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Transforming University Libraries with Artificial Intelligence: Librarians' Awareness and Infrastructural Readiness in North Eastern Nigeria

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Abstract: ***This study examines librarians' awareness and infrastructural readiness for integrating artificial intelligence (AI) into university libraries in North Eastern Nigeria. Using a descriptive survey design, data were collected via a Google Form questionnaire from 123 professional librarians across federal and state universities. Analyzed with mean, standard deviation, and Pearson Chi-square tests, the findings reveal a moderate awareness of AI applications-such as expert systems, catboats, and virtual references-among librarians, alongside a low level of infrastructural preparedness. The hypothesis test indicates that awareness does not significantly influence library services. These insights underscore the need for enhanced training and investment to leverage AI effectively in this region's academic libraries.***

Keywords: Artificial Intelligence, Librarians, Infrastructural Readiness, University Libraries, Nigeria

1.Introduction

In the past, libraries only used conventional methods to provide patrons with library and information services. This makes it too difficult for librarians to provide users with the appropriate information at the appropriate time, which leads to the delivery of ineffective, inefficient, irrelevant, and out-of-date material that is unable to meet their demands. Information and communication technology (ICT) has advanced and been quickly incorporated into library operations over the years, particularly in industrialized and some developing nations. This has significantly enhanced library and information services, including circulation, reference, document delivery, current awareness, and selective dissemination of information (SDI), among others, to the point where users can now receive these services at their doorstep, wherever they may be, with little time and effort, and without having to visit the library. Computers, the Internet, virtual libraries, library 2.0, cloud computing, artificial intelligence (AI), and other technology are among those that the libraries have embraced.

A new technology called artificial intelligence (AI) is present in every facet of human endeavours, including manufacturing, banking, education, healthcare, and sports, to name a few. Libraries, which are an essential component of educational institutions, are adopting technology, particularly in the world's wealthy nations. According to Obama (2023), artificial intelligence (AI) is a revolutionary technology that has the ability to alter how we work, learn, and create in addition to changing the globe in ways we're only now starting to comprehend. Omame and Alex-Nmecha (2020) claim that AI has an impact on a large number of our everyday computer tasks. The majority of modern computer systems and smartphones contain artificial intelligence (AI) capabilities, and we have most likely used them without realising they were sophisticated devices. AI is defined by CILIP (2021) as machines that simulate human social skills, learning, reasoning, and decision-making. Speech recognition, natural language processing, autonomous or self-driving cars, machine learning, deep learning, and robotics are a few examples of artificial intelligence in computers. By removing the physical constraints, artificial intelligence integration can transform the library into an intelligent environment. Descriptive cataloguing, subject indexing, reference services, technical services, shelf reading, collection development, and information retrieval systems are just a few of the library operations areas where artificial intelligence (AI) can be used. With less human involvement, it can replace the customary library procedures and offerings in a more appealing and efficient way. In order to do these, libraries must be prepared in terms of infrastructure and librarians must understand how technology may be used to enhance library services. Awareness refers to an individual's level of knowledge and comprehension about a particular topic. As a relatively new technology, artificial intelligence is slowly gaining traction among university library librarians. According to studies, librarians in underdeveloped nations like Nigeria have demonstrated some understanding of the use of AI in libraries. According to Sambo and Oyovwe-Tinuoye (2023), the majority of Nigerian Certified Librarians stated that their awareness was mediocre. According to research by Ajani, Tella, Salawu, and Abdullahi (2022), the majority of Nigerian librarians were highly knowledgeable about artificial intelligence (AI) technology and knew that most libraries in developed nations have integrated AI systems.

University libraries must be equipped with the necessary technology, including computers, Wi-Fi, bandwidth, radio frequency identification (RFID), cloud computing, online databases, and integrated library management systems, in order to be considered infrastructure-ready. They also need to have the necessary expertise to promote the application of AI to library and information services. These and other infrastructures serve as the catalyst for the integration of AI into university libraries, which would enable the libraries to provide effective and efficient information services. According to studies, university libraries in wealthy nations have incorporated these technologies and minimized the use of artificial intelligence (AI) in providing information and library services. The majority of university libraries in poor

nations, particularly those in Nigeria, have the opposite situation.

