

Cloud Computing Competencies of Librarians and Information Service Delivery in Federal University Libraries in South-South and South-East, Nigeria

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ABSTRACT

Background: This study investigated cloud computing competencies of librarians and Information Service delivery in federal university libraries in South-South and South-East, Nigeria.

Objectives: Three objectives, research questions were raised and hypotheses were formulated to guide the study.

Methods: Descriptive survey research design was employed. The population for the study was 147 electronic library staff from 11 federal Universities in South-South and South-East, Nigeria. All the 147 electronic library staff were sampled using census sampling technique. An instrument titled “Cloud Computing Competencies of Librarians and Information Service Delivery Questionnaire (CCCLISD)” was used for the data collection. The instrument was face validated by the researchers. The researchers and their trained research assistants administered the copies of the questionnaire. The data generated was analyzed using linear regression.

Results: The result of the study revealed that there exists a significant relationship between cloud computing competencies of librarians and information service delivery in University libraries in South-South and South-East, Nigeria. The findings further showed that librarians in federal universities in South-South and South-East, Nigeria could competently utilized cloud computing for information service delivery.

Conclusion: The study concluded that the ability of librarians to competently utilized cloud computing have enhanced information service delivery to library growing clientele

Significance: The study act as a bridge in closing the information gap from traditional method of information service delivery to digital using cloud computing.

Recommendations: It was recommended among others that university libraries in Nigerian should train and re-train their librarians on cloud computing technologies in order to provide efficient service delivery to users.

Keywords: Virtual shared servers, data centre, middleware, authentication, modular architectures

INTRODUCTION

Cloud computing is an internet-based computing delivery model where virtual shared servers provide data storage, software, infrastructure, platforms, devices, and other resources. It is a type of computing that relies on shared computing resources, often in large centralized data-centers rather than on-premises servers or personal devices. Adegbilero-Iwar and Hamzat (2017) defined cloud computing as a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (example networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal

management effort or service provider interaction. According to Harkut *et al.* (2019), the term cloud is often used as a metaphor for the internet and can be defined as new type of utility computing that uses virtual servers that have been made available to third parties via internet. Fagbola and Oluwaseun (2020) described it as a process of running workloads remotely over the internet in a commercial providers' data centre.

Poelka (2021) termed it as the realization of utility computing for the masses, where traditional information technology services are virtualized and provided via modular reference architectures that are created by the providers and vendors rather than to end users. Onwubiko *et al.* (2021) maintained that its virtual pool of corrupting resources through the internet makes it possible to separate the process of building an infrastructure for service provisioning in an organization while Kumar (2021) explained it to be a process that provides virtual machines to store data permanently on the web

Cloud computing is becoming a key factor in the modernization of libraries. Awa *et al.* (2023) noted that with the coming of Web 3.0, Web 4.0 and the high speed of Internet, academic libraries the world over have rapidly embraced the paradigm shift from traditional to virtualized services and cloud computing are used for services provision to information users in the library. According to Scientific World (2023), cloud computing, commonly referred to as the Fourth Industrial Revolution (4IR) is blurring the lines between the physical, digital and biological spheres and is helping libraries perform operations using third-party services to save costs and market information resources to users. Ezenwoke and Igbekele (2019) support that in this 21st century era of information age; cloud technology has become the concern of libraries as it plays a critical role in the provision of real time information to library users.

Different service model exists in cloud computing. Sahu (2020), Tritt and Kendall (2018), Benlian *et al.* (2018), Kumar (2021) and Knorr (2021) identified three service models; Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS), while Poelka (2021) identified six service models. These are: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), Storage as a Service (StaaS), Security as a Service (SECaaS) and Human as a Service (HaaS). This study would examine three service models. This include: Infrastructure as a Service (IaaS), Software as a Service (SaaS) and Storage as a Service (StaaS).

Infrastructure as a Service (IaaS) is described as a pay-as-you-go or pay-as-you-use model where the library provides only the software while the service provider provides the hardware and computing devices such as servers, storage systems, networking equipment, and data centre space. According to Gowda *et al.* (2019), the company provides the network infrastructure such as the virtual machines, virtual storage, disk drives, physical servers, web servers, email servers domain name server, private networks, while the library provides the operating system software and their associated software. This service model is utilised in several academic libraries the world over due to the fact that it helps eradicate the fear associated with sensitive file leaking, crash of library databases, software malfunction and malware attack on library hardware devices.

