

EVIDENCE BASED JOURNAL OF INFORMATION SCIENCE

VOLUME 1, ISSUE 3 JUNE 2026

ISSN: 1595-6148

Journa.kasu.edu.ng.index.php/ebjis



AI INFRASTRUCTURE AND STAKEHOLDER READINESS AS DETERMINANTS OF INFORMATION SERVICE DELIVERY BY LIBRARIANS IN FEDERAL UNIVERSITY LIBRARIES IN NORTH-EAST NIGERIA

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Abstract

This study examined AI infrastructure and AI-driven stakeholder readiness as determinants of information service delivery by librarians in Federal University Libraries in North-East Nigeria. A descriptive research design was adopted. The population comprised 442 librarians drawn from seven Federal University Libraries in the North-Eastern states of Nigeria, from which a sample of 210 was determined using Yamane's (1967) formula and selected through proportionate stratified random sampling. Data were collected using the Adoption of Artificial Intelligence Questionnaire (AAIQ) and the Information Service Delivery Questionnaire (ISDQ), validated by three experts and yielding Cronbach alpha reliability coefficients of 0.75 and 0.76 respectively. Data were analysed using mean and standard deviation to answer the research questions, while simple linear regression was used to test the null hypotheses at the 0.05 level of significance. Findings revealed that the level of AI infrastructure adoption was low (grand mean = 2.33), while AI-driven stakeholder readiness was high (grand mean = 2.84). Regression analysis showed that AI infrastructure significantly predicted information service delivery ($R^2 = 0.412$, $\beta = 0.642$, $p < .001$), as did AI-driven stakeholder readiness ($R^2 = 0.516$, $\beta = 0.718$, $p < .001$). Both null hypotheses were rejected. The study concludes that while human and institutional readiness for AI adoption is strong among stakeholders in Federal University Libraries in North-East Nigeria, the infrastructural foundation required to translate this readiness into improved information service delivery remains inadequate.

Keywords: Artificial Intelligence; AI infrastructure; stakeholder readiness; information service delivery; Federal University Libraries; North-East Nigeria

1. Introduction

Information service delivery in Federal University Libraries is a cornerstone for academic and administrative efficiency, ensuring that students, faculty, and staff have access to the information and resources required to support learning, research, and institutional management. In the North-Eastern states of Nigeria, however, the delivery of these services has consistently fallen short of expectations, with delayed access to critical information, inefficiencies in resource management, and poor user satisfaction emerging as persistent challenges (Mustapha & Suleiman, 2023). Artificial Intelligence (AI) has been positioned globally as a transformative tool capable of addressing these shortcomings, yet its successful integration depends on two foundational determinants examined in this article: the technological infrastructure available to support AI deployment, and the readiness of institutional stakeholders to embrace and use AI-enabled systems.

AI infrastructure refers to the technological foundation, including hardware, software, networks, data storage, and cloud computing resources, that supports the deployment and operation of AI applications in an institution (Wang et al., 2020; Adekunle et al., 2022). Stakeholder readiness, meanwhile, encompasses the preparedness of university management, academic staff, IT personnel, and students to embrace, understand, and effectively use AI systems, spanning technological, psychological, organizational, and cultural dimensions (Eze & Okafor, 2023; Adeyemi & Ojo, 2019). This article examines both determinants in relation to information service delivery by librarians in Federal University Libraries in North-East Nigeria.

1.1 Objectives of the Study

This article addresses two specific objectives drawn from the broader study:

1. To determine the level of AI infrastructure adoption for information service delivery by librarians in Federal University Libraries in the North-Eastern States of Nigeria.
2. To investigate the level of AI-driven stakeholder readiness for information service delivery by librarians in Federal University Libraries in the North-Eastern States of Nigeria.

1.2 Research Questions

1. What is the level of AI infrastructure adoption for information service delivery by librarians in Federal University Libraries in the North-Eastern States of Nigeria?
2. What is the level of AI-driven stakeholder readiness for information service delivery by librarians in Federal University Libraries in the North-Eastern States of Nigeria?