According to Owolabi, Okorie, Yemi-Peters, Oyetola, Bello, and Oladokun (2022), Nigerian university libraries were not particularly prepared for the adoption and application of robotic technology in the country. It showed that even though this technology has many advantages for library operations, university libraries across the nation were not prepared to embrace its use. According to Moustapha and Yusuf (2023), university libraries in Kwara State, Nigeria, still lacked AI systems including catboats, bots, facial recognition, touch recognition, RFID technologies, humans, AI classification tools, machine-readable catalogues, and not-smart AI characteristics. These studies, along with others, were carried out in the southern region of Nigeria; none were carried out in the north-eastern region. The purpose of this study was to fill this knowledge gap by determining the infrastructure preparedness and librarian understanding of the use of AI in library and information services in university libraries in northeastern Nigeria.

2. Statement of the Problem

The necessity of implementing artificial intelligence in university libraries has changed with time, both in terms of structure and content, in the ancient, mediaeval, and contemporary periods. Because of their strong economy and advancement, the modern world has since embraced technology and is making the most of it to provide library and information services. According to studies, librarians in developed economies have a convincingly high level of awareness of emerging technologies, and their libraries are equipped with all the tools and knowledge needed to successfully and efficiently integrate AI into the delivery of library and information services. However, based on their initial analysis, the researchers found that university libraries in northeastern Nigeria had not yet implemented AI into their daily operations. This study investigates whether librarians' limited knowledge of AI contributes to this gap. To what extent are libraries ready to implement artificial intelligence? These and other considerations served as the foundation for the study, which evaluated the degree of knowledge and preparedness for the use of AI in library and information services in North Eastern Nigerian university libraries. This study's significance lies in addressing a critical gap in AI adoption, offering insights to enhance library efficiency in a developing region.

3.Objectives of the Study

The main objective of this study was to investigate how Artificial Intelligence is Transforming University Libraries with Librarians' Awareness and Infrastructural readiness in North Eastern Nigeria". The following were the specific objective:

1. To ascertain the level of awareness of Librarians towards application of Artificial Intelligence on library and information services in University Libraries in North Eastern Nigeria.
2. To identify the AI infrastructure readiness in University Libraries in North Eastern Nigeria.

Research Questions

The study was guided by the following research questions:

1. What is the level of awareness of Librarians towards application of Artificial Intelligence on library and information services in University Libraries in North Eastern Nigeria?
2. What is the extent of AI infrastructure readiness in University Libraries in North Eastern Nigeria?

Research Hypothesis

The following null-hypothesis was tested at 0.05 level of significance in the course of this study:

Ho_1: Awareness of Librarians towards Artificial Intelligence has no significant influence on library and information services in University Libraries in North Eastern Nigeria.

4.Review of Related Literature

Artificial intelligence is not a new concept across the world, but, its application in all aspect of human endeavor is what the world is witnessing recently in areas such as health, banking, manufacturing, industries, governance, education among others, and library is not an exception. Researchers have reported various findings concerning the extent of awareness, perception and readiness of librarians towards the emerging technology in libraries.

The degree to which librarians are aware of the use of artificial intelligence libraries

Librarians' awareness reflects their understanding of AI applications. As a novel technology, artificial intelligence is gaining traction among academic library librarians. In Asia, Shaheen and Khurshid (2023) investigated how Pakistani library patrons perceived and experienced the usage of artificial intelligence (AI) in libraries. This study used a survey research approach, and its population consisted of 71 library patrons from several public and university libraries in Islamabad. They were invited to fill out an online survey with multiple-choice questions and a Likert scale after being recruited through social media and email. Survey data was analysed using descriptive statistics like frequency and percentage distributions. Then, to find correlations between factors like user demographics and views towards AI use in libraries, inferential methods like chi-square tests of independence were used. About 60% of participants said they had never or hardly ever utilised an AI-powered recommendation system, whereas 40% said they did so frequently or constantly. Additionally, when participants are looking for new resources, they find AI-powered recommendation systems to be somewhat useful. Additionally, 44% of participants reported considerable uneasiness with the use of AI to examine library usage statistics. However, just 8% reported feeling "very uncomfortable" with this use of AI, indicating that most people are either indifferent or at least somewhat at ease with its possible use in this situation. Nearly half (48%) felt at ease with this use of AI.