Software as a Service (SaaS) is another cloud computing model used in academic libraries. In this service model, the service provider provides the software and application on a pay-as-you go basis. Instead of the purchase, installation and maintenance of software, which is usually very expensive, the library rents or pays for the software and application to the service provider. According to Wada (2020), the SaaS provider manages the infrastructure, operating systems, middleware, and data necessary to deliver the programme, ensuring that the software is available whenever and wherever users need it. Libraries are provided with the access to the applications through licenses or subscriptions. Iles and Erturk (2015) maintained that SaaS applications run directly through web browsers, eliminating the need for downloads or installations of software. Several academic libraries have incorporated the services due to the fact that it helps reduce the time and cost of software installation and maintenance as well as facilitate system and software automatic update.

Storage as a Service (StaaS) is a model of computer data storage in which the digital data is stored in logical pools, said to be on the cloud. The physical storage spans multiple servers (sometimes in multiple locations), and the physical environment is typically owned and managed by a hosting company. Huang (2019) described it as the storage of online data in a cloud environment, which includes multiple connected computing resources. Adegbilero-Iwari and Hamzat (2017) explained that Storage as a Service (SaaS)

allows libraries to save data and files in an off-site location that could be accessed either through the public internet or through a dedicated private network connection. The provider hosts, secures, manages, and maintains the servers and associated infrastructure and ensures that users have access to the data whenever it is needed. Ibrahim *et al.* (2016)) reiterated that, it is essentially a system that allows a library to store data on the Internet, as it would save on a computer. Libraries use SaaS to mitigate risks in disaster recovery, provide long-term retention for records and enhance efficient service delivery to users.

Consequently, academic libraries need competent personnel to be able to provide the setup as well as intermediate between the technology and users. It apparently need competent librarians that would handle the networks, servers, storage, applications, and perform authentication, authorization, access, control and monitoring in order for users to optimally benefits from cloud computing service delivery. Otherwise, the essence of the provision of cloud computing in libraries may not be achieved. According to Sahu (2020), one-way academic library could meet the diverse information needs of users in this information age is to hire competent staff who would be able to provide cloud computing services to users. Kumar (2021) pointed out that it is wishful to think that cloud-based systems will manage themselves. It need skilled professionals to handle the system. It therefore becomes imperative for academic libraries to hire competent librarians to manage the cloud services in order to enhance effective service delivery to library esteem clientele.

Information service delivery is the degree to which a service meets or exceeds the expectations and needs of the users. They are library processes and activities deployed by libraries to deliver information services and resources to users, with the aim of enhancing the activities and productivity of library users. Ezenwoke and Igbekele (2019) defined information service delivery as arrays of activities and facilities targeted at providing information in various formats so as to satisfy the broad and varying information needs of library patrons within the academic community. Onwubiko *et al.* (2021) viewed it as sets of distinctive activities that jointly and individually contribute to the development and dissemination of information resources to users. They are services that aimed towards providing users with the right information needed to answer their queries and to help them accomplish the task for decision-making or reduction of the level of uncertainty (Obiano *et al.*, 2021). In this information age, cloud computing has been identified as a leading technology that enhance library service delivery as it provide information in real time.

The place of cloud computing in enhancing information service delivery cannot be over-stressed. However, the cloud computing competencies of librarians in university libraries in Nigeria remain a mirage. It is against this background that this study investigates cloud computing competencies of librarians and information service delivery in federal university libraries in South-South and South-East Nigeria.

Statement of the Problem

There exist a huge gap between government capital expenditure on cloud computing technologies and service delivery in Nigerian academic libraries. According to Echono (2023), The Tertiary Education Trust Fund (TETFund) has, in the last seven years, committed a sum of N27.76 -13824 as ICT intervention support to public tertiary schools in the country. The Finance Department of TETFund (2023) buttressed that 15.2 billion naira was proposed for ICT Support in 2023 and over 50% of the money have been released for the intended project. These exclude other monetary values and internal generated revenues (IGR) expended on cloud computing technologies by academic institutions.

Despite this huge amount of money, library users still complain of poor service delivery. Users lament of the inability of ICT librarians to manage technical services such as online databases, digital archives, library website, development and implementation of digital literacy programme, troubleshoot computer systems to prevent complete breakdown of the system, perform data backup, enhanced multi-user support, performs authentication of files and disaster recovery management system for security of all library's digital content, carryout intrusion test to all library's web documents, perform email security system that exercises control over the library's email as well

Poor service delivery was further identified by Chukwudum and Dika (2017) as inability of ICT librarians to manage and provide digital access and support to library users, perform data analysis and preservation to ensure that digital resources are effectively stored, preserved, accessible and utilized by library growing clientele,

perform virtual reference, document delivery, users education, compilation of reading list to information users, provide virtual selective dissemination of information, current awareness, information resource sharing and information literacy.