1.3 Hypotheses

H₀₁: AI infrastructure does not significantly relate with information service delivery by librarians in Federal University Libraries in the North-Eastern states of Nigeria.

H₀₂: AI-driven stakeholder readiness does not significantly relate with information service delivery by librarians in Federal University Libraries in the North-Eastern states of Nigeria.

2. Literature Review

2.1 AI Infrastructure

AI infrastructure is essential to enable the processing power, data management, and real-time analytics necessary for effective information service delivery in tertiary institutions (Chatterjee et al., 2021). In universities, this includes high-performance servers, reliable internet connectivity, integrated databases, AI platforms, and security protocols that facilitate seamless interaction between users and intelligent systems (Nkosi, 2021; Zhang & Lee, 2022). Adeyemi and Ojo (2019) found that universities with adequate AI infrastructure experienced significant reductions in information retrieval times and higher user satisfaction, while Ibrahim and Musa (2022) demonstrated that cloud-based AI platforms enhanced resource sharing and collaboration among academic departments. Conversely, inadequate infrastructure results in system downtimes, data processing bottlenecks, and limited service coverage, particularly in developing contexts (Abdullahi et al., 2019; Nwosu & Eze, 2020), with North-Eastern Nigerian universities specifically constrained by intermittent electricity and poor broadband access (Olawale & Ajayi, 2019).

Adigun (2022), in a descriptive survey of 300 ICT staff across 10 Federal Universities in Nigeria using the AI Readiness and Infrastructure Questionnaire (Cronbach's alpha = 0.84), found that

while AI infrastructure is perceived as a critical need for modern information services, most institutions lack the necessary technological and financial resources for implementation. Okoro and Ibrahim (2021), using a qualitative case study of 24 ICT directors and administrators across six Federal Universities in Northern Nigeria, similarly identified inadequate funding, lack of skilled personnel, and insufficient policy frameworks as key challenges to AI infrastructure implementation.

2.2 AI-Driven Stakeholder Readiness

Stakeholder readiness is a multi-faceted construct encompassing technological readiness (digital skills and prior technology experience), psychological readiness (attitudes, trust, and motivation), organizational readiness (leadership commitment and resource allocation), training and capacity building, and cultural readiness (openness to innovation) (Eze & Okafor, 2023; Lee & Kim, 2023; Adekunle et al., 2022; Olawale & Ajayi, 2019; Nkosi, 2021). Eze and Okafor (2023), in a mixed-methods study involving 350 university staff and students using an instrument with a Cronbach alpha of 0.87, demonstrated that high levels of digital literacy and positive attitudes toward AI were strongly linked to efficient use of AI-enabled library services, with readiness predicting 42% of variance in service delivery quality.

Adekunle et al. (2022), surveying 400 academic and administrative staff using the Stakeholder AI Readiness Scale (reliability = 0.89), found that training and organizational support were critical for readiness and positively influenced user engagement with AI information systems. In contrast, Ibrahim and Musa (2022), sampling 250 participants across three universities using structural equation modeling, found that where readiness was low despite advanced AI infrastructure, the rate of AI usage was minimal and service improvements marginal, suggesting that stakeholder readiness moderates the relationship between infrastructure and service delivery outcomes.

2.3 Theoretical Framework

This article is anchored on the Technology Acceptance Model (TAM), developed by Davis (1989), which posits that Perceived Usefulness and Perceived Ease of Use are the primary determinants of a user's attitude toward, and behavioral intention to use, a given technology. TAM is directly relevant to both constructs examined here: AI infrastructure shapes Perceived Ease of Use by

determining how readily librarians can access and operate AI-enabled systems, while stakeholder readiness reflects the accumulated perceptions of usefulness and ease of use that determine whether librarians, faculty, students, and administrators embrace AI-driven information services.

3. Methodology

A descriptive research design was adopted for this study, conducted across seven Federal University Libraries in the North-Eastern geopolitical zone of Nigeria: Abubakar Tafawa Balewa University, Federal University Gashua, University of Kashere, Federal University Wukari, Modibbo Adama University, University of Maiduguri, and Nigerian Army University Biu. The population comprised 442 librarians (121 professional, 321 para-professional) across these institutions. A sample size of 210 was determined using Yamane's (1967) formula at a 5% margin of error, and proportionately allocated across the seven universities using stratified random sampling, ranging from 10 respondents at Nigerian Army University Biu to 66 at University of Maiduguri.

