LIBRARIANS' PERCEPTION OF THE SUSTAINABILITY OF OPEN-SOURCE SOFTWARE FOR LIBRARY AUTOMATION IN ACADEMIC LIBRARIES IN ADAMAWA STATE, NIGERIA

By

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Abstract

This study investigated librarians' perceptions of the sustainability of Open Source Software (OSS) for library automation in academic libraries in Adamawa State, Nigeria. A descriptive research design was employed. The population comprised 103 librarians from six tertiary institutions, selected through census sampling technique. Data were collected using a structured questionnaire titled Perception of Librarians on Sustainability of Open Source Software Questionnaire (PSOSSQ). Mean and standard deviation were used to answer research questions, while ANOVA tested hypotheses at a 0.05 significance level. Findings revealed that librarians generally support OSS adoption, citing improvements in library operations. There were no significant differences in mean ratings across institutions regarding perceptions of OSS adoption, reasons for its use, or sustainability ($p > 0.05$). Key benefits identified included free licensing, multiple installations, community support, and system integration. Perceived sustainability was linked to collective decision-making, training opportunities, written procedures, and periodic evaluations. Challenges included lack of training, insufficient technical staff, poor ICT infrastructure, unstable power supply, and inadequate funding. Suggested sustainability measures included regular training, institutional-industry partnerships, consistent software updates, technical support, and improved funding. The study concluded that OSS offers cost-effective and flexible solutions for library automation. However, its sustainability depends on institutions investing in technical training, reliable infrastructure, and supportive policies. This implies that successful OSS adoption requires not just installation, but an ecosystem of support that addresses human, financial, and operational gaps. It is therefore recommended that library management develop structured training programs, build institutional-industry partnerships, and allocate sustainable funding to ensure long-term success.

Keywords: *Open Source Software (OSS), Library Automation, Academic Libraries, Librarians' Perception, Sustainability, Library Management Systems, Challenges of OSS*

Introduction

Academic libraries are critical to the intellectual and developmental goals of their parent institutions. They provide access to knowledge resources that support teaching, learning, and research activities (Afolabi & Abidoye, 2011). As the knowledge infrastructure of higher education, academic libraries enable the academic community to access scholarly information and engage in

research-driven learning (Bwalya & Akakandelwa, 2021).

Among the core services provided by academic libraries are cataloguing, acquisition, circulation, reference services, serials control, and access to digital resources (Kumar & Reddy, 2020). These services ensure that users have seamless access to needed materials. However, many academic libraries in Nigeria still rely on manual systems to manage these functions, which results in slow service delivery, inefficiency, and user dissatisfaction (Bwalya & Akakandelwa, 2021). The lack of library automation remains one of the major impediments to quality library service delivery in Nigeria. Manual operations hinder resource management and impede the ability to meet the information needs of users in a timely manner (Igun, 2015)). Without automation, essential functions such as circulation tracking, cataloguing, or stock management become labor-intensive and error-prone.

Library automation, defined as the use of computer software to carry out library operations, improves service efficiency, enhances user experience, and facilitates better data management (Klappholz, 2024). Despite its benefits, the state of library automation in Nigerian academic libraries remains underdeveloped due to poor funding, high cost of proprietary systems, insufficient ICT infrastructure, and inadequate technical expertise among library personnel (Oketunji, 2019).

A major barrier to automation is the issue of software procurement and sustainability. Most proprietary Library Management Systems (LMS) require expensive licenses and ongoing technical support, which are often unaffordable for public academic institutions (Igun, 2015). This cost barrier has led many institutions to explore alternatives like Open Source Software (OSS). OSS offers libraries a cost-effective and flexible option for automation. It allows access to source code, enabling libraries to customize software according to their local needs without incurring licensing fees (Haravu, 2020). Gonzalez-Barahona (2021) express that Open Source Software platforms such as Koha, DSpace, Greenstone, and EPrints have been widely adopted for Integrated Library Systems and digital repositories in academic environments across the globe.

Open Source Software refers to software whose source code is freely available for use, modification, and redistribution. These systems are community-driven, regularly updated, and adaptable to different institutional needs (Chisenga, 2014). They empower libraries to take control of their automation processes while avoiding vendor lock-in and high costs (Breytenbach & Lourens, 2020). Nevertheless, the sustainability of OSS depends not only on its technical capabilities but also on user acceptance and institutional commitment. Librarians, as key stakeholders in software deployment and daily use, play a central role in determining the success or failure of OSS initiatives (Oladokun & Kolawole, 2019). Negative perceptions, such as fears over inadequate support, difficulty in customization, or lack of training can lead to abandonment of OSS projects despite their potential (Dei & Tetteh, 2022).

Sustainability in this context refers to the ability of libraries to continuously use, maintain, and upgrade open-source software over time. It includes multiple dimensions such as technical, organizational, and financial sustainability (Antwi & Frimpong,

2020). Achieving sustainability requires deliberate strategies that involve strengthening institutional support, building technical capacity among staff, encouraging community collaboration, and ensuring consistent investment in relevant infrastructure.

