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Examining the types and purpose of cloud computing used for library services delivery in academic libraries in Kwara State, Nigeria

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Abstract

Background of the study: The implementation and integration of information and communication technology in library services and operations has revolutionized traditional practices, enabling libraries to adapt to the evolving needs of users in the digital era.

Purpose: The main purpose of this study is to examine the types and purposes of cloud computing used for library service delivery in academic libraries in Kwara State, Nigeria.

Methods: The study used a descriptive survey approach. The population was all the 108 librarians in the eight universities in Kwara State, Nigeria. A total enumeration sampling technique was employed, and a questionnaire was used to collect data from the librarians. The study answered three research questions.

Findings: The study revealed that OCLC, Word cat, Google Docs, and other types of cloud computing are being utilized by the librarians. The study also revealed that poor internet connectivity, among other challenges, militates against the use of cloud computing for academic library service delivery.

Conclusion: The study concluded that the librarians make use of cloud computing for library services. The study recommends that the library should provide reliable internet facilities with fast speeds, high broadband, and reliable power supplies, among others.

Keywords: *Cloud Computing, Academic Libraries, Service Delivery, ICT, Librarians*

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Introduction

The incorporation of information and communication technologies (ICTs) into library services has transformed traditional methods, allowing libraries to meet evolving user demands in today's digital era. ICTs have not only enhanced access to information but also streamlined library operations, broadening the array of resources accessible to patrons (Inyang, 2016). These technological advancements have instigated substantial shifts across multiple sectors, such as education, healthcare, business, and entertainment. They have redefined information creation, storage, dissemination, and consumption, fostering improved efficiency, connectivity, and avenues for collaborative innovation (Earl et al., 2014). Cloud computing, a key ICT, has revolutionized the management and utilization of computing resources for organizations. These services offer flexible access to scalable computing capabilities, storage, applications, and more via the internet. For organizations aiming to leverage the advantages of this technology, understanding its diverse offerings is crucial (Srivastava & Verma, 2015). Nevertheless, despite the global strides in ICT integration within libraries, disparities and challenges persist across various regions and institutions. Issues like inadequate infrastructure, limited financial resources, digital skill gaps, and resistance to technological change hinder the full potential of the ICT transformation in libraries (Chutia, 2015).

Cloud computing services offer an efficient solution for delivering services in university libraries. Implementing cloud computing can significantly enhance the quality of library services by ensuring visually appealing and user-friendly library websites. This not only enhances the library's online presence but also improves its reputation for quality web-based service delivery. According to Dinesh et al. (2015), adopting cloud computing in academic libraries enables innovative and efficient operations. This flexibility allows for the seamless transition from traditional barcode systems to advanced Radio-Frequency Identification (RFID) technologies for library items (Acharya, 2019). Given the global trends in cloud computing technology and its successful application in university libraries worldwide, there is an imperative to embrace these innovations in Nigeria, particularly in university libraries in Kwara State, to harness the extensive benefits of cloud computing for library services.

Makori & Mauti (2016) articulated that modern libraries are adopting innovative digital systems with the aim of ensuring that the institutions and users access timely and relevant information and knowledge resources irrespective of their location. This has been due to a sudden transformation in the way accessibility of information has dynamically shifted to virtual platforms. Yuvaraj (2015b) stated that nowadays, phones, laptops, and tablets are found everywhere owing to their ease in portability and improved computing power. This prompts academic libraries to provide services and information resources in the virtual environment in line with the preference of users or risk isolating them.

Khatib & Opulencia (2015) expressed that cloud computing technologies have provided libraries with great opportunities which enhance the management, access, and dissemination of information resources to users. This has greatly transformed the educational procedure and enhanced the quality of services offered in libraries. Tritt & Kendrick (2014) reiterated that with efficiency improvements and large savings in operational cost as well as upfront capital costs for tech startups, cloud computing carries the characteristics of a disruptive general-purpose technology with a potential to greatly impact the economy as a whole. According to Aher et al. (2016), cloud computing technologies permit the sharing and use of services and resources via the web instead of having them on native servers or individual devices. For example, Chunhong (2014) identified that implementation of cloud technologies among university libraries in China is manifested through the development and growth of library digital portals which consist of three features: the integration of services, resources, and the management platform.

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Cloud service provider's offer several software and hardware services that academic libraries can determine how they can become part of the cloud environment. The selected cloud computing services by academic libraries can help in saving resources where software and servers are located outside the library premises (Yuvaraj, 2016b). Yuvaraj (2016a) stated that libraries in the USA have also adopted several cloud applications like Dropbox, Libguides, Makerspaces, VMware, OfficeLive, and Bluelock in service delivery. A study conducted by Khatib & Opulencia (2015) detailed that libraries in the United Arab Emirates (UAE) found out that constant electricity disruptions and local power blackouts affected the access to online services.