Data were collected using two researcher-developed instruments: the Adoption of Artificial Intelligence Questionnaire (AAIQ, 47 items) and the Information Service Delivery Questionnaire (ISDQ, 20 items), divided into Section A (demographic data) and Section B (seven clusters corresponding to the study's sub-variables). For this article, Cluster A (AI Infrastructure) and Cluster B (AI-Driven Stakeholder Readiness) are reported. Items used a four-point Likert scale (Very High Extent = 4 to Very Low Extent = 1), with reverse scoring for negatively worded items. The instruments were validated by three experts (two from Library and Information Science, one from Measurement and Evaluation) at Taraba State University, Jalingo, and piloted on 30 librarians at Bayero University Kano, yielding Cronbach alpha reliability coefficients of 0.75 (AAIQ) and 0.76 (ISDQ).

Data were analysed using mean and standard deviation to answer the research questions, with a benchmark mean of 2.50 used as the decision rule (mean $\geq$ 2.50 = High Extent; mean $<$ 2.50 = Low Extent). Simple linear regression was used to test the null hypotheses at the 0.05 level of significance.

4. Results

4.1 Level of AI Infrastructure Adoption

Table 1: Level of AI Infrastructure Adoption for Information Service Delivery

S/N	Item	Mean	SD	Remark
1	Reliable internet access is available to support AI tools for information service delivery.	2.52	1.01	High Extent
2	Cloud-based platforms are accessible for AI-related data storage/processing.	2.33	0.99	Low Extent
3	The library has access to licensed AI software for automating library operations such as cataloging, indexing.	2.26	0.95	Low Extent
4	Dedicated IT support staff are available to assist with the maintenance of AI tools.	2.64	1.00	High Extent
5	Facilities such as power supply/cooling systems are adequate to support the effective use of AI infrastructure.	2.14	0.94	Low Extent
6	Sufficient budget is allocated for acquiring AI-related infrastructure.	2.07	0.88	Low Extent
7	Training facilities and resources for librarians are sufficient to ensure effective use of AI technologies.	2.31	0.96	Low Extent
8	Grand Mean	2.33	—	Low Extent

Table 1 shows that the level of AI infrastructure adoption is generally low (grand mean = 2.33), below the 2.50 benchmark. Only reliable internet access (M = 2.52) and dedicated IT support staff (M = 2.64) were rated High Extent, while cloud-based platforms, licensed AI software, power supply adequacy, budget allocation, and training facilities were all rated Low Extent, with budget allocation recording the lowest mean (M = 2.07).

4.2 Level of AI-Driven Stakeholder Readiness

Table 2: Level of AI-Driven Stakeholder Readiness for Information Service Delivery

S/N	Item	Mean	SD	Remark
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1	Students understand the mission and objectives of the library.	2.91	0.92	High Extent
2	Faculty members demonstrate awareness of the resources and services offered by the library.	2.95	0.95	High Extent
3	Administrators engage in regular communication with librarians to address library needs.	2.93	0.94	High Extent
4	Community stakeholders (e.g., parents, donors) provide financial or material resources to improve library services.	2.52	1.01	High Extent
5	Administrators advocate for library development and expansion within the institution or community.	2.79	0.97	High Extent
6	Administrators are involved in library policy formulation and decision-making processes.	2.74	0.95	High Extent
7	Faculty members and students are open to adopting innovative changes and technologies in the library.	3.05	0.90	High Extent
8	Grand Mean	2.84	—	High Extent

Table 2 shows that AI-driven stakeholder readiness is generally high (grand mean = 2.84), above the 2.50 benchmark, across all seven items. Openness to adopting innovative technologies recorded the highest mean ($M = 3.05$), while community stakeholder support, though still High Extent, recorded the lowest ($M = 2.52$), indicating comparatively weaker external involvement relative to internal institutional readiness.