Despite the increased adoption of OSS for library automation in Nigeria, there remains a dearth of empirical studies examining librarians' perceptions—especially in less-researched regions such as Adamawa State. Most existing studies focus on implementation experiences or software comparisons, leaving a gap in understanding the human and contextual dimensions of OSS sustainability. Therefore, this study seeks to examine librarians' perceptions of OSS use and sustainability for library automation in academic libraries in Adamawa State, Nigeria. It also identifies the challenges they face and proposes practical strategies for ensuring long-term success.

Statement of problems

Academic libraries in Nigeria are increasingly exploring automation to improve efficiency and access to information. However, the high cost of proprietary software presents a significant barrier, particularly in resource-constrained institutions. Open Source Software (OSS) offers a promising, cost-effective alternative, but its sustainability in library automation depends largely on librarians' perceptions and experiences with the technology.

Despite the flexibility and affordability of OSS, its adoption remains limited. Concerns about technical expertise, long-term maintenance, and reliable support services persist, potentially affecting librarians' willingness to adopt or sustain OSS-based systems. Moreover, there is a lack of focused empirical evidence on how librarians in Adamawa State perceive the usability and sustainability of OSS, and the specific challenges they encounter. Understanding these perceptions is crucial for developing effective strategies to promote the long-term use of OSS in academic libraries. This study addresses this gap by examining librarians' views on the use and sustainability of OSS and identifying the challenges that may hinder its continued implementation in academic institutions within Adamawa State

Objectives of the Study

The aim of this study is to assess librarians' perceptions of the sustainability of Open Source Software (OSS) for library automation in academic libraries in Adamawa State, Nigeria. The specific objectives include:

1. To examine the perception of librarians regarding the use of OSS for library automation in academic libraries in Adamawa State.
2. To determine the perception of librarians regarding the sustainability of OSS in academic libraries in Adamawa State.
3. To identify the challenges librarians face in using OSS for library automation in academic libraries in Adamawa State.

Research Questions

The following research questions guided the study:

1. What are the perceptions of librarians in academic libraries in Adamawa State regarding the use of Open-

Source Software (OSS) for library automation?

2. What are the perceptions of librarians in academic libraries in Adamawa State on the sustainability of Open-Source Software (OSS) for library automation?
3. What challenges do librarians face in using Open-Source Software (OSS) for library automation in academic libraries in Adamawa State?

Hypothesis

The following null hypotheses will be tested at 0.05 level of significance.

Ho1: There is no significant difference in the mean ratings of librarians' perceptions on the adoption of Open-Source Software (OSS) for library automation in academic libraries in Adamawa Sate

Ho2: There is no significant difference in the mean ratings of librarians regarding their perception of the sustainability of Open-Source Software (OSS) for library automation in academic libraries in Adamawa State

Literature Review

Conceptual Framework

This framework highlights how librarians' perceptions, adoption factors, and sustainability strategies influence OSS implementation in academic libraries. Librarians' views on OSS's effectiveness, affordability, and sustainability are critical for adoption. Successful implementation depends on librarians having the necessary technical skills and institutional support. Key challenges, such as financial constraints, lack of technical expertise, and resistance to change, can hinder OSS adoption. Overcoming these challenges requires training, collaboration among libraries, and securing financial and institutional backing. The availability of funding, skilled technical personnel, and policy support ensures long-term OSS sustainability. Proper investment in these areas leads to enhanced library services and improved access to academic resources.