This worrisome situation has made researchers seem to loss interest in seeking for information resources from the library. Kwanya *et al.* (2020) confirmed that for a moment, information seekers seemed to believe that they could do without libraries and librarians, hence the need to turn to Google as their primary means of getting information. In light of these challenges, this study aim to ascertain the cloud computing competencies of librarians and service delivery in university libraries in South-South and South-East, Nigeria.

Purpose of the Study

The main purpose of this study is to examine cloud computing competencies of librarians and information service delivery in University libraries of South-South and South-East, Nigeria. The specific objectives of the study are to:

- (i) determine the relationship between librarians Infrastructure as a Service (IaaS) competence and information service delivery in University libraries in South-South and South-East, Nigeria.
- (ii) examine the relationship between librarians Software as a Service (SaaS) competence and information service delivery in South-South and South-East, Nigeria.
- (iii) ascertain the relationship between librarians Storage as a Service (StaaS) competence and information service delivery in South-South and South-East, Nigeria.

Research Questions

The following research questions were raised to guide the study:

- (i) What is the relationship between librarians Infrastructure as a Service (IaaS) competence and information service delivery in University libraries in South-South and South-East, Nigeria?
- (ii) What is the relationship between librarians Software as a Service (SaaS) competence and information service delivery in University libraries in South-South and South-East, Nigeria?
- (iii) What is the relationship between librarians Storage as a Service (StaaS) and information service delivery in University libraries in South-South and South-East, Nigeria?

Research Hypotheses

The following null hypotheses were formulated for testing.

H₀₁: There is no significant relationship between librarians Infrastructure as a Service (IaaS) competence and information service delivery in University libraries in South-South and South-East, Nigeria.

H₀₂: There is no significant relationship between librarians Software as a Service (SaaS) competence and information service delivery in University libraries in South-South and South-East, Nigeria.

H₀₃: There is no significant relationship between librarians Storage as a Service (StaaS) competence and information service delivery in University libraries in South-South and South-East, Nigeria.

Theoretical Framework of the Research

The theoretical framework of the study is based on two Diffusion of Innovation theory (Roger, 2003) and Service Quality Theory (SERVQUAL) Zeithaml and Berry (1988).

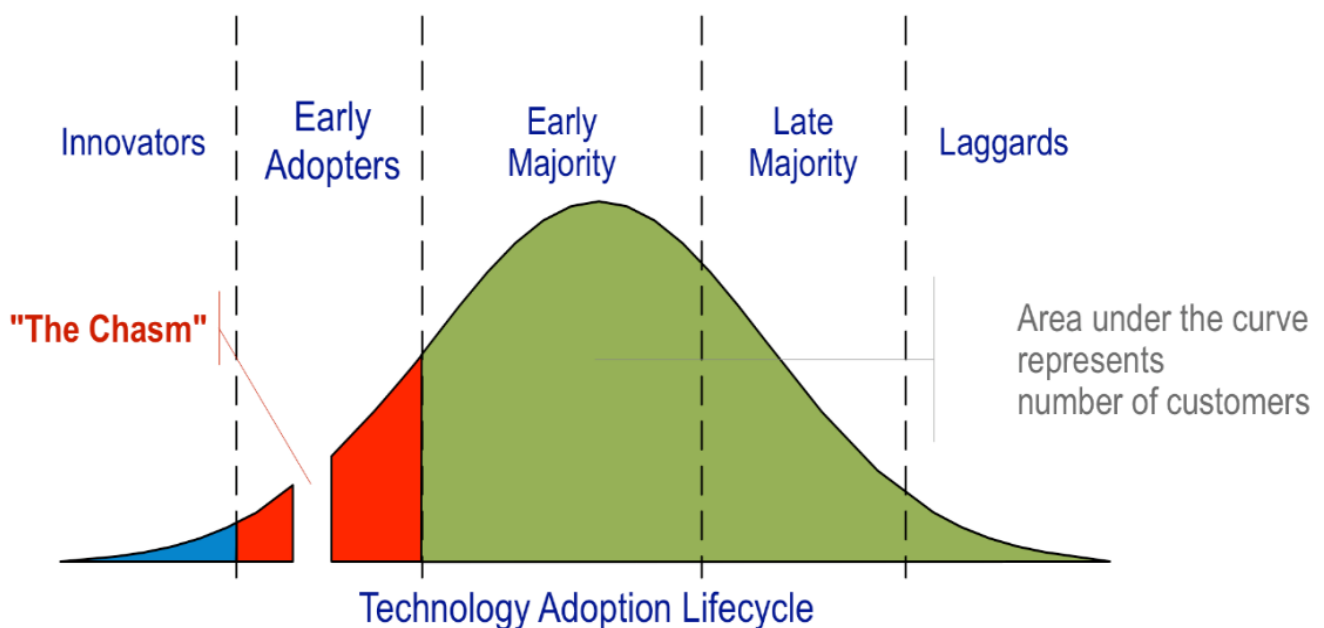
The Diffusion of Innovation Theory (Rogers, 2003)

