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Assessment of Cloud Computing Technologies for Library Service Delivery in Ignatius Ajuru University of Education, Port Harcourt, Nigeria

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Abstract
The study assessed cloud computing technologies for library service delivery in Ignatius Ajuru University of Education (IAUE), Rivers State. Specifically, the study sought to assess cloud computing technologies used in the library, areas of application of cloud computing, benefits and challenges of cloud computing technologies in IAUE library. Descriptive survey design was used for the study. The population of the study consists of 15 librarians working in IAUE library in Rivers State. The entire population was used in the study and as such there was no sampling. This is because the population was of a manageable size. The instrument used for the study was a self-designed four-point rating scale questionnaire, which elicited responses based on the study objectives. Mean and standard deviation was used to analyze the gathered data. The study found that Google, YouTube, Google Apps are the cloud technologies used in IAUE library. Also, the library used cloud technologies in the areas of cataloguing and classification, circulation, acquisitions, integrated management system, and web OPAC. Low capital expenditure on demand services and economies of scale amongst others are found to be the benefits of cloud computing. The challenges that militate against cloud computing technologies for library services and practices include security and privacy, computing performance, reliability, availability and portability. The study established that cloud computing is very important and its utilization in library services by librarians would enhance efficiency in information packaging, retrieval and storage, and recommended that the library should ensure more integration of cloud technologies for easy information service delivery within and beyond the institution.
Keywords: *Cloud Computing Technologies, Library Services Delivery, Port Harcourt, Nigeria*

1.1 Introduction

Cloud computing has become a major revolution in the world of technology and has gained ascendance in many sectors. It is a new form of computing in web technology that is provided via the Internet; it simply implies a pool of computing resources that are delivered through the Web (Fox, 2009).This technology

is server based, requiring remote servers and network to keep, organize and maintain data organizations and applications (Suman and Singh, 2016). Cloud computing involves the visualization and reshaping of Information Technology (IT) to meet broad concept of using Internet to gain access into technology-based services. It is a computing paradigm, where large pools of systems are connected in private or public networks, to provide dynamically scalable infrastructure for application, data and file storage (Harris, 2010). Goldner (2010) opines that libraries would need to add more systems to manage their changing collections over time because of the use of the new cloud technology, which will entail the movement from strictly physical collection management to a combination of physical, licensed and digital collections, so that files could be saved in the cloud, while some can be tracked as photos, videos, paper presentations and written documents as the case may be.

Cloud computing is a device that plugs into the cloud in order to gain access into the world of IT resources. It is a component made up of organs like clients, data centre and distributed servers. In other words, cloud computing allows individual users to own virtualized computing resources on a central physical data centre that is in fact shared among many other users around the world. Pal (2017), citing National Institute of Standards and Technology (NIST), affirms that cloud computing is a model that enables convenience, on-demand network access to a shared pool of configurable computing resources like servers, networks, storage, applications and services that can be quickly provisioned and released with less management effort. On the operational trend, Yaghmaei and Binesh (2017) asserts that personal computer can be connected to the broadband internet, G-mail or Yahoo mail services because of the quick and easy access to internet through smart phones, tablets and laptop that are relatively affordable.

With its emergence, Suman and Singh (2016) asserts that resources could be efficiently and dynamically allocated to multiple users as per demand that is cheaper and cost effective to maintain. In this same vein, David (2010) also stressed that cloud computing centralization offers service providers' total control over the versions of browser-based applications provided to clients, thereby removing the necessity for version upgrades or license or management to individual client computing devices. Kurelovi, Rako and Tomljanovi (2013) compared the value of cloud computing to traditional IT environment, that it offers economies of scale through aggregating computing resources and virtualization and ensures global reach of information and services using a computing environment which allows on-demand scalability and minimal initial investment, in addition to establishing a unified, open and flexible network teaching platform by reducing the hardware input, and these could expedite data efficiency. Goldner (2010) avows that common data can now be easily shared among services and users as well as remove the local storage, maintenance and backups which are prevalent in other applications.

Cloud computing as an emerging trend in contemporary librarianship has been amazing, especially its advantages over computing with central processing unit (CPU) accessed with desktop. Its application in the library involves the shifting of vital components of the library or information centres to the cloud in case of any eventuality like fire outbreak, flood or earthquakes for the safety and protection of records. The question on how the Nigeria libraries, especially academic libraries, are faring in the wake of this third revolution is mind bogging. While some have migrated partially, others are still at the verge of adopting the new technology which has come to stay, with lots of

advantages and some impeding challenges, which can be overcome.

