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Exploring the Potential Applications of Artificial Intelligence in Public Libraries in Taraba State, Nigeria

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Abstract

This study explores the potential applications of artificial intelligence (AI) in public libraries in Taraba State, Nigeria. Public libraries in Taraba State are facing several challenges, including limited funding for resource acquisition, unattractive infrastructure, low public awareness and usage, and inadequate staffing with limited training. AI has the potentials to address these challenges through various applications, such as 24/7 virtual reference services via chatbots, personalized book 3 purposes. Three research questions were formulated to guide the study, the population was 30 public librarians, and survey research design was used for the study. The findings of the study revealed that to successfully implement AI, libraries need to conduct needs assessments and feasibility studies, train staff on AI tools, invest in robust internet infrastructure and data security, and consider partnerships with external technology providers. It was therefore recommended that policymakers and library administrators should promote AI adoption in public libraries, ensuring effective planning, implementation, and evaluation.

Keywords: Public Libraries, artificial intelligence, chatbox and Librarians

Introduction

Public libraries play a vital role in promoting literacy, education, and community development. However, public libraries in developing countries like Nigeria often face some challenges such as limited resources, inadequate infrastructure, and lack of trained personnel. Artificial intelligence (AI) has emerged as a transformative technology with the potential to address these challenges and enhance the effectiveness of public libraries. Asemi and Asemi (2018) studied the application of artificial intelligence (AI) in library systems in Iran and introduce the potential of library systems to use AI techniques.

The authors used Exploratory Factor Analysis (EFA) to identify the most applicable AI techniques categories in Library and Information Science (LIS). They found that recommender systems are the most commonly used intelligent systems in LIS, and natural language processing is the most underdeveloped. The study evaluates the development of AI library systems in Iran based on the

underdevelopment in three areas: public services, technical services, and management services.

The results showed that recommender systems are the most developed, while natural language processing is the most underdeveloped. The concepts of "development degree" and "underdevelopment rank" were introduced to reflect the amount of use of AI facilities in library systems. In Johnson's (2018) article, the author discusses the impact of artificial intelligence (AI) on libraries and the institution of librarianship. They believe that AI will change the way we seek information and make decisions and that machines will become better at tasks that used to require human intelligence and support dissemination of information in public libraries.

Research Objectives

This research's primary objective is to explore potential applications of AI in public libraries in Taraba State. The specific objectives are to :

1. Identify the key challenges faced by public libraries in Taraba State
2. Assess the potential of AI to address these challenges and improve library services,
3. Develop a framework for implementing AI solutions in public libraries in Taraba State.

Literature Review

A study undertaken by Williams (2019) maintained that AI personal assistants like Siri, Alexa, Cortana, and Google Assistant have changed how people expect to get answers to their questions. As a result, students' expectations for database search functions have changed, and they expect databases to know and understand what they are searching for. However, using databases requiring complex search strategies and training can still be difficult to convince researchers to use, they opt for quicker and more accessible solutions such as Google Scholar. AI personal assistants have limitations and can also lead to snarky replies. To convince researchers to use databases, librarians need to emphasize the value and legitimacy of information found in them and continue to provide training on effective search strategies. Miao (2019) investigated human rights ethics in artificial intelligence (AI) research.

The study analysed the ethical dilemmas related to AI technology and its development and highlighted the importance of human rights protection in AI systems. The study defined human rights from a philosophical and ethical perspective. The study argued that the development of AI technology should serve humanity as the highest goal and consider "human nature." The research also highlighted the need to regulate AI human rights ethics, including the ethical and moral status of humans in front of intelligent machines and the specific human rights of intelligent machines. The study emphasizes the need to balance sensitivity and the importance of human control over AI technology. Shelton (2019) explored the concerns and potential impacts of robots, AI, and machine learning (ML) on libraries and

professions. Shelton discussed the fourth industrial revolution driven by AI, robots, and connectivity, highlighting the disruptive potential they pose to libraries. Shelton explained the benefits of robots and AI in libraries, such as robotic retrieval systems and AI-powered chat services.

The article concluded by acknowledging the challenges posed by robots and AI while emphasizing the need to adapt and embrace progress. Ylipulli and Luusua (2019) presented public libraries as nodes for technological empowerment in the era of smart cities, AI, and big data. The authors discussed the flaws in smart city development, which they argued is too technology-led and business-oriented, resulting in diminished citizen agency and digital divides. They proposed the need for more participatory and inclusive approaches, suggesting that public libraries can act as allies and partners in participatory design and technology education. The paper highlighted the challenges of smart city development, introduced the Finnish library system as a democratic project, and presented examples of how libraries provide technological education. The authors emphasized the need for bridging micro-level actions with macro-level techno-political development through collaborations with Meso-level actors and networks.

