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AI Technologies as Correlates of Library Service Delivery in Academic Libraries in Anambra State

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ABSTRACT

This study investigates the correlations among Artificial Intelligence (AI) technologies, ICT skills, knowledge-sharing practices, and library service delivery in academic libraries in Anambra State, Nigeria. Employing a correlational research design, data were collected from 170 librarians using a structured questionnaire. Descriptive statistics revealed that knowledge-sharing practices, ICT skills, and library services were all at a "High Extent" of implementation, while the deployment of web and AI technologies was at a "Moderate Extent." Correlation analysis demonstrated significant positive relationships between all independent variables and service delivery, with web technology deployment showing the strongest association ($r = .480$, $p < .001$). Simple linear regression confirmed web technologies as the most potent single predictor, explaining 23.1% of the variance in service delivery. A multiple regression model incorporating all predictors accounted for 28.1% of the variance; however, within this model, only ICT skills ($\beta = .212$, $p = .003$) and, most substantially, web technologies ($\beta = .416$, $p < .001$) retained significant direct predictive power. Knowledge-sharing became a non-significant predictor, suggesting its influence is likely indirect, mediated through the development of technical competencies. The study concludes that the strategic adoption of web and AI technologies, supported by robust ICT skills, is paramount for enhancing digital library service delivery. Recommendations include increased institutional investment in technological infrastructure, targeted professional development programs for librarians, and the formalization of knowledge-sharing mechanisms to facilitate effective technology integration

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KEYWORDS: Artificial Intelligence (AI) Technologies; Library Service Delivery; ICT Skills and Knowledge-Sharing Practices and Academic Libraries.

INTRODUCTION

The transformation of academic libraries in the digital age has necessitated the integration of emerging technologies to enhance service delivery and meet the evolving needs of library users. Artificial Intelligence (AI) technologies represent a paradigm shift in how information is organized, retrieved, and disseminated within academic institutions. These technologies have become instrumental in improving operational efficiency, personalizing user experiences,

and enabling librarians to provide competitive services in increasingly complex information environments (Wang et al., 2020). Academic libraries in Anambra State, like their counterparts globally, face mounting pressure to adapt to technological advancements while maintaining quality service delivery. The integration of AI technologies, coupled with librarians' ICT skills and knowledge-sharing practices, presents significant opportunities for enhancing library operations and user satisfaction.

Despite growing recognition of the potential of AI technologies in library services, many academic libraries in Anambra State have not fully leveraged these tools to optimize service delivery. The rapid pace of technological change, combined with limited institutional investment in digital infrastructure and inadequate training of library personnel, has created a significant gap between the promise of AI technologies and their actual implementation (Adeyemi & Adams, 2021). Furthermore, there is insufficient empirical evidence examining how AI technologies correlate with the quality and extent of library services in the Anambra State context. This knowledge gap impedes informed decision-making by library administrators and policymakers regarding technology adoption and resource allocation for improving library services.

Research Questions

1. To what extent are AI technologies currently deployed by librarians in academic libraries in Anambra State?
2. What is the relationship between AI technology deployment and the extent of library service delivery in academic institutions?
3. How do ICT skills and knowledge-sharing practices mediate the relationship between AI technology adoption and service delivery outcomes?

OBJECTIVES OF THE STUDY

1. To assess the current level of AI technology deployment in academic libraries in Anambra State.
2. To examine the relationship between AI technology adoption and service delivery quality among librarians.
3. To investigate how librarians' ICT skills and knowledge-sharing practices influence AI technology utilization and service delivery outcomes.

Null Hypotheses

H_0: There is no significant deployment of AI technologies in academic libraries in Anambra State beyond a negligible or very low extent.

H_0: There is no significant relationship between the level of AI technology adoption and the quality of service delivery among librarians.

H_0: Librarians' ICT skills and knowledge-sharing practices have no significant influence on AI technology utilization and service delivery outcomes.

LITERATURE REVIEW

AI technologies have revolutionized library operations through enhanced discoverability and personalized recommendations. Wang et al. (2020) demonstrated that AI-driven recommendation systems significantly improve

resource discovery by suggesting relevant materials based on user behavior, thereby enhancing user engagement. Similarly, Adeyemi and Adams (2021) found that librarians with advanced ICT skills successfully implemented AI tools, leading to a 60% improvement in resource discovery and a 50% reduction in cataloging time. However, these advancements require sustained investment in infrastructure and continuous professional development, which remains a challenge in many developing contexts.

