise, and attitudes about using and evaluating AI technologies and software in libraries. These competencies enable academic librarians to provide innovative, effective, and efficient services that support education, learning, and research in tertiary institutions (UNESCO, 2023). Academic librarians need a broad range of digital skills, including computer skills, searching online databases, managing electronic resources, providing virtual reference services, creating metadata, managing institutional repositories, digital preservation of records, managing research data, and teaching information literacy skills (UNESCO, 2023). Moreover, since AI is increasingly being adopted in libraries, librarians need competencies in utilizing large AI technologies such as ChatGPT, Gemini, and Microsoft copilot to conduct literature searches, provide virtual reference services, generate content, support learning and research activities, and engage with library users (Cox et al., 2023). Such competencies are vital in delivering successful services and intelligent automation while helping users make the most out of the information.

Furthermore, AI competencies also entail skills in rapid engineering, AI-enabled cataloging and indexing, data analysis, ethical AI decision-making models, and critical understanding of ethical issues such as auditing algorithms, copyright, and data privacy. According to the International Federation of Library Associations and Institutions (IFLA, 2024), AI literacy is essential for ensuring that librarians evaluate information produced by AI accurately and advise students on utilizing such information in their studies appropriately. However, the current study reveals that academic librarians, particularly in developing countries, have a wealth of digital skills but lack AI competencies. The limitations to developing AI competencies among

academic librarians include inadequate infrastructure, limited resources, insufficient professional development opportunities, and access to training materials on AI competencies (Boateng and Agyemang, 2023; Okorie and Ekere, 2024). Therefore, the need for continuous professional development and training programs to enhance digital and AI competencies among academic librarians cannot be underestimated. Digital and AI competencies are vital skills needed by academic librarians to perform their duties efficiently. Continuous education and training in new digital and AI skills can help academic librarians deliver quality services and contribute to the overall efficiency of academic libraries while advancing scholarly communication and innovation in tertiary institutions.

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Table 2: Digital and AI Competencies Possessed by Academic Librarians

S/N	Digital and AI Competency	Frequency	Percentage
1	Basic computer and ICT proficiency	168	96.0
2	Online database searching and retrieval	161	92.0
3	Use of AI chatbots (e.g., ChatGPT, Gemini, Copilot)	149	85.1
4	Digital reference service delivery	145	82.9
5	Electronic cataloguing and metadata management	138	78.9
6	Digital information literacy instruction	133	76.0
7	Use of institutional repositories	127	72.6
8	AI-assisted literature searching and summarization	121	69.1
9	Data analysis using digital tools (Excel, SPSS, etc.)	116	66.3
10	Research support using AI tools	112	64.0
11	Digital preservation and archiving	104	59.4
12	Prompt engineering for generative AI	98	56.0
13	AI-assisted cataloguing and indexing	94	53.7
14	Machine learning or data analytics applications	62	35.4
15	Programming or scripting for library automation	47	26.9

Availability of Institutional and Technological Resources Supporting AI Implementation among Academic Libraries

The results presented in Table 3 demonstrate that academic libraries have a range of institutional and technological resources necessary for implementing AI, with varying levels of availability. The most commonly cited resources included: reliable internet connection (90.9%), computers and digital workstations (88.0%), electronic library management systems (84.0%). Additionally, other resources such as subscriptions to electronic databases (81.1%), institutional ICT support services (77.7%), and stable electricity with backup systems (73.1%) were also reported as frequently available. On the other hand, resources specifically tailored to support advanced AI implementation were less commonly found. Only 36.0% of respondents noted the presence of high-performance computing infrastructure, 33.1% mentioned having AI-enabled library software, 26.3% reported having a dedicated AI innovation or digital transformation unit, and just 22.3% stated that their institutions had collaborations with AI technology