In the meantime, Harisanty, Anna, Putri, Firdaus, and NoorAzizi (2022) investigated the degree of AI awareness

among Indonesian academic library leaders. The 38 participants in the study were chosen using a purposive sample technique, and the data were analysed using theme analysis. According to the poll, participants had passionate and favourable thoughts about AI and its potential benefits for libraries. Among the advantages of AI that have been mentioned are better circulation services, better classification of library resources, data analytics, and research help. The participants emphasised that librarians must possess a solid knowledge of IT, data analytics, library management, and user behaviour in order to deploy AI in libraries effectively.

Bakiri, Mbembati, and Tinabo (2023) investigated the awareness, uptake, and future prospects of artificial intelligence services in Tanzanian academic libraries within the African environment. 36 librarians from seven large and well-known higher education institutions (HLI) were interviewed using a qualitative methodology. Seventy-one percent of the librarians surveyed said they were familiar with some of the AI tools used in libraries. Additionally, 68% of participants stated that they knew the advantages AI technologies gave libraries. Last but not least, 66% of those surveyed claimed to be familiar with AI technology. In a different study, Alam, Subaveerapandiyan, Mvula, and Tiwary (2024) investigated Zambian librarians' perceptions and applications of AI literacy. Purposive and convenience sampling techniques were used to collect data from 82 different participants. The study's conclusions showed that Zambian librarians had a firm grasp of AI principles and were optimistic about the technology's potential advantages for library services. Notwithstanding their optimism, worries about the possible abuse of AI mirrored worries already expressed in more general technology discussions. The results showed that Zambian librarians were becoming more and more knowledgeable about AI principles, especially in the areas of cataloguing, classification, and the possibility of customising user experiences. Nevertheless, difficulties like the requirement for more advanced AI understanding, opposition to change, and financial limitations were recognised.

Sambo and Oyovwe-Tinuoye (2023) conducted a poll in Nigeria to find out how Certified Librarians in that country felt about the employment of robotic technologies in libraries. 452 Certified Librarians of Nigeria libraries that received their certification from the Librarians' Registration Council of Nigeria (LRCN) on November 24, 2021, made up the study's population, which was conducted using the social survey technique. Among the Certified Librarians, the majority (182; 48.9%) indicated an average degree of awareness, 119 (31.9%) reported a high level, and 71 (19%) reported a low level, according to the survey. Because so many academic librarians participated in the survey, the majority of respondents displayed an average degree of awareness of robotic technologies in Nigerian libraries.

In a similar vein, Owolabi, Adenekan, Adeleke, Ajayi, and Adesina (2021) investigated the degree of knowledge and understanding of artificial intelligence in the administration of Nigerian university libraries. To enable triangulation of research findings, the study employed both qualitative and quantitative paradigms. A random selection of 100 academic librarians was made from Ten Nigerian Universities. The chiefs of the ICT/automation departments at each of the 10 purposefully chosen Nigerian university libraries participated in a structured interview for the study. According to study responses, 98 (98%) of academic librarians were aware of the use of AI technologies in library operations, while 02 (2%) acknowledged their ignorance. Furthermore, Ajani et al. al. (2022) looked into how librarians in Nigerian academic libraries perceived their knowledge of and preparedness to use artificial intelligence (AI) in their operations and services. According to the survey, academic libraries in Nigeria were aware that libraries around the world were using artificial intelligence (AI), but they were not yet fully ready to integrate the technology into their everyday operations.

Additionally, Ajani, Tella, Salawu, and Abdullahi (2022) focused on librarians' perceptions of academic libraries' awareness and preparedness to incorporate AI into library operations and services in Nigeria. Six libraries were selected from Nigeria's six geopolitical zones. Data was gathered via an open-ended questionnaire that was mailed to the respondents. Thematic analysis was used to examine the collected data. The findings showed that the majority of librarians were knowledgeable with artificial intelligence (AI) technology, that their awareness was high, and that they were aware that most libraries in developed nations had integrated AI systems.