They argued for scalable approaches to increase citizens' understanding and control over new technologies, addressing the digital divide and empowering individuals. Morriello (2020) presented an overview of the impact of digital revolution in libraries. The article focused on three main technological evolutions: The Internet of Things (IoT), Blockchain, and Artificial Intelligence (AI). The author explained the development and features of these technologies and then delves into their applications in libraries. The author presented projects conducted in Italy and abroad in various library activities such as cataloguing, collection development, information literacy, scientific communication, and academic librarianship.

The impact of IoT, Blockchain, and AI in transformation of libraries was highlighted. The author opined that using these technologies in libraries is inevitable and called for their adoption and application in libraries. The article provided valuable insight into the potential benefits libraries can reap from these technologies Abayomi et al. (2021) examined the awareness and perception of academic librarians in Nigeria regarding using artificial intelligence (AI) in managing university libraries. The study was conducted using a survey design that included qualitative and quantitative approaches and involved 80 academic librarians from 8 purposively selected university libraries in the country.

The results showed that the academic librarians were aware of the use of AI in library operations. Still, they were concerned about the potential loss of their jobs due to its adoption. The study also found that AI was seen as a tool to improve job performance and user satisfaction, but there was a need to create more awareness of its significance in

library operations. The study recommended that academic librarians acquire the necessary skills to comply with AI in library operations, that library management should educate librarians about the benefits of AI, and that librarians attend training and conferences to prepare for the adoption of AI in library operations. Li (2021) explored the application of artificial intelligence (AI) technology in library network security. The article discussed the concept and characteristics of library network system security and proposed an AI-based preventive mechanism for library network system security. It presented an AI technology method and an analytic hierarchy process to evaluate network security situations, improving real-time performance and prediction accuracy.

The study also focused on data fusion, hierarchical artificial immune situation assessment, and an improved algorithm based on population cognition. Experimental research demonstrated the effectiveness of the proposed AI models for predicting and assessing library network security situations. The findings suggested that AI can enhance library management networks' defense capabilities and safety. The paper therefore provided valuable insights into the application of AI in library network security.

Methodology

This study adopted a descriptive survey research design. The survey design according to Nworgu (2015) is one in which a group of people or items is studied by collecting and analyzing data from only a few people or items considered to be representative of the entire group. Nworgu noted that descriptive survey studies is aimed at collecting data on, and describing in a systematic manner the characteristics, features or facts about a given population. This design is considered appropriate because the researcher intent to collect and analyzed data on the group of librarians in public libraries in Cross River State in order to ascertain AI's potential applications in public libraries in Taraba State.

The population of the study comprised all the thirty (30) librarians in public libraries in Taraba State. All the thirty (30) librarians in public libraries in Taraba State were used in this study. Therefore, no sampling process was carried out as the entire population constituted the sample for the study. This is because the population is manageable.

Data were collected using questionnaire. The questionnaire comprised two sections A and B; Section A of the instrument sought information about the personal data of the subjects while Section B of the questionnaire comprised 12-items which are divided into three clusters. Cluster 1 sought information about key challenges faced by public libraries in Taraba State, Cluster 2 sought information about potentials of AI to address these challenges and improve library services, while Cluster 3 sought information about the framework for implementing AI solutions in public libraries in Taraba State. It was designed on a four point liker scale of strongly agree (SA), agree (A) , disagree (D), and

strongly disagree (SD). The researcher first visited the public libraries, introduced herself and explained the purpose of the study. Secondly, the researcher administered the instrument to the respondents after being permitted by the library authorities to do so. The research questions were answered using mean and standard deviations. The mean value of 2.50 was used as a bench mark for decision.

Results

Research Question One

What are the key challenges faced by public libraries in Taraba State?

Table 1: Mean and Standard Deviation of Respondents on the key challenges faced by Public Libraries in Taraba State

S/N	Item Statement	N = 30 Mean ($\overline{x}$)	SD	Dec.
1	Limited funding hinders the acquisition of new books and resources.	3.02	0.79	A
2	Inadequate infrastructural facilities make libraries unattractive to users.	3.00	0.90	A
3	Lack of awareness and promotion leads to low public library usage.	3.07	0.81	A
4	Staffing shortages and inadequately trained personnel limit service quality.	3.01	1.03	A

Dec = decision, A = agreed, D = disagreed

Table 1 shows the mean and standard deviations of respondents on the key challenges faced by public libraries in Taraba State. The result obtained show that items 1- 4 had mean ratings of 3.02, 3.00, 3.07 and 3.01 with standard deviations of 0.79, 0.90, 0.81, and 1.03 respectively. These mean values are above the bench mark value of 2.50 which implies agreed. This means the following responses on the key challenges faced by public libraries in Taraba State are agreed. These include: limited funding hinders the acquisition of new books and resources, inadequate infrastructural facilities make libraries unattractive to users, lack of awareness and promotion leads to low public library usage, and staffing shortages and inadequately trained personnel limit service quality.