The Diffusion of Innovation theory is one of the oldest social science theories originated in communication with the purpose of explaining how, over time, an idea or product gains momentum and diffuses through a specific

population or social system. The theory holds that acceptance of any technology/information system by users is influenced by such characteristics as compatibility, complexity, observability and relative advantage of the technology as well as to the intensity of promotion by individuals, known as change agents. It provides a holistic insight into organisational adoption of innovations (new ideas, concepts, or objects) and is appropriate to understand issues around the adoption of technologies/information system such as cloud computing.

Under the diffusion of innovation theory, there are five established categories of technology adopters, while the majority of the general population tends to fall in the middle categories. The categories are: innovators, early adopters, early majority, late majority and laggards. Innovators are "venturesome", they are cosmopolitan in outlook, tend to be better educated, willing to take risks, and are more socially mobile than their peers. While the early adopters are already aware of the need to change and so are very comfortable adopting new ideas, early majority usually adopts new ideas before the average person but typically needs to see evidence that the innovation works before they are willing to adopt it. The late majority, people that are always skeptical of change, and will only adopt an innovation after it has been tried by the majority. The laggards are tradition bound people and they are very conservative. They are very skeptical of change and are the hardest group to bring on board.

Figure 2.1: Diffusion of Innovation Theory



Source: (communicationtheory.org, 2023)

Conceptual Framework

Concept of Cloud Computing

The concept of cloud computing is not a revolution in terms of technology. It has been established based on the solid ground of virtualization, distributed system, and web services. According to Venters and Whitely (2012), the cloud computing concept emerged from the evolution of two specific strands in the form of technological innovations (e.g. virtualization, data center automation and high performance networks) and a more pronounced emphasis on the service perspective of IT provision (e.g. the service providers focus had shifted from the management of IT assets to ensuring that customers derive the maximum amount of value from using their services). Ali and Gatiti (2020) pointed out that cloud computing refers to both applications delivered as services via the internet and the Infrastructure in data centers that enable the services.

In the words of Suman and Singh (2016), cloud computing is not a new technology but a new form of computing that has not yet got a definite generally accepted definition and interpretation. However, the authors maintain

that cloud computing is a web-based technology, which is a new form of computing. It is a service provided on the internet or network. Aloysius and Eyene (2018) noted that cloud computing is one of the most important cloud services in the 21st century that offers infrastructure, platform and software as a service. Cloud computing is a conjunction of technologies with trends that make infrastructures and applications more dynamic, more flexible and replaceable. Arokia (2021) supported that cloud technology is a term used as a metaphor for the wide area networks (like internet) or any such large networked environment. It came partly from the cloud-like symbol used to represent the complexities of the networks in the schematic diagrams. It represents all the complexities of the network, which may include everything from cables, routers, servers, data centers, and all such other devices.

Cisco (2021) in its own attempt defined cloud computing as “IT resources and services that are abstracted from the underlying infrastructure and provided on-demand and at scale in a multitenant environment. Ezenwoke and Igbekele (2019) defined cloud computing as the dynamic provisioning of IT capabilities (hardware, software, or services) from third parties over a network. National Institute of Standards and Technology (NIST) (2021) saw cloud computing to be a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. Arokia (2021) defined cloud computing as an emerging computer paradigm where data and services reside in massively scalable data centers in the cloud and can be accessed from any connected devices over the internet.

Concept of Quality Information Service Delivery

Essentially, library and information service delivery are library processes and activities that are deployed by libraries to deliver information services and resources to users, with the aim of enhancing the activities and productivity of library users. Onwubiko *et al.* (2021) defined quality library services as sets of distinctive activities that jointly and individually contribute to the development and dissemination of information resources to users. Ezenwoke and Igbekele (2019) submitted that quality information service delivery consists of arrays of activities and facilities targeted at providing information in various formats so as to satisfy the broad and varying information needs of library patrons within the academic community. Islam and Sheikh (2019) supported that they are services that are aimed towards providing users with the right information needed to answer their queries and to help them accomplish the task of for decision-making or reduction of the level of uncertainty. Information service delivery are of various types ranging from reference and information service, document delivery services, online reservation of books, current awareness service, selective dissemination of information (SDI) services, inter library loan service, online database services, resource sharing, information repackaging, email alerts, instant messaging.