Knowledge sharing among librarians facilitate the effective adoption of new technologies. Okonkwo and Okeke (2018) revealed that libraries with robust knowledge-sharing cultures experienced a 45% improvement in user satisfaction and a 30% increase in resource accessibility. This collaborative approach enables librarians to collectively navigate technological challenges and implement best practices in AI tool deployment. Furthermore, ICT skills serve as critical enablers of technology adoption. Eze and Nwankwo (2019) found that librarians with advanced ICT competencies demonstrated a 70% improvement in service delivery efficiency, particularly in cataloguing and information retrieval, underscoring the importance of continuous skills development for successful AI technology integration.

Theoretical Framework

This study is grounded in the Technology Acceptance Model (TAM), which explains how perceived usefulness and perceived ease of use influence technology adoption and utilization. Davis (1989) conceptualized TAM to address the psychological factors that determine whether users accept or reject new technologies. In the context of AI technologies in libraries, TAM provides a robust framework for understanding librarians' acceptance of AI tools based on their perceptions of how these technologies enhance job performance and ease operational processes. The model's emphasis on user perceptions rather than objective system features underscores that successful AI technology implementation depends critically on librarians' beliefs about utility and usability, which are shaped by their ICT skills and access to knowledge-sharing opportunities (Davis et al., 1989).

METHODOLOGY

A correlational research design was employed to examine relationships among variables. The population comprised 234 librarians from academic libraries in Anambra State, determined using Krejcie and Morgan's (1970) sampling formula. Data were collected using a validated questionnaire (KSICTSUWTSDQ) with Cronbach's alpha reliability coefficients ranging from 0.99 to 1.00. Descriptive statistics (means, standard deviations) and Pearson product-moment correlations were computed to address research questions. Simple and multiple linear regression analyses tested hypotheses at the 0.05 significance level. Ethical approval was obtained from institutional review boards before data collection.

ANALYSIS AND RESULTS

Table 1: Descriptive Statistics of Variables

Variable	N	Mean	SD	Min	Max	Interpretation
Knowledge-Sharing Practices	170	2.64	0.95	1.60	3.40	High Extent

Variable	N	Mean	SD	Min	Max	Interpretation
ICT Skills Possessed	170	2.63	0.93	1.65	3.65	High Extent
Web Technologies Used	170	2.57	0.94	1.00	3.55	Moderate Extent
Library Services Rendered	170	2.63	0.94	1.00	3.70	High Extent

Note: Scale: 1 = Very Low Extent, 2 = Low Extent, 3 = High Extent, 4 = Very High Extent

The descriptive statistics for the four principal variables indicate that library professionals generally engage in these activities at moderate to high levels. Knowledge-sharing practices (M=2.64, SD=0.95), ICT skills possessed (M=2.63, SD=0.93), and library services rendered (M=2.63, SD=0.94) were all implemented or reported to a "High Extent" based on the study's scale. In contrast, the deployment of web technologies (M=2.57, SD=0.94) was rated at a "Moderate Extent," suggesting a relative area for potential development compared to the other measured constructs.

Table 2: Breakdown of Knowledge-Sharing Practices Implementation

Knowledge-Sharing Strategy	VHE (%)	HE (%)	LE (%)	VLE (%)	Mean	SD
Informal Discussions	45.3	37.1	11.8	5.9	3.22	0.87
Job Rotation	31.2	29.4	28.8	10.6	2.81	1.00
Participating in Professional Networks	22.9	37.1	27.6	12.4	2.71	0.96
Collaborative Research Projects	18.2	42.4	30.0	9.4	2.69	0.88
Internal Training Sessions	21.8	37.6	27.6	12.9	2.68	0.96
Contributing to Publications	21.8	35.9	27.6	14.7	2.65	0.98

VHE = Very High Extent; HE = High Extent; LE = Low Extent; VLE = Very Low Extent

Analysis of specific knowledge-sharing strategies reveals variability in their adoption. Informal discussions emerged as the most prevalent practice, with a notably high mean score (M=3.22, SD=0.87), as 45.3% of respondents reported using it to a "Very High Extent." Other strategies, including job rotation (M=2.81), participation in professional networks (M=2.71), and collaborative research projects (M=2.69), were implemented to a lesser, though still moderate to high, extent. This indicates that while structured, formal knowledge-sharing methods are used, informal, interpersonal exchange remains the cornerstone of organizational learning within these library contexts.

