



Librarians' Perception and Use of Cloud Computing Technology for Library Services Delivery in Academic Libraries North-East Zone, Nigeria

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Abstract. The study investigated librarians' perception and use of cloud computing technologies for library service delivery in academic libraries in the North-East Zone of Nigeria. To achieve this purpose, four research questions and one hypothesis were formulated to guide the study. The study adopted a survey research design. The population comprised 209 librarians from three selected university libraries in North-East Nigeria. Since the population was manageable, a census approach was adopted, and all the 209 librarians were included in the study. The instrument for data collection was a self-developed questionnaire titled Librarians' Perception and Use of Cloud Computing for Library Services (LPUCLS). The instrument was subjected to face validation, and a reliability coefficient of 0.87 was obtained using the Cronbach Alpha statistic. Descriptive statistics of frequency distributions and percentages were used to answer Research Questions One, Two, and Three, while simple linear regression (R-value) was used to answer Research Question Four. The hypothesis was tested using the corresponding p-value at the 0.05 level of significance. The findings revealed that librarians had a positive perception of cloud computing technologies; however, the technologies were utilised to a low extent for library service delivery. The study further revealed that slow internet connectivity, epileptic power supply, inadequate technical skills, data security concerns, irregular staff training and development, and data privacy issues were the major challenges affecting the utilisation of cloud computing technologies. The study also found that librarians' perception has a significant influence on the utilisation of cloud computing technologies in academic libraries in the North-East Zone of Nigeria. The study recommended, among others, that adequate training

programmes should be provided to equip librarians with the knowledge and technical skills required for the effective utilisation of cloud computing technologies in library service delivery.

1. Introduction

The primary function of a university library is to enhance the academic endeavors of the university by delivering valuable services to its users. The university library plays a crucial role in assisting its user community, which includes postgraduate students, research scholars, and faculty members. It does so by procuring a diverse range of library resources that are relevant to the academic curriculum, as well as those associated with extracurricular and co-curricular activities, aligning with the mission and vision of the university libraries. Beyond its central academic support functions, the university library also contributes to research, publication, and the broader engagement activities of the university. With the advent of technological innovations in teaching and learning, the university library faces new challenges of dealing with growing literature and patrons which has necessitated incorporating information and communication Technologies. This involves initiatives like digitization, the creation of institutional repositories, and providing training for library personnel to effectively navigate the technological landscape. These efforts aim to ensure that the library can offer up-to-date and relevant content to its users, thus meeting the evolving needs of the academic community. In the twenty first century, library has to perform many challenging roles in addition to the traditional library services (Fagbola, Smart and Oluwaseun, 2021). Library is dealing with many

advanced operations and their resources are available not only in print format but also many resources procured, processed and disseminated in digital or electronic format in a network or cloud environment.

According to Ahmadi (2024), Cloud computing is a Technology that can provide a service through which one can use applications that are not actually installed on his/her computer, the platform is provided to you as a service by another company and accessed over the Internet. It is a Technology that harnesses the power of the Internet in conjunction with centralized, remote servers to store, distribute, and oversee data. In essence, cloud computing is the Technologies that enables users to access applications, store files, and share information via the Internet. Eneh, Oviri and Ekhortonmwen (2024) looked at cloud computing as the computing software and services that can be accessed via the internet rather than residing on a desktop or internal server. However, cloud computing services differ based on requirements. These requirements are called service models such as the followings:

Software as a Service (SaaS) necessitates libraries to make payments for access to utilize an application. The responsibility for providing data, software, and hardware maintenance to libraries lies with the service provider. Examples of such services include LibGuides, Hotmail, Survey Monkey, and Google Apps.

Platform as a Service (PaaS) offers libraries the tools and a supportive environment to adopt, test, install, and incorporate the cloud-based platform of their choice. However, the management of information systems and internet access is solely handled by the service providers, not the libraries. Examples of PaaS offerings encompass 800APP and Salesforce.

Infrastructure as a Service (IaaS) delivers storage and data-sharing services to libraries through various platforms with flexible options like an on-demand and "pay-as-you-go" model. The range of storage resources includes data centers, bandwidth, private line access, servers, server rooms, firewalls, and storage areas. Notable examples of IaaS services are Amazon's Elastic Compute Cloud (EC2) and Rackspace.

Cloud computing can transform the way information systems are built and services delivered. This offers the library a chance to broaden its influence to users regardless of their location and the time they choose. Practically anyone connected to the internet is likely to be actively involved in some form of cloud computing routinely. Whether individuals are utilizing

services such as Google's Gmail, managing their photo collections on Flickr, or conducting web searches using Bing, they are essentially participating in a cloud-based environment. Mabawonku, Babatope Anyanwu and Akintunde (2024) asserted that cloud computing comes into focus when there is need for increased capacity or added capabilities of computer without investing in new infrastructure, training new personnel, or licensing new software. Users have the ability to connect to database resources through the internet from any location, for as much time as required, without the need to be concerned about the upkeep or oversight of information Technologies infrastructure.

To effectively cope with the overwhelming volume of information available in contemporary society, it's essential to establish a means within educational institutions, such as libraries, for the efficient acquisition, processing, documentation, retrieval, and dissemination of information. Present-day education is increasingly intertwined with Information Technologies (IT), encompassing content delivery, communication, and collaboration. Tertiary institution libraries are experiencing a substantial demand for server, storage, and software resources. Libraries are transitioning their services to cloud computing Technologies, allowing them to provide services seamlessly, regardless of location or time. Within libraries, several potential applications of cloud computing have been identified, including the creation of digital libraries/repositories, data retrieval, web hosting, scholarly content searching, file storage, community building, and library automation. However, the most significant advantage of adopting cloud computing Technologies is that it operates on a utility-like model – users pay only for what they use and can deactivate it when it's no longer needed. The necessity for physically owning a server is therefore eliminated, enabling library communities to harness cloud infrastructure to enhance collaboration and establish a unified, prominent online presence. This approach to computing has not only saved libraries time and money but has also streamlined their operational processes. To date, the main focus of libraries moving into the cloud has been due to the need to disclose their vast collections (Mabawonku, BabatopeAnyanwu and Akintunde ,2024).

