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The Application Of Artificial Intelligence On Information Retrieval Systems In Libraries In Nigeria

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Abstract: *This study is on the application of artificial intelligence on information retrieval systems in libraries in Nigeria. The population of this study are the students of the department of Library and Information Science, Lead City University, Ibadan. The study made used of a survey research design in which 141 respondents were selected for the study. The questionnaire was adopted as research instrument. Two research questions were answered and one hypothesis was tested using Pearson Correlation. Data was analyzed using SPSS version 25.0. The result of the study revealed that majority of the respondents claimed that AI is perceived as a way for libraries to innovate and remain competitive in an increasingly digital and information-driven world (X = 1.71, SD = 0.49) and AI is perceived as a tool that can enhance access to information by improving the organization, retrieval, and dissemination of digital resources (X = 1.63, SD = 0.61). Some of the challenges Nigerian university libraries face in implementing AI and automation include financial constraints or a lack of awareness, limited budgets, shortage of librarians and IT staff with adequate skills. Also, the result of the hypothesis showed there was a significant negative relationship between perception of AI and challenges faced by Nigerian university libraries in implementing AI (r = 745; P<.05). The study recommended that libraries should invest in the necessary infrastructure, such as powerful computing systems, data storage solutions, and fast internet connectivity, to support AI technologies.*

Keywords: Academic libraries, Artificial Intelligence, Information Technology, Information retrieval, Library automation

Introduction

In today's rapidly evolving technological landscape, information and library professionals must leverage creative and intelligent technologies to meet the dynamic information needs of digitally savvy users. Artificial intelligence (AI) is a key driver of modern civilization's development, transforming library services and operations. AI's potential to revolutionize various sectors, including library and information science, has garnered significant attention (Duggal, 2023).

Libraries have transitioned from static repositories to dynamic information hubs, facilitating seamless access to information through technologies like IoT, big data, cloud computing, blockchain, RFID, AI, and virtual/augmented reality (Vijayakumar & Sheshadri, 2019; Yu, 2019). In Nigeria, academic libraries have integrated technology into daily operations, including computers, printers, scanners, barcode readers, internet, databases, OPAC, security cameras, social media, and RFID technology (Okoro & Ukwoma, 2020). However, the adoption of cutting-edge technologies like AI, cloud computing, blockchain, IoT, big data, and augmented/virtual reality remains a goal for Nigerian academic libraries.

Statement of the Problem

The advent of Artificial Intelligence (AI) and library automation has brought significant transformations to library services globally. However, the extent and impact of these innovations in Nigerian university libraries remain under-researched. Nigerian universities face numerous challenges, including limited funding, inadequate infrastructure, and a shortage of skilled personnel, which may hinder the effective implementation and utilization of AI and automation technologies in their libraries.

Research Questions

i. What is the perception on the importance of AI on library services in Nigeria?
ii. What challenges do Nigerian university libraries face in implementing AI and automation?

Hypothesis:

H_{01}: There is no significant relationship between perception of AI and the challenges faced by Nigerian university libraries in implementing AI

Literature Review

Artificial Intelligence

The library and information science field is on the verge of a transformative shift with the emergence of artificial intelligence (AI) as a game-changing technology. As knowledge hubs and information providers, libraries are embracing AI to enhance operational efficiency, user experiences, and service delivery. AI encompasses machine learning, natural language processing, and data analytics, enabling computers to simulate human intelligence and automate tasks (Asemi, 2018). AI integration unlocks vast potential in libraries, including: improved information retrieval and management through AI-driven algorithms, personalized recommendations via sophisticated systems, automation of repetitive tasks, freeing staff for high-value duties and data-driven decision-making through insightful analysis (Jha, 2023).

The objectives of Ai include natural language processing, object manipulation, generalization, logical reasoning, and knowledge discovery (Allison, 2012). Recently, AI has gained significant attention across various disciplines, including computer science, information science, mathematics, linguistics, psychology, and more.

