



# Assessment of the Availability of Cloud-Based Information Resources for Service Delivery in University Libraries North-East, Nigeria

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## Abstract

### Keywords

Cloud  
Computing  
Technologies,  
Information  
Resources,  
Services,  
University  
Libraries

**Introduction:** The study assessed cloud-based information resources for service delivery in university libraries in North-East Nigeria. The objective was to compare the availability of cloud-based information resources among federal, state, and private university libraries in the region.

**Method:** An evaluation research design was used for this study. The population consisted of 369 librarians from six university libraries. The entire population was used as the sample. A total of 369 copies of the questionnaire were administered, and 273 copies were retrieved and used. Descriptive statistics were employed to analyze the data, and ANOVA was used to test the hypothesis. To determine group differences and the level of significance, post-hoc statistics with Hochberg's GT2 were tested, revealing multiple comparisons of the libraries by type (ownership).

**Results/Findings:** The findings revealed that private university libraries have a higher level of available cloud-based information resources for service delivery compared to both federal and state university libraries. Additionally, federal university libraries have a higher level of available cloud-based information resources than state university libraries.

**Conclusion/Recommendations:** The study recommends that university libraries in North-East Nigeria should develop a sustainability plan to increase the availability of cloud-based information resources for effective service delivery.

## Introduction

When searching for scholarly information, scholars and researchers turn to libraries

which are the operational hub of learning establishments for a fountain of well-structured information. A library can be defined as a collection of structured



information sources accessible to scholars for research and information seekers (Noaman, Ragab, Madbouly, Khedra & Fayoumi, 2017). The trend of searching and sourcing for information within walls of a building is changing rapidly as a result of advances in technology which brought about a new paradigm as new technologies evolve which in turn change the perception and expectations of information seekers.

Libraries, as information warehouse and managers must keep up with the latest trends and technological advancements for effective service delivery. This pursuit led to the development of the Integrated Library System (ILS)/Library Management System (LMS) which has undergone several redesigns and enhancements to suit the needs of today's information seekers and to address the difficulties of the information age (Adegbilero-Iwari & Hamzat, 2017). The desire to keep up with technological breakthroughs in information technology resulted in the development of the ILS, which was the first-generation library information system, then the second-generation Library Management System (LMS) and the present third-generation library information system known as the Library Service Platform (LSP). While the distinction between ILS, LMS and LSP is blurry, it is worth noting that ILS and LMS were originally designed to be client-server-based applications and the newer LSP is a cloud-based application which is more cost-effective to deploy and maintenance requirement is negligible. Kouis and Agiorgitis (2020) underscored the advantages of LSP cloud-based infrastructure over ILS/LMS as cost-effectiveness, easy installation and configuration, less personnel requirement to operate and manage the system, faster and universal accessibility and rapid scalability.

Cloud Computing Technology (CCT) is an innovative technology that aids most libraries in mitigating some of the challenges associated with digitization such as the cost of acquiring Information Technology (IT)

hardware and software, maintenance, hosting, security, operations, and extensive requirements for skilled IT personnel. Cloud computing facilitates easy access to storage, processing, transmission and delivery of services efficiently and seamlessly, regardless of time and location. In a similar vein, it was established that cloud computing is becoming increasingly popular due to its collaborative nature, flexibility, scalability, cost-effectiveness, and relief from IT management complexity (Ahmed & Abraham, 2014; Yeboah-Boateng & Essandoh, 2014; Qasem, Abdullah, Jusoh, Atan & Asadi, 2019; Jahangiri, Saberi & Vakilimofrad, 2021).

Electronic information resources are libraries' informational materials that are presented in digital forms that can be transmitted and accessed using electronic devices and other associated technologies needed for preservation and transmission (Johnson, Evensen, Gelfand, Lammers, Sipe & Zilper, 2012). Electronic information sources in a library are products of modern advancements in IT existing in various formats, including e-books, online periodicals, e-learning instructors, and online assessments. Because of the effective presentation of these e-resources through the use of multimedia technologies, they have become indispensable sources of information for library managers and users. Libraries are increasingly evolving into digital and virtual libraries at a rapid pace. Akpojotor (2016) stipulated that electronic resources exist in many formats such as full text, images and audiovisual in the forms of databases, e-journals, multimedia devices, internet websites and so on. Several of the electronic resources are accessible as blogs, wikis, emails, e-journals and social media applications.

