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Awareness and Adoption of Cloud Computing Technologies by Librarians for Effective Service Delivery: Evidence of Academic Libraries in Kogi State (North-Central), Nigeria

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Abstract
The study investigated the awareness and adoption of cloud computing technology for effective service delivery in academic libraries in Kogi State, Nigeria. Three (3) specific objectives guided the conduct of the study. The descriptive research method of the survey design was used in this study. The study focused on University libraries in Kogi State, Nigeria based on ownership (Federal, State, and Private). The population of the study comprised 68 academic librarians in three (3) selected University libraries based on ownership in Kogi State. Based on this therefore, a census sampling technique was employed in the study. The questionnaire was used as an instrument for data collection. The study found that library professionals at the University libraries under investigation have a significant level of awareness of cloud computing technologies. These technologies facilitate collaboration, information sharing, and digital preservation, and are used for various purposes such as resource repositories, data storage, and library portals. However, the adoption of cloud computing faces challenges including poor funding, librarians' attitudes and technical knowledge, internet connectivity issues, data security and privacy concerns, and inadequate power supply. The study, among others, recommended that University library management should develop and implement training programs to enhance librarians' technical knowledge and skills in cloud computing. University administration and library management should improve internet connectivity and infrastructure to support cloud computing adoption in University libraries.
Keywords: *Cloud computing technologies, Academic libraries, library management and University administration*

1.1 Introduction

Libraries are undergoing a transition from traditional library operations to digital resource centers giving information in various formats namely, text, image, video, and audio. Information communication technologies (ICT) have made significant progress in the access and distribution of information to users. Advancements in technology have led to a new concept known as cloud computing. The role of academic libraries has moved from traditional repositories of physical materials

to digital resources and services. Cloud computing offers libraries scalable storage, enhanced accessibility, and collaborative tools to manage and preserve digital collections effectively (Azam, 2019).

The delivery of computing services over the internet encompassing servers, space, databases, networks software, and intelligence to enable faster innovation, highly adaptable resources, and scale economies (Zubairu, 2021). Cloud computing enables the use of a network of remote servers hosted on the internet to store, manage, and process data rather than a local server or a personal computer. Shifting to cloud solutions allows libraries to save time and resources. Rahoo and Khan (2020) posited that cloud computing enables the migration of desktop applications to web-based applications such as communication tools (Gmail, Google Calendar, and Google Talk) and productivity tools (Google Docs: text files, spreadsheets, and presentations). Yuvaraj (2016) defines cloud computing as "a style of computing in which massively scalable and elastic information technology-enabled capabilities are delivered as a service to external customers using internet technologies."

Cloud computing is considered the fifth generation of computing after mainframe, personal computers, client-server computing, and the web. In a cloud computing environment, the organization running an application does not typically own the physical hardware used for the applications, instead, a subscriber copies files to the server over the internet. Njoku and Ken-Agbiriogu (2021) see cloud computing as a technology that allows users to use computation, storage, and data access services. Cloud computing is about moving services, computation, and data for cost and business advantage. By making data available in the cloud, it can be more easily accessed often and at a much lower cost, increasing its value by enabling opportunities for enhanced collaboration, integration, and analysis on a shared common platform.

Since cloud computing can fulfill virtually all information technology needs there is a need to identify four different types of cloud computing, namely: infrastructure, platform, applications, and services. These classifications are necessary to indicate the role that a particular cloud service offers and how the services perform its role. Infrastructure is buying Space/ time on external servers; examples are Amazon, A3, and Bungee. A platform on the other hand, is an existing software on which one can build its application, such as Facebook, while the application is software accessed with a Web browser, examples are Google Docs Service is ready to uses services accessed with a Web browser. Atuase (2019), defines each of the service models thus: Software as a Service (SaaS) allows users to use the provider's applications on a cloud through a web browser, while Platform as a Service (PaaS) allows users to deploy the cloud computing own applications on the provider's cloud infrastructure. Infrastructure as a Service (IaaS) allows users to control and manage computing resources.