Anike and Otubelu (2024) stated that, application of cloud computing technologies in libraries have numerous benefits in terms of maintenance, improving computing performance, increasing storage capacity, cultivating global accessibility of library content and most important reduce the operational cost in IT investment of both hardware and software as well as

computer services. Libraries have experienced several notable advantages from this approach, particularly in areas such as streamlining maintenance, reducing costs associated with investments in IT hardware and software, as well as computer services. Furthermore, libraries have the ability to proactively prevent technological challenges such as computer virus attacks, minimize financial inefficiencies, improve the tracking of library team activities, and safeguard against software crashes and data loss. Academic libraries are increasingly integrating various cloud computing technologies into their daily operations. An exemplary instance of this is the utilization of web cataloguing tools provided by OCLC, where numerous libraries upload their cataloguing records through the shared resources service of OCLC on the web. Google Apps, OCLC Services, Ex-Libris, OSS Labs, LibLime, Polaris, Dropbox and Dura space are the major examples of cloud service in academic libraries (Adegbilero-Iwari, 2017).

Perception refers to the ability of librarians to apprehend, recognize, understand and accept cloud computing Technologies for library services. The perception of cloud computing such as Institutional repository (e.g Dspace, E-prints, Fedora and other open access repository), Web based email (e.g Gmail, Yahoo mail, Hotmail etc.), Social networking (e.g Facebook, Twitter, Whatsapp), Databases (e.g Science Direct, Ebscohost, Hinari, Agora etc.), Library website, WorldCat, Google Apps (Google Drive, Google Doc), Youtube and Dropbox for library services depend largely on the acceptance of these cloud computing. Kumar (2021) indicated that libraries are shifting their services to the cloud from which, with the help of networking and other facilities; they are able to access both their existing applications and documents from anywhere and at any time. This informs that using cloud computing enables librarians to access library resources without geographical restrictions.

Libraries can take advantage of cloud computing to get out of Technologies headache such as hardware breakdown, software problems, staff training deficiency and focus on collection building, patron services and innovation. George (2024) also added that with the adoption of cloud computing Technologies in libraries, data can be easily shared among users, and the need for local storage, maintenance and backups will equally be a thing of the past for libraries. Libraries can also take advantages of cloud computing to build digital libraries/repositories, search library data, host website, search scholarly content, store files, build community power and improve library automation.

Libraries can use Dspace or Fedora to develop and maintain their digital libraries and institutional repositories. Another cloud Technologies worth noting is DuraCloud, which offers a comprehensive solution for building institutional repositories. It comes with a standardized interface and open-source code to facilitate straightforward implementation. Consequently, academic libraries have a range of options at their disposal when it comes to selecting how and where to employ cloud computing services. This flexibility aligns with the specific requirements and goals of the library services they aim to provide to their users. The main focus of libraries moving into the cloud has been a discovery service that is the need to disclose libraries' vast collections on the Web. Mitchell (2010) shared the Z. Smith Reynolds Library's experience of migrating key IT services (e.g., Open URL resolver, journal listing service, instructional guides, ILS, and institutional repository discovery layer) to cloud-based environments. These case studies provide a practical perspective on the implementation of cloud-based solutions within library settings and how to make the most of these technologies in library functions. There are key areas in the library where cloud solutions can be advantageous:

- Acquisitions - Beneficial for librarians who are overseeing increasingly diverse collections.
- Cataloguing - Useful for librarians tasked with describing a continuously expanding body of information and information sources managed by the library.
- Serials - Valuable for librarians striving to maintain control and access to collections distributed across the web.
- Electronic resources - Helpful for librarians who are managing growing collections and ever-evolving lists of vendors.

However, preliminary observation by the researchers shows that the library services at time seems to be automated but at some point, the servers, software and other hardware facilities began to develop problems which requires funding to further maintain it. The researchers through preliminary investigation on librarians perception and use of cloud computing Technologies for library services in academic libraries of north east, Nigeria seems not to frequently use these cloud computing Technologies, such as Institutional repository (e.g Dspace, E-prints, Fedora and other open access repository), Web based email (e.g Gmail, Yahoo mail, Hotmail etc.), Social networking (e.g Facebook, Twitter, Whatsapp), Databases (e.g Science Direct, Ebscohost, Hinari, Agora etc.), Library

website, WorldCat, Google Apps (Google Drive, Google Doc), Youtube and Dropbox for library services. It is against this background that the researcher evaluated the perception of librarians' and use of cloud computing for library services in academic libraries of North East Zone, Nigeria.

1.1 Statement of the Problem

Despite the presence of computerization and the integration of automated library services that result in digitization of resources, academic libraries in Nigeria face a multitude of challenges that hinder their growth. These challenges encompass issues like unreliable internet connections, the technical proficiency of librarians, a shortage of computer-literate staff, inadequate power supply, lack of maintenance and updating practices, and insufficient funding. Furthermore, problems include bandwidth subscription, the routine upkeep of computer hardware, software glitches, staff training deficiencies, and the deliberate obsolescence of commercial software. The need for workforce training and development, along with outdated business applications, also adds to the concerns faced by automated libraries. By embracing cloud computing, libraries can alleviate technological burdens, such as hardware failures, software issues, and staff training gaps. This shift allows libraries to concentrate on expanding their collections, enhancing patron services, and fostering innovation. With the use of cloud computing, libraries may simply share data with users, doing away with the need for local backups, maintenance, and storage. The establishment of digital libraries and repositories, the facilitation of data searches, the hosting of websites, the access to academic content, the storage of files, the improvement of library automation procedures, and other tasks can all be accomplished by libraries using cloud computing. The researchers observed that librarian's seems not to frequently use these cloud computing such as Institutional repository (e.g.Dspace, E-prints, Fedora and other open access repository), Web based email (e.g Gmail, Yahoo mail, Hotmail etc.), Social networking (e.g Facebook, Twitter, Whatsapp), Databases (e.g Science Direct, Ebscohost, Hinari, Agora etc.), Library website, WorldCat, Google Apps (Google Drive, Google Doc), Youtube and Dropbox for library services. Thus, it is against this background that the study evaluates the librarians' perception and use of cloud computing for library services in academic libraries of North East Zone, Nigeria.