1.2 Scope of Study

The institution under study is the Ignatius Ajuru University of Education (IAUE), Port Harcourt, Nigeria, established in 2019 by the Rivers State government. It was actually the old Rivers State College of Education, Rumuorlumeni, the institution is geographically located in the rainforest of the Niger Delta region in Nigeria. This oil rich zone is in the gulf of Guinea with enormous oil and gas activities and environmental pollution. With the exponential growth of literature, information explosion, high and increasing student population of over fifteen thousand (IAUE newsletter 2013), the demand for information and pressure on existing library resources and facilities increased significantly. Therefore, the need to embrace emerging technologies like cloud computing to cushion the pressure on poor resources and lack of facilities necessitated this study. IAUE, like other universities, is still grappling with underfunding, poor IT infrastructure, information storage challenges, resource metering, recovery and protection of records or data as against the problems experienced during the conversion of library records of the old Rivers State College of Education library to Ignatius Ajuru University of Education (IAUE) library. The cloud computing would be a quick alternative for the library, especially now that the student population is growing.

In this information age, where information is the crucial element for research, and technology is the driving force, no institution can afford to shy away from the reality because this cloud technology is economical, cheap and the easiest mode of storing and disseminating information. It is worthy of mention that the cloud computing technology as defined by Harris (2010)has no maintenance cost, no third party interference, no space occupied, no moving of devices, very flexible and enhances availability and accessibility. With the enormous advantage, Nigerian university libraries are still slow in utilizing fully this technology for all storage and service delivery.

1.3 Statement of the Problem

Cloud computing typically provides an opportunity for institutions to adopt an alternative model for computing or storing library resources because of reliability and availability; security, privacy; and interoperability which poses serious problem in library services and practice. These trends, like e-publication, internet usage, web tools, and consortium practices have become common practices. The Nigerian institutions are left with no option than to use software delivered through the internet on the browser without any installation, host an application on the internet, set up their own remote file storage and database system and more by merely utilizing the cloud computing methods. However, in spite of the obvious advantages associated with cloud computing, most university libraries have undermined its necessity and have not embraced the technology.

In addition to that, the resources in Nigerian university libraries are usually limited, due to poor funding, which invariably affects provision of good service and quality technical skills of Library and Information Science professionals. This study therefore sought to assess the cloud computing technologies for library service delivery in Ignatius Ajuru University of Education, Rivers State.

1.4 Objectives of the Study

The study assessed the cloud computing technologies for library service delivery in Ignatius Ajuru University of Education, Rivers State. To this end, four (4) research questions were asked to guide the study.

a) What are the cloud computing technologies in use in IAUE library?
b) What are the areas of application of cloud computing technologies in IAUE library?
c) What are the benefits of cloud computing technologies in IAUE library?
d) What are the challenges associated in cloud computing technologies in IAUE library?

2.1 Reviewed of Related Literature

There are several cloud technologies that have been developed to enhance library service delivery. Cloud is a third revolution technology specifically developed for storage and management of enormous data which is very adaptable to library routines and services, it operates without compromising on the architectural control required to ensure the integrity and confidentiality of any institutional data, systems, and processes.

On the types of services these technologies could enhance in the library, Mahipal (2015) identified the Online Computer Library Centre (OCLC) as one of the popular services for searching library data using cloud computing technology. The use of OCLC has led to improved library activities such as; circulation, cataloguing, acquisition, analytics, and other library related services on cloud platform through the web share management system. Amazon web services are also a major cloud computing service often used in the library. It helps to provide users with scalable and reliable low cost platform of cloud infrastructure. Some of the solutions offered by Amazon through cloud computing include application hosting, web hosting, backup and storage, enterprise IT, content, delivery, and databases. Amazon services are utilized in the library as unlimited database to store relevant materials in the cloud with assurance of storage and ease of retrieval. Moreover, Google offers varieties of application for cloud computing. Google Apps cloud services, a multi-tenant internet scale infrastructure, offer faster access to innovation. YouTube is another cloud application that helps to store audio-visual information resources. It offers cheap medium of storing videos with reliable backup. This is one of the leading cloud services, which provide users with free accessibility to audio-visual information resources.