Application of AI in Libraries

Artificial Intelligence (AI) has a profound influence on various business activities within Smart Libraries. While some might argue that public libraries are better positioned to introduce AI to their users, academic libraries hold a unique advantage in integrating AI literacy with their existing information literacy programs." The integration of AI in libraries is enhancing user experiences and accessibility. By embracing AI, libraries are modernizing traditional services and transforming how they engage with patrons, ultimately broadening access to knowledge in creative and impactful ways.

i. Smart Book Recommendation system: Recommendation systems driven by AI are revolutionizing the way libraries show and arrange their materials. In order to provide individualized reading lists and pertinent resources, these systems examine user preferences, borrowing history, and reading habits. This method improves user involvement and pleasure while streamlining the process of finding materials.
ii. Chatbots and Virtual Assistants: AI-powered chatbots help users instantly by responding to their questions, directing them to the materials available in the library, and helping them to navigate both the real and virtual areas of the library. These virtual assistants make it possible for consumers to get information and support whenever they need it, which greatly increases accessibility.
iii. Automated Administrative Tasks: Regular administrative duties like scheduling books, keeping track of deadlines, and sending out past-due alerts can be automated by AI. Staff members at the library can now concentrate more on helping users, selecting materials, and creating initiatives that improve the user experience thanks to this automation.
iv. Enhanced Accessibility for People with Disabilities: AI plays a critical role in improving accessibility for people with disabilities. Text-to-speech and speech-to-text features provide accessibility for people who have vision impairments or trouble reading. AI-powered image recognition makes visual content more accessible to people with vision problems by facilitating its description.

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), introduced by Fred Davis in 1989, predicts and explains user behavior towards new technology (Davis, 1989). Building on the Theory of Reasoned Action (TRA), TAM emphasizes the impact of external factors like attitude, beliefs, and usage intentions on user behavior. TAM identifies two crucial factors influencing internet adoption: perceived usefulness and perceived ease of use. Users' willingness to adopt technology hinges on their belief in its utility and their confidence in using it. Over time, TAM has undergone refinements, expanding its applicability to better understand users' intentions regarding internet technology (King & He, 2006). According to TAM, user attitudes, intentions, and perceptions of usefulness and ease of use directly or indirectly drive the adoption of new technology systems.

Empirical Reviews

Manjunatha (2023) conducted a comprehensive study to examine the effects of artificial intelligence (AI) on library services. Employing a correlational research design, the study targeted a diverse population of 966 participants, comprising researchers, faculty members, and post-graduate students from the Arts, Social Sciences, and Science faculties of Mysore University. Data collection was facilitated through questionnaires, and statistical analysis was performed using both descriptive and inferential methods to uncover meaningful insights. The findings showed a positive significant relationship between awareness and utilisation of AI based library services ($r=.179$; $p<0.05$). In his study titled "Artificial Intelligence: Opportunities and Challenges for Libraries in Developing Countries,"

Opara (2021) conducted a study titled "Artificial Intelligence and its Implications for Libraries and Information Science Professionals in Nigeria". This research examined the effects of AI on librarians and information science professionals, uncovering both benefits and challenges. The findings indicated that AI can significantly improve library services by automating routine tasks and expanding

collections. However, the study also identified concerns regarding job displacement and the imperative for library professionals to develop new competencies to remain relevant in a rapidly evolving technological landscape. Abubakar (2021) conducted a study examining the adoption of artificial intelligence (AI) in libraries, weighing its opportunities and challenges. The findings highlighted AI's potential to elevate library services, particularly in improving user experience and facilitating research. Nonetheless, significant hurdles were identified, including the need for comprehensive staff training, addressing ethical implications, and mitigating job displacement risks.

Research Methodology

The survey research design was used in this study. The population of the study are students of Library and Information Science Department, Lead City University, Ibadan. A total number of 141 students were administered research questionnaire which was used as instrument for data collection. The sampling technique used in this study was purposive sampling. The study was focused on participants that possess certain attributes or experiences required in the study (students of library department). A structured questionnaire was used for data collection. The analysis was done using SPSS version 21.0 by applying descriptive and inferential statistics. The socio-demographic characteristics of the respondents was analyzed using descriptive statistics while hypothesis was analyzed using Pearson Correlation.

