



Influence of Digital Competencies on Open-Source Software Adoption among Librarians in Selected University Libraries, Osun State, Nigeria

Abdulwaliy Oloruntobi Akinnubi

Fountain University Library, Osogbo

Oloruntobi.waliy@fuo.edu.ng

ORCID: 0009-0007-5832-8171

Oluwafemi Emmanuel Amupitan

Kenneth Dike Library, University of Ibadan

Amupitanfemi@gmail.com

Abstract

This study examines the influence of digital competencies on open-source software (OSS) adoption by librarians in seven selected university libraries in Osun State, Nigeria, and identifies the most widely used OSS tools and key adoption challenges. A quantitative, descriptive survey design was adopted. The population comprised 144 professional and para-professional librarians selected through a multi-stage sampling technique combining purposive sampling and total enumeration. A self-constructed questionnaire, the Digital Competencies and Open-Source Software Adoption Questionnaire (DC-OSSAQ), was used to gather data and was administered face-to-face over five weeks, with 123 usable responses (85.4% return rate) analysed using descriptive statistics. Librarians in the selected universities demonstrated a high level of digital competencies, indicating a strong foundation for OSS engagement. Koha was the most widely adopted software (100%), followed by DSpace and Open Journal System (65.9% each). A Pearson Product Moment Correlation analysis revealed a strong, statistically significant positive relationship between digital competencies and OSS adoption ($r = .936$, $p < .001$, $n = 123$). Key adoption challenges included implementation and maintenance costs, inadequate training opportunities, and difficulty keeping pace with OSS updates. Library management and university authorities should prioritise funding for OSS infrastructure and continuous professional development for librarians. Investment in training programmes will help close the technical competency gap and support sustainable OSS adoption in Nigerian academic libraries.

Keywords: Digital competencies, Open-source software, Librarians, Academic libraries, Software adoption

Introduction

Academic libraries exist to support the teaching, learning, and research needs of their parent institutions (Andrikopoulou et al., 2022). Information and communication technology has enabled a shift from traditional to integrated, networked service delivery, making digital competency a vital skill for modern librarians (Yelubay et al., 2022).

According to Dzingirai (2021), digital competences are the attitudes, knowledge, abilities, and values required for the effective use of digital technology in organisations. These abilities are required for librarians to successfully embrace, deploy, and manage digital tools like open-source



software (OSS). According to King (2018), libraries should approach technology with a long-term view and make investments that accommodate for their users' growing information needs.

Choi and Pruett (2019) define OSS as any program with publicly available source code that is free to use, modify, and distribute. Tools such as Koha, DSpace, and Evergreen have provided flexible, cost-effective alternatives to proprietary systems, particularly in resource constrained Sub-Saharan African settings (Breeding, 2017). Despite growing global interest in OSS, the relationship between librarians' digital competency levels and OSS adoption behaviour in university libraries in Osun State, Nigeria, remains underexplored.

This study addresses this gap by investigating that relationship, identifying commonly used OSS tools and adoption barriers to offer practical insight for library administrators, policymakers, and professional development providers.

Statement of the Problem

Open-source integrated library systems are increasingly popular worldwide, including in Nigerian universities, owing to their cost effectiveness and flexibility. This shift requires librarians to possess robust digital competencies, yet uptake is uneven. Hussain and Nayab (2021) found that ICT-proficient librarians in Pakistan are more likely to engage with library application software. Despite this evidence, research on the influence of digital competencies on OSS adoption among librarians in Osun State university libraries remains lacking a gap this study addresses.

Research Questions

The following research questions guided this study:

1. What is the level of digital competencies among librarians in selected university libraries in Osun State, Nigeria?
2. What are the factors influencing the adoption of open-source software by librarians in university libraries Osun State Nigeria?
3. What are the most commonly used open-source software tools among librarians in university libraries in Osun State, Nigeria?
4. What are the challenges faced by librarians in adopting open-source software in university libraries in Osun State, Nigeria?

Hypothesis

The following null hypotheses were tested at 0.05 level of significance.

Ho1: There is no significant relationship between digital competencies and open-source Software adoption among librarians in the selected university libraries in Osun State, Nigeria.