Makori (2016) conveyed that in Kenya, libraries have also adopted some of these cloud solutions. The commonly used cloud-based services include emails, social media, electronic databases, institutional repositories, remote access software, and library management systems like Koha. Aher et al. (2016) opined that globally, libraries are shifting towards the implementation of cloud services with the sole purpose of improving service delivery, managing resources, and finding new avenues for growth. Subsequently, the application of cloud computing technologies eliminates the need for libraries to host multiple servers and other infrastructures within the vicinity and regularly deal with hardware breakdowns, installation, and upgrading of software, as well as compatibility problems.

Moreover, Srivastava & Verma (2015) state that cloud computing services are offered globally through global service providers in addition to being always available on demand irrespective of the size and location of the library. This popularity of cloud computing technologies in libraries has been attributed to its capability of providing quicker on-demand computing infrastructures, self-service, and independent capability to access information resources (Changchit & Chuchuen, 2018). Alkhater at al. (2017) indicated that cloud computing has been among the present-day popular technologies offering IT resources as utility services. Cloud computing technologies are valuable for private use as well as to the library users as they can access resources dynamically depending on their information requirements. However, the utilization of these technologies is quite low at the individual level.

Ashtari & Eydgahi (2015) specified that the growth of cloud computing usage presents several adoption and learning challenges to the ultimate users. The influence of users' perceptions towards these cloud computing technologies is a matter that requires further assessment and analysis. A study by Hashim & Hassan (2015) found that behavioral intention significantly influences cloud service utilization. Increased behavioral intention among users leads to higher cloud computing usage. Effort expectation also affects behavioral intent, with users at the University of Kufa finding cloud service access and usage easy. Social influence, including peers, library staff, and lecturers, strongly impacts users' behavioral intent to utilize cloud services at Kufa University.

Gambo (2017) and Hashim & Hassan (2015) affirmed that cloud computing implementation has been a hype in academic libraries, but only a few studies have discussed the way experiences of users are formed in cloud-based services, and the fundamental factors influencing the use of the technology among users. The library community can apply cloud infrastructure to amplify the power of cooperation and to build a significant, unified presence on the web. This approach to computing can help libraries save time and money while simplifying workflows. To date, the main focus of libraries moving into the cloud has been due to the need to disclose their vast collections (Gbaje & Aliyu, 2014).

Suman & Singh (2016) stated the benefits of cloud computing to libraries include easy access to data over the internet, promoting accessibility to file sharing and savings, reducing the cost of managing and maintaining IT systems, and facilitating cost-effective project collaboration. Despite the benefits of adopting cloud computing technology, there are

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challenges facing its implementation. These include security and privacy issues, application migration from one cloud to another, interoperability, computing performance, reliability, and availability (Mate, 2016). Gartner Research (2015) asserts that cloud computing is a style of computing in which massively scalable and elastic IT-enabled capabilities are delivered as a service to external customers using Internet technologies. Frost (2014) posited that cloud computing represents a paradigm shift where users no longer require expertise or control over the underlying technology infrastructure.

Given the above perspectives, it is crucial to examine the types and purposes of cloud computing used for library service delivery in academic libraries. Understanding these aspects will illuminate the specific benefits and challenges associated with cloud adoption in library contexts, providing insights into how libraries can optimize cloud technologies to enhance service delivery, improve resource management, and ultimately better serve their users. It is against this background that this study therefore, tends to examine the types and purpose of cloud computing used for library services delivery in academic libraries in Kwara State.

Research Questions

The following research questions were generated:

1. What are the types of cloud computing software used for library services delivery in academic libraries in Kwara State, Nigeria?
2. What are the purposes of using cloud computing for library services delivery in academic libraries in Kwara State, Nigeria? And
3. What are the challenges militating against the uses of cloud computing for library services delivery in academic libraries in Kwara State, Nigeria?

Literature Review

Types of cloud computing used for academic library services delivery

Cloud computing has fundamentally reshaped the landscape of information technology by transitioning from product-based to service-oriented solutions. This transformative technology leverages the internet to facilitate the transfer of computer storage and processing to remote servers. The backbone of this infrastructure comprises robust data centers, offering expansive storage capacities and a suite of applications as services to end-users, made feasible by web 2.0 technologies (Demissie & Dahiru, 2017).