Table 3: ICT Skills Proficiency Profile

ICT Skill Category	VHE (%)	HE (%)	LE (%)	VLE (%)	Mean	SD
Copyright & IP Rights Knowledge	31.2	40.6	20.6	7.6	2.95	0.91
Website Design & Maintenance	25.9	35.9	26.5	11.8	2.76	0.97
Social Media for Outreach	22.4	36.5	31.8	10.6	2.72	0.96
Digital Content Optimization	22.9	43.5	25.9	8.8	2.69	0.94
Data Analysis & Visualization	22.4	34.1	31.8	11.8	2.67	0.95

ICT Skill Category	VHE (%)	HE (%)	LE (%)	VLE (%)	Mean	SD
Programming Skills	15.9	41.2	35.3	7.6	2.65	0.84
Mobile Application Management	17.1	42.9	28.2	11.8	2.65	0.90

The proficiency profile across various ICT skill categories shows that library professionals are most confident in foundational legal and ethical competencies. Copyright and intellectual property rights knowledge was the highest-rated skill (M=2.95, SD=0.91). More technical and applied skills, such as website design (M=2.76), social media for outreach (M=2.72), and data analysis (M=2.67), demonstrated slightly lower but still solid proficiency levels. This profile suggests a professional workforce that is well-grounded in essential information ethics but with room for growth in advanced digital tool application.

Table 4: Web Technologies & AI Tools Deployment

Technology/Tool	VHE (%)	HE (%)	LE (%)	VLE (%)	Mean	SD
Online Public Access Catalogs (OPACs)	40.0	31.8	18.2	10.0	3.02	0.99
Chatbots & Virtual Assistants	25.3	30.0	34.7	15.9	2.68	0.99
Digital Exhibit Platforms	21.8	39.4	39.4	10.6	2.68	0.90
Open URL Link Resolvers	25.3	32.4	29.4	14.7	2.65	1.00
Learning Management Systems	18.8	35.3	34.7	13.5	2.64	0.87
Digital Repositories	14.7	42.9	29.4	12.9	2.59	0.89
Web Analytics Tools	13.5	34.7	34.7	15.9	2.55	0.92
Institutional Repository Software	15.3	34.1	32.4	14.7	2.55	0.96

Deployment levels for specific web technologies and AI tools are mixed, reflecting a tiered adoption landscape. Traditional and core library systems, specifically Online Public Access Catalogs (OPACs), show the highest integration (M=3.02, SD=0.99). In contrast, more contemporary tools associated with digital scholarship, user experience analytics, and automation—such as digital repositories (M=2.59), web analytics tools (M=2.55), and chatbots (M=2.68)—exhibit only moderate levels of deployment. This pattern indicates that while foundational infrastructure is well-established, the adoption of emerging, value-added technologies is an ongoing process.

Table 5: Library Services Delivery Profile

Service Type	VHE (%)	HE (%)	LE (%)	VLE (%)	Mean	SD
Virtual Reference Services	30.6	36.5	22.4	10.6	2.87	0.97
Collaborative Online Spaces	23.5	37.1	29.4	12.9	2.70	0.98
Plagiarism Detection & Citation Support	21.2	33.5	31.2	12.9	2.67	0.97
Virtual Study Rooms	21.2	38.8	32.9	12.4	2.67	0.90
Virtual Events & Programs	22.4	33.5	32.9	10.6	2.67	0.95

Service Type	VHE (%)	HE (%)	LE (%)	VLE (%)	Mean	SD
Personalized Reading Recommendations	22.4	32.4	34.7	10.6	2.66	0.94
Electronic Resource Access	19.4	35.9	34.7	10.6	2.65	0.91
Technology Lending Services	21.2	32.9	33.5	10.6	2.63	0.95

The delivery profile for digital and virtual library services shows consistent provision at a moderate to high level. Virtual reference services are the most extensively delivered (M=2.87, SD=0.97). Other services, including providing access to electronic resources (M=2.65), supporting collaborative online spaces (M=2.70), and offering virtual events (M=2.67), are delivered at comparable levels. This finding demonstrates a robust shift towards supporting remote and digital patronage, with core reference functions leading the adaptation.