Sahabi and Otobo (2021) maintained that library services are assuming a different dimension in philosophy, model and information delivery. Chukwudum and Dika (2017) avowed that quality and timely information service delivery is one among the several factors that drives the library profession, which is in consonant with the fifth Law of Library Science that says “save the time of the users. Therefore, it is important to note that service delivery is geared towards meeting the information demands and needs of users at the right time when the need arises (Agbo, 2015).

In view of this, Okiki (2021) added that librarians are information specialist with expertise in acquisition, processing, preservation and dissemination of information sources, for authenticity, objectivity, authority and currency. Librarians have to reach user populations and their need for up-to-date relevant information. When this is done, there can be limitless access to information services by millions of users and information seekers. On the other hand, Alabi and Sani (2021) are of the opinion that librarians are at the forefront of providing information services to respective academic communities in order to support their teaching, learning and research needs. Effective delivery of information services that meet the needs and aspirations of academic library users and lifelong learners is a long-standing goal of the library and information profession.

Breeding (2018) pointed out that with the emergence of cloud computing, library operations and service delivery have been redefined and redesigned for unlimited information service delivery to users. Shonhe (2017) supports

various information service delivery techniques such as personalized collections, SMS/text notifications, online reference services, social networks, websites, mailing lists and OPACs and cloud computing have been used as effective medium of information service delivery in academic libraries in the past years. Ogar and Sani (2021) observed that print materials are no longer sufficient to store information. CDROM databases, electronic document delivery, automated cataloguing, circulation systems and online information retrieval (OPAC) have become the order of the day.

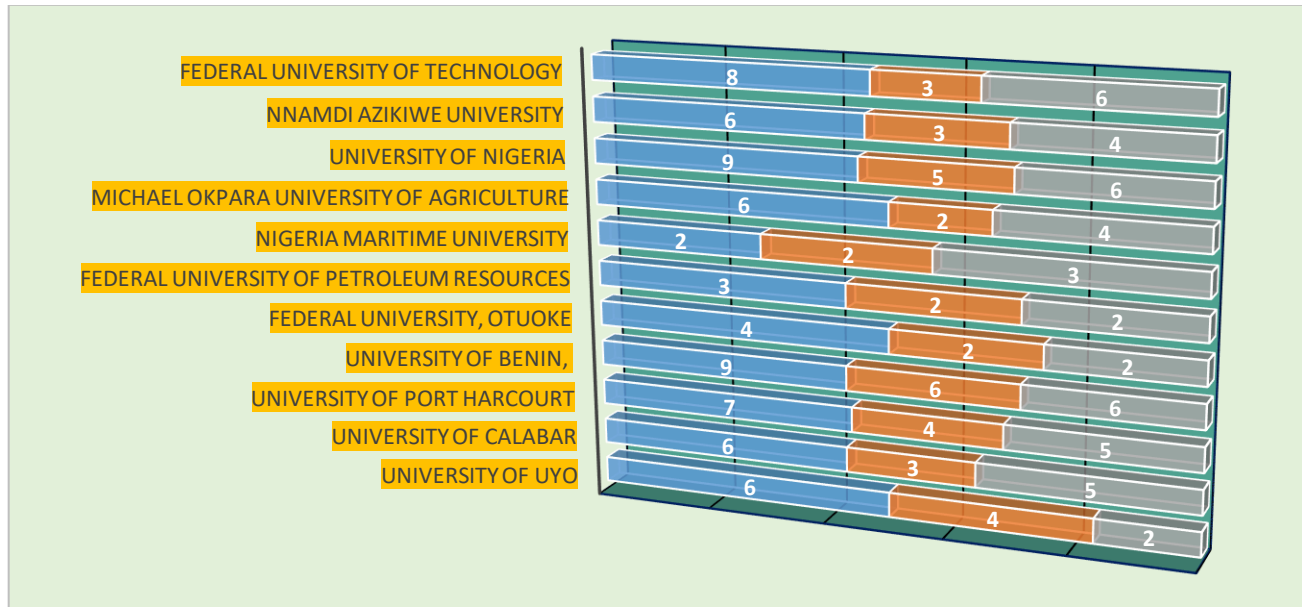
METHODOLOGY

Descriptive survey design was adopted for this study. The study area was South-South and South-East, Nigeria. The population of the study was 147 e-library staff in eleven federal Universities in South-South and South-East, Nigeria. The e-library comprised three units; internet, institutional repositories and automation units. All the 147 e-library staff was sampled using census sampling technique. A structured questionnaire known as “Cloud Computing Competencies of Librarians and Information Service Delivery Questionnaire (CCCLISD)” was used in collecting data for the study. The instrument was face validated by the researchers. The researchers and their trained research assistants administered the copies of the questionnaire. The data generated was analyzed using linear and regression.