The perceived awareness and use of artificial intelligence technology for effective library operations in university libraries in Kwara State, Nigeria, was surveyed by Isiaka, Olarongbe, Sulyman, Aremu, and Saba-Jibril (2024) in North Central Nigeria. 108 librarians and paraprofessionals from all Kwara State university libraries made up the population of the descriptive survey design. Frequency counts and straightforward percentages were used to examine the collected data. According to the findings, the majority of respondents-87, or 80.6%-were quite aware of AI robots, 65, or 60.2%, of AI catboats, 62, or 57.4%, of face recognition technology, 61, or 56.4%, of virtual references, 60, or 55.6%, of humanoids and dynamicmed, and 59, or 54.6%, of AI expert systems. Nonetheless, 60 (55.6%) of the participants were aware of Micromedex and thump recognition technologies, respectively.

In a different study, Odigie (2024) investigated librarians' awareness, usage, and obstacles to integrating AI into library services in North-Central Nigerian university libraries. Using a case study design and a qualitative methodology, the study documented the viewpoints of reference librarians in Nigeria's North-Central Geopolitical Zone. Semi-structured interviews with fifty-two reference librarians were used to gather data. According to the interviewees' comments, reference librarians in Nigerian university libraries were largely aware of artificial intelligence (AI) and chatbots such as ChatGPT and Gemini. In their own research, they employed AI as a tool for paraphrasing and general concept synthesis, and they generally referred to them as apps that may help with research and research writing. None of the respondents indicated that they had incorporated AI into any library services; in other words, the use of AI in Nigerian libraries was purely personal and had not progressed to professional use in library service delivery.

Additionally, a study was conducted by Eiriemiokhale and Sulyman (2023) to ascertain the knowledge and opinions of librarians in university libraries in Kwara State, Nigeria, regarding artificial intelligence. The population of the study, which used a descriptive survey approach, was made up of 37 professional librarians from two particular Kwara State university libraries. This includes 14 librarians from Kwara State University and 23 librarians from the University of Ilorin library. Frequency tables, percentages, and mean (x) were used to display and interpret the obtained data. The majority of librarians, 22 (59.5%), were aware of catboats, according to the report, followed by 20 (54.1%) for Dynamed. However, 62.2% were unaware of expert AI, 48.6% were unaware of Micromedex, and 43.2% were unaware of virtual references. This suggests that the AIs the respondents were aware of were chatbots and dynamicmed.

Oyekale and Zubairu (2023) evaluated the degree of artificial intelligence awareness, perceptions, and acceptance in university libraries in Osun State, Nigeria, in Southern Nigeria. A descriptive survey was used in the investigation. Ten university libraries in Osun State, Nigeria, made up the study's population. According to the poll, 80% of respondents said they were aware of artificial intelligence (AI), while 20% said they were not. Some of the respondents gave examples of AI uses, such as automated doors, video, cameras, and integrated library systems (ILS).

AI Infrastructure Preparedness for Artificial Intelligence in Library Applications

Establishing all the infrastructure required to facilitate the adoption and integration of artificial intelligence into library operations and services is known as "infrastructural readiness." Jan, Khan, and Khan (2024) examined organisational preparedness to implement AI in Pakistan's library and information industry within an Asian setting. The qualitative investigation was led by a theoretical framework that included the Technology Readiness Index (TRI) and the Technology-Organization-Environment (TOE) paradigm. 27 top leaders from 27 universities spread throughout four provinces and the capital city of Islamabad were interviewed, including registrars and library managers. The results showed that university libraries' digitalisation efforts were much behind schedule and that its technological infrastructure was not prepared for the use of AI in libraries. Organisational technological practices, financial resources, university size, and data management and protection concerns are some of the factors that affect how prepared university libraries are to adopt AI. These factors can either help or hinder the adoption of AI in the library sector.

The use of AI tools in Pakistani university libraries was investigated by Ali, Naeem, and Bhatti (2024), who also compared how AI tools were used in public and private institutions. Data was gathered using a survey approach. The data was gathered from 175 academic libraries using purposive sampling. A statistical tool for social sciences (SPSS-version 22) was used to evaluate the data that was gathered. The results showed that although AI-based services were beginning to be deployed in Pakistani university libraries, none of them had fully adopted the AI-based toolkit. The most well-known and often utilised tools in the libraries were catboats, voice search, and natural language processing. However, due to the high level of IT skills and financial commitment needed, robots' technology was rarely deployed (mean value of 1.62). Additionally, the study discovered that, in contrast to university libraries in the public sector, private university libraries were utilising AI techniques more frequently. The study's conclusions included a number of important suggestions, such as better financial support and ICT infrastructure to establish AI technology-based library services; training development plans for library staff; and closer cooperation between the library and the relevant university IT department for technical support and assistance.