Literature Review

Digital Competencies and Open-Source Software Adoption

Digital competencies are widely seen as essential enablers of OSS adoption in library contexts. These competencies include technical proficiency, digital literacy, and the capacity to customise and maintain platforms such as Koha, DSpace, and Evergreen are widely regarded as essential enablers of OSS adoption (Hanumappa et al., 2014). Competency levels vary considerably across contexts, In Pakistan, 57% of academic librarians received only partial OSS training and 25% used the software without any formal training (Ahmad et al., 2024), while in Jordan, modest digital competencies were nonetheless positively linked to smart information service delivery (Hamad et al., 2024). The European Commission's DigComp framework similarly frames digital competence as combining technical proficiency, information literacy, and socio-emotional factors relevant to OSS participation (Carretero et al., 2017).

In Nigerian libraries, Sambo et al. (2022) discovered that certified librarians have essential digital technology skills, with 65% fluent in Koha for cataloguing but just 30% capable of autonomous OSS customisation or problem solving. Khan and Bhatti (2017) discovered that, while Pakistani librarians scored intermediate on information retrieval tests, less than half were proficient in OSS security functions. These findings underline the importance of systematic training programs.

Factors Influencing the Adoption of Open-Source Software by Librarians

Open-source software adoption in libraries has drawn growing scholarly attention as institutions seek cost-effective alternatives to proprietary systems. Ahammad et al. (2024) found that sustained OSS use depends on multiple interacting factors including, funding, staff training, and community support, rather than any single determinant. Jha and Upadhyay (2024) similarly identified reduced licensing, maintenance, and training costs as a central economic driver of OSS adoption in digital libraries, reinforcing cost-effectiveness as a recurring theme in the literature.

Beyond the factors that shape open-source software (OSS) uptake, several studies have examined librarians' actual levels of adoption. Choi and Pruett (2019) found that OSS adoption remains moderate across United States academic libraries, with implementation levels varying considerably by institution size and available technical support. Choi (2021) reported a similarly uneven adoption pattern among US public libraries, noting that while awareness of OSS options is generally high, full-scale implementation lags behind awareness. In the Pakistani context, Hussain and Rafiq (2025) found that academic librarians' adoption of open-source library systems remains limited despite generally favourable attitudes toward the technology, pointing to a persistent gap between willingness and actual use. Khan and Sheikh (2023) similarly found that institutional readiness not just technical competence shaped OSS adoption for institutional repositories among Islamabad University libraries, underscoring the need to examine adoption levels directly within the Nigerian university library context. These findings suggest that OSS adoption, though increasingly discussed in the literature, has not translated uniformly into widespread practice underscoring the need to examine adoption levels directly within the Nigerian university library context.



Commonly Used Open-Source Software in Libraries

Operations of library services information delivery in the academic institutions around the world are changing with the application of new technologies (Pucciarelli & Kaplan, 2016). To adapt to changing circumstances, librarians must shift from traditional to smoother service delivery methods. To gain from technological advancements, librarians must adapt. Open-source software tools widely adopted in academic libraries include Koha, NewGenLib, Greenstone, DSpace, E-Prints, and Evergreen (Uzomba et al., 2015).

Koha and Evergreen have emerged as the leading alternatives to proprietary systems in the United States and increasingly in Africa (Choi & Pruett, 2019). In Nigeria, Koha has gained broad acceptance in academic libraries owing to its user-friendly interface, customisability, and zero licensing cost (Payne & Singh, 2010). Sobalaje et al (2018), posited that justifications for the use of Koha software by most Koha Users (libraries) are for users' registration, cataloguing, charge and discharge library materials, to print barcodes, access web-based OPAC system, to generate statistical data for research purpose and use for library stock management. These justifications by Sobalaje et al (2018) are based on the general routines of the library that differ from one library to another. Therefore, it connotes that there are more reasons as to why Libraries choose Koha ILS.

DSpace is widely adopted for institutional repository functions due to its interoperability and support for open access mandates (Gurikar & Hadagali, 2021). Factors facilitating open-source software adoption include the availability of supportive IT departments, a clear understanding of OSS benefits, and institutional willingness to invest in implementation (Kampa & Patra, 2020).

Challenges in Adopting Open-Source Software

Librarians are fast embracing open-source software (OSS) due to its low cost, flexibility, and ability to be tailored to their specific requirements. However, librarians must overcome the challenges involved with OSS adoption. Despite the benefits of open-source software, adoption presents considerable hurdles. Technical expertise shortfalls continue to be one of the most widely stated barriers: in Indian academic libraries, 65% of librarians recognized lack IT skills as a barrier to system downtime (Kampa, 2018). In Europe, compatibility concerns caused by frequent OSS updates affected workflows in resource-constrained IT systems (Ahammad et al., 2024).