Given the assertions above, cloud computing has become an integral part of the library as an information manager and provider, thereby giving the library a new lease of tools for managing information resources and giving the library users an efficient and satisfying



means of accessing information from the library. This was further corroborated by Dadhich, Rao, Sethy, and Sharma (2021) that information seekers were no longer interested in a library that serves as a one-stop shop for information, but that information should be accessible anywhere and at all times.

### **Statement of the Problem**

Cloud computing technology avail libraries with a great opportunity to effectively transform and disseminate its services to meet up with the expectations of library users, while reducing the burdens libraries usually face with respect to challenges associated with maintenance of physical systems, technological changes, costs, among many others. However, it has been observed that not many of the libraries have transformed into utilizing this technology, it therefor becomes imperative to carry out this study by investigating the availability of cloud-based information resources and services provided by the libraries, and to establish the difference in the availability of these resources among the various groups of the institutions under study.

### **Objectives of the Study**

The objective of the study wasa to:

Compare the difference in availability of cloud-based information resources for services delivery in Federal, State and Private University Libraries in North-East Nigeria

### **Research Question**

The following research question was answered:

What are the available cloud-based information resources for service delivery in Federal, State and Private University Libraries in North-East Nigeria?

### **Hypotheses**

The hypothesis was tested at a 0.05 level of significance:

**H<sub>01</sub>:** There is no significant difference among the availability of cloud-based information resources for services delivery in Federal, State and Private University Libraries in North-East Nigeria.

### **Literature Review**

Libraries have a lot of opportunities to utilize CCT to build, manage and deliver services to their patrons. Evidence-based research has justified the various areas where CCT can be of significant benefit to libraries in the technologically evolving environment. It was stipulated that with the merging digital and physical world, it is expected that irrespective of time, location and resources, cloud computing platforms seem to be the practicable option to achieve the goal of delivering effective and qualitative services as people will increasingly continue to seek information resources (Bushhousen, 2011).

To reduce the time needed by librarians to manage libraries' enormous resources, most library services could fully or partially on an incremental basis engage the use of CCT for the management of resources and dissemination of information to users. Since the deployment and implementation of cloud computing in many sectors and organisation has transformed their operations and services for good, it is naturally expected that the adoption of CCT in the library can facilitate discovery, collaboration, dissemination and publishing of research (Singh & Veralakshmi, 2012). More so, re-routing of traffic in case of disaster, automatic backups, scalability, data integrity management, round-the-clock services, limited management and maintenance efforts are some of the cloud computing features that will be beneficial to the libraries.

Relocating library services to the cloud has made library patrons use library resources



through cloud technologies and associated devices. Consequently, it is unavoidable for librarians to familiarize themselves with these technologies to store, manage and disseminate library resources and services to its patrons. In a study by Breeding (2012), it was highlighted that libraries are already utilizing CCT for the daily task of managing and disseminating library services using Integrated Library Systems that were designed to be cloud-based service models such as SaaS. CCT may be used in different areas in libraries, including LibGuides, library consortiums, reference services, discovery services, repositories, and so on.

An assessment of CCT for library service delivery was carried out by Omehia and Tom-George (2020). The research evaluated CCT for library service delivery at the Ignatius Ajuru University of Education (IAUE) in Rivers State, Nigeria. The study was prompted by the desire to determine the types of CCT already in use in the library, as well as their benefits and drawbacks, and identify the areas and applications that are being used. Since the population size was manageable, the researchers opt not to use any sampling procedure, instead using the whole population as a sample. The responses were collected utilising a self-designed questionnaire. The study found that the most prevalent areas of cloud computing applications are Collection development/Acquisition with a mean ( $x=2.80$ ), Circulation ( $x=3.20$ ), Cataloguing and Classification ( $x=2.73$ ), Web OPAC ( $x=2.87$ ), Serial/Government Information ( $x=2.40$ ), Integrated Library Management ( $x=2.53$ ) and e-Learning ( $x=2.47$ ). Also, the study revealed that Google, YouTube, and Google Apps are the cloud technologies used in the IAUE library. Findings revealed that cloud computing would considerably escalate the efficacy of services and the deployment of library resources outside the confines of the institution.

The advantages and models of IT service delivered through CCT are significantly more attractive, simple and effective than the earlier

models of computing such as grid and distributed computing, as such, library professionals must significantly acquire computing skills and use of ICT tools (Liu and Cai, 2013). Among the advantages of using cloud technologies are universal availability, scalability, ease of use, cost reduction, collaboration and on-demand services making it the most widespread platform for content-sharing (Han, 2013; Prince, 2012).