Table 1: Distribution of Population of the Study. Sources: (University Librarians Office and Circulation Desk of the Respective Institutions under Study, 2023/2024 Academic Session)

Population Distribution of E-Library Staff				
Universities	Internet Unit	Institutional Repositories Unit	Automation Unit	Total
University of Uyo, Uyo.	6	4	2	12
University of Calabar, Calabar.	6	3	5	14
University of Port Harcourt, Port Harcourt.	7	4	5	16
University of Benin, Benin.	9	6	6	21
Federal University, Otuoke.	4	2	2	8
Federal University of Petroleum Resources, Effurum.	3	2	2	7
Nigeria Maritime University, Okerenkoko.	2	2	3	7
Michael Okpara University of Agriculture, Umudike.	6	2	4	12
Federal University of Technology, Owerri	8	3	6	17
University of Nigeria, Nsukka	9	5	6	20
Nnamdi Azikiwe University, Awka	6	3	4	13
Total	66	36	35	147

Figure 1: Bar Chart of Population Distribution of E-Library Staff



Correlation Coefficient Value

Relationship Strength

1.00	-	perfect relationship
0.80-0.99	-	very strong relationship
0.60-0.79	-	strong relationship
0.40-0.59	-	average relationship
0.20-0.39	-	weak relationship
0.01-0.19	-	very weak relationship
0.00	-	no relationship

Correlation Coefficient Value according to Ramsey (2021)

RESULT AND DISCUSSION

Results

Research Question 1:

What is the relationship between librarians Infrastructure as a Service (IaaS) competences and information service delivery in federal university libraries in South-South and South-East, Nigeria?

Table 4.1: Linear Regression on the relationship between librarians Infrastructure as a Service (IaaS) competences and Information Service Delivery in Federal University Libraries in South-South and South-East, Nigeria.

Variable	R	R ²	% of contribution	Adjusted R	Remark
Librarians IaaS Com.	0.422	0.362	36.2	0.41	average relationship
Information Service Del.					

Source: Field data (2024)

Data in Table 4.1 shows that the correlation coefficient of (R) 0.422 indicates that there is an average linear relationship between librarians Infrastructure as a Service competences and information service delivery in federal university libraries in South-South and South-East. This implies that for the ability of e-librarians to be able run operating systems, perform data migration and perform data loss prevention, there is a corresponding effectiveness in information service delivery. The R^2 of 36.2 indicates that librarians Infrastructure as Service competences contributed 36.2 % to the observed variation in information service delivery in federal university libraries in South-South and South-East, Nigeria.

H₀₁: There is no significant relationship between librarians Infrastructure as a Service (IaaS) competences and Information Service Delivery in federal university libraries in South-South and South-East, Nigeria

Table 4.2: Regression Analysis of the relationship between librarians Infrastructure as a Service competences (IaaS) and information service delivery in federal university libraries in South-South and South-East, Nigeria

Model	Sum of Squares	Df	Mean Square	F.	Sig.
Regression1 Residual	113.720	1	7.651	3.51	.000
Total	511.128	146	9.802		
	626.848	147			
Model	Unstandardized Coefficients		Standardized Coefficients	t	sig.
	B	Std. Error	Beta		
(Constant)	33.024	1.797		18.380	.000
1Information Service Delivery (y)	.534	.054	.056	5.97	.000

Level of Significance 0.05, df= 147-1.

Source: Field data (2024)

The data in Table 4.2 indicates that the calculated f-value is 3.51, while the critical r-value is 2.27 at 0.05 level of significance. Since the calculated f-value is greater than the critical r-value, the null hypothesis is rejected. This implies that there is a significant relationship between librarians Infrastructure as a Service competences and information service delivery in federal university libraries in South-South and South-East, Nigeria. Also, to determine the level of effectiveness in service delivery, the standardized beta coefficient of .056 was obtained with t-calculated of 5.97 and p-value of 0.000($p < 0.05$). The standardized beta is positive which implies that for e-librarians competences in Infrastructure as a Service, there is a corresponding effectiveness in information service delivery.