Cloud computing can transform the way information systems are built and services delivered. This provides a library with an opportunity to extend its impact to its users anywhere, anytime. Anyone connected to the internet is probably using some type of cloud computing regularly. Whether they are using Google's Gmail, organizing photos on Flickr, or searching the Web with Bing, they are engaged in a cloud computing environment. As Aiyebelehin et al. (2020) pointed out, the interesting thing about cloud computing is that it did not start as a technology for the business enterprise but was driven by the public with services like Facebook and Flickr. Education is becoming completely associated with Information Communication Technology (ICT) in content delivery, communication, and collaboration. The need for servers, storage, and software is highly demanding in

Universities libraries. Edwin (2018) remarks that the primary purpose of university libraries is to support University functions of teaching, learning, research, and community services in ways consistent with and supportive of the institution's mission and goals. According to Zubairu (2021), a library can benefit from using cloud computing technology by increasing computing performance, storage capacity, universal accessibility, and cost reduction. This can help the library in terms of fixed and maintenance cost reduction in the IT investment of both hardware and software as well as computer services (Eskrootchi et al, 2020). With cloud computing, libraries may prevent financial waste, better track staff activities, and avert technological headaches such as computer viruses. The biggest benefit for libraries is that you don't "buy" the cloud; you just pay for what you use, when you use it, and then turn it off when you're done. Shifting to cloud solutions allows libraries to save time and resources.

1.2 Statement of the Problem

The 21st century is experiencing a great revolution in terms of technological advancement. This has led to different institutions such as libraries adopting the use of modern technologies in carrying out library services. The numerous benefits associated with the use of such technologies have led to their widespread usage among librarians in different libraries. Cloud computing technology has been highly embraced by librarians in the Western world for rendering library services. From the researcher's observation, there is a paucity of studies on librarians' awareness and deployment of cloud computing technologies for effective service delivery in academic libraries in Nigeria. However, it has also been shown that the deployment and utilization of cloud facilities are very low in the libraries understudy (Muahmmed & Abdullah, 2021; Dine & Okeji, 2023). This may be because of librarians' inadequate awareness and attitude towards the deployment of cloud computing technologies. It is against this backdrop that the study sought to investigate the level of awareness and adoption of cloud computing technologies by academic librarians in Kogi State (North-Central), Nigeria.

1.3 Objectives of the Study

The specific objectives of the study are to:

1. Find out whether library staff are aware of cloud computing technologies in the libraries under study.
2. Ascertain the areas in which cloud computing technologies are adopted in the libraries under study
3. Identify the challenges associated with adopting cloud computing technologies in the libraries under study.

1.4 Research questions

1. What is the level of awareness of cloud computing among librarians in the libraries under study?
2. What are the areas in which cloud computing technologies are adopted in the library?
3. What are the challenges associated with adopting cloud computing technologies in the libraries under study?

2.1 Literature Review

Information technology is the acquisition, processing, storage and dissemination of information by means of computers, office machines and telecommunication devices. Computers provide the processing, storage and retrieval facilities, while communication provides the facilities for the transfer or communication of data and information. The necessity for efficient data communication and the convergence of telecommunication, computer technology and software engineering have facilitated the development of networks

specially designed for cloud computing (Azam, 2019). The emergence of the integrated services in digital network is a major development for cloud computing. The network carries digital information which combines both voice and data in the same channels and so formed the bases for a wide range of communication options and services. The main three types of cloud computing are Public cloud, private cloud and hybrid cloud. Within these deployment models, there are four main services: infrastructure as a service (laas), platform as a service (Paas), software as a service (Saas), and server less computing. Libraries play a prominent role in academic institution by providing access to information resources and services that stimulate learning, teaching and research activities in the institution. Academic libraries support learning, teaching, and research activities of their parent bodies; they cater for the needs of the library users, not only for the needs but also in the conservation of knowledge (Singh, 2018).

Cloud computing is now being used by most organizations, its application includes, data backup in a case of disaster recovery, software development, and big data analytics. Cloud computing is now being adopted by various professions as well, such as health where it is used to develop personalized treatments for patients also financial services companies are using the cloud to sway real-time fraud detection and prevention more so, Video game producers are not left out as they use the cloud to deliver online games to limitless players. The National Institute of Standards and Technology (NIST) has identified five essential characteristics of cloud computing: “on-demand service, broad network access, resource pooling, rapid elasticity, and measured service”. Cloud services exhibit five essential characteristics that demonstrate their relation to, and differences from, traditional computing approaches. Many authors have defined awareness, Edwin (2018) defines awareness as the knowledge and understanding of something, especially as it relates to its development and its uses among people. Awareness in this study concerns the librarian's knowledge and understanding of cloud computing technology in the library.

