

THE ADOPTION AND APPLICATION OF OPEN-SOURCE INTEGRATED LIBRARY SYSTEMS IN UNIVERSITY LIBRARIES IN BORNO STATE

By

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Abstract

This study investigated the adoption and application of open-source integrated library systems (ILS) in university libraries in Borno State, Nigeria. Specifically, it examined the types of open-source software technologies in use, the extent of their adoption, their significance, and the challenges associated with their implementation. A quantitative research method was employed using a descriptive survey design, which was deemed appropriate due to its reliability and ability to generalise findings. The target population comprised 80 library staff from three universities: the University of Maiduguri, Borno State University, and Al-Ansar University, Maiduguri. Purposive sampling was applied; given the small and manageable population size, the entire population was studied, in line with Borg and Gall's (2007) guidance. Data were analysed using descriptive statistics such as frequency counts, percentages, means, and standard deviations. A criterion mean of 2.50 was used to determine acceptance or rejection of responses. The findings revealed that although some open-source systems are in use, their application is limited due to factors such as inadequate training, insufficient technical infrastructure, and a lack of awareness. Based on these findings, the study recommends regular capacity-building programs, the adoption of formal ICT policies, increased promotion of open-source benefits, and improvements in infrastructure such as power and internet connectivity.

Keywords: Open-source software, Integrated Library Systems, University libraries, Borno State, Library automation, ICT in libraries

Introduction

Open-source Integrated Library Systems (ILS), such as Koha, have increasingly gained relevance in university libraries across Nigeria due to their flexibility, cost-effectiveness, and potential for local customisation (Ogunla et al., 2021; Adoption of Koha ILS in UMYU, Katsina et-al, 2021).

These systems automate core library functions—cataloguing, circulation, acquisitions, digital resource access—and because they are open source, they allow institutions to adapt them without incurring licensing fees. In contexts where financial resources and infrastructure are limited (e.g. many Nigerian universities),

open-source ILS offer practical solutions for improving library services and management (Omopupa et al. 2019; Kari & Baro, 2014). Success depends on technical expertise, stable infrastructure, institutional support, and staff training, while challenges such as erratic power supply, limited IT support, and insufficient funding remain significant constraints (Omopupa et al., 2019; Okoro, 2016; Iwhiwhu & Okoh, 2023).

Open source software (OSS) is computer software that has its underlying 'source-code' made available under a license. The main type of software use in libraries today is the ILS, which are multifunction adaptable software applications that allow libraries to manage, catalog and circulate their materials to patrons. An ILS provides a search interface to the library catalogue and automates library tasks such as the tracking of book loans and returns (Riewe, 2008). Although ILS vendors have added many different features, every ILS has nearly the same core components of cataloguing and circulation tracking. An ILS usually comprises a relational database, software to interact with that database, and two graphical user interfaces (one for patrons, one for staff). Most ILS(s) separate software functions into discrete programs called modules, each of them integrated with a unified interface (Uzomba et al., 2012).

Although in the field of library and information management. In the initial stage, due to a lack of awareness on technical aspects, right of use, sustainability, and so on, there has been a lot of confusion among librarians about 'Free/Open-Source Software'. For instance, several arguments have been put forward that free software, by its very nature, is not well supported and can only be installed and made ready to use by computer experts. The deployment and use of software in academic libraries to manage its processes and functions are speedily changing the frontiers of the libraries. This software may either be Open-Source Software (OSS) or proprietary software. Proprietary software is software that costs money to acquire, and the source code of the software is restricted, unreadable, and cannot be modified, copied, or changed from its original construction (Randhawa, 2018).

Selection of library management software (LMS) is not a simple task. Sometimes librarians go with either renowned software or maximum number of usages of the library. Selection of LMS may consist the following steps, which might help the librarians (Kumar, 2010) to select the right software for their house-keeping operations as well as information retrieval. There are many LMS, which are very popular and being used by number of libraries. Librarians may have the comprehensive study about them before taking decision in this regard. While examining the software, librarian must have the followings information about the software which might help them to select the right software for housekeeping operations as well as information retrieval.