Rabatseta, Modiba, and Ngulube (2024) examined the use of AI in the University of Limpopo libraries to provide information services in an African context. The results showed that the UL library requires AI infrastructure in order to provide high-quality information services in the 4IR. Expert systems utilised for reference services, such RefSearch and Plexus, as well as Refworks, which is accessible through the UL library, are crucial parts of this AI infrastructure. Additionally, Bakiri, Mbembati, and Tinabo (2023) investigated the potential, uptake, and awareness of AI services at Tanzanian university libraries. According to the results of the content analysis, 61% of respondents stated that "it is not adopted," whereas 23% of respondents stated that their libraries had implemented some AI-based services.

In Nigeria, academic librarians' preparedness for the implementation of robotic technology in university libraries was examined by Owolabi, Okorie, Yemi-Peters, Oyetola, Bello, and Oladokun (2022). From the ten universities that were purposefully chosen, 100 academic librarians were chosen for the study, which employed survey research based on the positivist paradigm. Ten academic librarians were chosen from each university library using the snowballing sample technique. According to the study's findings, Nigerian university libraries were not particularly prepared for the country's acceptance and usage of robotic technologies. It showed that even though this technology has many advantages for library operations, university libraries across the nation were not prepared to embrace its use. In a different study, Ajani, Tella, Salawu, and Abdullahi (2022) focused on librarians' perceptions of academic libraries' understanding and preparedness to incorporate AI into operations and services in Nigeria. According to the majority of respondents, Nigerian university libraries were ill-equipped to incorporate AI technology into their operations and services. With the exception of a small number that have tried to incorporate new technologies like cloud computing, social media, e-resources, and online databases to enhance their services, they claimed that Nigerian academic libraries were not prepared to incorporate AI systems into their operations and services because the majority of them were not fully automated. Odeyemi (2019) investigated the potential for library services and the preparedness of the infrastructure in a study on robots in Nigerian university libraries. According to the study's overall findings, Nigerian university libraries were only partially prepared to adopt any technology framework in order to provide library and information services; nevertheless, there are still some infrastructure and skill-related difficulties that need to be resolved. According to Oyekale and Zubairu (2023), all

academic librarians surveyed (100%) said that no Osun State library had yet to implement AI.

Moustapha and Yusuf (2023) investigated the acceptance and use of artificial intelligence by librarians at university libraries in Kwara State, Nigeria, in North Central Nigeria. For the study, 450 librarians from Kwara State Universities in Nigeria were chosen at random using a descriptive survey method and random sample methodologies. The respondents were asked to complete a self-made questionnaire, and the results were analysed using a straightforward method. The findings indicated a low level of AI use in university libraries. The study also found that the most common AI systems were security scanning devices at university library entrances and exits. Other AI systems, including chatbots, bots, face recognition, touch recognition, RFID technologies, humans, AI classification tools, machine-readable catalogues, and less sophisticated AI features, were still absent from the libraries under investigation.

5.Research Methodology

Descriptive survey research design was adopted for the study. The population of the study comprised of all professional and paraprofessional librarians working in federal and state-owned universities in North East Nigeria. The universities included: Abubakar Tafawa Balewa University, Bauchi, Adamawa State University, Mubi, Federal University, Gashua, Borno State University, Maiduguri, Federal University, Kashere, Federal University, Wukari, Gombe State University, Gombe, Modibbo Adama University, Yola, Saadu Zungur University, Gadau, Bauch State, Taraba State University, Jalingo, University of Maiduguri and Yobe State University, Damaturu. Preliminary investigation revealed that there were one hundred and eighty-six (186) professional and paraprofessional librarians working in the universities. Due to the manageable number of the population, total enumeration was adopted. A self-developed questionnaire was designed using Google Form mobile application with 4-Points-Likert scale. The title of the questionnaire was "QALAAILISULNEN" and was administered by the researchers by posting the links to the respondents on the various professional Whatsapp platforms. The personal data of the respondents was analysed using frequency counts, table and simple percentages for descriptive analysis. The data generated from the research questions were analysed using mean and standard deviation. The decision rule was, any mean score of 2.50 and above was accepted, while, any mean score of 2.49 and below was rejected. Furthermore, inferential statistics of Pearson Chi-square (X^2) was used to test null-hypothesis tested at 0.05 level of significance as criterion for accepting or rejecting the null-hypothesis. SPSS version 23.0. was used for the analyses.