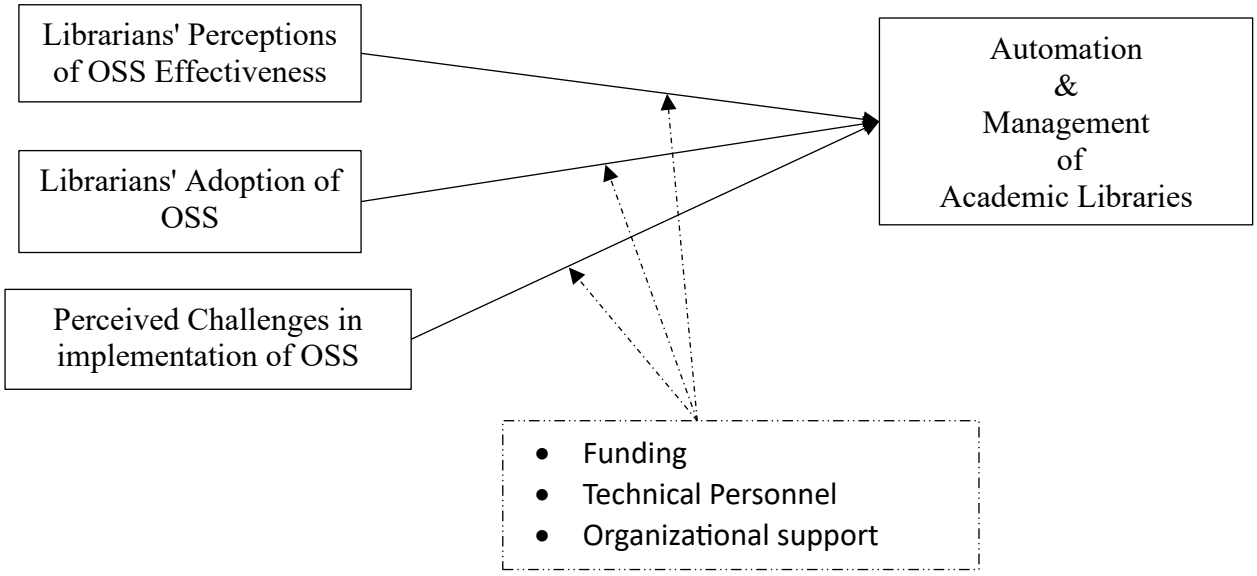

Figure 1: Conceptual Framework

Technology Acceptance Model (TAM)

The determinants of the (TAM) are perceived usefulness, ease of use, attitude, behavioral intention, and system usage (Figure 2)

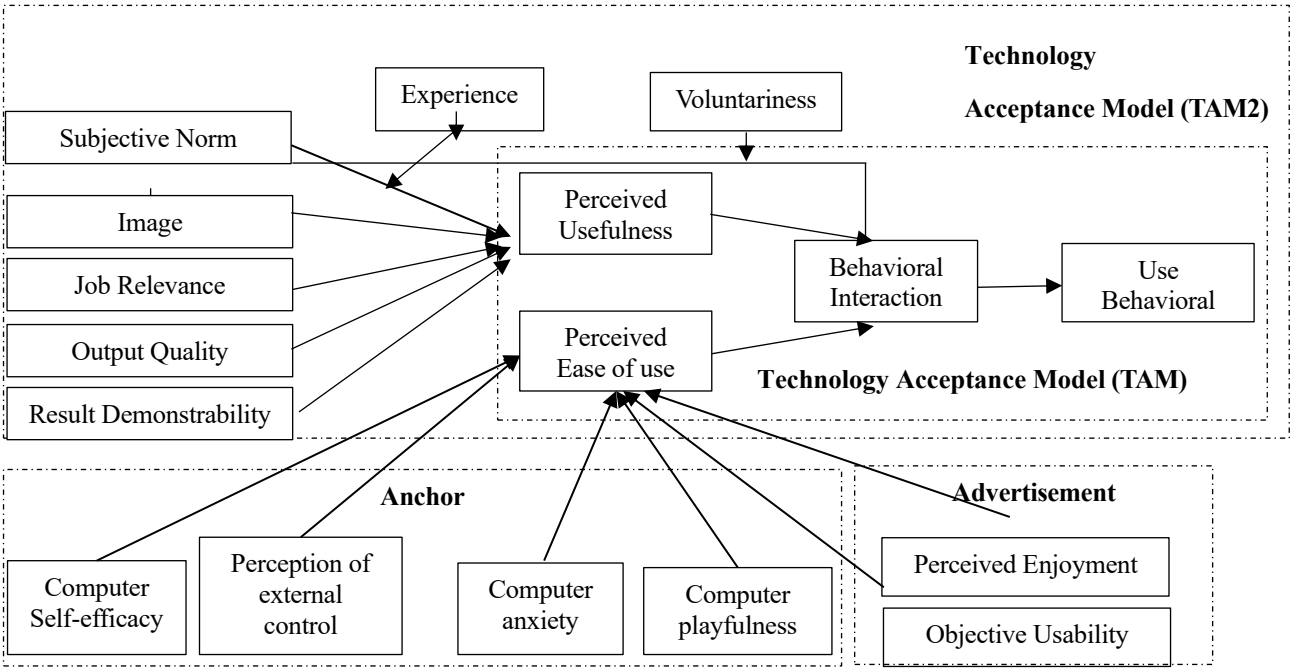

Figure 2: **Technology Acceptance Model (TAM)**

The study uses the Technology Acceptance Model (TAM) to understand the adoption of e-resources in libraries. TAM, developed by Fred Davis, explains how users come to accept and use technology. It emphasizes perceived ease of use (PEOU) and perceived usefulness (PU) as key factors influencing technology adoption. According to Davis (1989) as cited by Klappholz (2024), PEOU refers to the degree to which a system is free from effort, and PU is the degree to which a system enhances job performance.

User acceptance is higher when systems are easy to use and perceived as useful. TAM has been widely applied to various fields, including technology adoption in libraries. For this study, TAM is used to assess librarians' perceptions of OSS sustainability in academic libraries, focusing on its efficiency, cost-effectiveness, and usability. Challenges such as technical expertise, customization demands, and institutional support shape adoption, influencing OSS's long-term viability and sustainability in library automation.