providers. These results suggest that academic libraries possess some of the basic digital infrastructure required for the adoption of artificial intelligence but lack the complementary institutional and technological resources to actualize its effective integration into their operations. Additional investment, directives, and collaboration are needed to actualize the incorporation of this technology into the operations of academic libraries. Institutional and technological resources are critical assets for implementing artificial intelligence in academic libraries. Institutional resources refer to policies, funding, commitment, planning, training, and organizational strategies that enable the adoption and efficient use of artificial intelligence in academic libraries. At the same time, technological resources include reliable internet connection, computer hardware and software, cloud platforms, library management systems, artificial intelligence tools, digital repositories, data storage, and security systems that support the use of this technology to transform library services (Cox et al., 2023). Digital infrastructure plays a significant role in supporting academic libraries to adopt artificial intelligence technologies, including cataloging, indexing, reference services, collection management, information retrieval, research assistance, and interactive services. Such technology resources as high-speed internet, modern computers, institutional repositories, digital libraries, and databases are essential components of academic libraries that use artificial intelligence to improve their operational efficiency and service performance. Moreover, generative artificial intelligence tools such as ChatGPT, Gemini, and Microsoft Copilot can empower these libraries to innovate information services, automate routine tasks, and offer personalized recommender systems to their users (UNESCO, 2023). Institutions can invest in their human resources by providing adequate funding, strategic direction, artificial intelligence policies, training, and collaboration opportunities to improve the capacity of their employees in adopting and leveraging this technology for better performance (IFLA, 2024). Leaders play a crucial role in promoting academic library innovation by allocating resources to update infrastructure, upgrading employees' skills, and developing policies that guide the ethical use of artificial intelligence. This investment is likely to motivate employees to acquire new skills and advance their careers while enhancing the sustainability of digital innovation in academic libraries.Many academic libraries worldwide are beginning to appreciate the potential of artificial intelligence to redefine library services and operational processes. However, most academic libraries, particularly in the global south, face critical institutional and technological resource constraints hindering the adoption and effective implementation of this innovative technology. Limited financial resources, unreliable energy supplies, inadequate internet connections, insufficient information and communication technology infrastructure, and a lack of skilled professionals and institutional policies to guide the use of artificial intelligence hinder efficient adoption and use of this technology in many academic libraries (Boateng and Agyemang, 2023; Okorie and Ekere, 2024). These challenges contribute to the slow rate at which academic libraries are adopting and implementing artificial intelligence and the significant disparities in proficiency levels between developed and developing countries. Therefore, academic libraries must invest more in institutional and technological resources to actualize artificial intelligence adoption successfully. Such resources as modern information and communication technology infrastructure, cloud computing platforms, artificial intelligence-powered library systems, human resource development, institutional policies, and partnerships with technology

companies will empower these libraries to improve the quality and speed of their services in the digital age.

Table 3: Availability of Institutional and Technological Resources Supporting AI Implementation among Academic Libraries

S/N	Institutional and Technological Resource	Frequency	Percentage
1	Reliable internet connectivity	159	90.9
2	Computers and digital workstations	154	88.0
3	Electronic library management system (LMS)	147	84.0
4	Subscription to electronic databases	142	81.1
5	Institutional ICT support services	136	77.7
6	Stable electricity/power supply (backup systems)	128	73.1
7	Access to AI tools (e.g., ChatGPT, Gemini, Copilot)	121	69.1
8	Staff training on AI and digital technologies	114	65.1
9	Institutional policy supporting AI adoption	102	58.3
10	Adequate funding for AI implementation	91	52.0
11	Cloud computing and digital storage facilities	86	49.1
12	High-performance computing infrastructure	63	36.0
13	AI-enabled library software	58	33.1
14	Dedicated AI innovation or digital transformation unit	46	26.3
15	Partnerships with AI technology providers	39	22.3

Adoption of Artificial Intelligence in Academic Libraries

The data presented in Table 4 shows that the adoption of artificial intelligence in academic libraries in Imo State is at a moderate level, with an average of 2.64 and a standard deviation of 1.01, exceeding the average benchmark of 2.50. Survey participants indicated that AI tools are utilized in various library operations, such as reference and information services (Average = 2.81, SD = 0.98), information retrieval and discovery services (Average = 2.78, SD = 0.98), and cataloguing and classification (Average = 2.70, SD = 1.00). Nevertheless, lower average ratings for AI-driven chatbots (Average = 2.51, SD = 1.04) and the general level of AI integration (Average = 2.53, SD = 1.02) suggest that AI implementation is still in its early stages in many academic libraries. In summary, the results indicate that while AI usage has begun in academic libraries in Imo State, additional investment in infrastructure, personnel training, and institutional backing is necessary to achieve more widespread implementation. The integration of Artificial Intelligence (AI) in academic libraries is increasingly crucial for enhancing service quality, automating regular tasks, and boosting users' information access. AI adoption involves incorporating AI technologies into library operations to enhance efficiency, precision, and decision-making processes. AI-driven tools like smart search systems, chatbots, virtual assistants, automated cataloging, recommendation systems, plagiarism checkers, and research aids are reshaping conventional library roles, enabling libraries to adapt to users' evolving information needs (Asemi et al., 2021). Academic libraries are leveraging artificial intelligence to enhance processes, information extraction and delivery, digital research, and provide