Data Analysis

Out of the total one hundred and eighty-six (186) questionnaire administered, one hundred and twenty-three (123) representing 66.1% responded and their responses were analysed and found valuable.

Demographic Information of the Respondents

Table 1: Demographic Variables of Respondents

N = 123

Variables	Respondents	Percentage
University:		
Abubakar Tafawa Balewa University, Bauchi	16	13.0
Adamawa State University, Mubi	10	8.1
Federal University, Gashua	8	6.5
Borno State University, Maiduguri	5	4.1
Federal University, Kashere	9	7.3
Federal University, Wukari	6	4.9
Gombe State University, Gombe	11	8.9
Modibbo Adama University, Yola	14	11.4
Saadu Zungur University, Gadau, Bauch State	7	5.7
Taraba State University, Jalingo	5	4.1
University of Maiduguri	24	19.5
Yobe State University, Damaturu	8	6.5
Level of Education:		
PhD	19	15.5
Msc/MLS/MTech/MPhil.	26	21.1
Bsc/B.Tech/B.Ed./BLIS	41	33.3
Diploma / NCE	37	30.1
Rank:		
Professor	3	2.4
Associate Professor	7	5.7
Senior Librarian	17	13.8
Librarian I	21	17.1
Librarian II	24	19.5
Assistant Librarian	33	26.8
Graduate Librarian	18	14.7

Source: Field survey, 2024

Table 1 above showed the demographic variables of respondents. Respondents from University of Maiduguri constituted the majority with 24(19.5%), followed by those from Abubakar Tafawa Balewa University, Bauchi with 16(13.0%), Modibbo Adama University, Yola 14(11.4%), Gombe State University, Gombe 11(8.9%), Adamawa State University, Mubi 10(8.1%), Federal University, Kashere 9(7.3%), Federal University, Gashua 8(6.5%), Yobe State University, Damaturu 8(6.5%), Saadu Zungur University, Gadau, Bauch State 7(5.7%), Federal University, Wukari 6(4.9%), while, Borno State University, Maiduguri and Taraba State University, Jalingo had 5(4.1%) each and constituted the least among the respondents. Respondents with Bsc/B.Tech/B.Ed./BLIS were the majority with 41(33.3%), they were followed by those with Diploma / NCE 37(30.1%), those with Msc/MLS/MTech/MPhil. Were 26(21.1%), while, those with PhD were 19(15.5%) and were the least among the respondents. Respondents in the rank of Assistant Librarian constituted the majority with 33(26.8%), followed by Librarian II with 24(19.5%), Librarian I were 21(17.1%), Graduate Librarian were 18(14.7%), Senior Librarian were 17(13.8%), Associate Professors were 7(5.7%), while, Professors were the least among the respondents with only 3(2.4%).

Research Question 1: What is the level of awareness of Librarians towards application of Artificial Intelligence on library and information services in University Libraries in North Eastern Nigeria?

Table 2: Level of Awareness of Librarians in the Application of Artificial Intelligence in Federal University Libraries

S/N	Statements	N	Sum	Mean	Std	Decision
1	Natural Language Processing	123	208	1.60	0.60	Lowly Aware
2	Expert Systems	123	369	3.00	0.66	Moderately Aware
3	Robotics	123	331	2.69	0.97	Moderately Aware
4	Intelligent agents	123	276	2.24	1.07	Lowly Aware
5	Computational intelligence	123	265	2.15	0.95	Lowly Aware
6	Chatboat	123	368	2.99	0.64	Moderately Aware
7	Virtual reference	123	391	3.18	1.26	Moderately Aware
8	Speech recognition	123	354	2.88	0.88	Moderately Aware
9	Virtual Reality Technology	123	380	3.09	0.76	Moderately Aware
10	AI-powered chat services	123	341	2.77	0.81	Moderately Aware
	Total		**3283**	**2.66**	**0.86**	**Moderately Aware**