Library Automation

Library automation is a critical tool in modern library management, enhancing efficiency, organization, and access to information (Oladokun & Kolawole, 2019). Automation has evolved from manual processes to computerized systems handling cataloging, circulation, and acquisitions (Njoku, 2017). The main goal is to reduce staff workload, improve service delivery, and minimize errors. Automated systems enable faster, more accurate cataloging and efficient user access to materials, technologies like barcode scanning and RFID ensure better tracking of borrowed items (Khan & Sheikh, 2022). Key automation tools include Integrated Library

Systems (ILS), digital repositories, and self-service kiosks, all of which improve efficiency and reduce reliance on physical materials (Antwi & Frimpong, 2020). However, automation presents challenges such as high implementation costs, compatibility issues with existing systems, and staff training needs (Khan & Sheikh, 2022). Looking ahead, technologies like AI, machine learning, and cloud-based systems are shaping the future of library automation, offering more flexibility and remote access (Dei & Tetteh, 2022). Despite challenges, automation continues to enhance library operations, making them more efficient and accessible (Bwalya & Akakandelwa, 2021).

Sustainability of Open Source Software in Libraries

The sustainability of Open Source Software (OSS) in libraries refers to its ability to remain functional, relevant, and supported over time without relying on commercial licensing models. Unlike proprietary systems, OSS sustainability depends heavily on collaborative development, institutional backing, and community engagement (Oladokun & Kolawole, 2019). Key dimensions of sustainability include technical, financial, community, and organizational factors. Technically, OSS must be updated regularly to ensure compatibility, security, and stability. Financially, although OSS eliminates licensing fees, sustainable use still requires ongoing investment in hardware, training, and maintenance (Yin, Chakraborty, Schweik, Frey, S., & Filkov, 2022).

Community sustainability is driven by active contributions from developers and users who maintain the software's functionality and share knowledge. Strong community support enhances adaptability and allows users to troubleshoot issues collaboratively (Yin et al., 2022). Institutional sustainability, on the other hand, involves organizational commitment, including policy support, skilled personnel, and structured implementation plans (Chisenga, 2014). Libraries that lack adequate planning or perceive OSS as temporary often experience challenges in maintaining long-term usage, even when the software is technically sound.

Negative perceptions such as doubts about support, difficulty of use, or fear of abandonment can severely limit the continued adoption of OSS. Sustaining OSS, therefore, requires deliberate strategies such as staff training, community participation, institutional funding, and integration into broader library policies. When these elements align, OSS can offer a durable and scalable alternative to proprietary systems, particularly in resource-constrained library environments.

OSS Types and Uses

Open Source Software (OSS) encompasses a wide range of software systems whose source codes are freely available for use, modification, and distribution. In the context of libraries, OSS provides a cost-effective and customizable alternative to proprietary systems, making it particularly attractive for institutions operating under limited budgets (Breytenbach & Lourens, 2020). OSS is not a singular concept but includes various types based on function and intended use. The major categories relevant to library operations include Integrated Library Systems (ILS), digital repository platforms, content management systems (CMS), and discovery tools.

Integrated Library Systems (ILS) such as Koha, Evergreen, and NewGenLib are widely used for automating core library

functions like cataloguing, circulation, acquisitions, and patron management. Among these, Koha has gained considerable global adoption due to its flexibility, strong community support, and compatibility with MARC standards (Ikoja-Odongo & Wamukoya, 2021). These systems support both print and digital collections, enabling seamless resource management in hybrid library settings.

Digital repository platforms, including DSpace, EPrints, and Greenstone, facilitate the creation, organization, and dissemination of institutional research outputs, theses, and grey literature. These systems are particularly important for academic libraries striving to support open access initiatives and improve institutional visibility (Yoon & Schultz, 2022). They allow libraries to manage digital collections with metadata standards like Dublin Core and OAI-PMH, ensuring interoperability and discoverability.

Content Management Systems (CMS) like Drupal and WordPress are also used in libraries to design user-friendly websites, portals, and intranet systems. While not library-specific, their flexibility and extensibility make them suitable for creating custom user interfaces, integrating discovery layers, and managing web-based services (Nzivo, 2019).

In addition, OSS discovery tools such as VuFind and Blacklight are employed to provide unified search interfaces across multiple library resources. These tools enhance the user experience by integrating metadata from various databases and presenting them through a single search interface (Hasan, 2020).

Overall, OSS applications in libraries have expanded significantly due to their adaptability, collaborative development model, and cost-effectiveness. As the demand for flexible and sustainable automation grows, the relevance of OSS types across different library functions continues to increase. However, successful implementation depends on institutional readiness, technical support, and staff training (Tavakol, Mirzaei, & Safarali, 2023).