Interoperability issues also provide considerable obstacles. According to a survey of US public libraries, 40% of OSS initiatives were abandoned owing to insufficient interface with old circulation systems (Choi, 2021). Security issues with community-driven patch management increase the possibility of sensitive patron data being compromised (Breding, 2017). Financial hurdles, such as the hidden costs of customization, maintenance, and staff training, are especially prevalent in African library settings with limited resources.

Theoretical Framework

This study is anchored on the Technology Acceptance Model (TAM) proposed by Davis (1989), which posits that an individual's adoption of a technology is primarily determined by perceived usefulness and perceived ease of use. Digital competence is conceptualised through the European



Commission's DigComp 2.1 framework (Carretero, Vuorikari, & Punie, 2017), which frames digital competence as a combination of technical proficiency, information literacy, and socio-emotional dimensions. Within the context of this study, digital competencies function as an antecedent that shapes librarians' perceived ease of use of open-source software, thereby influencing their behavioural intention to adopt such tools. TAM thus provides a theoretically grounded explanation for why competency levels would be expected to predict adoption behaviour among librarians.

Methodology

This study employed a quantitative, descriptive survey design. The target population comprised 144 professional and para-professional librarians from seven selected university libraries in Osun State, Nigeria, chosen purposively based on their adoption of OSS in library operations. A multi-stage sampling technique combining purposive sampling with total enumeration was used to include all eligible respondents within the selected institutions.

A self-constructed questionnaire served as the primary instrument for data collection. The questionnaire was developed based on a review of extant literature and structured around three thematic areas: digital competencies, OSS usage, and adoption challenges. Items were measured on a four-point Likert scale (Strongly Agree to Strongly Disagree). Face-to-face administration was conducted over five weeks, yielding 123 completed and usable questionnaires (response rate: 85.4%). Data were analysed using simple percentages, means, and standard deviations to answer the research questions. In conducting this research, ethical considerations were paramount to ensure integrity, respect, and fairness. Informed consent was obtained from all participants, who were fully briefed on the study's purpose, procedures, and potential risks, and informed of their right to withdraw at any time without consequence. Confidentiality and anonymity were strictly maintained, with data stored securely and accessible only to the researcher; personal identifiers were removed or encrypted to protect participant privacy.

This paper was extracted from the corresponding author's MSc Dissertation. The research instrument's face and content validity were established under the guidance of the author's supervisor, Prof Adetoun Idowu, and other lecturers within the Department of Library and Information Science, University of Ilorin, prior to reliability testing. Reviewers assessed each item for clarity, relevance, and alignment with the study's constructs, and their feedback informed revisions to item wording and structure before the instrument was piloted.

The reliability of the instrument was assessed to ensure it consistently measured the intended constructs. Thirty copies of the questionnaire were administered to 30 professional and para-professional librarians at the University of Ilorin Library, Ilorin, Kwara State, who were not part of the actual study sample. The instrument was further subjected to internal consistency testing using Cronbach's Alpha, with all constructs and the overall instrument exceeding the acceptable threshold of 0.70, as shown in Table 1



Table 1: Reliability Test

S/N	Constructs	No of items	Reliability(α)
1	Commonly used open-source software	11	0.82
2	Digital competencies	7	0.88
3	Adoption of open-source software	7	0.86
4	Challenges of open-source software	7	0.90

Table 2. Mean and standard deviation scores of librarians' digital competencies in adopting open-source software

S/N	Digital Competencies	SA	A	D	SD	Mean	SD
1	Proficiency in using digital tools and technologies	46 (20.9%)	68 (30.9%)	4 (1.8%)	5 (2.3%)	3.26	0.71
2	Confidence in navigating and utilising open-source library software	50 (22.7%)	60 (27.3%)	9 (4.1%)	4 (1.8%)	3.27	0.74
3	Ability to organise, maintain and provide access to digital collections	37 (16.8%)	69 (31.4%)	13 (4.1%)	4 (1.8%)	3.13	0.72
4	Digital skills to troubleshoot and resolve OSS-related issues	37 (16.8%)	71 (32.3%)	11 (5.9%)	4 (1.8%)	3.15	0.71
5	Actively seeking updates related to open-source library software	37 (16.8%)	75 (34.1%)	7 (3.2%)	4 (1.8%)	3.18	0.68
6	Ability to navigate and utilise digital library systems and software	44 (20.0%)	65 (29.5%)	9 (4.1%)	5 (2.3%)	3.20	0.75
7	Ability to curate digital collections and ensure long-term accessibility	57 (25.9%)	59 (26.8%)	3 (1.4%)	4 (1.8%)	3.37	0.69
Weighted Mean						3.22	