1.2 Objectives of the Study

The objectives of the study determined the;

- Perception of Librarians toward Cloud Computing Technologies for Service delivery in Academic Libraries of North East Zone, Nigeria
- Extent of Utilization of Cloud Computing Technologies by Librarians for Services in Academic Libraries of North East Zone, Nigeria
- Challenges associated with Utilization of Cloud Computing Technologies in Academic Libraries of North East Zone, Nigeria.
- Influence of perception on utilisation of cloud computing technologies for service delivering by librarians in academic libraries of North East Zone, Nigeria

1.3 Research Questions

The following research questions were answered:

- What is the perception of librarians on cloud computing technologies in the academic libraries of North East Zone, Nigeria?
- What is the extent of utilization of cloud computing technologies for service delivering by librarians in academic libraries of North East Zone, Nigeria?
- What are the challenges of utilization of cloud computing technologies in academic libraries of North East Zone, Nigeria?
- What is the influence of perception on utilisation of cloud computing technologies for service delivering by librarians in academic libraries of North East Zone, Nigeria

1.4 Hypothesis

To direct the study, the following null hypothesis was formulated:

H1. There is no significant influence of perception on utilisation of cloud computing technologies for service delivering by librarians in academic libraries of North East Zone, Nigeria.

2. Literature Review

2.1 Conceptual Framework

The study was anchored on Technologies Acceptance Model (TAM) by Davis (1989). According to the

Model, staff productivity would grow as a result of Technologies' perceived value and simplicity of use. The concept goes on to say that two beliefs: perceived usefulness and perceived ease of use, determine a person's behavioral intention to embrace a system. Perceived usefulness according to Davis (1989) is "the

extent to which an individual believes that the usage of a particular system would increase his or her productiveness" at the same time as perceived ease of use is described as "the degree a person believes that the use of a particular machine would be free of effort" (Davis, 1989).

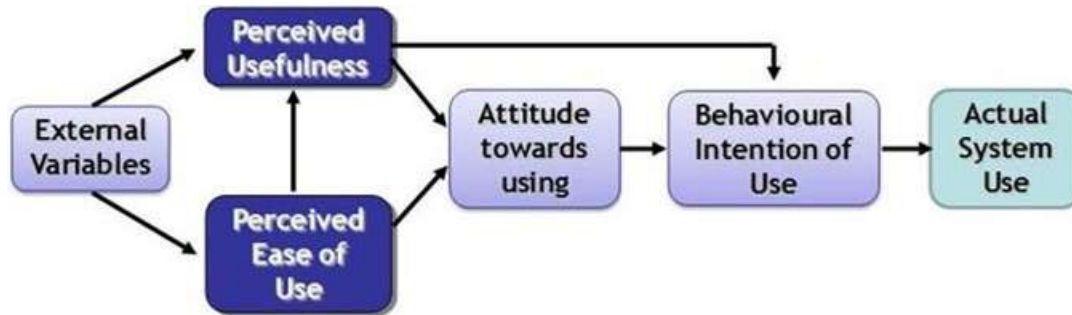


Fig 2.1 Davis (1989) Technologies acceptance model (TAM)

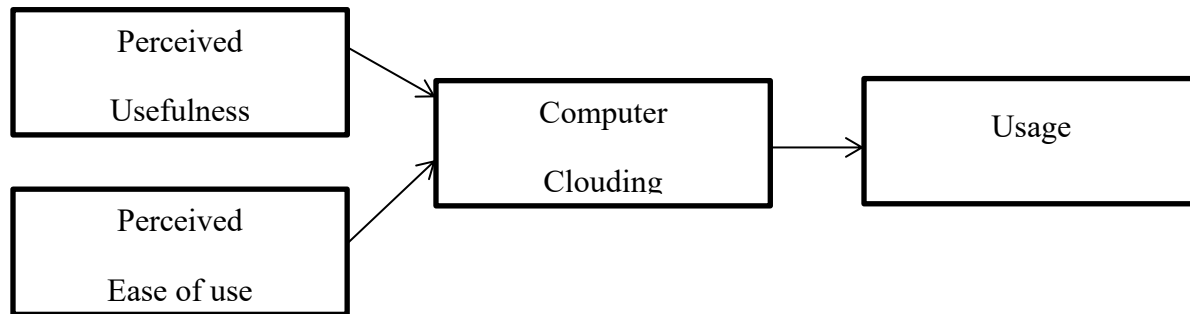


Fig.2.2: Adapted Technologies Acceptance Model (TAM) by the Researcher

The application of the Technologies Acceptance Model (TAM) to assess the extent to which librarians accept and are likely to adopt cloud computing Technologies can be summarized as follows:

- The use of TAM to comprehend how librarians accept cloud computing applications and their potential future utilization is grounded in several assumptions:
- If librarians perceive cloud computing applications as useful and user-friendly, they are likely to hold a positive attitude toward using them.
- When librarians find cloud computing applications straightforward to use, their inclination towards viewing the Technologies as beneficial is reinforced.
- A positive attitude among librarians toward cloud computing applications is associated with more frequent and intensive usage, as well as a favourable intention to continue using these applications.

- Librarians' continuous use of the Technologies signifies the presence of benefits.

This model and the current study are related because the model clarifies how employees view the value and simplicity of employing Technologies to deliver services. The study will instead assess librarians' opinions and use of cloud computing for library services. Both aspects involve the assessment of how Technologies, including cloud computing, is perceived and utilized in the context of service delivery.

3. Perception of Librarians on Cloud Computing Technologies in Academic Libraries

Different librarians' perspectives on the use of cloud computing are diverse. A study by Idhalama and Fidelis (2020) on attitude of library professionals on cloud computing applications in University of Dar es Salaam Library revealed that, majority of

professionals strongly agreed with the opinion that cloud computing applications improve quality of library services. This is an indication of a positive view library professionals have of cloud computing applications. However, the study raised concerns about cloud computing indicating that moving from ground to the cloud is surrounded by ambivalence as to whether cloud computing offers the best solution for serving users' needs or not. This was an obvious indication that, despite some people being enthusiastic about cloud computing, others are delaying adoption, as suggested by the literature.