Data Analysis

Research Question One: What is the perception on the importance of AI on library services in Nigeria?

Table 1: The perception on the importance of AI on library services in Nigeria

S/N	ITEMS	A	SA	U	D	SD	$\bar{x}$	Std Dev
1	AI can help automate routine tasks, freeing up librarians to focus on more complex tasks	73 (51.8%)	60 (42.6%)	7 (5.0%)	1 (0.7%)	-	1.55	0.65
2	AI-powered systems can provide personalized recommendations and improve access to information	65 (46.1%)	71 (50.4%)	2 (1.4%)	2 (1.4%)	1(0.7%)	1.60	0.66
3	AI is perceived as a tool that can enhance access to information by improving the organization, retrieval, and dissemination of digital resources	61 (43.3%)	71 (50.4%)	9 (6.4%)	-	-	1.63	0.61
4	AI is perceived as a way for libraries to innovate and remain competitive in an increasingly digital and information-driven world	43 (30.5%)	96 (68.1%)	2 (1.4%)	-	-	1.71	0.49

Table 1 shows that 73 (51.8%) of the respondents agree, 60 (42.6%) strongly agree, 7 (5.0%) are undecided while 1 (0.7%) disagree that AI can help automate routine tasks, freeing up librarians to focus on more complex tasks, 65 (46.1%) of the respondents agree, 71 (50.4%) strongly agree, 2 (1.4%) are undecided, 2 (1.4%) disagree while 1(0.7%) strongly disagree that AI-powered systems can provide personalized recommendations and improve access to information. Also, 61 (43.3%) of the respondents agree, 71 (50.4%) strongly agree while 9 (6.4%) are on undecided that AI is perceived as a tool that can enhance access to information by improving the organization, retrieval, and dissemination of digital resources. Furthermore, 43 (30.5%) of the respondents agree, 96 (68.1%) strongly agree while 2 (1.4%) are undecided that AI is perceived as a way for libraries to innovate and remain competitive in an increasingly digital and information-driven world. This implies that majority of the respondents agree that AI can help automate routine tasks, freeing up librarians to focus on more complex tasks, AI-powered systems can provide personalized recommendations and improve access to information, AI is perceived as a tool that can enhance access to information by improving the organization, retrieval, and dissemination of digital resources and AI is perceived as a way for libraries to innovate and remain competitive in an increasingly digital and information-driven world.

Research Question Two: What challenges do Nigerian university libraries face in implementing AI and automation?

Table 2: The challenges Nigerian university libraries face in implementing AI and automation

ITEMS	A	SA	U	D	SD	$\bar{x}$	Std Dev
Many libraries struggle to access the latest technology due to financial constraints or a lack of awareness	62 (44.0%)	41 (29.1%)	35 (24.8%)	1 (0.7%)	2 (1.4%)	1.91	0.94
University libraries often operate with limited budgets, which are insufficient to cover the costs of acquiring, maintaining, and upgrading AI and automation systems	57 (40.4%)	9 (6.4%)	12 (8.5%)	62 (44.0%)	-	2.47	0.77
Many university libraries do not have a clear strategic plan for adopting AI and automation	58 (41.1%)	43 (30.5%)	38 (27.0%)	1 (0.7%)	1(0.7%)	2.14	0.89
There is a shortage of librarians and IT staff with the skills needed to implement and manage AI and automation technologies	95 (67.4%)	2 (1.4%)	1 (0.7%)	43 (30.5%)	-	1.68	1.00