In the realm of cloud computing, the term "cloud" metaphorically symbolizes the internet, drawing from the cloud-like shape often used in telecommunication schematics to represent networks. The acronym "cloud" encapsulates its key attributes: C for computing resources, L for location independence, O for online accessibility, U for utility usage, and D for on-demand availability (Swapna & Birader, 2017). Major players in the tech industry, including Amazon Web Services, Microsoft Azure, Digital Ocean, and Google Cloud Platform, offer robust cloud platforms that empower users to streamline their operations and enhance efficiency (Rittinghouse & Ransome, 2016; Stergiou, et al., 2018). These platforms encompass various cloud models like hybrid, private, and public, providing businesses with flexible data storage solutions.

One standout application of cloud computing is Google Docs, exemplifying the collaborative ethos that underpins this technology. Students can harness this platform to collaborate on documents seamlessly, transcending geographical constraints. Such online collaboration tools foster teamwork and offer students the flexibility to work synchronously from any location, enhancing their educational experience (Nithya & Selvi, 2017). These digital tools are invaluable for group assignments, seminars, presentations, documentation, and data creation, illustrating the multifaceted benefits of cloud-based collaboration.

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Purpose of using cloud computing for university library services

Nigerian universities have long recognized the pivotal role of libraries in bolstering research and learning, embracing technological advancements to optimize their capabilities. This is evidenced by the progressive digitization of Nigerian libraries and the integration of library information networks with university campus networks, facilitated by cloud computing services. Ogunsola (2015) highlighted the pioneering efforts of Mobile Telephone Network (MTN) Nigeria in establishing digital libraries at prominent institutions like Ahmadu Bello University, Zaria; University of Lagos; and University of Nigeria, Nsukka.

Yuvaraj's comprehensive studies (2014, 2015a, 2015b, 2016a, 2016b) underscored the manifold benefits of cloud computing adoption in academic libraries. These advantages encompass ease-of-use, scalability, cost-effectiveness, and enhanced accessibility, leading to a transformative shift from traditional library operations. Libraries have strategically employed various cloud-based applications, notably Email, marking the evolution of cloud computing into an indispensable tool for data storage and exchange. This technology has proven instrumental in cost savings, time efficiency, and workflow optimization for libraries (Singh & Sahu, 2017). Specific benefits include cost reduction through maintenance and server expenses, overcoming licensing constraints, promoting eco-friendly practices, facilitating adaptable performance during workload peaks, and ensuring seamless data storage and retrieval. Moreover, cloud adoption enables libraries to stay abreast of software updates, enhancing operational efficiency.

Iyer and Henderson (2015) elucidated the compelling rationale behind the integration of cloud computing in libraries. This paradigm shift empowers libraries to achieve significant cost savings by eliminating server maintenance and consultant fees. Utilizing appropriate cloud solutions fosters transparency, promotes collaboration among libraries, and simplifies workflow processes. Importantly, cloud computing diminishes the dependence on extensive IT infrastructure, reducing the need for constant upgrades and a larger IT workforce, as software management becomes the prerogative of the service provider. Embracing cloud computing allows libraries to declutter their physical spaces by minimizing IT equipment. For optimal security, libraries are advised to access cloud services via private or secure Wi-Fi connections.

Cloud computing technology benefits in libraries

Research by Srivastava and Verma (2015) underscores the manifold advantages that cloud computing brings to library operations. Their findings highlight improved file security, streamlined access with reduced security risks, an efficient virtual workspace, and enhanced information storage and retrieval capabilities. These benefits are further accentuated by Reid (2017), who points out the significant advantage of broad network access facilitated by cloud technologies. Such accessibility extends across various devices, including mobile phones, laptops, and PDAs, ensuring versatility and user-friendliness across multiple platforms.

In a similar vein, Kroski (2019) emphasizes the cost-effective connectivity offered by cloud services. This capability enables users to avail of library services seamlessly, regardless of the device or location, enhancing accessibility and user convenience. Complementing these insights, Olson (2014) identifies resource pooling as a pivotal benefit for libraries embracing cloud computing. This approach allows for the aggregation of computing resources, facilitating a multi-tenant model that dynamically allocates physical and virtual assets based on demand. Such pooled resources encompass storage, processing capabilities, memory, network bandwidth, virtual machines, and email services, ultimately driving economies of scale for libraries.