A study by Dumbiri Babatope and Owairu (2024) showed that some librarians prefer to have their information kept on hard drives they have access to, or something like that, instead of cloud. This appears to have its roots in the librarians' lack of confidence in the cloud as a storage option for their data. This is in contrast to what a study by Comfort (2018) found. The research findings indicated that IT personnel within libraries play a crucial role in the realm of cloud computing. They serve as valuable complements or substitutes for in-house computing resources, contributing significantly to hardware and software maintenance. In a broader context, existing literature underscores that individuals hold diverse attitudes toward cloud computing, influenced by various factors. Burger (2019) submits that the utilization of cloud computing may not be a positive transformation as perceived as there are quite a number of complexities and implications that ought to be considered, for instance, is there a technical skill on the part of librarians? Other experts have discovered that the cloud computing revolution will undoubtedly change the economy in a variety of ways.

Muhammad, Fahad, Tasleem, & Muhammad (2017) conducted a study on cloud computing, exploring the general user's perspective and security concerns at universities in Faisalabad, Pakistan. The findings revealed that 70% of the respondents agreed that Cloud Computing is a relatively new Technologies with the potential to not only benefit libraries but also various other aspects of life. Despite this, it's worth noting that some scholars still hold critical viewpoints regarding this Technologies. The study of Bolaji and Aboki (2026) examined the perception, training and adoption of cloud computing by library staff in selected university libraries in Kwara State, Nigeria. Based on the Findings of the study, it was revealed that majority of the respondents had a positive perception of cloud computing adoption in the university studied. For Islam (2023), the concept of Cloud Computing represents a highly transformative development for national progress. As a result, people in academic and

other settings perceive it as a noteworthy shift in the paradigm of computing services, bringing about substantial positive change. According to Sivankalai (2021) libraries are using the cloud for putting together user resources, i.e. using Software as a Service (SaaS), such as in library catalogues, WorldCat, Googledocs, and the aggregated subject gateways like SUMMON, and others; the web Platform as a Service (PaaS) as in the use of Google AppEngine, or Infrastructure as a Service (IaaS) as in the use of D-Space, FEDORA, and others.

The study of Edwin (2018) investigated librarians' awareness and perception towards the adoption of cloudbased technologies in public university libraries in South-south, Nigeria and determine the perception of librarians towards the adoption of cloud-based technology in university libraries. The descriptive survey method was used for the study. The population of this study was 226 librarians in public university libraries in South-south Nigeria. Questionnaire was the instrument used for data collection and 226 copies of questionnaire were administered. In response, 188 copies were retrieved and found useable, thereby indicating a response rate of 83%. The data was analysed using descriptive statistics. The study established that the level of librarians' awareness and perception towards the adoption of cloud-based technologies in public university libraries in South-south, Nigeria is poor. The study also revealed that the perception of librarians towards the adoption of cloud-based technologies in the university libraries is poor. The study recommended that proper and adequate trainings, workshops and conferences should be organized to sensitize and improve librarians' knowledge and understanding of emerging technologies in libraries. In a study by Ashtari and Eydgahi (2017), the researchers explored the impact of user perceptions regarding cloud computing technologies. The study concentrated on the interactions between factors found in the literature that were thought to affect students' perceptions at a university in Southeast Michigan. Users' opinions on the usefulness and efficacy of cloud computing apps, as well as their perceptions of ease of use, Internet self-efficacy, computer anxiety, and computer self-efficacy, were all included in these factors. The study featured an online poll of 40 Michigan University undergraduate students, and the Technologies Acceptance Model (TAM) was used to gauge student adoption of cloud computing.

Extent of Utilization of Cloud Computing Technologies Services in Academic libraries in North East Zone, Nigeria
The adoption of cloud computing within libraries has

become increasingly prevalent, driven by the need to facilitate collaboration among staff and users, enhance accessibility, manage resources effectively. Research indicates a growing recognition of the importance of cloud computing in supporting collaborative endeavors within library settings (Rasmussen and Hjørland 2023). Cloud computing serves as repositories of knowledge and information, enabling staff and users to collaborate on projects, share resources, and engage in scholarly discourse more efficiently. Furthermore, the adoption of cloud computing technology is instrumental in enhancing accessibility and availability of resources for library users. Cloud computing offer users convenient access to a vast array of materials, irrespective of their physical location or institutional affiliation (Borgman, Scharnhorst, and Golshan 2019). Through digitizing collections and implementing user-friendly interfaces, libraries can broaden access to resources, promote inclusivity, and cater to the diverse needs of their user communities. Moreover, libraries are increasingly leveraging cloud computing to manage and preserve their collections effectively. Digital technologies enable libraries to streamline non-print resources workflows, improve metadata management, and implement preservation strategies to safeguard against data loss or degradation (Nwankwo 2023). Additionally, cloud computing technology serves as valuable tools for storing and organizing diverse types of content, ranging from textual documents and audio-visual recordings to multimedia artefacts and born-digital materials. This comprehensive approach to managing digital resources ensures their long-term accessibility and usability for current and future generations of users. The findings of Zubairu, Akiola and Hamzat (2021) on awareness and adoption of cloud computing in Nigerian libraries shows that 88% of library professions sees library management software (LMS) as an area where cloud computing is used, while 7% perceive the second majority area as Storage of data and files. Then 5% agreed to Back up/ storage of information resources followed by Data import and export and Resource Repository respectively. Acquisition, Cataloguing and classification were found to be the least area where it is applied.