However, some studies suggest evidence of poor level of awareness among librarians on deploying cloud computing technologies in libraries. Edwin (2018) found that the level of awareness of librarians on the use of cloud computing in general in University libraries in Nigeria is very low. His findings reveal that librarians in University libraries in South-South, Nigeria have a very confused understanding of the 'cloud computing' concept. As such librarians have not fully engaged in using the cloud to perform some library services. Research suggests that many librarians may not fully grasp the potential benefits and implications of cloud technologies for library services (Sivankalai, 2021). This lack of awareness can hinder decision-making processes and the efforts to integrate cloud solutions into library workflows effectively. Aiyebelehin et al. (2020) discovered that a major benefit of deploying cloud computing technologies in libraries is relatively low cost compared to its functionality. Cloud computing reduces paperwork, lowers transaction costs, and minimizes investment in hardware (and the resources to manage it). Idahosa and Eireyi-Edewede (2023) reveal that the use of cloud computing technologies facilitates easier collaboration. Since services in the cloud can be accessed anytime from any computer, it's easy to collaborate with employees in distant locations.

There are numerous challenges associated with cloud computing. Aiyebelehin et al. (2020) found that security is a big concern during the deployment of cloud computing technology due to the availability of different systems that may be working in multiple

environments. Atuase (2019) reveals that integrity, trust, privacy, expectations, control, and regulations intellectual property management has put three critical issues which include technical, legal, and organizational policy. Idahosa and Eireyi-Edewede (2023) found that inadequate power supply, data privacy, service provider reliability, and poor internet connectivity were challenges associated with cloud computing technologies in Nigeria academic libraries.

While studying other related studies, Zubairu et al. (2021) investigated the awareness and adoption of cloud computing in Nigerian libraries. Given the importance of cloud computing to information resources storage and service delivery, it has become necessary to find out the extent of awareness among library personnel and to ascertain what they use it for, either for personnel or professional use as well as the area to which cloud-based services has been adopted in some selected Private Universities in Osun State. The study concluded that most library personnel are aware of cloud computing and use it mostly for personal rather than professional purposes also, most libraries provide mailing services and social networking cloud-based services, more so, the most adopted area of cloud-based services in their libraries is in the area of Library Management Software (LMS) others raised concerns over the security of their resources.

Dime and Okeji (2023) investigated the use of cloud computing technologies for library service delivery by librarians in University libraries in Africa. The study found that YouTube, Google Drive, OPAC, Google Form, Gmail, and Google Scholar are the most mentioned cloud computing (CC) technologies used by librarians in University libraries in Africa. The study also revealed that the librarians use CC technologies to store and share files, for sharing videos related to library orientations/other video contents, to collaborate with other librarians for research projects, to survey users' level of satisfaction with library services, online document editing services, and provision of virtual/online reference services. The majority of the librarians mentioned lack of funds, no security and privacy of data, irregular staff training and development, and lack of CC knowledge and awareness as challenges associated with the adoption of CC technologies in Universities in Africa. Solutions to the security of data threats in the cloud environment are offered in the study.

Furthermore, Kolawole (2023) studied the perception of librarians on cloud computing technology for library service delivery in public universities in Ekiti State, Nigeria. The study found that librarians generally had positive perception of the advantages of cloud computing technology for library service delivery, including its potential to improve user experience and facilitate collaboration and resource sharing among libraries. The study concluded that though librarians perceived advantages of the technology to be enormous, yet there were concerns about the risks and challenges associated with cloud computing adoption, such as data security and privacy issues.

Aiyebelehin et al. (2020) examined the awareness and use of cloud computing services by librarians in selected universities in Edo State. A descriptive survey research design was employed and the instrument used was a questionnaire. The population of the study was 132 professional and Para-professional librarians. The findings revealed the librarians are aware of the use of OCLC, world cat, and Google Docs to a very high extent. It was found that the librarians used cloud computing services and technologies for collection development functions and cataloging. Also, Ekhaguosa et al. (2022) investigated cloud computing applications for accessing e-resources by Librarians in university libraries in Niger Delta Region,

Nigeria. In this study, the descriptive research design was adopted, and 43 items self-structured questionnaire was used to collect data. The findings discovered that librarians in university libraries in Niger Delta use applications of cloud computing. Regarding librarians' response to the question of librarians' cloud computing applications, the majority of librarians agreed that they use cloud computing applications to access, store, and share e-resources. In addition, a strong recommendation was made that Institutions and governments should provide internet and, facilities for effective and efficient cloud computing applications in accessing e-resources.

In a similar study, Efevberha-Ogodo and Ivwegherghweta (2023) studied librarians' knowledge about and attitudes toward using cloud computing technology in university libraries in South-South, Nigeria. The study's conclusions showed that South-South, Nigerian librarians had a high degree of understanding of cloud-based technologies. OCLC, Dropbox, and World Cat were some of the cloud computing technologies used by the libraries. Their usage was intended for the digital preservation of information resources as well as bibliographic checking and bibliographic compilation. The majority of participants were enthusiastic about their use. Some of the obstacles preventing the use of cloud computing technologies in the examined libraries were epileptic power supplies, sluggish internet connections, and a lack of technical expertise.