A research by Yuvaraj (2013) explored how university libraries in India use cloud computing tools. The result revealed that 354(86.97%) expressed their interest in moving library collections services to the cloud environment, however, 296(72.7%) of the respondents expressed fear about the safety of data stored in cloud. In a similar twist, 301(73.9%) of the respondents preferred internal IT networks for library services over cloud-based services which were mainly attributed to security concerns. This shows that private cloud services were preferred over public cloud service offering by most of the library professionals in India.

Before the recent technological advances and proliferation of ICT, most library tasks and related services were executed manually and autonomously from each other. Activities performed in the libraries such as circulation and reference services, cataloguing and classification, cooperative acquisition, Current Awareness (CA), Selective Dissemination of Information (SDI), collection development and other bibliographic services were performed manually with little or no electronic assistance.

Conversely, with the convergence of interdisciplinary concepts brought about through developments in ICT such as computer hardware, software, telecommunication and technology, library management and administration might well be easily accomplished using a library-oriented application known as Integrated



Library System (Adegbilero-Iwari & Hamzat, 2017). An Integrated Library System (ILS) which metamorphosed due to advancement over time into a Library Management System (LMS) is a computer-based software which can be utilized by a library for resource management and planning to essentially monitor library facilities, information resources, acquisitions and management of records of library users who have at one point or time borrowed library material.

The most affordable means for a library to effectively and efficiently deploy electronic resources is through CCT, this is highly attainable given its effectiveness, flexibility, scalability, reduction of cost involving electricity, reduced bandwidth requirement, reduced operating cost and hardware requirement. Greenberg (2008) asserted that despite the benefits accorded to individuals and organizations when migrating to cloud computing services, some data and applications such as mission-critical applications that such individuals and organizations may choose not to migrate to the cloud.

### **Methodology**

The evaluation research design was used for this study. The population for the study was three hundred and sixty-nine (369) librarians from the six (6) University libraries investigated. The six libraries were Ramat Library, University of Maiduguri, University Library, Abubakar Tafawa Balewa University, Bauchi, Robert Pastor Library, American University of Nigeria, Yola, Kwararafa University Library, Wukari, Goodluck Ebele Jonathan Library, Yobe State University, Damaturu and Abdulrahman Gaji Library, Adamawa State University, Mubi, Adamawa State. The entire population was used for the study. This is because the population was manageable. This is in line with Gall and Borg (2007) stressing that the

whole population should be studied when the entire size of the population is manageable.

The research instrument for this study was a self-designed questionnaire. The reliability of the instrument was tested using the Cronbach's Alpha reliability test method and the reliability coefficient = 0.921. Descriptive statistics of frequency counts, percentages, and mean scores were used to analyze the data to answer the research questions. Inferential statistics using One-Way Analysis of Variance (ANOVA) was used to test the formulated hypothesis at a 0.05 level of significance, and to determine whether there was any significant difference between Federal, State and Private university libraries in terms of the availability of cloud-based information resources for services delivery. To determine the group differences and the level of significance, post-hoc statistics with Hochberg's GT2 were tested to reveal multiple comparisons of the libraries by type (proprietorship) and the significant difference among the libraries. The analysis was carried out using SPSS version 23.

### **Results and Discussion**

Three hundred and sixty-nine copies of the questionnaire were administered to the respondents in the six (6) surveyed university libraries in North-East Nigeria. The university libraries surveyed were Abdulrahman Gaji Library, Adamawa State University, Mubi, Abubakar Tafawa Balewa University Bauchi Library, Kwararafa University Library, Wukari, Ramat Library, University of Maiduguri, Robert Pastor Library, American University of Nigeria (AUN) and Goodluck Ebele Jonathan Library, Yobe State University. Out of the 369 copies administered, 273 (74%) were filled, returned and found usable.

Table 1 presents response rate in respect of the questionnaire administered and returned in the surveyed university libraries.