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Challenges that militate against the use of cloud computing for university library services

While cloud computing promises transformative benefits for university libraries, its adoption is not without challenges. One of the foremost obstacles is the financial constraint faced by academic libraries, as highlighted by Jain (2017). Limited budgets often hinder these institutions from investing in the necessary infrastructure required for robust cloud computing services. Unlike their counterparts in the private sector, academic libraries grapple with resource limitations, making it challenging to fully embrace cloud technologies for web-based services (Roknuzzaman & Umemoto, 2019).

In addition to financial constraints, inadequate ICT facilities pose another significant challenge. The absence or insufficiency of essential equipment like monitors, power supply units, printers, and photocopiers further impedes the seamless adoption of cloud computing in academic settings. Beyond these tangible challenges, the issue of data privacy and security remains a paramount concern. Yuvaraj's (2015) underscores the complexities of ensuring the confidentiality and security of cloud-stored data. Such concerns deter potential users from fully embracing cloud technologies, given apprehensions about entrusting sensitive digital information to third-party providers (Tritt & Kendrick, 2014; Sahu, 2015). Furthermore, libraries and their patrons remain wary about data ownership and the potential risks associated with cloud storage, such as unauthorized access or data loss. The opacity surrounding service providers' hiring practices, access protocols, and oversight methods further exacerbates these apprehensions, contributing to the broader challenge of building trust in cloud computing solutions.

Security issues in cloud computing

Cloud computing, with its diverse range of technologies like virtualization, activity frameworks, and resource allocation, has become integral to modern business applications. This encompasses a broad spectrum of services including Software as a Service (SaaS), Web Services, Platform as a Service (PaaS), Managed Service Providers (MSP), Service Commerce, and Internet Integration. However, despite its widespread adoption, there are lingering concerns about the reliability and security of educational applications associated with these cloud technologies.

Satyanarayanan (2017) emphasizes that while cloud computing offers numerous benefits, it also presents challenges in ensuring data security and integrity. Service providers often grapple with effectively managing web applications, services, and data hosted in the cloud. This can result in availability risks and increase the vulnerability to malicious attacks, jeopardizing sensitive data. To bolster the security of SaaS, key considerations include network security, data confidentiality, data integrity, data locality, and robust access control mechanisms (Li et al., 2018). While SaaS provides a promising infrastructure for business growth, it is imperative to address potential security pitfalls. Issues like host and system interruptions require meticulous control and management to safeguard customer interests. Moreover, ensuring uninterrupted power supply and devising effective mitigation strategies for potential issues are paramount.

Despite the advantages of on-demand access and diverse interfaces offered by cloud services, the existing cloud standards fall short in providing robust data security and seamless integration with new hosts. The multifaceted nature of cloud computing, which encompasses applications, platforms, and infrastructure, poses challenges for service providers in managing resources efficiently (Mokhtar et al., 2016). As organizations and individuals continue to leverage cloud computing for diverse needs, proactive measures and stringent security protocols are essential to mitigate risks and ensure data protection.

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Method

Research Design

The research study utilized a survey research design to explore the types and purposes of cloud computing used for library services delivery in academic libraries.

Population and Sample

The study included a population of 108 librarians and library officers from eight university libraries in Kwara State.

Sampling Technique and Sample Size

The entire population was included in the study using a total enumeration technique, resulting in a sample size of 108 participants.

Instrument for Data Collection

Data collection was done through the administration of a questionnaire titled "Types and Purpose of Cloud Computing Used for Library Services Delivery in Academic Libraries (TPCCLSDAL)" scale. The questionnaire was divided into four sections:

1. Demographic Information: Institution, highest qualification, age, gender, years of work experience, and professional status.
2. Types of Cloud Computing Software: Adapted from a scale developed by Aiyebelehin et al. (2020), with responses of 1 for YES, 2 for NO, and 3 for NOT SURE.
3. Purpose of Cloud Computing for Library Services Delivery: Adapted from Zubairu et al. (2021), consisting of thirteen items with a response scale from 1 for strongly agree (SA) to 4 for strongly disagree (SD).
4. Challenges Hindering the Use of Cloud Computing: Adapted from a scale developed by Aiyebelehin et al. (2020), consisting of seven items with a response scale from 1 for strongly agree (SA) to 4 for strongly disagree (SD).

Validity of the Instrument

The scales used in the questionnaire were adapted from previously developed and validated scales by Aiyebelehin et al. (2020) and Zubairu et al. (2021). To ascertain both face and content validity of these instruments, the items were evaluated by three expert in the field of library and information Science Research. All comments and observations were implemented prior to administering the questionnaire.