In India, Yuvaraj (2016) examined the constructs laid down by the information technology (IT) adoption theories to the cloud computing phenomena in conjunction with academic libraries of India to determine the factors responsible for the adoption of cloud computing. The findings validate the fact that perceived ease of use, usefulness and ubiquitous availability of the enabling technology are strong drivers of the adoption of cloud computing technology in libraries. Also, attitude is significantly correlated with the behavioral intention to adopt cloud computing services. High level of correlation was obtained between the cloud computing-perceived attributes and the librarian's intention to use cloud computing technology.
From the review, it was observed several studies have been conducted in Nigeria (particularly in the South-south and South-West regions), India, and other African countries to investigate the adoption, awareness, and use of cloud computing technologies in academic libraries, however, none of the studies particularly investigated the awareness and adoption of Cloud computing Technology by Librarians for effective service delivery in academic libraries in Kogi State, Nigeria. This study differs from other studies regarding the methodology, scope, and population. The researcher further observed that no study has been done regarding the awareness and adoption of cloud computing technologies in the North-Central region of Nigeria, hence the need for this study.

3.1 Research Methodology

The descriptive research method of the survey design was used in this study. The study focused on University libraries in Kogi State, Nigeria based on ownership (Federal, State, and Private). The reason for considering University libraries for the study out of other academic libraries is that Universities are considered to be the apex tertiary institutions in the state and also that Universities receive higher funding for acquiring library equipment and facilities. The population of the study comprised 68 academic librarians in three (3) selected University libraries based on ownership in Kogi State. This included the Federal University Lokoja (35); Prince Audu Abubakar University (22) and Salem University, Kogi State (11). Based on this, a census sampling technique was employed in

the study. The justification for using this technique was that the population size was relatively manageable by the researchers. The questionnaire was used as an instrument for data collection. Google form was employed to create the items of the questionnaire which was administered to the respondents through personal contacts to one of the academic librarians in each University who in turn distributed to colleagues using their WhatsApp group. Also, the statistical mean was used to answer the research questions and the criterion mean is set at 2.50. Any mean value less than 2.50 was rejected, while a mean value above 2.50 was accepted.

4.1 Data Analysis and Interpretation

This section presents the results of the findings based on the research questions as designed in the questionnaire.

Table 1: Level of library professionals' awareness

S/N	Level of library professionals' awareness	N	X	SD	Decision
1	Cloud computing facilitates collaboration among librarians.	64	3.63	.620	Accepted
2	Cloud computing can be used to serve multiple users at the same time.	64	3.49	.632	Accepted
3	Cloud computing technology is used for storing information over a network.	64	3.42	.583	Accepted
4	Cloud computing can be accessed by any device connected to the internet e.g. mobile phones, laptops, and tablets.	64	3.34	.696	Accepted
5	Cloud computing technologies enable librarians to share information with other libraries over a network	64	3.56	.618	Accepted
6	Cloud computing minimize investment in hardware	64	3.27	.742	Accepted
7	Cloud computing technologies are used for digital preservation of information resource	64	3.29	.724	Accepted
8	Cloud computing technologies are used for collection development function	64	3.23	.733	Accepted

Key: N= Total; X=Mean, SD = Standard Deviation

Table 1 shows that the mean responses of library professionals on the awareness of cloud computing in the libraries under study. The data revealed that all the responses indicated agreement with the level of library professionals' awareness to cloud computing technologies. The data in the table above revealed that, cloud computing facilitates collaboration among librarians (3.63), enables libraries to share information with other libraries over a network (3.56), serves multiple users at the same time (3.49), stores information over a network (3.42), cloud computing can be accessed by any device connected to the internet (3.34), cloud computing are used for digital preservation of information resources (3.29) and used for collection development functions (3.23). This implies that there is a significant level of awareness of cloud computing technologies among library professionals in the libraries under study.