While Gartener (2009) studies on cloud computing utilization revealed that universities and educational institutions are not prime users of the new technology rather industries and financial houses may have greater need for cloud than educational institutions. There are arguments and researches to buttress the fact that the cloud service will boost education, library management productivity and expose the wealth of the library collection to users. Ewuzie & Usoro (2012) expressed some concerns in the utilization or implementation of cloud computing in our education system in Nigeria, as lack of basic IT infrastructure, technical expertise, poor funding and security. Owusu-Ansah, Budu,& Budu (2019) studies on developing a cloud computing framework for university libraries to protect research output in Africa, explored the traditional storage approach with its associated risk as against the cloud computing storage and affirmed that research output would be secured for easy access, reliability, high lifespan, validation at a less cost.

The benefits of cloud computing in university libraries are enormous, but developing countries like Nigeria are still slow in utilizing these technologies. Haris (2014) cited in Owusu- Ansah, Budu,& Budu (2019) gives an analysis of the benefits of cloud storage especially for academic libraries and these include high performance, avenue for collaboration, cost saving, low technical expertise and timely access. This corroborates Li (2012) views that cloud storage reduces the cost of hardware and software, and makes the storage and

management of data on the internet possible. For instance, struggling academic libraries in developing countries that have challenges with funds or budget restraints can adapt the payment on data as pay-as-you-go.

Some of these benefits outweigh the challenges. Zainab, Chong & Chaw (2013) in their study revealed that the reasons why university research reports and findings were shifted into the clouds were to reduce the cost of ownership and maintenance of the cloud infrastructure and also for scalability of the services because of the large patronage and increased traffic of information user. Suman and Singh (2016) added that cloud computing technologies enable libraries to deal with technical issues that have nothing to do with their day-to-day mission and services; it is cheaper for users to collaborate in the area of projects using cloud technology than any other technologies, gain access to stored files from other devices like computers and other operating systems are very optimal. In this third revolution, library service delivery, storage, retrieval and capacity are laudable. Swapna and Biradar (2017) succinctly noted that cloud technology will facilitate the searching and sharing of data by users and librarians, so that information can simply be accessed from anywhere in the world on multiple platform. With the obvious benefits for university libraries, investing in this technology will be cost effective. Gosavi , et al (2012) pointed out that libraries are likely to benefit from cloud storage in the area of self-healing, multi-tenancy, linear scalable, service-oriented, SLA driven, virtualized and flexibility of services. These are the key functions of the academic libraries in this information technology era.

Every new technology has its challenges and cloud computing technology is not an exception. The challenges are enormous especially during the high traffic period: when most users are concurrently online, the service becomes extremely sluggish, because of the bulky nature of some files. Harris (2001) streamlines the common challenges of cloud computing to include data security, data recovery and availability when needed, management capability especially the infancy or newness of the technology, regulatory and compliance restrictions. Owusu-Ansah, Budu, & Budu (2019)also reiterated some similar challenges which include lack of regulatory policies, cloud computing policies as regards security of university information, lack of trust, copyright issues, privacy, security of information or data and interoperability are still nagging issues that need to be seriously resolved for cloud computing technology to be fully accepted in Nigerian universities. With the enormous advantages of cloud computing, some concerns have been expressed about the privacy of sensitive university documents domiciled in the library; they may be exposed to public views. Ume (2011) expressed some fears that hacking, theft and undue advantage of university security and privacy may be in the public domain. These fears can only be contained if necessary steps are taken by the authority to put restrictions and caution on usage and access. With the copious challenges, cloud service benefits outweigh the challenges. It is evident from the review of literature that cloud computing is a new technology whose application to library routine services such as cataloguing, classification, acquisition, storage, and dissemination of information is plausible. Several studies on cloud computing have been carried out, however, none in university library in Port Harcourt, Nigeria.

3.1 Methodology

This study employed the descriptive survey design. The study was carried out in Ignatius Ajuru University of education (IAUE). IAUE is a tertiary institution in Rumuolumeni, Port Harcourt, Rivers State, Nigeria that is specifically set up to train

potential teachers in the field of science, technology, business and agriculture. The population of the study comprised fifteen (15) librarians in the library. The entire population was used, as the number was small and accessible. The self-designed questionnaire tagged 'Assessment of Cloud Computing Technologies for Library Service Delivery (ACCTLSD)" was used as the instrument for data collection. The instrument was structured in the four-point rating scale of Strongly Agree (SA), Agree (A), Disagree (D), Strongly Disagree (SD). The instrument was face and content validated by experts in the Department of Library and Information Science, Ignatius Ajuru University of Education. The reliability of the instrument was established using Cronbach Alpha. The reliability coefficient obtained was 0.87.