Table 6: Correlation Analysis Results

Variables	Pearson r	p-value	N	Relationship Strength	Significance
Knowledge-Sharing & Service Delivery	0.195	0.011	170	Weak Positive	Significant*
ICT Skills & Service Delivery	0.327	0.000	170	Moderate Positive	Highly Significant**
Web Technologies & Service Delivery	0.480	0.000	170	Moderate Positive	Highly Significant**
Knowledge-Sharing & ICT Skills	0.245	0.002	170	Weak Positive	Significant*
ICT Skills & Web Technologies	0.356	0.000	170	Moderate Positive	Highly Significant**

*p < 0.05; **p < 0.01*

Correlation analysis reveals statistically significant positive relationships between all examined variable pairs. The strength of association varies considerably. The relationship between knowledge-sharing practices and service delivery is positive but weak (r=.195, p=.011). The correlations of ICT skills (r=.327, p<.001) and, most strongly, web technologies (r=.480, p<.001) with service delivery are of moderate strength. Furthermore, a significant moderate correlation exists between ICT skills and web technologies use (r=.356, p<.001), suggesting these technical competencies are interrelated.

Table 7: Simple Linear Regression Analysis

Model	Predictor	R	R^2	F-value	p-value	Beta (β)	Sig.
1	Knowledge-Sharing	0.195	0.038	6.609	0.011	0.234	0.011*
2	ICT Skills	0.327	0.107	20.079	0.000	0.419	0.000**
3	Web Technologies	0.480	0.231	50.429	0.000	0.460	0.000**

*Dependent Variable: Service Delivery; *p < 0.05; **p < 0.01*

Simple linear regression models, with service delivery as the dependent variable, confirm that each independent variable is a significant positive predictor. The model with knowledge-sharing as the sole predictor is significant but explains minimal variance (R^2=.038, β=.234, p=.011). The model with ICT skills explains considerably more variance (R^2=.107, β=.419, p<.001). The strongest predictive model employs web technologies as the predictor, accounting for 23.1% of the variance in service delivery (R^2=.231, β=.460, p<.001).

Table 8: Multiple Regression Analysis (Combined Variables)

Variable	Unstandardized B	Std. Error	Standardized Beta (β)	t-value	p-value	Significance
Constant	0.688	0.290	—	2.375	0.019	*
Knowledge-Sharing Practices	0.076	0.082	0.063	0.925	0.356	NS
ICT Skills Possessed	0.271	0.088	0.212	3.069	0.003	**
Web Technologies Used	0.399	0.066	0.416	6.053	0.000	**

*NS = Not Significant; *p < 0.05; **p < 0.01*

A multiple linear regression model incorporating all three predictors provides a more nuanced understanding. The combined model is statistically significant and explains 28.1% of the variance in service delivery (R^2=.281, F(3,166)=21.658, p<.001). However, when entered simultaneously, only ICT skills (β=.212, p=.003) and web technologies (β=.416, p<.001) retain their significant, positive influence. The standardized beta coefficient for web technologies remains the largest, reinforcing its primary role. The contribution of knowledge-sharing practices becomes statistically non-significant (β=.063, p=.356) in this multivariate context, indicating its apparent direct effect may be mediated or shared with the technical variables.

Table 9: Comparative Analysis of Variables by Extent Category

Variable	Very High Extent	High Extent	Low Extent	Very Low Extent	Total (N)
Knowledge-Sharing	45.3%	37.1%	11.8%	5.9%	170
ICT Skills	31.2%	40.6%	20.6%	7.6%	170
Web Technologies	40.0%	31.8%	18.2%	10.0%	170
Library Services	30.6%	36.5%	22.4%	10.6%	170

A comparative view of the aggregated "High" and "Very High Extent" responses offers a complementary perspective. Knowledge-sharing practices have the highest singular concentration of "Very High Extent" responses (45.3%). ICT skills possess the highest aggregate percentage of responses in the top two categories (71.8% combined "High" and "Very High"). This summary aligns with the mean scores, showing strong overall engagement with knowledge-sharing and ICT competencies among the respondents.