Statement of the Problem

The adoption of open-source Integrated Library Systems (ILS) in university libraries has gained global attention due to their cost-effectiveness, flexibility, and ability to be customised to meet local needs. However, in Borno State, Nigeria, the use and application of these systems in university libraries present several challenges and uncertainties. Despite the growing recognition of open-source ILS such as Koha and Evergreen, there is limited information on their actual adoption and implementation in the region. It remains unclear how many university libraries in Borno State have adopted these systems, which ones are in use, and to what extent they are being utilised effectively. Libraries in the region face infrastructural and technical limitations, including poor internet connectivity, erratic power supply, and a shortage of trained personnel capable of managing and customising the systems. Moreover, the sustainability of these systems is in question, as continuous maintenance, updates, and user training are often lacking due to budgetary constraints and insufficient institutional support. Usability challenges also exist, with some library staff and users struggling to adapt to new interfaces and workflows introduced by open-source ILS. Additionally, there is little evidence to show whether the adoption of these systems has translated into improved service delivery, efficiency, or user satisfaction. These challenges

point to a critical gap in understanding the practical realities of implementing open-source ILS in university libraries in Borno State. Therefore, it is necessary to investigate the extent of their adoption, the challenges encountered, and their impact on library operations and user experience within the local context.

Research Questions

1. What are the types of open source software technology in University Libraries in Borno State, Nigeria?
2. What is the extent of use of open source software technology in University Libraries in Borno State, Nigeria?
3. What is the significance of open source software technology in University Libraries in Borno State, Nigeria?
4. What are the challenges of using an open source integrated library system in University Libraries in Borno State, Nigeria?

Literature Review

One of the promising full-featured software for integrated library systems (ILS) currently being used by libraries all over the world is the OSS (Kamble & Raj, 2012). An ILS is a system of keeping track of the operations of a library - payroll, expenses, purchases, and most importantly, keeping track of the various media being checked out by the librarians' patrons (Tella et al., 2017). OSS is built using library ILS standards and uses the OPAC (open public access catalogue) interface (Randhawa, 2018). RajKumar & Krishnan (2011) posit that OSS is flexible as it allows users to be able to choose solutions suitable for their needs. OSS offers its users greater freedom to purchase other products, avoiding locking to particular manufacturers (Ahammad, 2019). Freedom from a single vendor and the freedom to modify your software (Segall, 2021; Fu, 2014). The peer-review process and community standards, plus the fact that source code is out there for the world to see, tend to drive excellence in design and efficiency in coding (Tetteh, 2019).

Randhawa (2018) investigated OSS usage in libraries and found that integrated sources such as Koha can be used to handle almost every function of the library and no wonder majority of

libraries have adopted it. Upasani (2016) states that modern libraries need to stay technologically active to provide different value-added services to their research community. Libraries need to hold library management systems and digital technologies as smart tools for providing advanced services to their users (Ray & Ramesh, 2017). Libraries should collaborate with computer experts to become technologically sound in using OSS (Upasani, 2016; Ray & Ramesh, 2017). Libraries are now completely dependent on Information and Communications Technology (ICT) for providing various services to the users (Vijayakumar et. al., 2016). The extent of the use of OSS was encouraging due to its perceived benefits. Baeza-Yates and Ribeiro (2011) also mentioned that Asian governments are considered OSS as a boost for their economies and a way to increase technological innovation in the region. The findings brought to bear that the majority of the library staff were found using the OSS.