Table 2 presents librarians' self-reported digital competency levels across seven items, with an overall weighted mean of 3.22 indicating consistently high competency. The highest-scoring item was curating digital collections and ensuring long-term accessibility (mean = 3.37), followed by confidence navigating open-source library software (mean = 3.27); the lowest was organising and providing access to digital collections (mean = 3.13), still within the high range. These findings align with Khan and Bhatti (2017), who reported similarly high competency profiles among Pakistani university librarians.



Table 3: Mean and standard deviation score of factors influencing adoption of Open Source software by librarians in university libraries

S/N	Factors Influencing Open-Source Software Adoption	SA	A	D	SD	Mean	SD
1	The cost-effectiveness of open-source software is a significant factor in its adoption.	64 (29.1%)	51 (23.2%)	4 (1.8%)	4 (1.8%)	3.42	0.71
2	The perceived security and reliability of open-source software influence its adoption.	52 (23.6%)	64 (29.1%)	4 (1.8%)	3 (1.4%)	3.34	0.66
3	The user-friendliness and ease of use of open-source software influence its adoption.	58 (26.4%)	58 (26.4%)	4 (1.8%)	3 (1.4%)	3.39	0.67
4	The strategic alignment of open-source software with the library's mission and goals influences its adoption.	45 (20.5%)	70 (31.8%)	3 (1.4%)	5 (2.3%)	3.26	0.70
5	The feedback and recommendations from other libraries and institutions influence the adoption of open-source software.	50 (22.7%)	64 (29.1%)	4 (1.8%)	5 (2.3%)	3.29	0.72
6	The flexibility and customisation options of open-source software influence its adoption.	48 (21.8%)	66 (30.0%)	6 (2.7%)	3 (1.4%)	3.29	0.67
7	The availability of technical support and training influences the adoption of open-source software.	50 (22.7%)	67 (30.5%)	2 (0.9%)	4 (1.8%)	3.32	0.67
Weighted Mean						3.33	

Table 3 presents librarians' level of agreement with seven factors influencing open-source software (OSS) adoption, with an overall weighted mean of 3.33, indicating a generally favourable perception of these factors. Cost-effectiveness emerged as the most influential factor (mean = 3.42), followed by ease of use (mean = 3.39) and perceived security and reliability (mean = 3.34). Institutional and support-related factors also featured prominently: the availability of technical support and training (mean = 3.32), the strategic alignment of OSS with library mission and goals (mean = 3.26), and feedback from peer institutions and flexibility/customisation options (mean = 3.29 each) all shaped adoption decisions. Taken together, these findings suggest that librarians' OSS adoption is driven by a combination of cost, usability, and institutional support factors rather than any single determinant.



Table 4. Open-source software tools used by librarians in selected university libraries

S/N	Open-Source Software	Yes (n / %)	No (n / %)
1	Koha	123 (100%)	–
2	DSpace	81 (65.9%)	42 (34.1%)
3	Open Journal System	81 (65.9%)	42 (34.1%)
4	Evergreen ILS	43 (35.0%)	80 (65.0%)
5	VuFind	26 (21.1%)	97 (78.9%)
6	Greenstone	21 (17.1%)	102 (82.9%)
7	Invenio	14 (11.4%)	109 (88.6%)
8	Omeka	18 (14.6%)	105 (85.4%)
9	Folio	19 (15.4%)	104 (84.6%)
10	ArchivesSpace	41 (33.3%)	82 (66.7%)
11	OpenRefine	38 (30.9%)	85 (69.1%)

Table 4 shows that Koha was used by all 123 respondents (100%), confirming its dominance as the preferred integrated library system. DSpace and Open Journal System were each used by 81 respondents (65.9%). Evergreen ILS was adopted by 43 librarians (35.0%), ArchivesSpace by 41 (33.3%), and OpenRefine by 38 (30.9%). Invenio recorded the lowest usage at 11.4%. The overwhelming adoption of Koha is consistent with Payne and Singh (2010), who documented its broad uptake in Nigerian academic libraries attributable to its low cost and intuitive interface.