## Response Rate

Table 1: The Response Rate.

| Items                                                            | Frequency  | Percentage |
|------------------------------------------------------------------|------------|------------|
| <b>Respondent's Library</b>                                      |            |            |
| Abdulrahman Gaji Library, Adamawa State University, Mubi         | 20         | 7.3        |
| ATBU Bauchi Library                                              | 78         | 28.6       |
| Kwararafa University Wukari Library                              | 7          | 2.6        |
| Ramat Library, University of Maiduguri                           | 124        | 45.4       |
| Robert Pastor Library, American University of Nigeria Yola (AUN) | 11         | 4.0        |
| Goodluck Ebele Jonathan Library, Yobe State University           | 33         | 12.1       |
| <b>Total</b>                                                     | <b>273</b> | <b>100</b> |

Table 1 reveals the response rate of the respondents according to libraries. Accordingly, Ramat Library, University of Maiduguri has the highest number of

Ebele Jonathan Library, Yobe State University has 33(12.1%) respondents, others are Abdulrahman Gaji Library, Adamawa State University 20(7.3%), Robert Pastor

respondents with 124(45.4%), followed by the Abubakar Tafawa Balewa University Bauchi library with 78 (28.6%) respondents. Goodluck

Library, American University of Nigeria (AUN) 11(4.0%) and Kwararafa University Library, Wukari, 7(2.6%) respondents in that order.

Table 2: Cloud-based Information resources and services provided in University Libraries in North-East, Nigeria

| Items | Information Resources and Services                                                       | Responses      |                |      |
|-------|------------------------------------------------------------------------------------------|----------------|----------------|------|
|       |                                                                                          | Available      | Not Available  | Mean |
| 1     | Institutional Repository (e.g. DSpace which house Scholarly content of the Institution)  | 53<br>(19.4%)  | 220<br>(80.6%) | 1.58 |
| 2     | File and Information storage on the Internet (e.g. google drive, dropbox)                | 111<br>(40.7%) | 162<br>(59.3%) | 2.22 |
| 3     | Library Website                                                                          | 239<br>(87.5%) | 34<br>(12.5%)  | 3.63 |
| 4     | Library Automation Software (e.g. Mandarin, Koha, OpenBiblio)                            | 183<br>(67%)   | 90<br>(33%)    | 3.01 |
| 5     | Social Networking Tools (e.g. Facebook, Instagram, myspace)                              | 104<br>(38.1%) | 169<br>(61.9%) | 2.14 |
| 6     | Online Public Access Catalogue (OPAC)                                                    | 107<br>(39.2%) | 166<br>(60.8%) | 2.18 |
| 7     | Databases (e.g Science Direct, Ebcohost, Hinary, Agora, Proquest)                        | 189<br>(69.2%) | 84<br>(30.8%)  | 3.08 |
| 8     | Emailing services                                                                        | 120<br>(44%)   | 153<br>(56%)   | 2.32 |
| 9     | Library Consortia (e.g. NULIB)                                                           | 87<br>(31.9%)  | 186<br>(68.1%) | 1.96 |
| 10    | Discovery tools (e.g ExLibris Primo, ProQuest Summon, OCLC WorldCat Discovery Services,) | 83<br>(30.4%)  | 190<br>(69.6%) | 1.91 |



Table 2 highlights the cloud-based information resources available for provision of service delivery in University libraries in North-East, Nigeria. These cloud-based information resources include Library Website which majority of the respondents agreed to its availability in the libraries for service delivery (mean=3.63). Databases (such as Science Direct, Ebscohost, Hinary, Agora, and Proquest) for downloads of scholarly publications (mean=3.08). Library Automation Software such as Koha is also available for providing library services for users (mean=3.01). On the other, Institutional Repository such as Dspace which stores and disseminate scholarly publications emanating from the institutions tends to be scarcely available in most of the libraries (mean=1.58). The e-mail services was affirmed to be adequately available and used for service delivery in the libraries (mean = 2.32). File and Information storage on the Internet is another service which indicated non-availability (mean=2.22). Online Public Access Catalogue (OPAC) is rarely available in most of the libraries (mean =2.18),

Similarly, Social Networking Tools are also not available for integration into the libraries to enhance their service delivery (mean = 2.14). Library Consortia (mean = 1.96), while the Discovery tools such as ExLibris Primo, ProQuest Summon, OCLC WorldCat Discovery Services, BiblioCore, Axiell Arena, ELiDOC Iguana, SirsiDynix Enterprise, Encore Discovery is (mean = 1.91).

### Hypotheses Testing

**H<sub>01</sub>:** There is no significant difference between the availability of cloud-based information resources for services provided by Federal, State and Private University Libraries in North-East Nigeria.

The null hypothesis was tested using One-Way Analysis of Variance (ANOVA) at 0.05 significant level. However, to determine the significant difference, a post-hoc test with Hochberg's GT2 was used to determine the significant difference.