Procedure for Data Collection

The questionnaire was distributed to the librarians and library officers in all eight university libraries in Kwara State by three research assistants who had undergone a two-day training on proper distribution methods. A total of 108 copies of the questionnaire were distributed, completed, and returned, achieving a response rate of 100%. Table 1 provides an overview of the distribution of the questionnaires and the response rate across the participating academic libraries in Kwara State, Nigeria.

Data Analysis

The collected data were analyzed using the Statistical Product and Service Solution (SPSS) version 26.0, utilizing frequency counts and percentages to interpret the responses.

Ethical Consideration

The study ensured ethical considerations by obtaining the cooperation of the respondents and training research assistants to properly and respectfully distribute the

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questionnaires. The confidentiality and anonymity of the respondents were maintained throughout the research process.

Result and Discussion

Response Rate

Table 1. Distribution of questionnaire and response rate

Distributed Questionnaire	Retrieved Questionnaire	Valid	Percentage (%)
108	108	108	100

The total number of 108 copies of questionnaires was administered to the librarians and library officers in the eight universities in Kwara State. All the 108 copies were retrieved and valid which resulting as response rate of 100%. As shown in table 1.

Demographic Information of the Respondents

Table 2. Distribution of the respondents based on institution

Institution	Frequency	Percentage (%)
University of Ilorin Library	62	57.4
Kwara State University Library	13	12.0
Al-Hikmah University Library	13	12.0
Landmark University Library		8.3
Summit University Library	3	2.8
Ojaja University Library	4	3.7
Thomas Adewunmi University Library	2	1.9
Ahman Pategi University Library	2	1.9
Total	108	100.0

The results in Table 2 showed that, out of the 108 respondents, 62 of them representing 57.4% are working in Unilorin library; 13(12.0%) are working in KWASU and Al-Hikmah library respectively; 9(8.3%) are working in Landmark library; 3(2.8%) are working in Summit; 4(3.7%) are working in Ojaja library and 2(1.9%) are working in Thomas Adewunmi and Ahman Pategi library respectively. This shows that majority of the respondents were from Unilorin library while Thomas Adewunmi and Ahman Pategi were the lowest. In summary, the majority of the respondents were from University of Ilorin library.

Table 3. Distribution of the respondents based on qualification

Highest Qualification	Frequency	Percentage (%)
ND	6	5.6
HND	13	12.0
BSc	56	51.9
MSc	24	22.2
PhD	9	8.3
Others	0	0.0
Total	108	100.0

The results in Table 3 showed that, out of the 108 respondents, 6 out of them representing 5.6% were ND holders;13(12%) were HND holders; 56(51.9%) were BSc holders; 24(22.2%) were MSc holders; while 9(8.3%) were PhD holders. This implies that most of the respondents were BSc holders while MSc holders followed and ND holders were the lowest.

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Table 4. Distribution of the respondents based on age

Age	Frequency	Percentage (%)
30 and below	25	23.1
31 – 40	56	51.9
41 – 50	20	18.5
51 – 60	7	6.5
61 and above	0	0.0
Total	108	100.0

The results in Table 4 revealed the age range of the respondents, 25 of them representing 23.5% were 30 years and below; 56(51.9%) were within the age range of 31-40; 20(18.5%) were within the age range of 41-50; 7(6.5%) were within the age range of 51-60. In summary, it can be deduced that majority of the respondents were within the age range of 31 to 40 while the lowest were within the age range of 51 to 60.

Table 5. Distribution of the respondents based on gender

Gender	Frequency	Percentage (%)
Male	70	64.8
Female	38	35.2
Total	108	100.0

The results in Table 5 revealed that, 70(64.8%) of the respondents were males, while the remaining 38(35.2%) were females. This indicates that more male respondents participated in the study than their female counterpart.

Table 6. Distribution of the respondents based on years of working experience

Years of work experience	Frequency	Percentage (%)
1 – 5	29	26.9
6 – 10	44	40.7
11 – 15	25	23.1
16 – 20	10	9.3
Total	108	100.0

The results in Table 6 revealed the years of work experience of the respondents, 29(26.9%) has worked for 1-5 years; 44(40.7%) has worked for 6-10 years; 25(23.1%) has worked for 11-15 years while the remaining 10(9.3%) has worked for16-20 years. This indicates that majority of the respondents have 6-10 years of working experience while the librarians with lowest years of work experience were 16-20 years.

Table 7. Distribution of the respondents based on professional status

Professional Status	Frequency	Percentage (%)
Library Officer	37	34.3
Librarian	71	65.7
Total	108	100.0

The results in Table 7 showed that, from the 108 respondents, 71 representing 67.7% were librarians (professional librarians) while the remaining 37(34.3%) were library officers (para-professional librarians).