personalized experiences. Artificial intelligence (AI) enables libraries to automate some of their mundane tasks, including metadata creation, cataloging, indexing, and collection organization, to focus more on higher-level functions such as research assistance, information literacy, and teaching roles (Asemi et al., 2021). Additionally, chatbots such as ChatGPT, Gemini, and Microsoft Copilot are being used to improve reference services, literature searches, content creation, and writing assistance. The extent to which individual academic libraries are adopting artificial intelligence depends on several factors, including organizational readiness and competence, technological infrastructure, financial considerations, and institutional support. The presence of a robust technological framework, internet connectivity, policies, and staff training contribute to the successful adoption and implementation of AI in academic libraries. On the other hand, limited budgets, inadequate technological infrastructure, insufficient knowledge and skills to deploy AI, and ethical issues such as copyright and privacy impede the use of AI in many institutions, particularly in the developing world nations (Boateng and Agyemang, 2023; UNESCO, 2023). To fully realize the benefits of using artificial intelligence, academic libraries must invest in cutting-edge technologies, develop protocols for implementing AI, upgrade staff skills through training, invest in organizational capacities, and collaborate with technology and educational partners. This will enable libraries to maximize the benefits of using AI to improve processes, research, and teaching and promote library excellence (IFLA, 2024).

Table 4: Level of Adoption of Artificial Intelligence in Academic Libraries in Imo State

	Item	Mean	SD	Decision
1	AI tools are currently used for reference and information services in my library.	2.81	0.98	Agree
2	AI applications have been integrated into cataloguing and classification activities.	2.70	1.00	Agree
3	AI technologies are used to improve information retrieval and discovery services.	2.78	0.98	Agree
4	My library uses AI-powered chatbots or virtual assistants to support users.	2.51	1.04	Agree
5	AI is applied in collection development and library management processes.	2.62	1.02	Agree
6	My library has adopted generative AI tools (e.g., ChatGPT, Gemini, Copilot) for library operations.	2.61	1.04	Agree
7	AI technologies are regularly utilized to support research and scholarly communication services.	2.59	1.00	Agree
8	Overall, the level of AI adoption in my library is satisfactory.	2.53	1.02	Agree

Opportunities Associated with AI Adoption in Digital Librarianship

The data presented in Table 5 indicates that academic librarians have pinpointed various advantages linked to integrating artificial intelligence into digital librarianship. The primary