Table 3: One Way ANOVA: Difference in information resources and services provided using CCT by Federal, State and Private University Libraries

|                | Sum of Squares | Df  | Mean Square | F      | Sig. |
|----------------|----------------|-----|-------------|--------|------|
| Between Groups | 2.343          | 2   | 1.172       | 28.357 | .000 |
| Within Groups  | 11.158         | 270 | .41         |        |      |
| Total          | 13.501         | 272 |             |        |      |

Table 3 shows three rows: the first row is between groups with the sum of square of 2.343, which represents the variance of the average in the cloud-based information resources for service delivery among Federal, State and Private University libraries. Within groups the sum of square of 11.158 which is the variance due to the R while the third row is the total. With one-way ANOVA ( $F(2,270) = 28.357, p = .000$ ), F-test greater than critical f-value ( $28.357 > 1.96$ ) and P value less than

the alpha level ( $.000 < 0.05$ ). This indicates that there are differences between rate of availability of cloud-based information resources for service delivery among Federal, State and Private University libraries. To determine the group differences and the level of significance, post-hoc statistics with Hochberg's GT2 was tested to reveal multiple comparisons of the libraries by type and significant difference among the libraries (Table 4 and 5).

**Table 4:** Multiple Comparison of the Libraries by type on information resources and services using CCT of Post-Hoc Hochberg's GT2

| (I) Libraries according to type | (J) Libraries according to type | Mean Difference (I-J) | Std. Error | Sig. |
|---------------------------------|---------------------------------|-----------------------|------------|------|
| Federal University Library      | State University Library        | .05341                | .03137     | .206 |
|                                 | Private University Library      | -.35254*              | .05001     | .000 |
| State University Library        | Federal University Library      | -.05341               | .03137     | .206 |
|                                 | Private University Library      | -.40595*              | .05546     | .000 |
| Private University Library      | Federal University Library      | .35254*               | .05001     | .000 |
|                                 | State University Library        | .40595*               | .05546     | .000 |

\* The mean difference is significant at the 0.05 level.

**Table 5:** Multiple Comparisons

| Test                                                     | p-value (sig.) | Significant? |
|----------------------------------------------------------|----------------|--------------|
| Federal University Library vs State University Library   | .206           | No           |
| Federal University Library vs Private University Library | .000           | Yes          |
| State University Library vs Private University Library   | .000           | Yes          |

Table 4 shows multiple comparisons of the mean difference according to the libraries by type, and it revealed that the Federal University Library and State University Library have a statistically no significant difference in availability of information resources and services provided using CCT ( $p = .206$ ). Furthermore, the Federal University Library and Private University Library have statistically significant difference in information resources and services provided

using CCT ( $p = .000$ ). Also, the private University library was found to have significant difference from the State University library in information resources and services provided using CCT ( $p = .000$ ). To further confirm the result and answer the null hypothesis, a post hoc Hochberg's GT2 test was performed, and the result is presented in table 6. Hochberg's GT2 was preferred because of the unequal number of samples from the groups (Field, 2009).

**Table 6:** Post-Hoc Hochberg's GT2 Homogeneous subsets

| University Libraries According to types | N   | Subset for alpha = 0.05 |              |
|-----------------------------------------|-----|-------------------------|--------------|
|                                         |     | 1                       | 2            |
| State University Library                | 53  | .4425                   |              |
| Federal University Library              | 202 | .4959                   |              |
| Private University Library              | 18  |                         | .8485        |
| <b>Sig.</b>                             |     | <b>.489</b>             | <b>1.000</b> |



The result in table 6 further confirms the significant differences in the extent of availability of cloud-based information resources for service delivery among Federal, State and Private university libraries. The State library with  $n = 53$ ,  $m = .4425$  is different from the Federal University library with  $n = 202$ ,  $m = .4959$  at  $p = .489$ . The private University library with  $n = 18$ ,  $m =$

$.8485$ ,  $p = 1.00$  has statistically different information resources and services provided using CCT among the libraries. A view of the mean plot in figure 1 revealed the clear differences in cloud-based information resources for service delivery among the Federal, State and Private university libraries.