This coefficient therefore ascertained the internal consistency of the instrument. Mean and standard deviation were used as statistical tools to analyze the data gathered from the respondents. Items with mean value greater than or equal to ($\geq$) 2.50 were accepted, otherwise rejected.

4.1 Results and findings
Research Question 1

Table 1: Cloud computing technologies

S/N	Cloud technologies	SA	A	D	SD	$\bar{X}$	Std.Dev	Remark
1	Google Apps (Drive, Gmail, Google docs)	5	4	4	2	2.80	1.08	Accept
2	Hotmail or Windows live mail	2	3	7	3	2.27	0.96	Reject
3	Facebook & Twitter	6	3	4	2	2.86	1.13	Accept
4	OCLC (online computer library center) webscale	4	6	4	1	2.87	0.91	Accept
5	YouTube	5	3	5	2	2.73	1.10	Accept
6	Amazon web service	1	4	6	4	2.13	0.92	Reject
7	Ex-Libris cloud	0	4	6	5	1.93	0.80	Reject
8	Duraspace's DuraCloud	0	4	4	7	1.80	0.86	Reject
9	Open source software (OSS)	2	3	4	6	2.07	1.10	Reject

Field Survey, 2020

Table 1 shows librarian responses on cloud computing technologies in use in IAUE library. Based on the criterion mean of 2.50, Google apps (2.80), Facebook & Twitter (2.86), OCLC (2.87), and YouTube (2.73) are cloud computing technologies accepted to be used in IAUE library. Whereas Hotmail or Windows live mail (2.26), Amazon web service (2.13), Ex-libris cloud (1.93), Duraspace's Dura cloud (1.80) and Open Source Software OSS (2.07) were rejected as the cloud computing technologies used in IAUE Library. This is shown by the grand mean scores of 2.61which is the benchmark for the items; this indicates that the respondents agreed that cloud computing technologies are used in IAUE library. These findings agree with the findings of Swapna and Biradar (2017) that cloud computing technology enhances libraries in storing, searching and sharing of its data. For example, OCLC World Cat service is one of the popular services for searching library data using cloud computing technology.

Research 2: What are the areas of application of cloud computing technologies?

Table 2: Areas of Application of cloud computing

S/N	Cloud technologies	SA	A	D	SD	$\bar{X}$	Std.Dev	Remark
1	Collection development /Acquisition	5	3	6	1	2.80	1.01	Accept
2	Circulation	6	7	1	1	3.20	0.86	Accept
3	Cataloguing and Classification	3	6	5	1	2.73	0.88	Accept
4	Web OPAC	7	3	1	4	2.87	1.30	Accept
5	Serials/Government Information	2	6	3	4	2.40	1.06	Reject
6	Integrated library Management	2	7	3	3	2.53	0.99	Accept
7	E-Learning	3	6	1	5	2.47	1.19	Reject
	Grand Mean					**2.71**	**1.04**	

Field survey, 2020

Result in Table 2 shows the areas of application of cloud computing technologies in IAUE library. Based on the criterion mean, collection development/Acquisition (2.80), Circulation (3.20), Cataloguing and Classification (2.73); Web OPAC (2.60), integrated library management.

(2.53) were accepted as the areas of application of cloud computing technologies, Serials /Government Information (2.40) and E-learning (2.47) were rejected as the areas of application of cloud computing technologies. These findings agree with the findings of Sahu (2015), which assert that cloud computing has become a new buzzword in the field of libraries and her routine functions (i.e. cataloguing and classification, circulation etc), different ICT services without much of a problem are third party services will manage server and undertake upgrades and take back backup of data.

David (2010) stressed that cloud computing centralization offers service providers' total control over the versions of browser-based applications provided to clients, thereby removing the necessity for version upgrades or license or management to individual client computing devices.

Research Question 3: What are the benefits of cloud computing technologies?