Dime and Okeji (2025) The study's objective was to look into how librarians in African university libraries employ cloud computing technology to provide library services. Methods: An online survey was used to gather qualitative information from 315 librarians employed by 67 university libraries in English-speaking African nations. Results: According to the study, the most often listed Cloud Computing (CC) tools utilized by African university library librarians

include YouTube, Google Drive, OPAC, Google Form, Gmail, and Google Scholar. The study also showed that librarians use CC technologies to store and share files, share videos related to library orientations and other video contents, collaborate with other librarians for research projects, survey users' level of satisfaction with library services, online document editing services, and provision of virtual/online reference services. The majority of librarians cited lack of funding, lack of data security and privacy, irregular staff training and development, and lack of CC knowledge and awareness as challenges associated with adoption of CC technologies in African universities. The study offers solutions to the security of data threats in cloud environments. The study concluded that, the results will help providers and prospective adopters develop context-specific strategies for cloud service penetration and wise adoption decisions (ADs), respectively. The study's conclusions will improve knowledge of and usage of CC to improve library services for patrons of academic libraries throughout Africa.

The study of Adejo (2024) was on the use of cloud computing technology by librarians at University of Nigeria, Nsukka Library. The study employed a descriptive survey research design of the quantitative method in order to gain a thorough understanding of the use of cloud computing technology for libraries. Ten (10) copies of the questionnaire were given to the university librarian and library staff of the ICT unit at the University of Nigeria, Nsukka Library. According to the results, five (50%) of the respondents said that the University of Nigeria, Nsukka Library used free software as a service (SaaS), followed by platform as a service (PaaS) and infrastructure as a service (IaaS), each of which was affirmed by two (20%) respondents. One (10%) respondent said that paid subscription software as a service (PaaS) was the least used layer of cloud computing technology services. It was concluded that the University of Nigeria, Nsukka Library uses cloud computing technology primarily in the areas of cataloging and metadata, storage, retrieval, and generation. Lastly, it is advised that cloud computing technology be implemented in all of the university's satellite campuses, that all library employees receive training and retraining on cloud computing technology, and that the library receive a sufficient annual budget in addition to making its cloud computing technology operations available to the public.

The use of cloud computing in a few academic libraries was investigated in this study by Mabawonku et al. (2024). The study employed a survey research

design. Out of 250 academic librarians and library officers, a sample size of 152 was chosen at random for the study. The tool for gathering data was a questionnaire. Descriptive statistics (frequency count, percentage, mean, and standard deviation) were used to examine the gathered data. According to the study, library staff members are knowledgeable about cloud computing technology, which could improve how well the technology is implemented in Lagos and Ogun States libraries. Additionally, cloud computing technology was embraced for staff and user collaboration, accessibility, digital resource storage, etc. Numerous obstacles to implementing cloud computing were identified by the study, including a lack of funding, worries about data security, a shortage of internal specialists, and—above all—staff aversion to change. In order to ensure that cloud computing technology is implemented effectively, the study advised library administration to increase internet connectivity and solve the shortage of internal expertise.

The application of cloud computing technology by library staff for service delivery in university libraries in Nasarawa State, Nigeria, was the subject of Ackley and Annune's (2025) study. Three research questions and two hypotheses guided the study; a descriptive survey research design was used; the population was 140 library staff, and since the population was small and manageable, there was no sample size; the instrument for data collection was a self-developed questionnaire; and Chi-square was used to test the null hypotheses at the 0.05 level of significance. Thirty librarians from the University of Abuja, which is outside the study area, participated in a trial test of the instrument for internal consistency, and the results were subjected to reliability analysis using the Cronbach Alpha technique. The study adopted the overall dependability coefficient of 0.93. Data analysis was done using frequency, mean, and standard deviation. The study's conclusions showed that library employees employed a variety of cloud computing technologies, including Koha ILS, Polaris SLO, WorldCat, and Online Computer Library Center (OCLC). Additionally, the results showed that university library employees use OCLC services to find and preserve print and electronic library materials. They also have the ability to navigate all cloud computing services, use digital devices like laptops, network with coworkers via computers, and apply cloud computing technology for service delivery in university libraries in Nasarawa State. Among other things, it was suggested that library employees receive frequent training to keep them up to date on how cloud computing technology is used in university libraries.

4. Challenges of Cloud Computing Technologies in Academic Libraries

Like every technological concept, cloud computing is not an exception in terms of trust and security issues. Ensuring both privacy and security of cloud information is not easy (Hussaini, Vishistha, Garba, & Jimah, 2017). As a result, efforts to encourage people to use these technologies are not yielding the needed results because people have fear of putting their digital information in the hands of third parties. The study further reveals that people fear that their information will no longer be confidential, or it will be more prone to theft and loss because the libraries do not have ownership of the servers on which they keep their contents. Overall, although some libraries and their users have adopted cloud computing, they have worries about their ownership and privacy of their information (Pegu, 2023). An additional cause for apprehension regarding privacy and security pertains to the worry about potential harm from insiders with malicious intent. This unease arises from the fact that service providers do not disclose their hiring procedures, access-granting practices, or monitoring mechanisms for their personnel. This lack of transparency leads both current and prospective users to be concerned that the absence of adequate monitoring of malicious insiders could jeopardize the safety of data handled through cloud computing. This was confirmed by study of Almanasir (2025) who revealed that deletion without a backup, loss of the encoding key or unauthorized access, data is always in danger of being lost or stolen. Considering that if the data managed through cloud computing are lost, a library will have no physical or local back up.

Another challenge for cloud computing is its dependence on internet connection. Libraries without or with unstable internet connections cannot implement cloud computing. Where cloud computing is in use, when an Internet connection goes down for any reason, all the operations of the organization in question will be in a stand-still until connectivity is back. Internet has been a driving force in various technologies that have been developed, including cloud computing. Apart from reliance on internet connectivity, cloud computing increases bandwidth demands because of their need for high-speed connections to perform effectively and efficiently (Hussaini, et al. 2017). As a result, libraries need to have sufficient financial budgets to run their service with reliance on cloud computing. This was confirmed by Hussaini, Vishistha, Garba, & Jimah (2017) in their study which revealed that budget constraint is another challenge for libraries that want to use cloud computing. The cost implications come from

equipment procurement, infrastructure set up and implementation.