Research Question Two

What are the potentials of AI to address these challenges and improve library services?

Table 2: Mean and Standard Deviation of Respondents on the potentials of AI to address these challenges and improve library services

S/N	Item Statement	N = 30 Mean $(\overline{x})$	SD	Dec.
5	AI-powered chatbots can provide 24/7 virtual reference services.	3.00	0.68	A
6	AI can personalize book recommendations based on user preferences.	2.99	0.73	A
7	Automated cataloguing and indexing can streamline library operations.	2.82	0.75	A
8	AI-powered translation tools can expand access to multilingual resources.	3.06	0.72	A

Dec = decision, A = agreed, D = disagreed

Table 2 shows the mean and standard deviations of respondents on the potentials of AI to address these challenges and improve library services. The results show that items 5-8 had mean ratings of 3.00, 2.99, 2.82 and 3.06 with standard deviations of 0.68, 0.73. 0.75 and 0.72 respectively. These mean values are above the bench mark value of 2.50 which implies agreed. This means the following responses on the potentials of AI to address these challenges and improve library services are agreed. These include: AI-powered chatbots can provide 24/7 virtual reference services, AI can personalize book recommendations based on user preferences, automated cataloguing and indexing can streamline library operations, and AI-powered translation tools can expand access to multilingual resources.

Research Question Three

What is the framework for implementing AI solutions in public libraries in Taraba State?

Table 3: Mean and Standard Deviation of Respondents on the framework for implementing AI solutions in public Libraries in Taraba State

S/N	Item Statement	N = 30 Mean ($\bar{x}$)	SD	Dec.
9	Conducting needs assessments and feasibility studies is crucial before implementation.	2.86	1.00	A
10	Training library staff on AI tools and applications is essential for successful integration.	3.09	1.04	A
11	Investing in robust internet infrastructure and data security is vital for AI adoption.	3.04	1.01	A
12	Developing partnerships with external technology providers can accelerate AI implementation	2.92	0.87	A

Dec = decision, A = agreed, D = disagreed

Table 3 shows the mean and standard deviations of respondents on the framework for implementing AI solutions in public libraries in Taraba State. The results show that items 9-12 had mean ratings of 2.86, 3.09, 3.04 and 2.92 with standard deviations of 1.00, 1.04, 1.01 and 0.87 respectively. These mean values are above the bench mark value of 2.50 which implies agreed. This means the following responses on the framework for implementing AI solutions in public libraries in Taraba State are agreed. These include: conducting needs assessments and feasibility studies is crucial before implementation, training library staff on AI tools and applications is essential for successful integration, investing in robust internet infrastructure and data security is vital for AI adoption, and developing partnerships with external technology providers can accelerate AI implementation.

Discussion of Findings

The discussion of findings of the study was presented under the following sub-headings

Key Challenges Faced by Public Libraries

The results from table 1 showed that the key challenges faced by public libraries in Taraba State include: limited funding hinders the acquisition of new books and resources, inadequate infrastructural facilities make libraries unattractive to users, lack of awareness and promotion leads to low public library usage, and staffing shortages and inadequately trained personnel limit service quality. This outcome was consistent with the research conducted by Asuquo and Udo (2019), who examined the difficulties faced by public libraries in Taraba State. Their findings indicated that three main challenges that are faced by public libraries in Taraba State are

inadequate funding, poor infrastructure, and insufficiently staffed libraries.

The Potentials of AI to address these challenges and improve library services

The results from table 2 showed that the potentials of AI to address these challenges and improve library services include: AI-powered chatbots can provide 24/7 virtual reference services, AI can personalize book recommendations based on user preferences, automated cataloguing and indexing can streamline library operations, and AI- powered translation tools can expand access to multilingual resources. The results are in agreement with the findings of Nawaz and Saldeen (2020), who highlighted the benefits of AI chatbots for libraries, including increased accessibility, improved user satisfaction, and reduced workload for librarians.

The framework for implementing AI solutions in library services

The results from table 3 showed that the framework for implementing AI solutions in public libraries in Taraba State include: conducting needs assessments and feasibility studies is crucial before implementation, training library staff on AI tools and applications is essential for successful integration, investing in robust internet infrastructure and data security is vital for AI adoption, and developing partnerships with external technology providers can accelerate AI implementation. These results are in agreement with the findings of scholars who emphasized the importance of needs assessments and pilot projects before AI implementation in libraries, ensuring solutions address specific needs, the need for ongoing training and development programs for librarians to adapt to and effectively utilize AI technologies in libraries (Chien & Tsai, 2018; Oduware & Ogunsanwo, 2023),.

Conclusion

Based on the findings of the study, the paper provides the imperative for adoption of AI and its potentials in public libraries in Taraba State with the following recommended policymakers and library administrators should promote the adoption of AI in public libraries, ensuring effective planning, implementation, and evaluation of AI initiatives.

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