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Cloud Computing and E-Resources Databases: A Study of Librarians' Adoption and Utilization in University Libraries in The Niger Delta Region, Nigeria.

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ABSTRACT

This research explored the adoption and utilization of cloud computing and electronic resources among librarians in university libraries within the Niger Delta Region of Nigeria. A descriptive research design was employed, utilizing a 52-item self-structured questionnaire to gather data from a sample of 150 librarians selected through stratified random sampling from three central states (Delta, Bayelsa, and Edo) out of the nine Niger Delta States. The target population consisted of 432 librarians. Six research questions guided the study. The instrument's reliability was ensured with a Cronbach's Alpha Guttman split-half coefficient index of 0.87. The findings indicate a moderate level of cloud computing knowledge and adoption, with varying degrees of e-resources database usage. Key factors influencing adoption include technological infrastructure, training, and institutional support. The study recommends enhanced training programs, infrastructure development, and collaborative efforts to fully harness the potential of cloud computing and e-resources databases in university libraries

Keywords: Cloud Computing, e-resources, Databases, Utilization, Adoption, University, Libraries, Niger Delta

Introduction

The emerging trends of digital libraries, e-publications, internet usage, web tools applications for libraries, consortium practices lead to the further development in library services. The latest technology trend in library science is the use of cloud computing for various purposes. Academic libraries are embracing innovative technologies, including cloud computing and social media, to broaden their service offerings and enhance user experience. The adoption of cloud computing, in particular, has enabled many academic libraries to augment their services, increase their appeal to users, and optimize resource sharing, ultimately amplifying their effectiveness in delivering value to their communities **(Mishra, 2016; Mate, 2016).** By leveraging these technologies, libraries can maximize the impact of shared resources, foster collaboration, and stay relevant in an increasingly digital landscape., According to **Makori (2016),** cloud computing has brought new innovative ways of empowering the creation, diffusion, utilization and sharing of information, knowledge and intellectual records in organizational libraries, while reducing management related issues. When information is needed on the real time basis, cloud computing ensures it is gotten fast and appropriate (Onwubiko, Okorie & Onu, 2021). Cloud computing presents numerous opportunities for libraries to minimize technology expenses, enhance reliability and performance, and streamline automation processes. With its vast potential, cloud computing enables libraries to migrate more content to the cloud, expanding their capabilities (Neethu & Vanaja, 2017).

According to the National Institute of Standards and Technology defined cloud computing is defined as a flexible model that allows seamless, on-demand access to a shared pool of scalable computing resources, including networks, servers, storage, applications, and services. This model enables rapid provisioning and release of resources with minimal administrative effort or provider interaction, making it an attractive solution for libraries seeking to optimize their operations. "One way to think of cloud computing is to consider your experience with email. Your email client, if it is Yahoo, Gmail, Hotmail, and so on, takes care of housing all of the hardware and software necessary to support your email account. When you want to access your email, you open your web browser, go to the email client, and log in. The most important part of the equation is having Internet access, and you can access it anywhere." (Apkorhonor & Ekhaguosa, 2021). The cloud computing model is structured around five fundamental characteristics, three distinct service models, and four deployment models, as outlined by Sivakumar and Singaravelu (2016). This framework provides a comprehensive architecture for understanding the cloud computing paradigm, encompassing its key features, service offerings, and implementation strategies., According to Kaushik and Kumar (2013), two models are working for cloud computing which are Deployment Models and Service Models. Cloud Deployment Models: Deployment models define the types of access to the cloud i.e. how the cloud is located. Cloud can have any of the four types of access- 1) Public Cloud. 2). Private Cloud. 3). Hybrid Cloud. 4) and Community Cloud while Cloud Service models: are- (1) Infrastructure as a service (IaaS) (2) Platform as a Service (PaaS) (3) and Software as a Service (SaaS).

Deployment Models: Currently, four types of cloud deployment models have been defined in the cloud community: Private Cloud is a deployment model solely developed and managed by a single organization or a third party regardless of whether it is on-premise or off-premise. Community Cloud is a joint venture of several organizations that come together to build a cloud infrastructure as well as policies through which cloud services will be rendered. The public cloud is meant for general public use and it is open to all. This kind of deployment model of cloud computing is developed by any cloud computing agency, and having own policy, value, and profit, costing, and charging model. Some popular public cloud services include Amazon EC2, $3, Google App Engine, and Force. A hybrid Cloud is made from more than one cloud deployment models that may be public, private, community, and other models also, bound together with standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load balancing between clouds).