Digital Library Management Systems have greatly evolved during the last few years. They are no longer only the digital counterpart of physical libraries (or physical museums, video archives, etc.) rather they are intricate networked systems capable of supporting communication and collaboration among different, worldwide distributed user communities. The digital library management system evolved with the inception of the Digital Library. Prasad (2007) acknowledged that a digital library management system provides the appropriate framework both for the production and administration of a Digital Library System by incorporating functionality essentially fundamental to Digital Libraries, and also provides provision for integration of additional software that provides more refined and advanced functionality. Digital Library can thus be established by setting up and deploying a dual Digital Library Management System and then loading or harvesting content. Reed (2013) said this approach will largely simplify and reduces the effort required to set up a Digital Library that promises a guaranteed better quality of service.

The adoption and usage of OSS in academic libraries have several advantages

(Hanumappa et al., 2014). Some of the known advantages include ease of availability and access, cost-effectiveness, server and software maintenance, ease of operations for users (endusers and staff), consortia approaches, and networking and internet support (Sarma, 2021; Upasani, 2016). Libraries prefer OSS to proprietary software due to the lost cost of acquisition (Tetteh, 2019). The cost also has to do with the low cost of maintaining OSS (Wan, 2007). Hanumappa et al., (2014) and Muir (2005) found that in comparison, implementing OSS had a cost advantage over commercial software. Advances such as cloud computing and the flexibility of modifying OSS functionalities make OSS more relevant to academic libraries (Singh, 2020; Ahammad, 2019) and electronic reprints of all resources to encourage scholarship and collaboration (Đurković et al., 2008). Libraries using OSS systems can discuss the problems with existing users and software experts, and this consortia approach will benefit all (Rathee, 2020). Also, the base product on which OSS is developed is free or without major licensing costs (Antwi & Frimpong (2020). This benefits the library and the patrons who have access to a wider variety of resources (Upasani, 2016).

Finally, OSS provides support services (Sato, 2010) such as forums, wikis, and listservs which help address user issues more economically (Smirnova et al., 2022). The development of OSS is based on open standards around communication. This makes the OSS more adaptive and interoperable (Letowski et al., 2020). This provides for ease in operations and management, intuitive navigation, and extensive permissions for both users and staff accounts. Although open source software is very essential for the smooth running of housekeeping operations of libraries, there are still challenges inhibiting their acquisition, installation,

maintenance and functionality. Klass and Muhammad (2020) agreed that although all over the world and particularly in western countries, software that are open source are extensively being embraced. However, the case of developing countries was far different, as misconceptions around open source software didn't help much towards its adoption. Akintunde & Anjo (2012) however, emphasized that the main constraint in adopting open-source software, by libraries in Nigeria has been the unavailability of the required technical maintenance in these libraries. In his assertion, almost all libraries do not automate or use any free and open source software as a result of manpower with the technical know-how that are lacking for the installation and maintenance of the software.

Methodology

This study adopted a quantitative research method using a descriptive survey design, which was considered appropriate due to its reliability and ability to generalize findings to a larger population (Fowler & Floyd, 2013). The target population comprised 80 staff members from three university libraries: the University of Maiduguri, Borno State University, and Al-Ansar University, Maiduguri. Given the small and manageable size of the population, purposive sampling was conducted. This aligns with Borg and Gall's (2007) recommendation that the entire population should be studied when it is relatively small. Data were analyzed using descriptive statistics such as frequency counts, percentage scores, mean, and standard deviation. A criterion mean of 2.50 was used to determine whether responses were accepted or rejected: items with a mean score of 2.50 and above were accepted, while those with a mean score below 2.50 were rejected.

Table 1: Population and Sample

S/N	Universities/Libraries	No. of e-Library Staff
1.	Ramat Library, University of Maiduguri	55
2.	Borno State University Library	15
3.	Al-ansar University	10
Total		80

Sources: Library Staff list of three (3) Universities under study (documents from 2024/2025).

Descriptive statistics of frequency counts and percentages will be used in analysing the data to answer the research questions, while results will be presented in tables and charts where necessary using the Statistical Packages for Social Sciences (SPSS).