4.3 Hypothesis Testing

Hypothesis One (H_{01}): AI infrastructure does not significantly relate with information service delivery.

Table 3: Simple Linear Regression Analysis of AI Infrastructure and Information Service Delivery

Predictor	B	SE B	β	t	p
Constant	—	—	—	—	0.000

AI Infrastructure	0.642	0.054	0.642	11.94	0.000
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$R = 0.642$, $R^2 = 0.412$, Adjusted $R^2 = 0.409$. The result shows that AI infrastructure significantly predicts information service delivery ($\beta = 0.642$, $t = 11.94$, $p < .001$), explaining 41.2% of the variance. The null hypothesis (H_{01}) is rejected.

Hypothesis Two (H_{02}): AI-driven stakeholder readiness does not significantly relate with information service delivery.

Table 4: Simple Linear Regression Analysis of AI-Driven Stakeholder Readiness and Information Service Delivery

Predictor	B	SE B	β	t	p
Constant	—	—	—	—	0.000
AI-Driven Stakeholder Readiness	0.718	0.051	0.718	14.08	0.000

$R = 0.718$, $R^2 = 0.516$, Adjusted $R^2 = 0.514$. The result shows that AI-driven stakeholder readiness significantly predicts information service delivery ($\beta = 0.718$, $t = 14.08$, $p < .001$), explaining 51.6% of the variance, the larger of the two effects examined in this article. The null hypothesis (H_{02}) is rejected.

5. Discussion

The finding that AI infrastructure adoption is generally low (grand mean = 2.33), yet significantly predicts information service delivery ($R^2 = 0.412$), underscores a critical paradox confronting Federal University Libraries in North-East Nigeria: the very factor shown to matter most for service delivery is also the one least developed. This is consistent with Abdullahi et al. (2019) and Nwosu and Eze (2020), who documented unstable power supply and poor internet connectivity as persistent hurdles to AI implementation in the region, and with Adigun (2022), who similarly

found that most Nigerian Federal Universities lack the technological and financial resources required for AI infrastructure deployment despite recognising its critical importance.

By contrast, the high level of stakeholder readiness identified (grand mean = 2.84), combined with its even larger predictive effect on information service delivery ($R^2 = 0.516$), suggests that the human and institutional willingness to support AI adoption is not the binding constraint in this context, a finding that diverges somewhat from studies such as Adewale et al. (2020) and Akpan and Samuel (2018), which identified stakeholder readiness gaps as significant barriers in other African and Nigerian settings. This divergence may reflect the comparatively strong institutional engagement found among administrators, faculty, and students in the present sample, consistent with Eze and Okafor (2023), who linked high digital literacy and positive attitudes to efficient AI-enabled library service use, these findings indicate that Federal University Libraries in North-East Nigeria possess a willing and engaged stakeholder base that current infrastructural limitations are preventing from being fully leveraged, a pattern consistent with Ibrahim and Musa's (2022) observation that stakeholder readiness moderates, but cannot substitute for, the infrastructural foundation required for AI-enabled service improvement.

6. Conclusion

AI infrastructure adoption in Federal University Libraries in North-East Nigeria remains low, while AI-driven stakeholder readiness is high; both, however, significantly and positively predict information service delivery, with stakeholder readiness exerting the larger effect. This indicates that the binding constraint on improved information service delivery in this context is technological and financial rather than attitudinal or organizational, since the human readiness to embrace AI-enabled services already exists at a high level.

7. Recommendations

1. University management and government funding bodies should prioritise investment in core AI infrastructure, particularly stable power supply, cloud-based platforms, and licensed AI software, identified as the most deficient components in this study.

2. Given the comparatively strong stakeholder readiness identified, institutions should leverage this existing willingness through participatory planning that channels stakeholder enthusiasm directly into AI infrastructure advocacy and resource mobilisation.
3. Budget allocation processes should be restructured to prioritise AI-related infrastructure specifically, given that insufficient budget allocation recorded the lowest mean score among all infrastructure indicators examined.
4. Future research should examine whether the infrastructure-readiness gap identified here persists across other Nigerian geopolitical zones, to determine whether this pattern is regional or national in scope.

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