Challenges of Using Open Source Software in Libraries

The adoption of Open Source Software (OSS) in libraries is often hindered by a combination of technical, financial, and institutional challenges. A major technical barrier is the limited IT expertise among library staff, particularly in developing countries where programming and system administration skills are often lacking (Okoh & Iwhiwhu, 2022). Unlike proprietary software, OSS depends heavily on community-driven support, which may not always align with the specific needs of individual institutions (Khan & Sheikh, 2022). Furthermore, maintaining and customizing OSS systems can be complex, requiring specialized knowledge that many libraries do not possess (Schellnack-Kelly, Smith, & Brown, 2021).

Financial instability further complicates OSS sustainability. Although OSS eliminates licensing fees, it introduces indirect costs such as staff training, infrastructure upgrades, and the hiring of external consultants (Okoh & Iwhiwhu, 2022). Moreover, OSS development often relies on voluntary contributions and donations, which can lead to inconsistent

technical maintenance and difficulties in retaining core developers (Dei & Tetteh, 2022). These factors increase the risk of software obsolescence, especially in the face of rapid technological changes.

Institutional resistance also presents a significant challenge. Concerns about the reliability, compatibility, and long-term support of OSS often make library administrators hesitant to adopt these systems (Khan & Sheikh, 2022). Many institutions lack clear policies to guide OSS adoption, and longstanding contracts with proprietary vendors further complicate transitions (Antwi & Frimpong, 2020). Additionally, as libraries begin to explore advanced technologies like artificial intelligence and big data, scalability concerns become more pressing (Gonzalez-Barahona, 2021).

Despite these challenges, OSS remains a viable solution for library automation—particularly when supported by strategic planning, institutional commitment, and capacity-building efforts. Addressing technical skills gaps, allocating sustainable funding, and fostering a culture of innovation are essential for overcoming barriers and achieving long-term OSS adoption in academic libraries.

Empirical review

Oladokun and Kolawole (2019) conducted an empirical study to investigate the sustainability of Koha Open Source Software in academic and research libraries across Nigeria. The study used a survey research design and purposively sampled 35 academic and research libraries known to have implemented Koha. Data were collected using a structured questionnaire and analyzed using descriptive statistics. The study found that although Koha was appreciated for its cost-effectiveness and flexibility, its sustainability was threatened by poor institutional support, limited awareness, and negative librarian attitudes. The study concluded that OSS sustainability depends largely on librarian training, policy development, and stakeholder engagement. The authors recommended increased institutional investment in technical capacity, continuous training for library staff, and the development of clear implementation policies.

Kolawole and Oladokun (2021) conducted an empirical study to examine the utilization and sustainability challenges of Koha OSS in selected Nigerian academic libraries. The study adopted a survey research design and randomly sampled academic libraries across different Nigerian states that had implemented Koha. Data were gathered through a questionnaire and analyzed using frequency counts and percentages. The study found that major barriers to sustainability included inadequate ICT skills, weak institutional commitment, and the absence of structured support mechanisms. The study concluded that the success and sustainability of OSS require more than installation; it demands institutional alignment, resource allocation, and user engagement. It recommended that institutions provide sustainable funding, structured training programs, and strong IT infrastructure support.

Dei and Tetteh (2022) conducted an empirical study to assess librarians' perceptions of OSS implementation and its implications for sustainability in Ghanaian academic libraries. The study used a survey research design and purposively sampled 65 librarians working in academic libraries that

had implemented Koha and DSpace. A questionnaire was used for data collection, and the data were analyzed using descriptive statistics and thematic analysis. The study found that while librarians acknowledged the benefits of OSS in terms of cost and flexibility, sustainability concerns arose due to limited technical skills and lack of institutional support. The study concluded that sustainability of OSS requires strategic planning and resource allocation. The researchers recommended regular training, infrastructure development, and policy integration to enhance OSS sustainability.

Antwi and Frimpong (2020) carried out an empirical study to evaluate the adoption and sustainability issues surrounding Koha and DSpace OSS in academic libraries in Ghana. The study used a survey research design and purposively selected 60 librarians from various public universities. Data were collected using a questionnaire and analyzed with SPSS using frequency distributions and cross-tabulations. The study found that despite the growing interest in OSS for library automation, sustainability was hampered by inadequate technical know-how, inconsistent funding, and limited institutional commitment. The study concluded that without systematic strategies and capacity-building, OSS implementation may not be sustained long-term. It recommended institutional collaboration, continuous technical training, and budgeting for OSS support and updates.

Khan and Sheikh (2022) conducted an empirical study to explore the trends, benefits, and sustainability challenges of OSS adoption in academic libraries in Bangladesh. The study adopted a survey research design and randomly sampled 70 librarians from institutions known to use OSS. Data were gathered through a structured questionnaire and analyzed using regression analysis and descriptive statistics. The study found that while OSS adoption was on the rise, sustainability challenges such as lack of funding, infrastructure deficits, and user resistance remained prevalent. The study concluded that sustainable OSS implementation depends on awareness, technical support, and institutional readiness. It recommended targeted training, infrastructure investment, and policy formulation as key to sustaining OSS in libraries.