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Research Question One (1): what are types of cloud computing software used for library services delivery in academic libraries in Kwara State, Nigeria?

Table 8. Types of cloud computing software used for library services delivery in academic libraries in Kwara State, Nigeria

Statements	Yes	No	Not sure
OCLC	81(75.0%)	19(17.6%)	8(7.4%)
World cat	80(74.1%)	22(20.4%)	6(5.6%)
Google docs	59(54.6%)	39(36.1%)	10(9.3%)
Discovery services	49(45.4%)	48(44.4%)	11(10.2%)
OSS Lib	49(45.4%)	42(38.9%)	17(15.7%)
Scribd	50(46.3%)	44(40.7%)	14(13.0%)
Encore	54(50.0%)	34(31.5%)	20(18.5%)
Exlibris	54(50.0%)	29(26.9%)	25(23.1%)
Polaris library system	49(45.4%)	31(28.7%)	28(25.9%)
Duraspace	52(48.1%)	30(27.8%)	26(24.1%)
Alexandria	35(32.4%)	48(44.4%)	25(23.1%)
Ex-Libris cloud	30(27.8%)	51(47.2%)	27(25.0%)

The results in Table 8 revealed the types of cloud computing software used for library services delivery in academic libraries in Kwara State are OCLC 81(75.0%); Wordcat 80(74.1%); Google docs 59(54.6%); Discovery services; OSS Lib and Polaris library system 49(45.4%) respectively; Scribd 50(46.3%); Encore and Exlibris 54(50.0%) respectively; Duraspace 52(48.1%); Alexandria 48(44.4%). This implies that OCLC and World cat are the most types of cloud computing used by the librarians from positive (Yes) response to them. While Alexandria 51(47.2%) and Ex-Libris cloud has negative response (No). It indicates that Alexandria and Ex-Libris cloud were not really being used by the librarians.

Research Question Two (2): what are the purposes of cloud computing for library services delivery in academic libraries in Kwara State, Nigeria?

Table 9. Purpose of cloud computing software used for library services delivery in academic libraries in Kwara State, Nigeria

Statements	Strongly Agree	Agree	Disagree	Strongly Disagree
To store files online	67(62.0%)	40(37.0%)	1(0.9%)	0(0.0%)
To store collaborative writing output	58(53.7%)	49(45.5%)	1(0.9%)	0(0.0%)
To store personal photos and videos	12(11.1%)	13(12.0%)	68(63.0%)	15(13.9%)
To assist users in information resources provision/ federated search	47(43.5%)	57(52.5%)	4(3.7%)	0(0.0%)
To store both received and sent mails	46(42.5%)	52(48.1%)	9(8.3%)	1(0.9%)
To store the output of professional collaborative research	46(42.5%)	57(52.5%)	4(3.7%)	1(0.9%)
Use it for file sharing services to users	44(40.7%)	61(56.5%)	2(1.9%)	1(0.9%)

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Use it to store created document/office software	46(42.6%)	60(55.6%)	1(0.9%)	1(0.9%)
To assist library users in information retrieval	50(46.3%)	54(50.0%)	3(2.8%)	1(0.9%)
To assist in providing document delivery services to users	50(46.3%)	54(50.0%)	3(2.8%)	1(0.9%)
Use it to create, upload and save newsletters, new arrivals and forthcoming events for user community	49(45.4%)	54(50.0%)	4(3.7%)	1(0.9%)
Use it for users records maintenance/ storage/creating alerts to users based on SDI	42(38.9.8%)	63(58.3%)	2(1.8%)	1(0.9%)
Use it for file synchronization services	17(15.5%)	36(33.3%)	53(49.1%)	2(1.9%)

The results in Table 9 revealed the purposes of using cloud computing for library services delivery in academic libraries in Kwara State were to store files online 67(62.0%); to store collaborative writing output 58(53.7%); to assist library users in information retrieval and to assist in providing document delivery services to users 50(46.3%) respectively. This implies that with the use of cloud computing, librarians can store files and information online, provides information retrieval services to users and provide document delivery service online. On the other hand, the librarians disagreed to statement: to store personal photos and videos 68(63.0%). This indicates that the librarians were not using of cloud computing for personal purpose.

Research Question Three (3): what are the challenges that militate against the use of cloud computing for library services delivery in academic libraries in Kwara State, Nigeria?