opportunities highlighted include enhanced accessibility to information and knowledge resources (94.9%), quicker and more effective information retrieval (92.0%), and improved support services for users and references (88.0%). Additionally, respondents acknowledged the following benefits of AI implementation: automation of regular library tasks (85.1%), personalized information and recommendation services (81.7%), and enhanced cataloging, indexing, and metadata creation (78.9%). Other significant opportunities mentioned encompass increased efficiency among staff (76.0%), better backing for research and scholarly communication (72.6%), improved digital preservation (69.1%), and enhanced decision-making using data analysis (65.1%). A smaller percentage of participants recognized cost savings through automation (50.9%) and heightened institutional visibility and global collaboration (46.9%) as potential advantages. In summary, the results suggest that academic librarians perceive the use of artificial intelligence as a way to improve service, effectiveness, and innovation in digital libraries. Artificial intelligence can transform the current practice of digital libraries by improving the quality of service, effectiveness of processes, and increased accessibility of services. Artificial intelligence can be used to automate routine tasks in academic libraries, such as organizing, classifying, cataloging, and managing information resources. As a result, academic libraries can provide quality services such as research assistance, information literacy instruction, and communication support services. The use of AI will increase the speed and accuracy of processes, resulting in improved service delivery. Other benefits of using AI in academic libraries include improved information retrieval and user services. Search tools, search assistants, and recommendation systems powered by AI can provide faster, more accurate, personalized, and convenient access to information resources. Additionally, generative AI tools such as ChatGPT, Gemini, and Microsoft 365 copilot can help with searching, analyzing, and retrieving information resources in academic libraries. These AI tools facilitate literature searches, summarize relevant articles, reply to user inquiries, and help with writing and research tasks, thus improving user satisfaction (Boateng and Agyemang, 2023; UNESCO, 2023). Moreover, AI supports improved research assistance and decision-making in academic libraries. Through the use of AI, academic libraries can analyze information resources, make research recommendations, track and evaluate user behavior, manage information resources, and make data-driven decisions to improve processes, user services, and collection management. Additionally, AI can improve digital preservation, institutional repositories, plagiarism detection, and information structuring in academic libraries. However, it is important to note that for AI to add value in academic libraries, there is a need for the right tools, support structures, and continuous training. Thus, the use of AI has the potential to improve the performance, service, and user experience of academic libraries while promoting teaching/learning and research in higher education institutions(IFLA, 2024)

Table 5:Opportunities Associated with AI Adoption in Digital Librarianship

S/N	Opportunities Associated with AI Adoption in Digital Librarianship	*Frequency	Percentage
1	Improved access to information and knowledge resources	166	94.9
2	Faster and more efficient information retrieval	161	92.0

S/N	Opportunities Associated with AI Adoption in Digital Librarianship	*Frequency	Percentage
3	Enhanced reference and user support services	154	88.0
4	Automation of routine library operations	149	85.1
5	Personalized information and recommendation services	143	81.7
6	Improved cataloguing, indexing, and metadata generation	138	78.9
7	Increased productivity and staff efficiency	133	76.0
8	Better support for research and scholarly communication	127	72.6
9	Enhanced digital preservation and collection management	121	69.1
10	Improved decision-making through data analytics	114	65.1
11	24/7 virtual library services through AI chatbots	108	61.7
12	Enhanced information literacy and user education	103	58.9
13	Greater innovation in library service delivery	97	55.4
14	Cost reduction through automation of repetitive tasks	89	50.9
15	Increased institutional visibility and global collaboration	82	46.9

***Multiple responses**

Challenges Affecting AI Implementation in Academic Libraries

The results presented in Table 6 show that academic librarians have identified several difficulties that impact the integration of artificial intelligence in academic libraries. The primary challenge reported was the insufficient funding for AI technologies, with 163 respondents (93.1%) highlighting this issue. Following closely were concerns about the lack of training and professional development in AI, as noted by 158 respondents (90.3%), and problems with internet connectivity, mentioned by 151 respondents (86.3%). Other significant challenges of AI adoption in education include insufficient infrastructure, unstable electricity supply, the lack of librarians with AI expertise, and high costs of AI software and maintenance. Respondents identified institutional and organizational challenges, including the absence of AI policies and guidelines, resistance to new technology, and data security concerns, as barriers to adopting AI in academic libraries. Although a few respondents highlighted the absence of AI knowledge and the complexity of AI software application as challenges, they regarded these problems as minor. Overall, the study reveals that financial, infrastructural, and human resource inadequacies, as well as institutional barriers, hinder the effective incorporation of AI in academic libraries. There is a need for additional investment, including strategic planning, to facilitate AI adoption. While the integration of Artificial Intelligence (AI) in academic libraries offers several advantages, the process faces multiple challenges hindering its growth. Notably, institutional, technological, financial, and human resource factors influencing the adoption of AI in academic libraries pose several challenges to its implementation. Insufficient funding is a primary constraint hindering the adoption of AI systems in academic libraries. Limited funds prevent the procurement of AI software, cutting-edge modern information communication technology (ICT), and cloud computing platforms needed to host and operate AI in academic