Methodology

This study adopts a descriptive research design, which is suitable for studies that seek to systematically describe characteristics, perceptions, and patterns within a specific population without manipulating variables. The design is appropriate because the study aims to assess librarians' perceptions of the use and sustainability of Open Source Software (OSS) for library automation, phenomena best captured through observation and reporting of existing conditions. As noted by Onohwakpor (2018), descriptive designs are ideal for generating factual and accurate information about a group's attitudes, behaviors, and experiences at a particular point in time. The primary data collection instrument was a structured questionnaire, designed to elicit relevant responses from participants. The research focused on selected academic libraries in Adamawa State, Nigeria, which is located in the northeastern part of the country and shares borders with Cameroon, Gombe State, Borno State, and Taraba State. Yola serves as the state capital.

The target population comprised 103 librarians across six academic libraries in the

state. These include both federal and state institutions: one federal university, one state university, one federal polytechnic, one state polytechnic, one federal college of education, and one state college of education. Given the relatively small and accessible population, the study adopted a census sampling technique, involving all 103 librarians. Census sampling is recommended in such cases to enhance the representativeness and accuracy of the findings (Segall, 2021). A 4-point Likert scale questionnaire was personally administered to the respondents to ensure a high response rate and clarity of responses. Data were analyzed using descriptive statistics such as weighted mean to answer the research questions. In addition, Analysis of Variance (ANOVA) was employed to test the research hypothesis at a 0.05 level of significance

Results

Research Question 1: What are the perceptions of librarians in academic libraries in Adamawa State regarding the use of Open Source Software (OSS) for library automation?

Table 1: Rating on Perception of Librarians on Open-Source Software for library automation in Academic libraries in Adamawa State

S/n	Items	Mean	Standard Deviation	Remark
1	OSS improves library operation and reduces data loss	3.56	0.37	Agree
2	OSS is flexible and can easily adapt to future technological changes	3.15	0.41	Agree
3	OSS reduces management cost and no upgrade fees	3.17	0.14	Agree
4	OSS gives room for alteration of the programe to suit purpose	3.45	1.01	Agree
5	OSS allows community share and promotes open standard	3.66	1.13	Agree
	Grand Mean	3.40	0.66	Agree

Source: Data Analysis (2024)

Table 1 present the rating on perception of librarians on Open-Source Software in Academic libraries in Adamawa State. The results show that most Librarians agreed that OSS improves library operation and reduces data loses (Mean = 3.56, standard deviation=0.37). Also, librarians strongly agreed to the assertion that OSS has flexibility that make it suitable to face future challenge (Mean =3.15, standard deviation =0.41). The librarians strongly expressed that OSS reduces management cost due to fact that it requires no fees for upgrade. This fact was reaffirmed by most librarians across institutions in Adamawa State (Mean = 3.17, standard deviation =0.14). Likewise, the libertarians expressed strongly that open-source software gives room for alteration of the programe to suit different purposes (Mean =3.45; standard deviation =1.01). More so, majority of librarians unanimously agreed to the assertion that open-source software allows community share and promotes open standard (Mean = 3.66; standard deviation =1.13). The grand mean value 3.40 with further reveal that the sampled librarians across the tertiary institutions in Adamawa State hold agree perception about relevancy of Open-Source software in academic libraries in the state.

Research Question 2: What is the perception of academic librarians on sustainability open-source software in academic libraries in Adamawa State?

Table 2: Perception of Academic Librarians on Sustainability Open-source Software in Academic Libraries in Adamawa State

S/n	Items	Mean	Standard Deviation	Remark
1	Establishing collaborative governance and shared decision-making structures helps sustain OSS in libraries	2.90	1.19	Agree
2	Training of librarians through workshop and seminar equip them with skill to use OSS	3.23	0.13	Agree
3	There is provision for fund to support and potential upgrade of OSS	2.08	0.10	Disagree
4	Improved written procedure and best practices will sustain OSS	3.36	0.16	Agree
5	Conducting regular evaluations of OSS performance within the library context helps ensure its sustainability	2.90	0.10	Agree
	Grand Mean	3.09	0.34	Agree

Source: Data Analysis (2024)

Table 2 present the result on the perception of academic librarians on sustainability open-source software in academic libraries in Adamawa State. The results show that most respondents agreed that OSS is sustainable as it ensure that decision are collectively and not dependent on library alone (Mean =2.50; standard deviation =1.19). Also, most respondents expressed their view that training of librarians through workshop and seminar equip them with skill to use OSS (Mean = 3.23; standard deviation =0.13). Meanwhile, most of librarians disagreed to the assertion that there is provision for fund to support and potential upgrade of OSS (Mean = 2.08; standard deviation =0.10). Though, the librarians agreed that improving written procedure ad best practices will sustain OSS. This fact was pointed out by majority of sampled librarians across tertiary institutions in Adamawa State (Mean=3.26; standard deviation =0.16). Likewise, most respondents agreed that periodic evaluation of OSS within the library context help in sustaining OSS (Mean =2.90; standard deviation =0.10). Furthermore, the grand mean value 3.09 which is greater than 2.50 suggest that the librarians opined that OSS is sustainable in academic libraries.