Table 10. Challenges that militate against the use of cloud computing software used for library services delivery in academic libraries in Kwara State, Nigeria

Statements	Strongly Agree	Agree	Disagree	Strongly Disagree
Poor internet connections	65(60.2%)	40(37.0%)	3(2.8%)	0(0.0%)
Unreliable power supply	56(51.9%)	49(45.4%)	3(2.8%)	0(0.0%)
Poor technical knowledge among library personnel	10(9.3%)	16(14.8%)	70(64.8%)	12(11.1%)
Technical problems associated with the use of cloud computing	12(11.1%)	38(35%)	57(52.8%)	1(0.9%)
Poor funding of the library	43(39.8%)	60(55.6%)	3(2.8%)	2(1.9%)
Problem of data security	10(9.3%)	10(9.3%)	60(55.6%)	28(25.9%)

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Problem of data privacy	9(8.3%)	10(9.3%)	62(57.4%)	27(25.0%)

The results in Table 10 revealed some of the challenges that militate against the use of cloud computing for library services in academic libraries in Kwara State are poor internet connections 65(60.2%); unreliable power supply 56(51.9%) and poor funding of the library 43(39.8%) among others. This implies that if these challenges persist, it may hinder the use of cloud computing effectively by the librarians. On the other hand, the librarians disagreed to statements: problem of data security 10(9.3%) and problem of data privacy 9(8.3%). This indicates that the two are not part of the challenges militating against the use of cloud computing for university library services.

Discussion

The results of this study indicate that respondents with BSc and MSc degrees have a higher proportion in the frequency distribution. Additionally, male respondents have a larger ratio compared to female respondents, Furthermore, the age range of 31-40 years has the highest response rate among the participants. In terms of work experience, respondents with 6-10 years of experience have the highest ratio in the frequency distribution.

The findings of this study reveal the various types of cloud computing used for delivering library services in academic libraries in Kwara State. These include OCLC, WorldCat, Google Docs, Discovery Services, OSS Lib, Polaris Library System, Scribd, Encore, Ex Libris, DuraSpace, Alexandria, and Ex Libris Cloud. These findings are consistent with a study conducted by Aiyebelehin et al. (2020), which discovered that librarians in selected universities in Edo State frequently utilize cloud computing platforms such as OCLC, WorldCat, and Ex Libris for their library services. However, they showed a lack of awareness and usage of OSS Lib. Furthermore, Zubairu et al. (2021) identified Software as a Service (SaaS) as the predominant cloud computing technology employed in university administration, surpassing other cloud service technologies in usage. These findings align with the study by Dime and Okeji (2023), who explored the use of cloud computing technologies by librarians in university libraries across Africa. Their results revealed that the most commonly mentioned cloud computing technologies were YouTube, Google Drive, Online Public Access Catalog (OPAC), Google Forms, Gmail, and Google Scholar. This is supported by Akanbi et al. (2022), who examined cloud computing vendors and services adopted by academic libraries. Prominent vendors included Alexandria, OCLC, Google Cloud, and DuraSpace, offering services like e-book lending, document sharing, digital preservation, e-learning, and user interactions. This highlights the diverse cloud computing solutions used to enhance library operations and services.

The study reveals that academic libraries in Kwara State use cloud computing for various purposes. They employ it for online file storage, collaborative writing, and providing information resources to users. Additionally, it serves as a repository for research outputs, manages emails, offers file-sharing services, and stores documents. Cloud computing aids in information retrieval, document delivery, and maintaining user records. It also facilitates creating and sharing newsletters and alerts based on user preferences. These findings are consistent with the study conducted by Aiyebelehin et al. (2020), which revealed that a significant number of librarians rely heavily on cloud computing to streamline library functions. These findings align with the existing literature, especially the publication by Dime and Okeji (2023), which found that the primary purpose for librarians' use of cloud computing technologies was to store and share files. They also used these technologies for sharing videos related to library orientations or other video content, as well as collaborating with other librarians on research projects. These findings are in consonance with the study by Akanbi et

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al. (2022), who explored the impact of cloud computing on academic services. The researchers found that cloud computing facilitates various aspects, including data searching, file storage, accessing scholarly content, web hosting, library automation, and digital preservation and repository management.