The study of Anike and Otubelu (2024) investigated the application of cloud computing services in public university libraries in South-East, Nigeria. The findings revealed that respondents had applied cloud computing services in their libraries amidst challenges such as pricing, acceptance, security, sustainability and post adoption concerns. The study recommended that based on the enormous benefits of cloud computing services, more Information Technology (IT) infrastructure which can enhance the application of cloud computing services should be provided for enhanced services delivery in public university libraries. Operating amidst declining budgets, increasing costs, and a resource-scarce environment are some of the challenges of internet of things in most of the academic libraries in India (Pant, Negi and Seth 2022). The challenges associated with the application of cloud computing technology for effective service delivery in University Libraries in North Central, Nigeria, anchor around poor institutional subscription, poor internet network development, epileptic power supply, and lack of awareness of cloud computing and its application to library services, among others (Alabi, Omekwu and Martins, 2024). Low internet bandwidth significantly hampers the implementation of cloud technologies in libraries, which increasingly depend on high-speed internet for various services. To function effectively, cloud-based applications require robust and reliable internet connections. When bandwidth is insufficient, libraries may experience slow service speeds, reduced access to digital resources, and impaired ability to offer new technologies that require high-speed internet, such as streaming media or large-scale data analysis (Golightly et al., 2022).

Implementing cloud technologies in libraries is a complex process that requires a blend of technical skills and strategic planning. When libraries lack experienced personnel, they face significant challenges in adopting cloud services effectively. Without skilled staff, libraries may struggle with the technical aspects of cloud migration, such as data transfer, system integration, and configuring cloud-based services to meet the unique needs of their patrons. Furthermore, lacking expertise can lead to an inadequate understanding of cloud security and privacy issues, potentially exposing sensitive user data to risks. The lack of experienced personnel can hinder the library's ability to leverage cloud technologies to improve service delivery, streamline operations, and expand access to digital resources. To address these challenges, libraries might consider investing in

training for existing staff, recruiting specialized personnel, or exploring collaborative arrangements where technical responsibilities are shared with institutional IT departments. Ultimately, the successful implementation of cloud technologies in libraries depends on the technology and the people who manage and utilize it (Alabi, Omekwu and Martins, 2024). Aviamu, Popoola, and Atuase (2019) found that the lack of institutional policy guidelines and cloud service provider authentication procedures were the main obstacles preventing academic libraries from adopting cloud computing.

5. Research Methodology

Survey research method was adopted for this study. The study population comprised 209 librarians from three university libraries in North-East Nigeria: Ramat Library, University of Maiduguri (146); Goodluck Ebele Jonathan Library, Yobe State University, Damaturu (37); and Zubairu Mohammed Library, Abubakar Tafawa Balewa University, Bauchi (26). Owing to the manageable population size, a census approach was adopted since all the 209 librarians were included in the study. A self-created questionnaire titled: Librarians' Perception and Use of Cloud Computing for Library Services in University libraries of North East Zone, Nigeria (LPUCLS). The instrument was subjected to face validity. A reliability coefficient of 0.87 was obtained for the instrument using Cronbach Alpha. Descriptive statistics, specifically frequency distributions and percentages, were used to answer Research Questions One, Two, and Three, while simple linear regression (R-value) was used to answer Research Question Four. The corresponding p-value was used to test the hypothesis at the 0.05 level of significance. Decision Rule: For Research Questions One and Three, combined Strongly Agree (SA) and Agree (A) responses of 50.0% or above indicated positive perception and agreement that a factor constituted a challenge, respectively, while combined Disagree (D) and Strongly Disagree (SD) responses of 50.0% or above indicated negative perception and disagreement. For Research Question Two, combined High Extent (HE) and Moderate Extent (ME) responses of 50.0% or above indicated high utilization, while combined Low Extent (LE) and Zero Extent (ZE) responses of 50.0% or above indicated low utilization. For Research Question Four, R-values of 0.10–0.39, 0.40–0.59, 0.60–0.79, and 0.80–0.99 indicated low, moderate, high, and very high relationships, respectively. The null hypotheses were rejected at $p < .05$.

6. Data Analysis and Results

The table 1 Presents the response rate of questionnaire administered and retrieved in the three (3) University Libraries under study.

Table 1: Distribution and Return of Questionnaire

Academic Libraries	Questionnaire administered	Questionnaire returned	Questionnaire not returned/ invalid
RLUM	146	97 (66.4%)	49 (33.6%)
GEJLYSU	37	34 (91.9%)	3 (8.1%)
ZMLATBU	26	26 (100%)	0 (00.0%)
Total	209	157(75.1%)	52 (24.9%)

KEY:

RLUM: Ramat Library, University of Maiduguri, Maiduguri

GEJLYSU: Good Luck Ebele Jonathan Library, Yobe State University Library, Damaturu

ZMLATBU: Zubairu Mohammed Library, Abubakar Tafawa Balewa University, Bauchi

Table 1 reveals that a total of 209 copies of the questionnaire were distributed to the respondents, and that 157 of the copies were successfully completed and recovered. This was deemed practical, resulting in a response rate of 75.1%.

Research Question 1: What is the perception of librarians on cloud computing technologies in the academic libraries in North East Nigeria?

Table 2: Perception of Librarians on Cloud Computing in the library

S/N	Statements	SA	A	D	SD
1	Security is a big concern in using the cloud computing applications	57 (36.3%)	43 (27.4%)	23 (14.6%)	34 (21.7%)
2.	Cloud computing use often requires constant internet connections which may be a barrier to its effective use	43 (27.4%)	59 (37.6%)	35 (22.3%)	20 (12.7%)
3.	Use of cloud computing requires special ICT skills which may be difficult to adapt to	64 (40.8%)	45 (28.7%)	29 (18.5%)	19 (12.1%)
4.	Cloud computing use have very little or no benefit to the library daily works and service delivery	7 (4.5%)	24 (15.3%)	93 (59.2%)	33 (21.0%)
5.	I feel cloud computing use may leave room for security threat to my documents or personal credentials	49 (31.2%)	47 (29.9%)	43 (27.4%)	18 (11.5%)
6.	I feel cloud computing use may lead to loss of data which may be difficult to recover if no backup is in place	52 (33.1%)	41 (26.1%)	33 (21.0%)	31 (19.7%)
	TOTAL	272(28.9%)	259(27.5%)	256(27.2%)	155(16.4%)