Research Question 2:

What is the relationship between librarians Software as a Service (SaaS) competences and information service delivery in federal university libraries in South-South and South-East, Nigeria?

Table 4.3: Linear Regression on the relationship between librarians Software as a Service (SaaS) Competences and Information Service Delivery in Federal University Libraries in South-South and South-East, Nigeria.

Variable	R	R ²	% of contribution	Adjusted R	Remark
Librarians SaaS Com.	0.641	0.592	59.2	0.44	Strong relationship
Information Service Del.					

Source: Field data (2024)

Data in Table 4.1 shows that the correlation coefficient of (R) 0.641 indicates that there is a strong linear relationship between librarians Software as a Service competences and information service delivery in federal university libraries in South-South and South-East. This implies that for the ability of e-librarians to be able to make subscription to SaaS, handle the software applications, use the search interface to search relevant information resources to users, monitors the application engine that enhances scalable hosting of multiple data, there is a corresponding effectiveness in information service delivery. The R² of 59.2 indicates that librarians Software as Service competences contributed 59.2 % to the observed variation in information service delivery in federal university libraries in South-South and South-East, Nigeria.

H₀₂: There is no significant relationship between librarians Software as a Service (SaaS) competences and Information Service Delivery in federal university libraries in South-South and South-East, Nigeria

Table 4.4: Regression Analysis of the relationship between librarians Software as Service competences (SaaS) and information service delivery in federal university libraries in South-South and South-East, Nigeria

Model	Sum of Squares	Df	Mean Square	F.	Sig.
Regression 1 Residual	471.528	1	8.518	5.72	.000
Total	318.470	146	9.772		
	789.998	147			
Model	Unstandardized Coefficients		Standardized Coefficients	t	sig.
	B	Std. Error	Beta		
(Constant)	48.624	1.897		19.444	.000
1 Information Service Delivery (y)	.651	.069	.078	6.88	.000

Level of Significance 0.05, df= 147-1.

Source: Field data (2024)

The data in Table 4.2 indicates that the calculated f-value is 5.72, while the critical r-value is 2.27 at 0.05 level of significance. Since the calculated f-value is greater than the critical r-value, the null hypothesis is rejected. This implies that there is a significant relationship between librarians Software as a Service competences and information service delivery in federal university libraries in South-South and South-East, Nigeria. Also, to determine the level of effectiveness in service delivery, the standardized beta coefficient of .078 was obtained with t-calculated of 6.88 and p-value of 0.000(p<0.05). The standardized beta is positive which implies that for e-librarians competences in Software as a Service, there is a corresponding effectiveness in information service

delivery.

Research Question 3:

What is the relationship between librarians Storage as a Service (StaaS) competences and information service delivery in federal university libraries in South-South and South-East, Nigeria?

Table 4.5: Linear Regression on the relationship between librarians Storage as a Service (StaaS) Competences and Information Service Delivery in Federal University Libraries in South-South and South-East, Nigeria.

Variable	R	R ²	% of contribution	Adjusted R	Remark
Librarians StaaS Com.	0.689	0.627	62.7	0.58	Strong relationship
Information Service Del.					

Source: Field data (2024)

Data in Table 4.1 shows that the correlation coefficient of (R) 0.689 indicates that there is a strong linear relationship between librarians Storage as a Service competences and information service delivery in federal university libraries in South-South and South-East. This implies that for the ability of e-librarians to be able to manage the digital data stored in logical pools and prevent logical and physical failure of stored files, there is a corresponding effectiveness in information service delivery. The R² of 62.7 indicates that librarians Storage as Service competences contributed 62.7 % to the observed variation in information service delivery in federal university libraries in South-South and South-East, Nigeria.

H03: There is no significant relationship between librarians Storage as a Service (StaaS) competences and Information Service Delivery in federal university libraries in South-South and South-East, Nigeria

Table 4.6: Regression Analysis of the relationship between librarians Storage as Service competences (StaaS) and information service delivery in federal university libraries in South-South and South-East, Nigeria

Model	Sum of Squares	Df	Mean Square	F.	Sig.
Regression 1	471.772	1	8.618	6.11	.000
Residual Total	428.115	146	9.870		
	499.887	147			
Model	Unstandardized Coefficients		Standardized Coefficients	t	sig.
	B	Std. Error	Beta		
(Constant)	50.713	1.852			.000
1 Information Service Delivery (y)	.622	.061	.071	6.42	.000

Level of Significance 0.05, df= 147-1.

Source: Field data (2024)

The data in Table 4.2 indicates that the calculated f-value is 6.11, while the critical r-value is 2.27 at 0.05 level of significance. Since the calculated f-value is greater than the critical r-value, the null hypothesis is rejected.