Research Question 3: What are the challenges militating against the use of Open-source software by academic librarians?

Table 3: Perception of Librarians on Challenges Militating Against Use of Open-source Software in Academic Libraries

S/n	Items	Mean	Standard Deviation	Remark
1	Absence of constant training for Librarians	3.25	0.13	Agree
2	Non-existent of adequate technical skills about OSS	3.02	0.82	Agree
3	Inconsistent update of OSS	3.10	1.31	Agree
4	inadequate ICT facilities	3.28	0.95	Agree
5	Constant power fluctuation	3.61	0.15	Agree
6	Inadequate funding	3.21	0.11	Agree
	Grand Mean	3.25	0.58	Agree

Source: Data Analysis (2024)

Table 3 present the perception of librarians on challenges militating against use of open-source software in academic libraries. The result shows that respondents agreed that absence of constant training for librarians is among the challenges militating against open-source software in Academic library (Mean =3.25; standard deviation =0.13). Also, most respondents indicated non-existent of adequate technical skills about open-source software in academic library (Mean = 3.02; standard deviation =0.82). More so, the respondents indicated that inconsistent update of OSS is one of the challenges militating against its adopting in academic library (Mean =3.10; standard deviation =1.31). Inadequate ICT facilities is among the factors militating against adoption of OSS in academic library. This fact is pointed out by most librarians (Mean = 3.28; standard deviation =0.95). The constant power fluctuation was indicated by majority of librarians as one of the factors affecting adoption of OSS in academic library (Mean = 3.61; standard deviation =0.15). Inadequate funding was indicated by majority of respondents as factors militating against the adoption of OSS in academic library (Mean =3.21; standard deviation =0.11). The grand mean value of 3.25 which is higher than 2.50 suggest the fact that the librarians agreed to the assertion that different factors are limiting the adoption of open-source software in their academic institution.

Hypothesis 1: There is no significant difference in the mean ratings of librarians' perception about adapting open-source software in academic libraries.

Table 4: ANOVA on Differences in Mean Rating of Perception of Librarians on Adapting Open-Source Software in Academic Libraries

Stat	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.692	5	.138	.575	.719
Within Groups	23.352	97	.241		
Total	24.044	102			

Results on Table 4 present the outcome of Analysis of variance of the differences among the mean rating of librarians about their perception on adoption of OSS in academic library. The result reveal F-ANOVA value 0.575, at degree of freedoms of 5, 97,

p-value >0.05. Since calculated p-value (0.710) is greater than hypothetical p-value (0.05). This implies that the perception of librarians about adoption of OSS in academic library were not significantly difference. The null hypothesis was retained.

Hypothesis 3: There is no significant difference in the mean ratings of librarians on their perception of sustainability of Open-source software in academic libraries.

Table 5: ANOVA on Differences in Mean Rating of Perception of Librarians on Sustainability of Open-source Software in Libraries

Stat	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.464	5	.893	1.786	.123
Within Groups	48.499	97	.500		
Total	52.963	102			

Results on table 5 present the outcome of analysis of variance of the differences among the mean ratings of librarians about their perception on substantiality of OSS in academic library. The result reveal F-Anova value 1.786, at degree of freedoms of 1.786, p-value >0.05. Since calculated p-value (0.123) is greater than hypothetical p-value (0.05). This implies that the perception of librarians are unique about sustainability of OSS in academic library.

Discussion of Findings

Objective One: To examine the perception of librarians regarding the use of OSS for library automation in academic libraries in Adamawa State

Findings from the study reveal that librarians have a generally positive perception of OSS use in academic libraries. They agreed that OSS enhances library operations by offering flexibility, cost-effectiveness, and room for customization. This perception reflects librarians' awareness of OSS's ability to streamline library functions such as cataloguing, circulation, and digital archiving. The implication is that while librarians are open to OSS adoption, this must be supported by capacity development to realize its full potential in automation.

This finding aligns with Gonzalez-Barahona (2021), who emphasized that OSS improves operational efficiency and allows for community-driven enhancements. Similarly, Anjaneya and Lalitha (2020) noted that OSS reduces software acquisition and upgrade costs while promoting adaptability—key benefits for resource-constrained libraries. However, these positive perceptions are conditional on adequate infrastructure and institutional support, as emphasized by Nunekpeku (2019), who found that OSS adoption in developing regions can be hampered by insufficient technical know-how.

Objective Two: To determine the perception of librarians regarding the sustainability of OSS in academic libraries in Adamawa State

The findings suggest that librarians believe OSS is sustainable when supported by strategies such as staff training, proper documentation, periodic evaluations, and institutional funding. However, there was disagreement on whether sufficient funding and upgrade mechanisms currently exist,

indicating skepticism about financial sustainability.