Data Analysis and Interpretation

This section presents the analysis and interpretation of data obtained from the responses of respondents during fieldwork.

Table 2: Types of Open Source Software Available in the Study Area

Items	Ramat library		BOSU library		Al-Ansar library	
	Available	Not - Available	Available	Not - Available	Available	Not - Available
Windows	√		√		√	
Linux		X		X	√	
R4L		X		X	√	
AJO		X		X	√	
Koha		X	√		√	
Evergreen		X	X			X
New Genlib		X	X			X
OPAC	√		√		√	
Dspace		X		X	√	
Greenstone		X	X			X
E-prints	√		√		√	
Fedora		X		X		X
Drupal		X		X		X
Moodle		X		X		X
OLAT		X		X		X
Word press		X		X		X
Fedora		X		X		X
Calibre		X		X		X
Moodle		X		X		X

Table 2 above displays the responses of respondents on the type of Open-Source Software available in the study area. The table reveals that Ramat library has Windows, OPAC, and E-prints. BOSU library indicated that Windows, Koha, OPAC, and E-prints are fully available in the libraries surveyed, while Al-Ansar library responded that Windows, Linux, R4L, AJO, Koha, OPAC, Dspace and E-prints are available. This implies that most of the types of open source software are not available in the Study area.

Table 3: Extent of Use of Open Source Services Available in the Study Area

Extent of Use	Frequency	Percentage
Very High Extent	10	12.5%
High Extent	55	68.5%
Low Extent	15	18.5%
Very Low Extent	0	0.0%

Source: Fieldwork, 2025

Table 3 above shows the response of respondents on the extent of use of Open Source Services available in the study area. Regarding the extent of usage, 55 respondents (68.8%) reported using

OSS to a high extent, 15 (18.8%) to a low extent, and 10 (12.5%) to a very high extent. None reported very low usage. This indicates that in the study area, while OSS tools are being used

frequently, other libraries in the study area tend to use is fairly, which shows that there is still room for increased adoption and deeper integration of

Open Source Library Software into the library processes of the study area.

Table 4: Benefits of Use of Open Source Software

Items	SA	A	D	SD	MEAN	SD
Lower Costs Software	0 (0.0%)	23 (28.8%)	53 (66.3%)	6 (7.5%)	2.21	0.57
Simplified License Management	5 (6.3%)	36 (45.0%)	39 (48.8%)	0 (0.0%)	2.58	0.57
Lower Hardware Costs	4 (5.0%)	28 (35.0%)	41 (51.3%)	7 (8.8%)	2.36	0.70
Scaling/Consolidation Potential	12 (15.0%)	54 (67.5%)	14 (17.5%)	0 (0.0%)	2.97	0.51
Support	63 (78.8%)	17 (21.3%)	0 (0.0%)	0 (0.0%)	3.79	0.41
Avoid Lock-In	18 (22.5%)	32 (40.0%)	26 (32.5%)	4 (5.0%)	2.80	0.86
Unified Management	32 (40.0%)	48 (60.0%)	0 (0.0%)	0 (0.0%)	3.40	0.49
Security and Reliability	0 (0.0%)	27 (33.8%)	53 (66.3%)	0 (0.0%)	2.34	0.47
Quality Software	19 (23.8%)	39 (48.8%)	22 (27.5%)	0 (0.0%)	2.96	0.68