This implies that there is a significant relationship between librarians Storage as a Service competences and information service delivery in federal university libraries in South-South and South-East, Nigeria. Also, to determine the level of effectiveness in service delivery, the standardized beta coefficient of .071 was obtained with t-calculated of 6.42 and p-value of 0.000($p < 0.05$). The standardized beta is positive which implies that for e-librarians competences in Storage as a Service, there is a corresponding effectiveness in information service delivery.

DISCUSSION OF FINDINGS

Librarians Infrastructure as a Service Competences and Information Service Delivery in Federal University Libraries in South-South and South-East, Nigeria

The finding of the study revealed that there exists an average and significant relationship between librarians Infrastructure as a Service competences and Information Service delivery in federal university libraries in South-South and South-East, Nigeria. The result from the study showed that librarians in federal university libraries in South-South and South-East, Nigeria can averagely run operating systems, perform data migration and perform data loss prevention and further used cloud computing to provide quick reference query and document delivery services directly to users' email.

The result of the study is in agreement with the findings of Aiyebilehin *et al.* (2020) studies whose result showed that the awareness, competencies and use of Infrastructure as a Service in academic libraries enhanced effective service delivery. The result of the study corroborated the findings of Njoku and Ken-Agbiriogu (2021) that librarians cloud infrastructure technology competencies enabled quality service delivery in academic libraries.

Librarians Software as a Service Competences and Information Service Delivery in Federal University Libraries in South-South and South-East, Nigeria

The finding of the study revealed that there exists a strong and significant relationship between librarians Software as a Service competences and Information Service delivery in federal university libraries in South-South and South-East, Nigeria. The result from the study showed that librarians in federal university libraries in South-South and South-East, Nigeria can competently subscribed to SaaS, handle the software applications, use the search interface to search relevant information resources to users and monitors the application engine that enhances scalable hosting of multiple data. The result further showed that they can used cloud computing to provide users education, share information resources and carry out online bulletin board services.

The finding of this study is in line with Yuvaraj (2015) study on adoption of Software as a Service in central University libraries of India, that the adoption of cloud computing software eases information service delivery in academic libraries. The result of the study buttressed the result from Taufiq-Hail *et al.* (2021) study that librarian's competences in software as a service facilitate effective service delivery to users of the 21st century academic libraries.

Librarians Storage as a Service Competences and Information Service Delivery in Federal University Libraries in South-South and South-East, Nigeria

The finding of the study revealed that there exists a strong and significant relationship between librarians Storage as a Service competences and Information Service delivery in federal university libraries in South-South and South-East, Nigeria. The result from the study showed that librarians in federal university libraries in South-South and South-East, Nigeria can competently manage the digital data stored in logical pools in the cloud and prevent logical and physical failure of stored files.

The result of this study is in line with Adegbilero-Iwari (2017) study that librarians can use Google Drive, DropBox and iCloud for information service delivery and it enable libraries uploads data through the Internet to cloud-based servers. Tritt and Kendrick (2014) study corroborated that academic librarians used Google Docs and One Drive to store and share library resources. Senyo (2018) study supports that Dropbox enable libraries to store, synchronize, retrieve files and share documents in the library.

CONCLUSION

Based on the findings of the study, it was concluded that librarians in federal universities in South-South and South-East, Nigeria could competently utilize cloud computing for information service delivery. The findings of this study became imperative, as academic libraries have rapidly embraced the paradigm shift from traditional to virtualized services, there is the need for librarians to possess the necessary skills and techniques of cloud computing in order to provide efficient services to library growing clientele. The ability of librarians in universities in South-South and South-East, Nigeria, to competently handle cloud computing has further strengthened their position as primary information providers in this information age.

RECOMMENDATIONS

Based on the findings of the study, the following recommendations were posited:

- i. Management of university libraries in Nigerian should train and re-train their librarians on the use of Infrastructure as a Service (IaaS) for optimal service delivery to users.
- ii. Management of university libraries in Nigerian should organize seminars and workshops on Software as a Service (SaaS) in order to educate librarians and other library staff on the use of the technology for service delivery.
- iii. Librarians and library assistants/officers should be trained by management of university libraries on the use of Storage as a Service (StaaS) in order to enhance efficient service delivery to library users.
- iv. Management of university libraries should provide constant power supply in order to facilitate the provision of efficient service delivery using cloud computing.
- v. Management of university libraries should provide reliable internet connection to facilitate the use of cloud computing technology for service delivery.

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