Source: Field Survey, 2023

Key: SA: Strongly Agree; A: Agree; D: Disagree; SD: Strongly Disagree

The findings in Table 2 indicate that librarians generally had a positive perception of cloud computing technologies in academic libraries in North-East Nigeria. Specifically, a majority of the respondents perceived that security is a major concern (63.7%), constant internet connectivity may hinder effective use (65.0%), cloud computing requires special ICT skills that may be difficult to adapt to (69.5%), cloud computing may expose documents or personal credentials to security threats (61.1%), and it may result in data loss where adequate backup is unavailable (59.2%). Conversely, a majority of the respondents (80.2%) disagreed with the statement that cloud computing has little or no benefit to library operations and service delivery, indicating that they recognized its usefulness in library services. Furthermore, the overall perception percentage of 56.4% (obtained from the combined percentages of Strongly Agree and Agree) exceeded the benchmark of 50.0%, implying that there is positive perception of cloud computing

technologies among librarians in academic libraries in the North-East Zone of Nigeria.

Research Question 2: What is the extent of utilization of cloud computing technologies in services delivery in the libraries?

Table 3: Utilization of Cloud Computing Services in the library

S/N	Statements	HE	ME	LE	ZE
1	I utilize library portal/website for new arrivals, book request, queries, and feedback	18 (11.5%)	43 (27.4%)	47 (29.9%)	49 (31.2%)
2.	I use Web OPAC, online renewal, and reservation storage	7 (4.5%)	24 (15.3%)	33 (21.0%)	93 (59.2%)
3.	I use the cloud (Drop Box, Google Apps (Google Drive, Google Doc) in backing up library information resources	19 (12.1%)	29 (18.5%)	45 (28.7%)	64 (40.8%)
4.	I often store the library data and files in the public server	7 (4.5%)	24 (15.3%)	33 (21.0%)	93 (59.2%)
5.	I do use the library management system software (LMS) on the cloud	20 (12.7%)	35 (22.3%)	59 (37.6%)	43 (27.4%)
6.	I do use the Web based email (e.g Gmail, Yahoo mail, Hotmail, etc.) for communication	52 (33.1%)	41 (26.1%)	33 (21.0%)	31 (19.7%)
	TOTAL	123(13.1%)	196(20.8%)	250(26.5%)	373(39.6%)

Source: Field Survey, 2023

Key: HE: High Extent; ME: Moderate Extent; LE: Low Extent; ZE: Zero Extent

The findings in Table 3 indicate that librarians generally had a low extent of utilization of cloud computing technologies in service delivery in academic libraries in North-East Nigeria. Specifically, a majority of the respondents reported a low or zero extent of utilizing the library portal/website for new arrivals, book requests, queries, and feedback (61.1%); Web OPAC, online renewal, and reservation services (80.2%); cloud applications such as Dropbox and Google Apps for backing up library information resources (69.5%); storing library data and files on public servers (80.2%); and library management system (LMS) software on the cloud (65.0%). However, a majority of the respondents (59.2%) reported a high or moderate extent of using web-based email services such as Gmail, Yahoo Mail, and Hotmail for communication. Furthermore, the overall utilization percentage of 33.9% (obtained from the combined percentages of High Extent and Moderate Extent) was below the benchmark of 50.0%, implying that there is low extent of utilization of cloud computing technologies in services delivery in the libraries.

Research Question 3: What are the challenges of using cloud computing technologies in the libraries?

Table 4: Challenges of using Cloud Computing Technologies in the library

S/N	Statements	SA	A	D	SD
1	Slow internet connectivity	64 (40.8%)	45 (28.7%)	29 (18.5%)	19 (12.1%)
2.	Epileptic Power Supply	49 (31.2%)	47 (29.9%)	43 (27.4%)	18 (11.5%)
3.	Lack of technical skills is hampering efficient use of cloud computing in your library	43 (27.4%)	59 (37.6%)	35 (22.3%)	20 (12.7%)
4.	Data Security	57 (36.3%)	43 (27.4%)	23 (14.6%)	34 (21.7%)
5.	Irregular Staff training and development	52 (33.1%)	41 (26.1%)	33 (21.0%)	31 (19.7%)
6.	Data Privacy	64 (40.8%)	45 (28.7%)	31 (19.7%)	17 (10.8%)
	TOTAL	329 (34.9%)	280 (29.7%)	194(20.6%)	139(14.8%)

Source: Field Survey, 2023

Key: SA: Strongly Agree; A: Agree; D: Disagree; SD: Strongly Disagree

The findings in Table 4 indicate that librarians generally agreed that several factors constitute challenges to the use of cloud computing technologies in academic libraries in North-East Nigeria. Specifically, a majority of the respondents agreed that slow internet connectivity (69.5%), epileptic power supply (61.1%), lack of technical skills for the efficient use of cloud computing (65.0%), data security concerns (63.7%), irregular staff training and development (59.2%), and data privacy issues (69.5%) were major challenges affecting the adoption and utilization of cloud computing technologies in their libraries. Furthermore, the overall agreement percentage of 64.6% (obtained from the combined

percentages of Strongly Agree and Agree) exceeded the benchmark of 50.0%, implying that slow internet connectivity, epileptic power supply, lack of technical skills, data security, irregular staff training and development as well as data privacy are the challenges of using cloud computing technologies in the libraries in the North-East Zone of Nigeria

Research Question 4: What is the influence of perception on utilisation of cloud computing technologies for service delivering by librarians in academic libraries of North East Zone, Nigeria?

Table 4: Result of Simple Linear Regression of the influence of perception and utilisation of cloud computing technologies for service delivering by librarians in academic libraries of North East Zone, Nigeria (N=157)

Variables	R	R ²	Adjusted R ²
Perception	0.825	0.681	0.679
Utilisation of cloud computing technologies			

The result in Table 4 shows a correlation coefficient (R-value) of 0.825, indicating a very high positive relationship between librarians' perception and the utilisation of cloud computing technologies for service delivery in academic libraries of the North-East Zone, Nigeria. The coefficient of determination (R²-value) of 0.681 indicates that 68.1% of the variance in the utilisation of cloud computing technologies for service delivery is explained or predicted by librarians' perception. This means that there is influence of perception and utilization of cloud computing technologies for service delivering by librarians in academic libraries of North East Zone, Nigeria.