Service Description model: Software as a Service (SaaS). This is the capability provided to the consumer to use the provider's applications running on a cloud infrastructure. The applications are accessible from various client devices either through a thin client interface, such as a web browser (e.g., web-based email), or a program interface. Platform as a Service (PaaS). This is the capability provided for the consumer which is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, services, and tools supported by the provider. Infrastructure as a Service (IaaS).

The cloud computing model offers consumers the ability to provision and utilize essential computing resources, such as processing power, storage, networks, and more, allowing them to deploy, run, and manage their own software environments, including operating systems and applications, with flexibility and control. Cloud computing and e-resources databases have transformed information management in academic libraries (Adeleke & Folorunso, 2020). University libraries in the Niger Delta Region, Nigeria, face unique challenges in adopting these technologies (Iwhiwhu & Okorodudu, 2022).

OBJECTIVES OF THE STUDY

This research explored the adoption and utilization of cloud computing and e-resources databases by librarians in university libraries within the Niger Delta Region of Nigeria. The study's specific objectives were to:

1. Assess the extent of cloud computing knowledge among librarians in university libraries in the Niger Delta Region.
2. Identify the e-resources databases accessed through cloud computing by librarians in the region.
3. Investigate the purposes for which librarians' access e-resources through cloud computing.
4. Evaluate the benefits of accessing e-resources databases via cloud computing.
5. Examine the challenges faced by librarians in using cloud computing to access e-resources databases.
By examining these aspects, the study aimed to provide a comprehensive understanding of cloud computing adoption and e-resources utilization in university libraries within the Niger Delta Region.

SIGNIFICANCE OF THE STUDY

This study will help librarians to acquire and improve their cloud computing knowledge efficiently in data access, usage, and sharing.

LITERATURE REVIEW

CONCEPTUAL OVERVIEW OF CLOUD COMPUTING

It is obvious that library is not only a knowledge ocean; its ultimate aim is to provide satisfactory services for all the users. So in the new era, library should improve itself constantly by sharing resource and information technologies (Shiferaw, 2015) Cloud computing is a new concept for delivery of application software through internet instead of installing and running the same on a user's computer. Cloud as it applies to information technology is offering remote access to any work-related data. Cloud computing enables users to access computer system resources, such as data storage and processing power, on-demand and without requiring direct management. According to Joshi (2015), cloud computing is a technology that facilitates the sharing of resources and services over the internet, rather than relying on local servers or personal devices. Rohani and Hussin (2015) describe cloud computing as a significant technological advancement in the field of Information Systems, essentially serving as a substitute for the internet. In recent years, numerous institute and organizations have adopted cloud services, uploading projects to cloud-based servers in a widely distributed environment. This cloud model is characterized by five key features, three service models, and four deployment

models, as outlined by Sivakumar and Singaravelu (2016)., According to Kaushik and Kumar (2013), two models are working for cloud computing which are Deployment Models and Service Models. Cloud Deployment Models: Deployment models define the types of access to the cloud i.e. how the cloud is located. Cloud can have any of the four types of access- 1) Public Cloud. 2). Private Cloud. 3). Hybrid Cloud. 4) and Community Cloud while Cloud Service models: are- (1) Infrastructure as a service (IaaS) (2) Platform as a Service (PaaS) (3) and Software as a Service (SaaS). Deployment Models: Currently, four types of cloud deployment models have been defined in the cloud community: Private Cloud is a deployment model solely developed and managed by a single organization or a third party regardless of whether it is on-premise or off-premise. Community Cloud is a joint venture of several organizations that come together to build a cloud infrastructure as well as policies through which cloud services will be rendered. The public cloud is meant for general public use and it is open to all. This kind of deployment model of cloud computing is developed by any cloud computing agency, and having own policy, value, and profit, costing, and charging model. Some popular public cloud services include Amazon EC2, $3, Google App Engine, and Force.

A hybrid Cloud is made from more than one cloud deployment models that may be public, private, community, and other models also, bound together with standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load balancing between clouds). Service Description model: Software as a Service (SaaS). This is the capability provided to the consumer to use the provider's applications running on a cloud infrastructure..