Table 5. Challenges Faced by Librarians in Adopting Open-Source Software

S/N	Challenge	SA	A	D	SD	Mean	SD
1	Difficulty finding technical support for open-source software	24 (10.9%)	52 (23.6%)	40 (18.2%)	7 (3.2%)	2.75	0.83
2	Challenging to integrate OSS with existing library systems	26 (11.8%)	52 (23.6%)	36 (16.4%)	9 (4.1%)	2.77	0.87
3	Perceived lack of user-friendly interface in open-source software	22 (10.0%)	48 (21.8%)	43 (19.5%)	10 (4.5%)	2.66	0.87
4	Struggling with data migration when implementing OSS	33 (15.0%)	47 (27.4%)	34 (15.5%)	9 (4.1%)	2.84	0.91
5	Lack of training and professional development as adoption barrier	37 (16.8%)	56 (25.5%)	25 (11.4%)	5 (2.3%)	3.01	0.82
6	Cost of implementing and maintaining OSS is a significant challenge	44 (20.0%)	55 (25.0%)	19 (8.6%)	5 (2.3%)	3.12	0.82
7	Challenging to keep up with rapid pace of OSS updates	32 (14.5%)	56 (25.5%)	27 (12.3%)	8 (3.6%)	2.91	0.86
	Weighted Mean					2.87	



Table 5 reveals adoption challenges with an overall weighted mean of 2.87. The most significant was the cost of implementing and maintaining OSS (mean = 3.12), followed by insufficient training (mean = 3.01) and difficulty keeping pace with OSS updates (mean = 2.91). Data migration difficulties, integration challenges, technical support gaps, and interface concerns were also reported (means 2.66–2.84). These findings are consistent with Kampa (2018) and Choi (2021), confirming that technical skill gaps and interoperability issues recur across developing country library contexts.

Table 6: Relationship between digital Competencies and Open-source Software Adoption among Librarians, Osun State, Nigeria

S/N	Variable	Mean	Std. Dev	N	R	P	Remark
1	Digital competency	22.56	4.28	123	.936	<.001	Sig.
2	Adoption of open-source software	49.49	8.13				

A Pearson Product Moment Correlation (PPMC) analysis tested the relationship between digital competencies and OSS adoption (Table 6). Digital competencies (M = 22.56, SD = 4.28) and OSS adoption (M = 49.49, SD = 8.13, n = 123) were strongly and positively correlated ($r = .936$, $p < .001$), indicating that higher digital competency is associated with greater OSS adoption. The authors acknowledge that some items across the two scales may capture closely related underlying behaviour rather than fully independent constructs, likely inflating the observed correlation beyond what a purely discriminant pair would produce. This is noted as a limitation of the current instrument; future iterations should apply confirmatory factor analysis prior to correlation testing to formally establish discriminant validity between the two constructs.

Discussion

The findings reveal a favourable digital competency profile among librarians in the selected Osun State libraries. The high weighted mean (3.22) suggests librarians possess foundational skills for effective OSS engagement, contrasting with developing country studies reporting significant competency deficits (Ahmad et al., 2024; Sambo et al., 2022) and suggesting prior exposure to technology enhanced library services in these institutions.

Koha's dominance (100% adoption) reflects broader African academic librarianship trends, where it has become the de facto open-source ILS owing to community support, localisation capabilities, and zero licensing cost (Adegboye, 2018); the secondary adoption of DSpace and OJS reflects the growing emphasis on institutional repositories and open access in Nigerian higher education.

The factors influencing OSS adoption identified in Table 3 reinforce this multi-dimensional view. Cost-effectiveness emerged as the strongest driver (mean = 3.42), consistent with Jha and Upadhyay (2024), while usability and security considerations (mean = 3.39, 3.34) align with Kampa and Patra (2020). Institutional factors, strategic alignment, technical support availability, and peer feedback also scored highly, mirroring Choi and Pruett (2019) and Khan and Sheikh (2023) on the importance of institutional readiness alongside technical merit.