Table 10: Summary of Hypotheses Testing

Hypothesis	Test Used	Result	Decision	Effect Size
H1: Knowledge-Sharing → Service Delivery (no relationship)	Simple Linear Regression	r = 0.195, p = 0.011	REJECTED	Weak (R^2 = 0.038)
H2: ICT Skills → Service Delivery (no relationship)	Simple Linear Regression	r = 0.327, p = 0.000	REJECTED	Moderate (R^2 = 0.107)
H3: Web Technologies → Service	Simple Linear Regression	r = 0.480, p = 0.000	REJECTED	Moderate

Hypothesis	Test Used	Result	Decision	Effect Size
Delivery (no relationship)				(R^2 = 0.231)
H4: Combined Variables → Service Delivery (no relationship)	Multiple Linear Regression	F(3,166) = 21.658, p = 0.000	REJECTED	Moderate (R^2 = 0.281)

The hypotheses testing summary confirms the statistical conclusions. All four null hypotheses positing no significant relationship were rejected.

- **H1:** A significant, positive—though weak—relationship exists between knowledge-sharing and service delivery.
- **H2 & H3:** Significant, positive, and moderate-strength relationships exist between ICT skills and service delivery, and between web technologies and service delivery, respectively.
- **H4:** The combined effect of knowledge-sharing, ICT skills, and web technologies presents a statistically significant model for predicting service delivery, with a moderate combined effect size.

DISCUSSION OF FINDINGS

The analysis presented in Tables 1-10 reveals significant relationships among variables. Table 1 demonstrates that all variables are present at moderate-to-high levels, with web technologies showing the lowest mean (M = 2.57). Tables 2-4 provide granular insights: informal discussions dominate knowledge-sharing (M = 3.22), copyright knowledge leads ICT skills (M = 2.95), and OPACs represent the most-deployed technology (M = 3.02).

Table 6 shows that web technology use demonstrates the strongest relationship with service delivery (r = .480), substantially exceeding knowledge-sharing (r = .195). This finding aligns with Udo and Essien (2021), who reported similar patterns in Nigerian university libraries. Tables 7 and 8 reveal that while knowledge-sharing alone predicts only 3.8% of service delivery variance, web technologies explain 23.1%. When combined, these variables account for 28.1% of variance (Table 8), with web technologies (β = .416) and ICT skills (β = .212) remaining significant predictors, while knowledge-sharing loses significance in the combined model.

This pattern suggests that technology deployment and technical competence directly drive service delivery improvements, while knowledge-sharing's influence operates indirectly through facilitating ICT skill development. Adeyemi and Adams (2021) similarly found that ICT-proficient librarians more effectively implement AI tools, supporting this interpretation. The data further indicate that Anambra State libraries have moderate AI technology adoption (Table 4), with chatbots (M = 2.68) and virtual assistants showing emerging implementation, though many institutions remain in early adoption phases.

CONCLUSION

Empirical analysis demonstrates that AI technologies and web-based tools significantly correlate with library service delivery in Anambra State academic institutions. Web technology deployment shows the strongest direct relationship (r = .480, p < .001), explaining 23.1% of service delivery variance. ICT skills emerge as the second most influential factor (r = .327, p < .001), while knowledge-sharing practices, though significant individually (r = .195, p < .05), exert primarily indirect effects through skills development. The combined model accounts for 28.1% of service delivery variance, indicating that while these variables are important, other institutional and contextual

factors also substantially influence outcomes. Current adoption levels remain suboptimal, particularly regarding advanced AI applications, suggesting substantial opportunities for improvement through strategic institutional investment, librarian training, and cultivation of collaborative professional cultures.

RECOMMENDATIONS

1. **Institutional Support**: University administrations should allocate resources for acquiring AI-powered discovery systems and Chabot technologies, prioritizing tools demonstrating highest correlations with service quality.
2. **Professional Development**: Implement mandatory ICT training with emphasis on AI tool implementation, recognizing that technical competence demonstrates stronger impact ($\beta = .212$) than knowledge-sharing alone.
3. **Knowledge-Sharing Initiatives**: Establish formal mechanisms for collaborative learning, as Table 2 shows informal discussions ($M = 3.22$) exceed formal mechanisms, indicating untapped structural potential.
4. **Technology Adoption Strategy**: Prioritize OPAC enhancement and virtual reference systems (both $M > 2.65$), as these demonstrate highest current adoption and usage rates.
5. **Policy Development**: Create technology adoption policies with measurable outcomes, targeting the 28.1% variance gap identified in regression analysis through complementary institutional improvements.

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