libraries. Many academic libraries, especially in the developing world, operate on a shoestring budget and cannot afford to subscribe to AI-enabled literature search platforms (Boateng and Agyemang, 2023). Another significant challenge affecting the application of AI in academic libraries is the lack of skilled personnel. Most academic librarian positions require personnel with adequate digital literacy skills to handle the increasing demand for digitized information. However, there is a shortage of academic librarians with sufficient AI expertise to operate advanced AI technologies such as rapid engineering, data analytics, and machine learning software. A primary cause of the lack of AI expertise is the absence of formal training programs to augment the knowledge of academic librarians in AI applications. Consequently, many academic librarians are not comfortable adopting new AI software in their practices (Boateng and Agyemang, 2023). Continuous professional development programs on AI applications are needed to empower academic librarians to embrace AI technologies to enhance their practices. A lack of sufficient ICT infrastructure constitutes another significant challenge hindering the adoption of AI in academic libraries. Lack of reliable internet connections, electricity, updated and compatible computers, and other digital equipment hinders the smooth functioning of AI applications in academic libraries. The process of adopting AI technologies and integrating them with existing library management systems is also not always straightforward and requires substantial resources (Okorie and Ekere, 2024; Cox et al., 2023). Therefore, the absence of these key components presents a critical barrier to implementing AI in academic libraries.

Institutional and ethical concerns also present a critical barrier to adopting AI in academic libraries. Most academic libraries lack the policies, strategies, and structures to guide the ethical use of AI and the necessary organizational measures required to support its adoption. In addition, the issues of data privacy, cyber security, copyright and intellectual property rights, and the credibility of AI-generated information hinder the adoption of AI in academic libraries. These issues have caused apprehension among many librarians, administrators, and policymakers regarding the benefits of implementing AI in academic libraries (International Federation of Library Associations and Institutions [IFLA], 2024; UNESCO, 2023). For instance, the fear that AI-generated information could replace traditional library resources has slowed the adoption process. Addressing the ethical concerns surrounding the use of AI in academic libraries requires developing relevant policies on the use and control of AI technologies, ensuring ethical and responsible use of AI, and promoting data privacy and cyber security. Moreover, there is a need for sensitization programs to alleviate the fears of stakeholders about the usefulness of AI in academic libraries. Lastly, collaboration among universities, government, and professional library bodies in investing in digital infrastructure, continuous training of academic librarians, and policy developments will promote the adoption of AI in academic libraries.

Table 6: Challenges Affecting AI Implementation in Academic Lib

S/N	Challenges Affecting AI Implementation	*Frequency	Percentage
1	Inadequate funding for AI technologies	163	93.1
2	Lack of AI-related training and professional development	158	9
3	Poor internet connectivity	151	86.3
4	Inadequate ICT infrastructure	147	84.0

S/N	Challenges Affecting AI Implementation	*Frequency	Percentage
5	Unstable electricity supply	143	81.7
6	Shortage of AI-skilled librarians	138	78.9
7	High cost of AI software and maintenance	133	76.0
8	Absence of institutional AI policies and guidelines	126	72.0
9	Resistance to technological change among staff	119	68.0
10	Data privacy and cybersecurity concerns	112	64.0
11	Ethical concerns regarding AI use	105	60.0
12	Limited management support	98	56.0
13	Lack of collaboration with technology providers	89	50.9
14	Difficulty integrating AI with existing library systems	82	46.9
15	Poor awareness of AI capabilities among library staff	74	42.3

Future Prospects of Artificial Intelligence for Library Service Delivery

The results presented in Table 7 show that academic librarians are positive about the potential use of artificial intelligence in library services. The main opportunities identified include: more efficient and automated library operations (95.4%); enhanced information retrieval and knowledge discovery (92.6%); personalized and user-centered library services (89.7%); AI-powered virtual reference services (86.3%); improved support for teaching, learning, and research (83.4%); increased utilization of AI in cataloging, indexing, and metadata creation (80.6%); better digital preservation and collection management (77.1%); data-informed decision-making in libraries (73.7%); collaboration using intelligent digital library platforms (69.7%); enhanced management of research data (66.3%). While fewer respondents highlighted autonomous library service systems (48.0%) and expandeglobal visibility and resource sharing (52.0%), these were still considered significant future opportunities. In general, the research results suggest that academic librarians are optimistic about how Artificial Intelligence (AI) will empower efficiency, creativity, accessibility, and sustainability in the future of library services. Artificial Intelligence is predicted to have a significant impact on the future of libraries by empowering efficiency, innovating the user experience, and introducing creative library services in academic institutions. As AI develops and evolves, libraries are expected to invest more in AI-driven processes that will automate various functions, including cataloging, indexing, abstracting, managing collections, and retrieving information. As a result, librarians will have more time to offer specialized services such as research assistance, digital scholarship, information literacy instruction, and outreach (Cox et al., 2023). Artificial Intelligence promises to offer a more personalized, user-centered approach to library services. The application of AI-driven recommenders, search engines, and virtual assistant technologies will be able to respond to individual requests and provide relevant information based on users' preferences and behaviors, thus enhancing access to knowledge. Moreover, generative AI technologies such as ChatGPT, Gemini, and Microsoft 365 copilot will empower libraries to offer reference services by automating literature searches, summarizing documents, responding to research questions, and assisting with writing assignments (UNESCO, 2023). As a result,