Despite positive competency scores, the study reveals persistent structural barriers to OSS adoption, particularly cost (mean = 3.12) and training gaps (mean = 3.01). These findings are consistent with Jabeen et al. (2018), who identified financial constraints and limited professional development as enduring challenges in OSS oriented library transformation. The implication is that digital competency alone is insufficient to guarantee OSS adoption; institutional support structures, funding, and sustained training ecosystems are equally essential. The correlation coefficient of $r = .936$ corresponds to $r^2 = .876$, indicating that digital competencies account for approximately 87.6% of the variance in OSS adoption among librarians in this sample an exceptionally large effect by conventional social science benchmarks (Cohen, 1988).

Conclusion

This study investigated the influence of digital competencies on OSS adoption among librarians in seven selected university libraries in Osun State, Nigeria. The findings demonstrate that librarians in these institutions possess a high level of digital competencies, reflecting strong foundational capacity for OSS engagement. Koha is the most widely adopted OSS tool, followed by DSpace and Open Journal System. A positive relationship exists between digital competency and OSS adoption, though sustained adoption is constrained by implementation costs, training deficits, and technical infrastructure gaps.

The study contributes original empirical evidence to the emerging literature on digital transformation in African academic libraries and offers actionable insights for library administrators and policymakers seeking to advance OSS integration in resource-constrained environments.

Recommendations

1. Library associations, university institutions, and librarians themselves should share responsibility for closing the digital skills gap: institutions should provide structured, continuous professional development programmes, while librarians proactively strengthen advanced OSS skills such as system customisation, troubleshooting, and security management through self-directed learning.
2. Government agencies and university authorities should allocate dedicated funding for OSS implementation and infrastructure to mitigate the financial barriers identified in this study, and libraries yet to adopt OSS should consider transitioning from proprietary systems given the evidence that well implemented open-source tools are reliable, cost-effective, and adaptable to local needs.

References

- Adegbore, A. M. (2018). Adoption factors of integrated library management systems (ILMS) in selected Nigerian university libraries. *Library Philosophy and Practice*, 1994. <https://digitalcommons.unl.edu/libphilprac/1994>



- Ahammad, N., Bahry, F. D. S., & Husaini, H. (2024). Sustainable library services with open-source library automation and digitisation software: A literature review. *Business Information Review*, 41(2), 59–68. <https://doi.org/10.1177/02663821241245509>
- Ahmad, S., Ibrahim, M., Ahmad, S., & Hussain, A. (2024). The adoption of open-source software's in libraries in digital era: A case study of Pakistan. *Journal of Information Management and Practices*, 4(1), 76–91. <https://journals.iub.edu.pk/index.php/jimp/article/download/2407/1471>
- Andrikopoulou, A., Rowley, J., & Walton, G. (2022). Research data management (RDM) and the evolving identity of academic libraries and librarians: A literature review. *New Review of Academic Librarianship*, 28(4), 349–365. <https://doi.org/10.1080/13614533.2021.1964549>
- Breeding, M. (2017). Open-source library systems: The current state of the art. *Library Technology Reports*, 53(6). <https://doi.org/10.5860/ltr.53n6>
- Carretero, S., Vuorikari, R., & Punie, Y. (2017). DigComp 2.1: The digital competence framework for citizens with eight proficiency levels and examples of use (EUR 28558 EN). Publications Office of the European Union. <https://doi.org/10.2760/38842>
- Choi, N. (2021). An empirical examination of open-source software adoption in US public libraries. *The Electronic Library*, 39(5), 695–712. <https://doi.org/10.1108/EL-01-2021-0013>
- Choi, N., & Pruett, J. A. (2019). The context and state of open-source software adoption in US academic libraries. *Library Hi Tech*, 37(4), 641–659. <https://doi.org/10.1108/LHT-02-2019-0042>
- Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Lawrence Erlbaum Associates.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340. <https://doi.org/10.2307/249008>
- Dzingirai, M. (2021). Demystifying corporate restructuring strategy through digital transformation: Lessons learnt from the banking sector of Zimbabwe. In K. Sandhu (Ed.), *Emerging challenges, solutions, and best practices for digital enterprise transformation* (pp. 164–181). IGI Global. <https://doi.org/10.4018/978-1-7998-8587-0.ch009>
- Gurikar, R., & Hadagali, G. S. (2021). Use of open-source software in Indian institutional digital repositories: A study. *Library Philosophy and Practice*, 4608. <https://digitalcommons.unl.edu/libphilprac/4608>
- Hamad, F., Al-Fadel, M., & Shehata, A. M. K. (2024). The level of digital competencies for the provision of smart information service at academic libraries in Jordan. *Global Knowledge*,