Cloud computing offers versatile access to applications through various client devices, using either a thin client interface like a web browser (e.g., web-based email) or a program interface. Platform as a Service (PaaS): Enables consumers to deploy custom-built or acquired applications onto the cloud infrastructure, utilizing programming languages, libraries, services, and tools supported by the provider. Infrastructure as a Service (IaaS): Provides consumers with fundamental computing resources, including processing, storage, networks, and more, allowing them to deploy and run arbitrary software, including operating systems and applications.

The integration of cloud computing and e-resources databases has revolutionized information management in academic libraries, as noted by Adeleke and Folorunso (2020). This transformative shift has enhanced the efficiency, scalability, and accessibility of library resources and services.

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DATABASES USED IN ACCESSING E-RESOURCES THROUGH CLOUD COMPUTING BY LIBRARIANS

Cloud computing is applied to the library through automation with multi user (client), federated search via web using Online Public Access Catalogue (OPAC), Integrated library system (ILS), web hosting, global OPAC, Online resources sharing, digital library and interlibrary and intra-library loan (Ouahabi, Eddaoui, Labriji, Benlahmar, & Guemmat, 2014).

In Africa, numerous academics depend heavily on their university and research institute libraries to meet their information requirements. However, these libraries face a significant challenge as they rely on government funding, which has been steadily decreasing, thereby threatening the libraries' ability to provide adequate resources and support to their users.. The situation could have been more serious, but for some interventions from non-governmental organizations and agencies. These interventions include the International Network for the Availability of Scientific Publications (INASP) initiative, through the Programme for the Enhancement of Research Information (PERI); African Journals Online (AJOL) initiative; JSTOR, Journal Donation Project (JDP), Research4life and others, which provide access to electronic journals by academics in developing countries. JSTOR (Scholarly Journal Archive) is a non-profit organization dedicated to two primary goals: preserving a reliable archive of esteemed scholarly journals and ensuring broad access to these journals. The comprehensive digital archive encompasses a wide range of disciplines. Through this online initiative, teaching staff in developing countries can access these journals, provided their university libraries are participating beneficiaries, thereby bridging the knowledge gap and fostering academic excellence (Ejimofo & Ohaji, 2008).

PURPOSE OF ACCESSING E-RESOURCES FROM CLOUD COMPUTING BY LIBRARIANS

Aregbesola and Oguntayo (2014) conducted a research study the use of electronic resources by faculty members in Landmark University, Omu-Aran. The findings of the study revealed that faculty members use electronic resources for academic purposes. Having access to wide range of books and journals, increased access to current materials, and, to carryout research are the major motivations of electronic resources use by faculty members. Mahalakshmi (2014)made an analytical study about the use of electronic resources by faculty and resources by faculty and students in higher education institutions in Chennai, surveyed 48 faculty and 57 students were conducted through a questionnaire method was used. From the study result revealed that (105%) of the respondents aware about the e-resources, nearly (45.33%) of them use the e-resources for their subject purpose, (43%) of them use the e-resources for their education purpose,

The study's findings indicated that faculty members utilize electronic resources primarily for academic purposes, driven by the benefits of accessing a vast array of books and journals, staying current with new materials, and conducting research. A study by Mahalakshmi (2014) analyzed the use of electronic resources among faculty and students in higher education institutions in Chennai. The study, which surveyed 48 faculty members and 57 students using a questionnaire, revealed that: 100% of respondents were aware of e-resources, 45.33% used e-resources for subject-specific purposes, 43% used e-resources for educational purposes, 15.42% used e-resources for entertainment (33.18%) used e-resources for references their subject work. These results highlight the significance of electronic resources in supporting academic activities and the need for continued access and awareness among faculty and students Krishnadass and Jayaraman (2014) discussed the utilization of E-Resources by Faculty Members and Research Scholars in Management Institutions affiliated to Bharathiar University, Coimbatore.

Questionnaire Response Rate

Table1: Questionnaire Response

Number of Questionnaire Administered	Number of Questionnaire Returned	Percentage of Questionnaire Returned
150	131	87%

A total of 150 copies of the questionnaire were distributed and 131 (87%) copies were returned.

The study achieved a satisfactory response rate of 87%, which is deemed adequate for reliable analysis. This response rate exceeds the commonly accepted threshold of 60%, as noted by Dulle, Minish-Majanja, and Cloete (2010), who suggest that a response rate of 60% is typically considered standard and acceptable for most research studies. The high response rate in this study enhances the validity and reliability of the findings.