users will be able to access efficient and accurate library services through these groundbreaking technologies.

Artificial Intelligence is also expected to enhance research assistance and library operations by enabling machine learning systems that can anticipate demand, manage collections, and make data-driven institutional decisions while improving data curation capabilities. Additionally, it will play a critical role in digitizing library collections and archives, accelerating the discovery of information, detecting plagiarism, and providing language translation options, thus facilitating more accessible and sustainable library services (IFLA, 2024). However, academic libraries must embrace continuous digital infrastructure investment, workforce development, ethical leadership, and regulatory environments to fully benefit from the innovations introduced by AI. Addressing issues such as data privacy, cybersecurity, algorithmic bias, and ethical AI use will be critical in maximizing the benefits of AI applications while minimizing the risks posed by these emerging technologies. With a comprehensive organizational commitment to leveraging this groundbreaking technology, libraries will undoubtedly witness increased efficiencies and excellence in service delivery (Asemi et al., 2021).

Table 7: Future Prospects of Artificial Intelligence for Library Service Delivery

S/N	Future Prospects of AI for Library Service Delivery	Frequency	Percentage
1	More efficient and automated library operations	167	95.4
2	Improved information retrieval and knowledge discovery	162	92.6
3	Personalized and user-centered library services	157	89.7
4	Expansion of AI-powered virtual reference services	151	86.3
5	Enhanced support for teaching, learning, and research	146	83.4
6	Greater use of AI for cataloguing, indexing, and metadata generation	141	80.6
7	Increased digital preservation and management of library collections	135	77.1
8	Data-driven decision-making for library management	129	73.7
9	Increased collaboration through smart digital library platforms	122	69.7
10	Improved research data management and scholarly communication	116	66.3
11	Greater adoption of intelligent recommendation systems	109	62.3
12	Development of smart and fully digital libraries	104	59.4
13	Better accessibility and inclusive library services	98	56.0
14	Increased global visibility and resource sharing	91	52.0
15	Emergence of autonomous library service systems	84	48.0

Strategies for Improving AI Adoption in Academic Libraries

The results presented in Table 8 reveal that academic librarians have identified various approaches to improve the integration of artificial intelligence in academic libraries. The most commonly suggested approach was to offer consistent training and development programs on AI for librarians (96.6%). This was followed by suggestions to increase financial support for

AI infrastructure and technologies (93.7%) and to enhance internet connectivity and ICT infrastructure (91.4%). Additionally, respondents stressed the significance of creating institutional policies and guidelines for AI implementation (88.0%), ensuring a reliable power supply (85.1%), and obtaining AI-powered library software and digital tools (82.9%). Other crucial strategies included ongoing professional growth (80.6%), forming partnerships with AI technology providers and research institutions (77.7%), hiring or training librarians with AI expertise (74.9%), and raising awareness about the benefits of AI among library staff (72.0%). While fewer respondents opted for consistently monitoring and assessing AI implementation (52.6%) and offering incentives for innovation (56.0%), these strategies were still considered valuable. In general, the results demonstrate that improving financial support, infrastructure, staff skills, institutional policies, and partnerships are essential for increasing the rate of successful AI adoptions in academic libraries. The effective integration of Artificial Intelligence (AI) in academic libraries requires deliberate efforts, financial investment, infrastructure development, staff training, and institutional commitment (Asemi et al., 2021;Cox et al., 2023). One of the most efficient ways of promoting the adoption of AI in academic libraries is by regularly upgrading the skills of academic librarians through training, conferences, seminars, and workshops. This will enable them to gain more insight into the nature of AI, acquire digital skills, and develop competencies for using AI in cataloging, reference service, information retrieval, research work, and managing digital resources. As a result, professional development activities should be conducted consistently to empower academic librarians with the required skills to operate AI software and integrate it into academic library practice successfully.