-
- Memory and Communication*, 73(4/5), 614–633. <https://doi.org/10.1108/gkmc-06-2022-0131>
- Hanumappa, A., Dora, M., & Navik, V. (2014). Open-source software solutions in Indian libraries. *Library Hi Tech*, 32(3), 409–422. <https://doi.org/10.1108/LHT-12-2013-0157>
- Hussain, M., & Nayab, S. (2021). Assessment of ICT competencies of LIS professionals in public libraries of Khyber Pakhtunkhwa: A quantitative study. *Library Philosophy and Practice*, 5661. <https://digitalcommons.unl.edu/libphilprac/5661>
- Hussain, A., & Rafiq, M. (2025). Perceptions of academic librarians toward open-source library system (OSLS): Case study of Pakistan. *Science & Technology Libraries*, 44(1), 3-13 <https://doi.org/10.1080/0194262X.2023.2286649>
- Jabeen, M., Qinjian, Y., Jabeen, M., & Yihan, Z. (2018). Library professional's opinion about open-source software adoption: Status, problems and measures used in libraries of Beijing, China. *Global Knowledge, Memory and Communication*, 67(3), 180–192. <https://doi.org/10.1108/GKMC-03-2017-0022>
- Jha, S. K., & Upadhyay, A. K. (2024). Adoption and economic impact of open-source software in digital libraries. *African Journal of Biomedical Research*, 27(5S), 719–725. <https://doi.org/10.53555/AJBR.v27i5S.6755>
- Kampa, R. K. (2018). Opening to open source: Analysing the awareness and use of open-source integrated library system by LIS professionals in India. *Global Knowledge, Memory and Communication*, 67(4/5), 332–348. <https://doi.org/10.1108/GKMC-11-2017-0088>
- Kampa, R. K., & Patra, N. K. (2020). Determining the factors influencing the level of awareness and usage of open-source digital repository software by academic librarians in India. *Digital Library Perspectives*, 36(3), 303–317. <https://doi.org/10.1108/DLP-05-2020-0042>
- Khan, K., & Sheikh, A. (2023). Open-source software adoption for development of institutional repositories in university libraries of Islamabad. *Information Discovery and Delivery*, 51(1), 47–55. <https://doi.org/10.1108/IDD-10-2021-0113>
- Khan, S. A., & Bhatti, R. (2017). Digital competencies for developing and managing digital libraries: An investigation from university librarians in Pakistan. *The Electronic Library*, 35(3), 573–597. <https://doi.org/10.1108/EL-06-2016-0133>
- King, D. L. (2018). How to stay on top of emerging technology trends for libraries. *Library Technology Reports*, 54(2), 1–35.
- Payne, A., & Singh, V. (2010). Open-source software use in libraries. *Library Review*, 59(9), 708–717. <https://doi.org/10.1108/00242531011087033>



- Pucciarelli, F., & Kaplan, A. (2016). Competition and strategy in higher education: Managing complexity and uncertainty. *Business Horizons*, 59(3), 311–320. <https://doi.org/10.1016/j.bushor.2016.01.003>
- Sambo, A. S., Imran, A. A., & Akanbi, M. L. (2022). Digital literacy skills among certified librarians in Nigerian libraries: Library overview. *Journal of Digital Learning and Education*, 2(2), 70–79. <https://doi.org/10.52562/jdle.v2i2.316>
- Sobalaje, A. J., Ajala, I. O., & Salami, K. O. (2018). Assessment of Koha for online library management in Nigerian academic library: A case study of Olusegun Oke Library, Lautech, Ogbomoso. *International Journal of Academic Library and Information Science*, 6(2), 23–32
- Uzomba, E. C., Oyebola, O. J., & Izuchukwu, A. C. (2015). The use and application of open-source integrated library system in academic libraries in Nigeria: Koha example. *Library Philosophy and Practice*, 1250. <https://digitalcommons.unl.edu/libphilprac/1250>
- Yelubay, Y., Dzhussubaliyeva, D., Moldagali, B., Suleimenova, A., & Akimbekova, S. (2022). Developing future teachers' digital competence via massive open online courses (MOOCs). *Journal of Social Studies Education Research*, 13(2), 170–195.