Source: Field survey, 2024

Table 2 presents the descriptive statistics on the responses of the level of awareness of Librarians towards application of Artificial Intelligence on library and information services. From the Table, it was discovered that virtual reference ($\overline{X}$ = 3.18, SD = 1.26) attracted the highest mean score, followed by virtual reality technology ($\overline{X}$ = 3.09, SD = 0.76), expert systems ($\overline{X}$ = 3.00, SD = 0.66), chatboat ($\overline{X}$ = 2.99, SD = 0.64), speech recognition ($\overline{X}$ = 2.88, SD = 0.88), AI-powered chat services ($\overline{X}$ = 2.77, SD = 0.81) and robotics ($\overline{X}$ = 2.69, SD = 0.97). Furthermore, the overall mean score of 2.66 implied that the level of awareness of Librarians towards application of Artificial Intelligence on library and information services was moderate.

Research Question 2: What is the extent of AI infrastructure readiness in University Libraries in North Eastern Nigeria?

Table 3: Extent of AI infrastructure readiness in University Libraries in North Eastern Nigeria

S/N	Statements	N	Sum	Mean	Std	Decision
1	There is adequate electricity to cater for Artificial Intelligence in the library	123	276	2.24	1.07	Low
2	The library is connected to Wi-Fi and is subscribing to bandwidth which can cater for integration of AI	123	265	2.15	0.95	Low
3	The library has enough space that can accommodate Artificial Intelligence infrastructure	123	279	2.27	1.11	Low
4	The library has security architecture such as security scanning devices at the entrances and exits to improve security and fraud detection	123	257	2.09	0.97	Low
5	The library has face and touch recognition for authentication	123	257	2.09	0.97	Low
6	The library has radio frequency identification (RFID) technologies	123	251	2.04	0.94	Low
7	The library has been automated so to cater for integration of AI	123	303	2.46	1.18	Low
8	My library has adopted cloud computing as a storage space	123	300	2.44	1.15	Low
9	My library has been subscribed to Online Databases	123	413	3.36	1.16	Moderate
10	The library has Integrated Library Management System	123	303	2.46	1.18	Low
	Total		**2904**	**2.36**	**1.07**	**Low**

Source: Field survey, 2024

Table 3 presents the descriptive statistics on the responses on the extent of AI infrastructure readiness in University Libraries in North Eastern Nigeria. From the Table, it was discovered that the only item that attracted mean score above the acceptable bench mark was the item that the librarians expressed that their libraries have been subscribing to Online Databases with ($\overline{X}$ = 3.36, SD = 1.16). All the rest of the items listed attracted low mean scores below the acceptable

bench mark. They include: availability of adequate electricity to cater for Artificial Intelligence, Wi-Fi and is subscribing to bandwidth which can cater for integration of AI, enough space that can accommodate Artificial Intelligence infrastructure, security architecture such as security scanning devices at the entrances and exits to improve security and fraud detection, face and touch recognition for authentication, radio frequency identification (RFID) technologies, automated so to cater for integration of AI, cloud computing as a storage space and integrated Library Management System. Furthermore, the overall mean score of 2.36 implied that the extent of AI infrastructure readiness in University Libraries in North Eastern Nigeria was low.

Hypotheses Testing

Ho_1: Awareness of Librarians towards Artificial Intelligence has no significant influence on library and information services in University Libraries in North Eastern Nigeria.

Table 4: Chi-Square Result on the significant influence of Librarians level of Awareness towards Artificial Intelligence on library and information services.

Chi-Square Tests

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	9.474[a]	6	.149
Likelihood Ratio	12.094	6	.060
Linear-by-Linear Association	3.994	1	.046
N of Valid Cases	123		

Source: Field survey, 2024

In Table 4, the Chi-Square result indicated that the level of awareness of Librarians towards artificial intelligence has no significant influence on library and information services at 0.05 level of significance. Therefore, hypothesis one (1) is accepted, because, the probability value (P = 0.149) is greater than critical value at 0.05 level of significance at a Chi-Square value = 9.474. Hence, awareness of Librarians towards artificial intelligence has no significant influence on library and information services in University Libraries in North Eastern Nigeria.