Source: Fieldwork, 2025

Table 4 above displays the responses of respondents on the benefits of using Open Source Software. Based on the mean score threshold of 2.5 and above, the interpretation of the table on the Benefits of Use of Open-Source Software reveals that five out of nine items are perceived by respondents as notable benefits, while the remaining four fall below the threshold and are not widely acknowledged as benefits. The items that scored above the 2.5 benchmark include Support (mean = 3.79), which had the highest agreement, indicating that respondents strongly recognise the availability of support as a significant advantage of open-source software. Scaling/Consolidation Potential (mean = 2.97) and Quality Software (mean = 2.96) were both

viewed positively, reflecting the perception that open-source solutions can grow with organisational needs and provide dependable performance. Additionally, Avoiding Vendor Lock-In (mean = 2.80) was seen as a moderate benefit, with respondents acknowledging the flexibility and freedom that open-source tools offer by not being tied to a single vendor. Simplified License Management (mean = 2.58), though slightly above the threshold, received a mixed response, indicating only marginal recognition as a benefit. Findings show that the benefits of open-source software are well recognised, such as support, scalability, and management efficiency, among many.

Table 5: Challenges of Use of Open Source Technology and Service

Items	SA	A	D	SD	MEAN	SD
Lack of technological knowledge for its adoption	71 (88.8%)	9 (11.3%)	0 (0.0%)	0 (0.0%)	3.89	0.32
Lack of Internet facilities to download and use software	80 (100%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4.00	0.00
Low level of technical skills and ability of librarians	80 (100%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4.00	0.00
Cost of Internet network	80 (100%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4.00	0.00
Data security/Piracy	80 (100%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4.00	0.00
Lack of community support	44 (55.0%)	32 (40.0%)	4 (5.0%)	0 (0.0%)	3.50	0.61
Passive attitude towards the use of technology by management	67 (83.8%)	13 (16.3%)	0 (0.0%)	0 (0.0%)	3.84	0.37
Fear of replacement of software by a newer version	64 (80.0%)	16 (20.0%)	0 (0.0%)	0 (0.0%)	3.80	0.40
Poor Infrastructure	80 (100%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4.00	0.00
Intellectual Property Right	80 (100%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4.00	0.00
Low Internet Bandwidth	73 (91.3%)	7 (8.8%)	0 (0.0%)	0 (0.0%)	3.91	0.29
Lack Awareness of Open Source Library Software among Librarians	80 (100%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4.00	0.00
Inadequate managerial support	80 (100%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4.00	0.00
Inadequate power supply	80 (100%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4.00	0.00
Inadequate funding for procurement for hardware/software	80 (100%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4.00	0.00
Lack of training and re-training of staff	80 (100%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4.00	0.00

Source: Fieldwork, 2025

Table 5 above shows the response of respondents on the challenges associated with the use of Open Source Software. The findings reveal that all the listed challenges to the use of open-source technology and services in libraries were perceived as significant by respondents, with mean scores of 2.5 and above. Most of the challenges recorded a perfect mean score of 4.00, indicating unanimous agreement among participants that these are critical issues. These include lack of internet facilities, low technical skills of librarians, high cost of internet, data security concerns, poor infrastructure, intellectual

property issues, lack of awareness of open-source library software, inadequate managerial support, poor power supply, insufficient funding for hardware and software, and lack of staff training and re-training. The consistency of these responses highlights a strong consensus on the systemic and infrastructural barriers impeding the adoption of open-source technologies in libraries. Other challenges, such as lack of technological knowledge (mean = 3.89), low internet bandwidth (mean = 3.91), passive attitude of management (mean = 3.84), fear of software replacement (mean = 3.80), and lack of community support

(mean = 3.50), were also acknowledged but showed slight variations in perception. Overall, the data suggests that for open-source technology to be effectively adopted in libraries, critical attention must be given to addressing these infrastructural, technical, managerial, and financial challenges. The findings reveal a strong consensus that numerous systemic, technical, and infrastructural challenges significantly hinder the use of open-source technology in libraries.

Discussion of Findings

Reveals that This implies that most of the types of open source software are not available in the Study area this has corroborated with the work of Randhawa (2018) study who investigated that OSS usage in libraries and found that integrated sources such as Koha can be used to handle almost every function of the library and no wonder majority of libraries have adopted it.