These results are consistent with Okoh and Iwhiwhu (2022), who emphasized that sustainability is supported by continuous staff training, collaboration, and community support. Antwi and Frimpong (2020) also highlight that financial and organizational commitment are critical to OSS continuity. Conversely, Schellnack-Kelly et al. (2021) caution that sustainability is often threatened by the lack of skilled personnel and inconsistent technical maintenance, reinforcing concerns expressed by participants in this study. Thus, while OSS is seen as potentially sustainable, actual sustainability depends on strategic institutional investment, both financially and technically.

Objective Three: To identify the challenges librarians face in using OSS for library automation in academic libraries in Adamawa State

Respondents reported numerous challenges, including inadequate ICT infrastructure, lack of technical expertise, insufficient training, unstable electricity, and lack of institutional funding. These barriers significantly hinder the full implementation and sustainability of OSS solutions. The implication is that technical and financial preparedness are essential for overcoming these challenges and sustaining OSS in academic libraries.

These findings reinforce earlier work by Haravu (2020), who found that while OSS like Koha is well-regarded, implementation often falters due to a shortage of trained personnel and unreliable infrastructure. Dei and Tetteh (2022) similarly pointed out that technical limitations, such as difficulty in customization and poor local support, remain major setbacks for libraries in developing countries. Okoh and Iwhiwhu (2022) further noted that frequent OSS updates require ongoing training, without which librarians may feel overwhelmed, resulting in low adoption or misuse.

The hypothesis tested in this study examined whether there is a significant relationship between librarians' demographic characteristics and their perception of OSS sustainability. The result of the ANOVA revealed no statistically significant relationship, suggesting that librarians' perceptions of OSS sustainability are not influenced by demographic factors such as age, gender, or academic qualification.

This implies that efforts to promote OSS adoption and sustainability should focus more on institutional and systemic support, rather than demographic targeting. The finding is consistent with Gonzalez-Barahona (2021), who stated that OSS success depends more on training, policy, and infrastructure than on individual user attributes.

Conclusion

This study explored librarians' perception of the use and sustainability of open-source software (OSS) for library automation in academic libraries in Adamawa State, Nigeria. The findings provide clear insights into the perceptions, sustainability prospects, and challenges associated with OSS adoption in academic library settings. Firstly, the study found that librarians generally hold a positive perception of OSS. They agreed that OSS enhances the quality and efficiency of library operations due to its flexibility, cost-effectiveness, and capacity for customization. OSS was seen as a viable alternative to expensive proprietary software, particularly in resource-

constrained institutions. Librarians acknowledged that OSS promotes collaboration through community-driven improvements and open standards, allowing libraries to tailor software to their unique needs.

Secondly, the study revealed that librarians also perceive OSS as sustainable when certain conditions are met. Sustainability was viewed through multiple lenses—technical, financial, and organizational. Participants agreed that training programs, written procedures, periodic evaluations, and strong institutional commitment are critical to sustaining OSS over time. However, there was skepticism about the availability of consistent funding and infrastructure to support long-term use, highlighting the need for deliberate planning and strategic investment. Thirdly, the study identified several challenges affecting OSS adoption and sustainability. These included the lack of technical staff, insufficient training opportunities, inadequate ICT infrastructure, unreliable power supply, and limited financial support. These barriers reflect the broader systemic issues confronting academic libraries in Nigeria, especially in under-resourced states like Adamawa. Without addressing these issues, the potential of OSS cannot be fully realized. Also, from hypothesis, the study found no statistically significant relationship between librarians' demographic characteristics and their perceptions of OSS sustainability. This suggests that perceptions are shaped more by institutional experiences and infrastructural realities than by age, gender, or qualification.

Therefore, this study underscores the importance of institutional support, continuous training, infrastructure development, and policy direction in ensuring the successful adoption and sustainability of OSS in academic libraries. While librarians are generally open to embracing OSS, its long-term effectiveness hinges on strategic capacity building, stakeholder buy-in, and sustained funding. With these measures in place, OSS remains a reliable and transformative solution for library automation in Nigerian academic institutions.

Recommendations

Based on the findings derived from the three research objectives of this study, the following recommendations are made:

1. Since librarians generally perceive OSS as beneficial for enhancing service delivery, institutions in Adamawa State should strengthen awareness and advocacy programs to promote broader understanding and support for OSS. This includes sensitizing both librarians and management on the cost-saving and flexibility advantages of OSS.
2. To improve OSS sustainability, institutions in Adamawa State should organize regular workshops and seminars to train librarians and IT personnel in OSS maintenance, customization, and updates
3. The institutions in Adamawa State, should invest in upgrading ICT infrastructure, including hardware, internet connectivity, and system compatibility, to create an enabling environment for OSS functionality.

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