6.Discussion of Findings

This study investigated the awareness of Librarians and infrastructural readiness towards application of Artificial Intelligence on library and information services in university libraries in North Eastern Nigeria. The study revealed that the level of awareness of Librarians towards application of Artificial Intelligence on library and information services was moderate. They expressed that they were aware of Expert Systems, Robotics, Chatboat, Virtual reference, Speech recognition, Virtual Reality Technology and AI-powered chat services. This study is in agreement with Sambo and Oyovwe-Tinuoye (2023) revealed that majority of Certified Librarians in Nigeria reported an average level of awareness. Majority of them showed the average level of awareness of robotic technologies in Nigerian libraries. Also, Isiaka, Olarongbe, Sulyman, Aremu and Saba-Jibril (2024) revealed that librarians and university libraries in Kwara State were highly aware of AI Robots, AI chatbots, face recognition technology, virtual references, Humanoids and Dynamed and AI expert systems. Harisanty, Anna, Putri, Firdaus and NoorAzizi, (2022) discovered the leaders of Indonesian academic libraries' opinions of AI and its potential advantages for libraries were positive and enthusiastic. Ajani, Tella, Salawu and Abdullahi (2022) revealed that most of the librarians in Nigeria were aware of the AI technology and that their level of awareness was high and they were aware of the integration of AI systems in most libraries in the advanced countries of the world. Eiriemiokhale and Sulyman (2023) revealed that Librarians in University Libraries in Kwara State, Nigeria were aware of Chatbots and Dynamed, while, Odigie (2024) showed that reference librarians in Nigerian university libraries were aware to a large degree of AI and chatbots like ChatGPT and Gemini.

Furthermore, the study revealed that the extent of AI infrastructure readiness in University Libraries in North Eastern Nigeria was low. This is because, the respondents expressed unavailability of adequate electricity to cater for Artificial Intelligence, no Wi-Fi and bandwidth, lack of enough space that could accommodate Artificial Intelligence infrastructure, lack of security architecture such as security scanning devices at the entrances and exits to improve security and fraud detection, lack of face and touch recognition for authentication, lack of radio frequency identification (RFID) technologies as well as lack of cloud computing as a storage space. This finding aligns with Owolabi, Okorie, Yemi-Peters, Oyetola, Bello and Oladokun (2022) which revealed that the readiness of university libraries in Nigeria towards the adoption and use of robotic technologies in Nigeria was nothing to write home about. It indicated that university libraries in the country were not ready to adopt the use of this technology despite the high benefits they have to offer in library operations.

Moustapha and Yusuf (2023) found that AI systems such as bots, chatbots, face recognition, touch recognition, RFID technologies, humans, AI classification tools, machine-readable catalogs, and not smart AI features were still missing in university libraries in Kwara State, Nigeria. Ajani, Tella, Salawu and Abdullahi (2022) study found that academic libraries in Nigeria were not prepared for the integration of AI systems into library operations and services, because, most of the them were not entirely automated, except a few that have attempted to integrate new technologies such as cloud computing, social media, e-resources, and online databases to improve their services. Jan, Khan and Khan (2024) indicated that the progress of digitalization in university libraries in Pakistan was significantly delayed, and their technology infrastructure was not well suited for adoption of AI in libraries. Moreover, the hypothesis tested in this study revealed that awareness of

Librarians towards artificial intelligence has no significant influence on library and information services in University Libraries in North Eastern Nigeria. This could be attributed to the fact that most of the librarians use the artificial intelligence for personal use rather than to deliver library and information services.

7.Conclusion

This study reveals that librarians in North Eastern Nigerian university libraries possess moderate awareness of AI applications, including expert systems and catboats, yet face significant infrastructural deficits, such as inadequate electricity and Wi-Fi. The lack of readiness hampers AI integration, while awareness alone does not meaningfully enhance services, as confirmed by the hypothesis test. These findings highlight a critical need for investment and training to bridge the technological gap, offering a foundation for improving library efficiency in this region.

8.Recommendation

Based on the findings of this study and the conclusion made, the following were recommended:

1. Librarians in university libraries in North East Nigeria should always keep in tune with the emerging technologies such as artificial intelligence, big data, quantum computing, virtual reality, cloud computing, among others, so as to remain relevant in the world of technology.
2. Management of universities and heads of university libraries in North East Nigeria should as a matter of priority devote more allocation to the libraries in order to procure state-of-the-art facilities that could help integrate artificial intelligence into the library services.
3. Librarians in university libraries in North East Nigeria should not only focus on adopting the artificial intelligence for personal use, but rather try and integrate it into their day-to-day professional activities in the libraries.

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