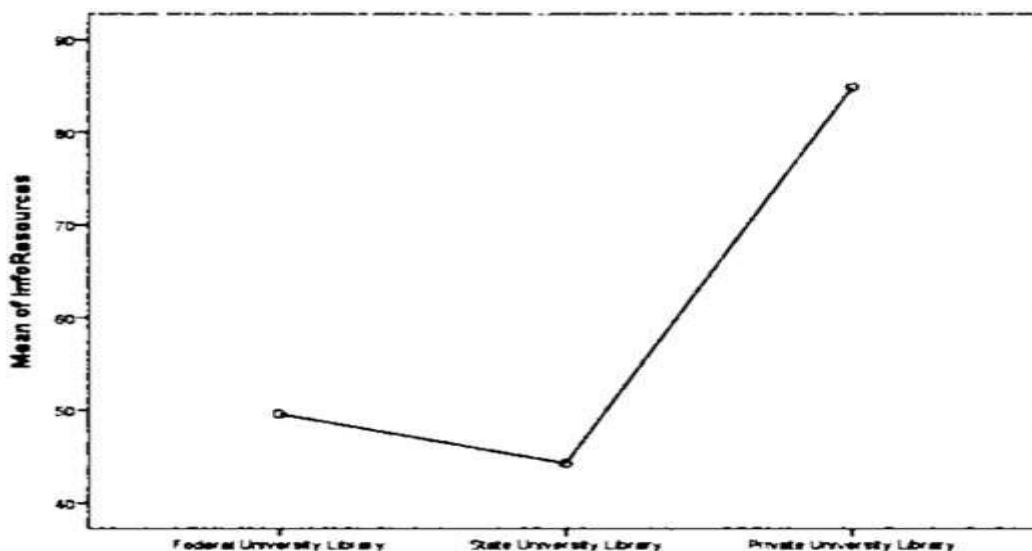


Figure 1: Mean Plot of Libraries type on information resources and services using CCT

The Federal University libraries have 49.6% of cloud-based information resources and services provided using CCT. The State University libraries have 44% of the same while the Private University library has 80% of cloud-based information resources and services provided using CCT. This indicates that there are significant differences between information resources and services provided using CCT among Federal, State and Private University libraries in North-East Nigeria. The null hypothesis is therefore rejected and the alternate hypothesis is adopted. This revealed that private university libraries have higher resources and services provision using CCT than Federal and State university libraries.

### Findings

Based on the analyses and data presented, the following are the summary of findings:

1. Cloud-based information resources for service delivery are available but slightly below average in Federal University Libraries, below average in State University libraries and above average in Private University Libraries in North East Nigeria.
2. There are significant differences among Federal, State and Private University Libraries in North East Nigeria on availability of cloud-based information resources for service delivery. There is no significant difference between Federal and State University libraries; there is a significant difference between Private and Federal as well as between Private and State University libraries.

### Discussion

Findings from Research Question 1 on the availability of cloud-based information



resources for service delivery in university libraries in North-East Nigeria, revealed a significant number of cloud-based information resources are provided using CCT, it revealed library website (mean=3.63), Library Automation Software (mean=3.01) and Database (mean=3.08). On the other hand, the study revealed a low extent of availability of Institutional Repository (mean=1.58) File and Information storage on the internet (mean=2.22), Social Networking Tools (2.14), Online Public Access Catalogue (OPAC)(2.18), Emailing services (2.32) and Discovery tools (1.91). While some of the information resources and services were available at a significant level, it is noticeable that availability of OPAC being one the most important information resources and services is low. This concurs with the study conducted by Bakrin, Bello and Ogunrinde (2020) on the cloud adoption and visibility of OPAC in Nigeria which revealed that availability and visibility of OPAC in university libraries is limited, in some cases it is completely absent while in other cases the hyperlink to the OPAC are broken and not reachable with few of the Internet Protocol (IP) address showing private IP address instead of the public IP address that is required to route information resources on the internet. However same study shows high availability of functional library websites.

The findings from  $H_{01}$  revealed that there is no significant difference between availability of cloud-based information resources for service delivery among Federal, State and Private University Libraries in North-East Nigeria. It is indicated that the Federal University libraries had 49.6% of its information services provided using CCT, the State University libraries had 44%, while the Private University libraries had over 80% of its information services provided using CCT. This indicates that there are significant differences between information services provided using CCT

among Federal, State and Private University libraries in North-East Nigeria. The null hypothesis was therefore rejected and the alternate hypothesis was adopted. By implication, the result implies that there are more cloud-based information resources and services in Private University libraries than what is obtainable in the Federal University Libraries and State University Libraries in North-East Nigeria.

### **Recommendations**

Based on the findings of this study, the following recommendations were made:

1. Federal and State University libraries in North-East Nigeria should have adequate cloud-based information resources for service delivery; the Private University libraries should sustain their current high cloud-based information resources and services status.
2. Federal and State University libraries in North-East Nigeria should provide adequate ICT facilities and cloud-based information resources for library services which can act as a springboard towards migration of library service to the cloud environment.
3. Federal and State university libraries need to do more like Private universities in terms of acquisitions of innovative information resources.

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