H₁. There is no significant influence of perception on utilisation of cloud computing technologies for service delivering by librarians in academic libraries of North East Zone, Nigeria.

Table 5: Result of Simple Linear Regression of the influence of perception on utilisation of cloud computing technologies for service delivering by librarians in academic libraries of North East Zone, Nigeria (N=157)

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	8461.89	1	8461.89	90.73	.00 ^b
Residual	14456.34	155	93.27		
Total	22918.23	156			

The result in Table 5 shows an F-ratio of 90.73 with the corresponding probability level of significance of .00 at 1 and 155 degrees of freedom. This level of significance is less than .05, on which the decision was based. With this result, the null hypothesis was rejected. This implies that there is significant influence of perception on the utilisation of Cloud Computing Technologies in Academic Libraries of North-East Zone, Nigeria.

7. Summary of Findings

The following are the summary of findings:

- There is positive perception of cloud computing technologies among librarians in academic libraries in the North-East Zone of Nigeria.
- There is low extent of utilization of cloud computing technologies among librarians in services delivery in the libraries.
- Slow internet connectivity, epileptic power supply, lack of technical skills, data security, irregular staff training and development as well as data privacy are the challenges of

using cloud computing technologies in the libraries in the North-East Zone of Nigeria

- There is significant influence of perception on the utilisation of Cloud Computing Technologies in Academic Libraries of North-East Zone, Nigeria

8. Discussion

The findings on the perception of librarians on cloud computing in libraries revealed that there is positive perception of cloud computing technologies among librarians in academic libraries in the North-East Zone of Nigeria. The finding is in agreement with that of Muhammad, Fahad, Tasleem, & Muhammad (2017) whose major findings indicated that the librarians have positive perception for cloud computing in the universities of Faisalabad libraries, Pakistan. The finding contradicted the studies of Dumbiri Babatope and Owairu (2024) who revealed that there have been a misconception among librarians that moving the library into the cloud will eradicate the need for library staff as majority of works will be done by cloud service provider, also they have lack of trust in cloud as a place to keep their information. The findings on

the extent of utilization of cloud computing technologies among librarians in services delivery in the libraries revealed that there is low extent of utilization of cloud computing technologies among librarians in services delivery in the libraries. The finding of the analysis is supported by Edwin (2018) who indicated that majority of librarians do not use the cloud computing for library services rather they use it for their personal purposes. In contradiction to the finding of the study, the work of Zubairu, Akinola, and Hamzat (2021) which reported that majority of librarians use cloud computing for providing services to users, they further supported that library management software were frequently use.

The finding on the challenges that hinder effective use of cloud computing indicated that slow internet connectivity, epileptic power supply, lack of technical skills, data security, irregular staff training and development as well as data privacy are the challenges of using cloud computing technologies in the libraries in the North-East Zone of Nigeria. The finding is in agreement with the study of Pegu (2023) who reported that data security and privacy as a challenge and the study further reported that people fear that their information will no longer be confidential, and that it may be more prone to theft and loss because the libraries do not have complete ownership of the servers on which these contents are kept. In the same vein, the findings was also supported by Hussaini, Vishistha, Garba, and Jimah (2017) who indicated that the cloud computing dependence on internet connection is another constraint in its application and use in the libraries as there is budget constraint which affect the purchase of adequate bandwidth. The finding of the influence of perception on the utilisation of Cloud Computing Technologies in Academic Libraries of North-East Zone, Nigeria revealed that there is significant influence of perception on the utilisation of Cloud Computing Technologies in Academic Libraries of North-East Zone, Nigeria. The finding is in agreement with that of Idhalama and Fidelis (2020) whose finding revealed that, majority of professionals strongly agreed with the opinion that cloud computing applications improve quality of library services. This is an indication of a positive view library professionals have of cloud computing applications. The finding is also in agreement with that of Sivankalai (2021) who reported that libraries are using the cloud for putting together user resources, that is, using Software as a Service (SaaS), such as in library catalogues, WorldCat, Googledocs, and the aggregated subject gateways like SUMMON, and others; the web Platform as a Service (PaaS) as in the use of Google AppEngine, or Infrastructure as a Service (IaaS) as in the use of D-Space, FEDORA, and

others.

9. Conclusion

The study concluded that librarians in academic libraries in the North-East Zone of Nigeria have a positive perception of cloud computing technologies. However, despite this positive perception, cloud computing technologies were utilised to a low extent in library service delivery. The low level of utilisation was attributed to several challenges, including slow internet connectivity, epileptic power supply, inadequate technical skills, data security concerns, irregular staff training and development, and data privacy issues. The study further concluded that librarians' perception significantly influences the utilisation of cloud computing technologies. Therefore, although librarians generally perceive cloud computing technologies favourably, addressing the identified infrastructural, technical, and organizational challenges is essential for improving their utilisation and enhancing effective service delivery in academic libraries in the North-East Zone of Nigeria.

10. Recommendations

Based on the findings of the study, the study offers the following recommendations:

- Librarians should be encouraged through proper training in order to have positive perception concerning the on utilisation of cloud computing for effective service delivery in the library.
- University libraries should have standby power generating source. This will be very important particularly in the situation of power outage; besides the generator, the university management should make frantic effort to generate an alternative source of electricity such as solar and inverters as this will be relatively cheap and help the process of using electronic resource provision on the cloud thereby reducing dependence on generating set.
- Institutional bandwidth should be increased and readily available as the cloud computing are more dependent on the internet. University library should have their own dedicated bandwidth with fast Internet connectivity. This will improve the use of the cloud applications and as well put an end to the problem of network fluctuations and slow speed in the process of uploading or downloading resources from the databases or

cloud.

- Information literacy is needed to be given to the users on the use of cloud computing app, so that librarians become aware and make use of them.

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