Table 3: **Benefits of Cloud Computing Technologies**

S/N	Benefits	SA	A	D	SD	$\bar{X}$	Std.Dev	Remark
1	Scalability	6	5	4	0	3.13	0.83	Accept
2	Flexibility/on demand Services	4	10	1	0	3.20	0.56	Accept
3	Access without Boundaries	5	4	3	3	2.73	1.16	Accept
4	No capital expenditure	5	5	5	0	3.00	0.85	Accept
5	Improves accessibility	6	6	1	2	3.07	1.03	Accept
6	Create convenience	7	2	3	3	2.87	1.25	Accept
	Grand Mean					**3.00**	**0.95**	

Field survey, 2020

Result in table 3 shows benefits of cloud computing technologies in IAUE library. Based on the criterion mean, scalability (3.13), Flexibility/on demand services(3.20), Access without boundaries (2.73), No capital expenditure(3.00), improves accessibility (3.07), Create convenience (2.87) are the benefits of cloud computing technologies in IAUE library. This agreement is confirmed by the grand mean scores of 3.00 which is the benchmark for the items which indicated that the majority respondents concede to the stated benefits of cloud computing in IAUE library. These findings agree with that of Skiba (2011), which emphasized economics of scale, no capital expenditures and on demand services as the three primary reasons higher institutions and her libraries consider the use of cloud computing.

Research Question 4: What are the challenges associated with cloud computing technologies?

Table 4: Challenges associated with cloud computing technologies

S/N	Challenges	SA	A	D	SD	$\bar{X}$	Std.Dev	Remark
1	Low service provider Reliability.	2	4	6	3	2.33	0.98	Reject
2	Insecurity and less privacy	4	2	3	6	2.67	1.28	Accept
3	Internet connectivity failure	5	4	3	3	2.73	1.11	Accept
4	Low interoperability	2	4	3	6	2.13	1.16	Reject
5	High cost of infrastructure	5	5	2	3	3.07	1.13	Accept
6	Lack of expertise	1	3	4	7	1.87	1.15	Reject

Field survey, 2020

Result in table 4 shows the challenges associated with cloud computing technologies in IAUE library. Based on the criterion mean, the findings revealed that insecurity and less privacy (2.67) and high cost of infrastructure (3.07), Internet connectivity failure (2.73) are the challenges associated with cloud computing technologies in IAUE library. However, low service reliability (2.33), low interoperability (2.13) and lack of expertise (1.87) were rejected. This finding is in line with Okai (2014) who pinpointed organizations' concerns, especially for higher institution, where security and confidentiality of data are stored in the cloud. Privacy has become a big issue in our contemporary information age, especially with cloud computing.

5.1 Discussion of Findings

Findings from the study reveal the following: cloud computing technologies are used in IAUE library such as Google Apps, Gmail, Google, Doc, Facebook, and Twitter, web OPAC, OCLC. This collaborates Swapna and Biradar (2017)'s claims that cloud computing technologies facilitate libraries search and sharing of data, and also recognize OCLC World cat service as one of the popular services for searching library data. On the application of cloud computing in library service delivery, the study reveals that services such as information resources

acquisition, data storage, circulation, cataloguing and Web OPAC are partially available. But these applications are minimally used by librarians because of their newness and staff poor attitude to IT utilization. On the benefits of cloud computing, the study revealed the enormous advantages libraries could derive from cloud computing technologies which include the economics of scale, low capital expenditures and on demand services which Skiba (2011), highlighted as the three primary reasons tertiary institution and her libraries must embrace the use of this technology. Although the study reveals some critical challenges such as insecurity and less privacy, computing performance, low interoperability and portability. This findings again confirm Okai (2014) earlier fears that organization would not want to throw its information to public view, especially tertiary institution's records. Privacy is a big issue in this information era, where security and confidentiality of data stored in the cloud are not secured.

Finally Sahu (2015) assertion that cloud computing is a new buzzword in library routine function because of its flexibility and reliability in utilization subsists.

Conclusion and Recommendations

The paper established that cloud computing is very important for university libraries and librarians especially in this era of information explosion and knowledge expansion for their routine duties and service delivery so that enormous information that could be stored in the cloud at a very low cost, no maintenance, no space, will benefit the IAUE librarians and information provider. In addition to cushioning some of the challenges like high student population, inaccessibility, poor library resources upsetting effective service delivery, the cloud computing becomes the best option. In view of the study, Ignatius Ajuru University of education library is yet to fully embrace cloud technologies because some vital cloud applications and policies for library and information service delivery are not fully in place. The paper concludes that IAUE management should be proactive to ensure that the librarians embrace cloud computing technologies to save cost and huge storage space which is one basic function of academic library

Management should draft the IT policy, invest in IT infrastructure because the world is inundated with information. Libraries should be automated, funded to subscribe to reliable internet companies, ensure good power supply, reliable network for easy and quick access to information so that cloud computing would become a reality. Librarians' IT skills should be regularly updated to get rid of technophobia and finally management should increase funding of academic libraries.

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