Table 2 shows that 62 (44.0%) of the respondents agree, 41 (29.1%) strongly agree, 35 (24.8%) are undecided, 1 (0.7%) disagree while 2 (1.4%) strongly disagree that many libraries struggle to access the latest technology due to financial constraints or a lack of awareness. Also, 57 (40.4%) of the respondents agree, 9 (6.4%) strongly agree, 12 (8.5%) are undecided while 62 (44.0%) disagree that university libraries often operate with limited budgets, which are insufficient to cover the costs of acquiring, maintaining, and upgrading AI and automation systems. In addition, 58 (41.1%) of the respondents agree, 43 (30.5%) strongly agree, 38 (27.0%) are undecided, 1 (0.7%) disagree while 1(0.7%) strongly disagree that many university libraries do not have a clear strategic plan for adopting AI and automation. Furthermore, 95 (67.4%) of the respondents agree, 2 (1.4%) agree, 1 (0.7%) are undecided while 43 (30.5%) disagree that there is a shortage of librarians and IT staff with the skills needed to implement and manage AI and automation technologies. This implies that financial constraints or a lack of awareness, limited budgets, lack of a clear strategic plan for adopting AI and automation and shortage of librarians and IT staff with the skills needed to implement and manage AI and automation technologies are some of the challenges Nigerian university libraries face in implementing AI and automation.

Hypothesis

H_{01}: There is no significant relationship between perception of AI and the challenges faced by Nigerian university libraries in implementing AI

Table 3: Pearson Correlations

		Perception of AI	challenges
Perception of AI	Pearson Correlation	1	-.745(**)
	Sig. (2-tailed)		.000
	N	141	141
challenges	Pearson Correlation	-.745(**)	1
	Sig. (2-tailed)	.000	
	N	141	141

** Correlation is significant at the 0.01 level (2-tailed).

The result of the hypothesis was tested using Pearson correlation and it shows that there was a significant negative relationship between perception of AI and challenges faced by Nigerian university libraries in implementing AI (r = 745; P<.05). This implies that perception of AI negatively significantly influences challenges faced by Nigerian university libraries in implementing. Therefore, the null hypothesis of no significant relationship between perception of AI and challenges faced by Nigerian university libraries in implementing was rejected while the alternative hypothesis of a significant relationship between perception of AI and challenges faced by Nigerian university libraries in implementing was accepted at 0.05 level of significance.

Discussion of Findings

The findings of this study showed that majority of the respondents agreed that AI is perceived as a way for libraries to innovate and remain competitive in an increasingly digital and information-driven world (X = 1.71, SD = 0.49) and AI is perceived as a tool that can enhance access to information by improving the organization, retrieval, and dissemination of digital resources (X = 1.63, SD = 0.61). Also, financial constraints or a lack of awareness, limited budgets, lack of a clear strategic plan for adopting AI and automation and shortage of librarians and IT staff with the skills needed to implement and manage AI and automation technologies are some of the challenges Nigerian university libraries face in implementing AI and automation. Furthermore, there was a significant negative relationship between perception of AI and challenges faced by Nigerian university libraries in implementing AI (r = 745; P<.05). This finding agrees with the study of Opara (2021) who reported that some of the challenges encountered in implementation of AI for libraries and information science professionals in Nigeria include job displacement and the need for library professionals to gain new skills and knowledge to adapt to the changing technology environment.

Conclusion

This study was on the application of artificial intelligence on information retrieval systems in libraries in Nigeria. The study made used of a survey research design in which the department of Library and Information Science, Lead City, Ibadan was used as a case study and 141 respondents were administered questionnaire. The study showed a negative significant relationship between perception of AI and challenges faced by Nigerian university libraries in implementing. Libraries in higher institution of learning in Nigeria could significantly benefit from AI-driven systems that offer natural language processing (NLP), predictive search capabilities, and semantic search, allowing users to find relevant information more easily. AI-driven information retrieval systems can support national development by improving access to research materials, enhancing educational resources, and facilitating innovation in various sectors.

Recommendations

i. Libraries should invest in the necessary infrastructure, such as powerful computing systems, data storage solutions, and fast internet connectivity, to support AI technologies.
ii. Libraries in higher institutions of learning should offer training programs for librarians and information professionals to enhance their skills in AI and related technologies.

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