The study's findings have highlighted several challenges that hinder the implementation of cloud computing for delivering library services in academic libraries in Kwara State. These challenges include internet connectivity, unreliable power supply, and insufficient funding for the library. These factors significantly impede the utilization of cloud computing for university library services in Kwara State. This finding is consistent with a study conducted by Kayode et al. (2020), who highlighted challenges including a lack of in-house expertise, unstable power supply, scarce resources, deficient ICT infrastructure, hardware failures, and insufficient internet connectivity. These obstacles significantly hinder the integration of cloud computing for web-based services in academic libraries across Kwara State. Similarly, Aiyebelehin et al. (2020) noted that librarians encounter major challenges in adopting cloud computing services due to poor internet connectivity, erratic power supply, and inadequate funding for library resources. These findings correlate with the study by Omehia and Tom-George (2020), who identified three key challenges faced by the Ignatius Ajuru University of Education library in adopting cloud computing technologies: concerns over data insecurity and privacy, high infrastructure costs, and internet connectivity failures. These findings support the study by Dime and Okeji (2023), which also identified several challenges encountered by librarians in adopting cloud computing technologies. The majority cited concerns over the security and privacy of data as a challenge. Lack of knowledge and awareness about cloud computing technologies was also a significant challenge mentioned. Furthermore, a lack of skills in using cloud computing technologies was indicated as a barrier, and low internet connectivity was cited as a challenge to adopting cloud computing technologies. This is supported by Akanbi et al. (2022), who revealed that libraries face challenges in adopting cloud computing services, such as data security and privacy concerns, lack of technical skills, maintenance issues, budget constraints, connectivity problems, high costs, and dependency on service providers, cloud management difficulties, and limited internet bandwidth.

Conclusion

The study underscores the paramount importance of cloud computing in enhancing academic library services. It validates that cloud technology bolsters both security and accessibility, enabling users to access resources remotely while facilitating cost-effective testing and evaluation of materials. One of the standout advantages highlighted is the potential for cost reduction by dynamically adjusting hardware and software resource consumption, thereby optimizing operational expenses. The research also delineates various cloud computing platforms utilized in academic libraries, including OCLC, WorldCat, Google Docs, Discovery services, OSS Lib, Polaris Library System, Scribd, Encore, Exlibris, Duraspace, Alexandria, and Ex-Libris. Additionally, the study sheds light on the primary reasons academic libraries embrace cloud computing. However, it also pinpoints challenges impeding its widespread adoption, such as limited funding from parent organizations, inconsistent power supply, and subpar internet connectivity.

Based on the study's findings, the following recommendations were provided: 1) Academic libraries should ensure uninterrupted power supply by having an alternative power source readily available for the library. This will enable them to fully utilize cloud computing for its intended purpose; 2) Academic libraries should strive to maintain the advantages and benefits associated with the use of cloud computing in order to enhance the delivery of effective services to their users; 3) It is crucial to provide good and reliable internet facilities with fast

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speed and high broadband connectivity to support the utilization of cloud computing for university library services, 4) The Nigerian Librarian Association (NLA) should organize workshops and conferences aimed at raising awareness and improving librarians' knowledge and understanding of emerging technologies in libraries.

The study is limited to only academic libraries in Kwara State, which may not fully represent the situation in other regions or countries. Additionally, the sample size of the libraries included in the study was small, which may limit the generalizability of the findings.

Practical and Theoretical Implications

The findings of this study have significant practical and theoretical implications for the implementation of cloud computing in academic libraries. Practically, there is a clear need for significant improvements in internet connectivity and power supply to support cloud computing initiatives effectively. Academic institutions should consider increasing funding specifically for ICT infrastructure and cloud computing services in libraries. Additionally, providing training and development opportunities for library staff to enhance their skills and knowledge in cloud computing can help mitigate some of the identified challenges. Developing and implementing supportive policies for the integration of cloud computing in library services can also facilitate smoother adoption and utilization. Theoretically, this study contributes to the understanding of technology adoption in the context of academic libraries by supporting and extending existing technology adoption models, highlighting specific challenges faced by libraries. It emphasizes the importance of contextual factors such as infrastructure and funding, which influence the adoption and implementation of technology. Furthermore, the research integrates concepts from cloud computing and library science, contributing to a more comprehensive theoretical framework for understanding technology adoption in libraries**.**

Suggestions for Further Research

Future research can build on the findings of this study by exploring a broader geographical scope, conducting similar studies in different regions or countries to compare challenges and identify common patterns or unique issues. Including a larger number of libraries in the sample can enhance the generalizability of the results. Additionally, investigating other potential challenges such as data security, privacy concerns, and the impact of cloud computing on library services and user satisfaction would provide a more comprehensive understanding. Performing cost-benefit analyses to determine the financial viability and benefits of adopting cloud computing in academic libraries is also recommended for future research.

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Authors' Contributions

All authors have contributed to the final manuscript. The contribution of all authors: conceptualization, methodology, formal analysis, writing original draft preparation, writing review and editing. All authors have read and agreed to the published version of the manuscript.

Conflict of Interest

All authors have no conflict of interest related to this study.

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