Another cost-effective way of enhancing the adaptation of AI in academic libraries is by improving technological infrastructure and financial resources while simultaneously developing institutional policies regarding the ethical use of AI. Academic libraries require proper internet connection, advanced computer systems and networks, cloud platforms, AI library software, institutional databases, and a constant electricity supply to operate AI smoothly and achieve favorable results. Financial support from the institution fosters successful AI adoption since the academic library will be able to afford to purchase, maintain, and develop software and hardware for AI practice (Cox et al., 2023 ; Asemi et al., 2021). Lack of sufficient capital for AI maintenance causes the failure of most AI initiatives in academic libraries to meet their intended objectives. In addition, institutions must develop robust policies on AI and provide strong leadership to promote its ethical use in the academic library field. This will result in increased commitment to adopting AI and building the necessary infrastructure for its smooth operation. Lastly, academic libraries must incorporate AI strategies into their strategic plans to support their overall purposes, objectives, and vision. Finally, the academic libraries must develop partnerships with private entities and other institutions that are willing and able to provide support for adopting AI in their practice. Partnerships can also help the academic libraries share knowledge and resources, collaborate on research projects, and jointly operate the new technologies to reduce capital spending and achieve their goals. Moreover, it is essential to educate and sensitize the librarians and library users about the significance and advantages of using AI to increase their willingness to embrace the new technology (Cox et al., 2023). Overall, the enhancement of the adoption of AI in academic libraries is considered an important strategy to promote the best practices, improve the quality and efficiency of services,

and achieve good academic performance in the learning process. Thus, the academic libraries need to boost their financial and infrastructural capabilities, increase the staff's professional skills, and develop institutional policies on the ethical use of AI.

Table 8: Strategies for Improving AI Adoption in Academic Libraries

S/N	Strategies for Improving AI Adoption in Academic Libraries	Frequency	Percentage
1	Provide regular AI training and capacity-building programmes for librarians	169	96.6
2	Increase funding for AI infrastructure and technologies	164	93.7
3	Improve internet connectivity and ICT infrastructure	160	91.4
4	Develop institutional AI policies and implementation guidelines	154	88.0
5	Ensure stable electricity supply and backup power systems	149	85.1
6	Acquire AI-enabled library software and digital tools	145	82.9
7	Encourage continuous professional development in AI competencies	141	80.6
8	Establish partnerships with AI technology providers and research institutions	136	77.7
9	Recruit or train AI-skilled librarians and ICT personnel	131	74.9
10	Promote awareness of AI benefits among library staff	126	72.0
11	Strengthen data privacy, cybersecurity, and ethical AI practices	119	68.0
12	Encourage collaborative research on AI applications in libraries	113	64.6
13	Integrate AI into library strategic planning	107	61.1
14	Provide incentives for innovation and AI adoption	98	56.0
15	Monitor and evaluate AI implementation regularly	92	52.6

Conclusion

This research delved into the role of artificial intelligence in digital librarianship within academic libraries in Imo State, Nigeria, examining AI adoption levels, opportunities, challenges, future potential, and strategies to enhance uptake. The findings reveal that while there has been some integration of AI technologies, overall adoption remains moderate, indicating ongoing development across many institutions. AI holds the promise of elevating digital librarianship through improved information retrieval, task automation, enhanced user services, research support, and more efficient library management. However, significant barriers such as insufficient funding, limited ICT infrastructure, unstable power supply, and a shortage of trained librarians hinder effective implementation. To harness AI's full potential in academic libraries, it is crucial to focus on staff training, upgrade technological infrastructure, create supportive policies, secure financial resources, and foster collaborations with technology partners. Ultimately, the study underscores that with proper support and investment, AI could

revolutionize library services, bolstering the contribution of academic libraries to education and innovation.

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