In terms of usage levels, the findings revealed variation of extent of usage of Open Source Software in the study area. The findings implies that open-source software is actively used in most libraries, but there is variation in depth of engagement. The high extent of use suggests that these systems are functional and integrated into daily library services in some libraries. However, the absence of “very low” responses does not necessarily mean universal satisfaction; it could also reflect partial use of certain modules, such as circulation or cataloging, while others like acquisitions or serials may be underutilized. The moderate group reporting low use may be struggling with technical challenges, limited training, or lack of support, which hinders full adoption. This extent of usage by the libraries under study approves Vijayakumar, et al., (2016) statement that libraries are now completely dependent on Information and Communications Technology (ICT) for providing various services to the users.

Findings on the benefits of open-source software among respondents is mixed. While some respondents agreed that Open Source Software provides strong support and unified management capabilities, only few agreed that it reduces software costs, and just a handful found it secure and reliable. However, majority of the respondents agreed on its scalability recognized it

as quality software. These results reveal a high appreciation for operational features like centralized control, flexibility, and support, but there is persistent skepticism regarding security and actual cost savings. This clearly approves Sarma, (2021) and Upasani, (2016) statement on some of the known advantages of OSS which include ease of availability and access, cost-effectiveness, server and software maintenance, ease of operations for users (end-users and staff), consortia approaches, and networking and internet support.

The findings also revealed reveals deep-rooted systemic, infrastructural, and human-capacity challenges. All respondents identified issues like lack of internet, poor infrastructure, insufficient funding, and low technical skills as major barriers. Similarly, lack of power supply, lack of awareness among librarians, and inadequate managerial support were also seen as critical challenges. Only a few respondents disagreed on the lack of community support and intellectual property concerns. These findings indicate that the adoption and sustainability of OSS in the surveyed university libraries are seriously threatened by both external and internal constraints. This relates to Akintunde & Anjo (2012) emphasis that the main constraint in adopting open-source software, by libraries in Nigeria has been the unavailability of the required technical maintenance in these libraries. In his assertion, almost all libraries do not automate or use any free and open source software as a result of manpower with the technical knowhow that are lacking for the installation and maintenance of the software.

CONCLUSION

This study investigated the adoption and application of open-source integrated library systems in academic libraries. The findings of the study have revealed that while open-source integrated library systems (OSS) such as Koha, OPAC, and NewGenLib are actively in use across university libraries in Borno State, their adoption and usage remain limited in scope. The extent of use is generally high among respondents, indicating a positive attitude toward OSS. However, the use is heavily concentrated on a few familiar platforms, with many other valuable OSS

tools either unknown or unavailable. Majority of the library staff possess basic to intermediate academic qualifications, and while they are generally aware of the existence of OSS, their knowledge of its benefits particularly regarding cost-effectiveness and security is limited. Although users acknowledge the advantages of OSS, such as unified management, scalability, and support, many remain skeptical about its cost-saving potential and reliability. More critically, the study exposed significant barriers hindering the successful implementation of OSS, including lack of internet connectivity, high cost of network access, low bandwidth, insufficient power supply, inadequate funding, and poor managerial support. These challenges are compounded by a lack of training, awareness, and technical skills among library staff, alongside an institutional culture that has yet to prioritize digital transformation fully. Therefore, the study concludes that open-source systems hold great promise for transforming academic library services, but to realize their full potential, strategic interventions are necessary to address both human and infrastructural deficiencies.

Recommendation

Based on the findings and conclusion of this study, the following recommendations are proposed, that:

1. Management of university should organize regular workshops, seminars and certification programs for library staff to enhance their technical knowledge and practical skills in operating, managing, and customizing open-source systems.
2. Management of university should adopt a formal ICT and library automation policy that integrates open-source software as a long-term strategy.
3. Management of university should actively promote the benefits of open-source systems to staff and students through awareness programs.
4. Management of university should upgrade power supply systems, increase internet bandwidth, and provide reliable network connectivity in all libraries.

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