Table 2:Area of adopting cloud computing technology in the library

S/N	Area of adopting cloud computing	N	X	SD	Decision
1	Library portal for new arrivals, book requests, queries, and feedback	64	2.75	.935	Accepted
2	Web OPAC, online renewals and reservation storage	64	2.69	.794	Accepted
3	Backup/ information resources storage	64	2.76	.901	Accepted
4	Storage of data and files in a public server	64	2.79	.841	Accepted
5	Library management software (LMS)	64	2.67	.850	Accepted
6	Data import and export	64	2.78	.870	Accepted
7	Resource Repository	64	2.81	.843	Accepted

Key: N= Total; X=Mean, SD = Standard Deviation \

Table 2 shows the mean responses of library professionals on areas for adoption of cloud computing in the libraries. The data in the table above revealed that cloud computing technologies are used for resource repository (2.81), cloud computing technologies are used for storage of data and files in public servers (2.79), cloud computing technologies are adopted for data import and export (2.78), cloud computing technologies are used for backup or information resources storage (2.76), cloud computing technologies are used in library portal for new arrivals, book requests, queries and feedback (2.75), cloud computing technologies are for OPAC, online renewals and reservation storage (2.69) and are used in library management software (2.67).

Table 3: Challenges associated with the adoption of cloud computing technologies

S/N	Challenges	N	X	SD	Decision
1	Poor funding of the library	64	3.42	.528	Accepted
2	Poor internet connectivity	64	3.27	.665	Accepted
3	Inadequate power supply	64	3.10	.821	Accepted
4	The problem of data security	64	3.23	.713	Accepted
5	Technical problems associated with the use of cloud computing	64	3.23	.763	Accepted
6	Poor technical knowledge among librarians	64	3.29	.866	Accepted
7	The problem of data privacy	64	3.18	.907	Accepted
8	Attitude of librarians	64	3.29	.833	Accepted

Key: SA = N= Total; X=Mean, SD = Standard Deviation

Table 3 shows the challenges associated with adopting cloud computing technologies in the libraries under study. These challenges ranged from poor funding of the library, the attitude of librarians, poor technical knowledge among librarians, poor internet connectivity, the problem of data security, the problem of data privacy, and inadequate power supply.

5.1 Discussion of the Findings

Findings revealed how much library professionals are aware of the cloud computing technologies at the university libraries under investigation. The findings showed that cloud computing technology facilitates collaboration among librarians, enables libraries to share information with other libraries over a network, serves multiple users at the same time, stores information over a network, cloud computing can be accessed by any device connected to the internet and are used for digital preservation of information resources. This implies that there is a significant level of awareness of cloud

computing technologies among library professionals in the libraries under study. The findings of the study collaborate with the study of Dime and Okeji (2023) who revealed that academic librarians in universities in Africa were aware of cloud computing technologies. However, this study contradicts the findings of Aiyebelehin et al. (2020) and Zubairu et al. (2021) found that many academic librarians are not aware of the concept of cloud computing technologies in University libraries.

Additionally, the study revealed the areas for the adoption of cloud computing in university libraries under investigation. Results reveal that cloud computing technologies are used for resource repositories, storage of data and files in public servers, data import and export, backup or information resources storage, and are used in library portals for new arrivals, book requests, queries, and feedback. This validates the findings of Dime and Okeji (2023) and Ekhaguosa et al. (2022). Furthermore, this finding also agrees with the study of Efevberha-Ogodo and Ivwegherghweta (2023) who found that cloud computing is essential for digital perseveration of information resources as well as bibliographic compilation.

The findings also indicated the challenges acclimated with adopting cloud computing technologies in the university libraries under investigation. The study found that challenges impeding the adoption of cloud computing technologies in the libraries ranged from poor funding of the library, the attitude of librarians, poor technical knowledge among librarians, poor internet connectivity, the problem of data security, the problem of data privacy, and inadequate power supply. The results of the study are in tandem with the findings of Idahosa and Eireyi-Edewede (2023) found that inadequate power supply, data privacy, service provider reliability, and poor internet connectivity were challenges associated with cloud computing technologies in Nigeria academic libraries. This also validates the findings of Atuase (2019).

Conclusion and Recommendations

Library professionals at the University libraries under investigation have a significant level of awareness of cloud computing technologies. These technologies facilitate collaboration, information sharing, and digital preservation, which are used for various purposes such as resource repositories, data storage, and library portals. However, the adoption of cloud computing faces challenges including poor funding, librarians' attitudes and technical knowledge, internet connectivity issues, data security and privacy concerns, and inadequate power supply. In general, the study highlights the potential benefits of cloud computing in University libraries, while also identifying areas for improvement to fully harness its capabilities. Based on the findings, the following recommendations were derived:

1. University library management should develop and implement training programs to enhance librarians' technical knowledge and skills in cloud computing.
2. University administration and library management should improve internet connectivity and infrastructure to support cloud computing adoption in university libraries.
3. Library management should develop and implement policies and guidelines to address data security and privacy concerns in cloud computing adoption.

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