Answering of the Research Questions

Research Question One: What is the extent of cloud computing knowledge librarians have to access e-resources databases in University Libraries?

Table 2: Extent of Librarians cloud computing knowledge

Librarian cloud computing knowledge	VLE	LE	Le	VLe	Mean
Knowledge of Cloud Computing	61	35	35	0	3.20
Access E-Resources Databases	48	44	39	0	3.10
Store E-Resources Databases	48	35	48	0	3.00
Share E-Resources Databases	57	0	74	0	3.44

Aggregate Mean   3.18

Criterion Mean   2.50

NOTE: Very Large Extent (VLE), **Large Extent (LE)**, **Very Little Extent**(VLe) **Little extent** (Le),

Table 2 presents responses of librarian cloud computing knowledge. The aggregate mean of 3.18 which is greater than the criterion mean of 2.50 shows that librarians have knowledge of cloud computing in accessing e-resources. With regard to librarians' response on the question of librarians cloud computing knowledge, the respondents agreed that they have cloud computing knowledge (3.20) to access e-resources databases, while the respondents can access, store and share e-resources databases given their following mean (3.10, 3.00 and 3.44) respectively. Thus, it can be concluded that the Librarians in University libraries has knowledge of cloud computing.

Research Question Two: What e-resources are accessed through cloud computing by librarians in University Libraries?

Table 3:E-resources accessed through cloud computing and e-resources databases

e-resources accessed through cloud computing e-resources databases	SA	A	D	SD	Mean
E-Journals	58	47	26	0	3.24
E-Books	62	21	48	0	3.12
Fulltext Database	47	31	53	0	2.95
Indexing and Abstract Database	66	48	17	0	3.37
Reference Database	67	12	62	0	3.11
E-Dictionaries	54	25	52	0	3.02
E-Directories	39	75	17	0	3.20
E-Encyclopeadia	54	33	44	0	3.07
Numerica and Statistical	48	53	30	0	3.15
E-Images	57	74	0	0	3.44
E-Audio/Visual	53	4	74	0	2.84

Aggregate Mean/SD   3.14 Criterion Mean   2.50

Table 3 shows that librarians in Niger Delta region agrees that they access e-resources through cloud computing considering that the aggregate mean of 3.14 is greater than the criterion mean of 2.50. It is evident that out of the numerous e-resources listed above, E-images (3.44) is mostly accessed. Others also mostly accessed are E- Indexing and Abstract Database (3.37), E-journals (3.24), E-directories (3.20), etc. the likely reason for this is that they are the most commonly used by librarians for reference purposes while E-Audio/Visual is least used.

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Research Question Three: What databases e-resources are accessed through cloud computing by Librarians in University Libraries in Niger Delta Region, Nigeria?

Table 4: E-resources Databases accessed through cloud computing

databases e-resources are accessed through cloud computing	Strongly Agreed	Agreed	Disagreed	Strongly Disagreed	Mean
Google Scholar	40	78	13	0	3.21
Ebscohost	51	67	13	0	3.29
Jstor	75	35	21	0	3.41
DOAJ	67	39	21	4	3.29
DOAB	43	35	53	0	2.92
Research Gate	43	35	53	0	2.92
Academia edu	51	23	57	0	2.95
Youtube	25	93	13	0	3.09
OPAC	53	62	16	0	3.28
Research4life	39	92	0	0	3.30
Institutional E-Repository	0	48	39	44	2.03

Aggregate Mean/S 3.06 Criterion Mean   2.50

Table 4 shows that the librarians access e-resources from listed databases with an aggregate mean of 3.06 which is more than the criterion mean of 2.50, it can be concluded that Librarians in University libraries access e-resources databases through cloud computing. The most access databases were the Jstor (3.41), Research4life (3.30) Ebscohost (3.29), DOAJ (3.29) and OPAC (3.28) respectively. Institutional E-Repository (2.03) was less than criterion mean of 2.50. it can be deduced from the above that the respondents are not well informed or the awareness level of their institutional e-repository is low.

Research Question Four: What are the purposes for accessing e-resources through cloud computing by Librarians in University Libraries in Niger Delta Region, Nigeria?

Table 5: Purpose for accessing e-resources databases through cloud computing by Librarians

Purpose for accessing e-resources through cloud computing by Librarians	Strongly Agreed	Agreed	Disagreed	Strongly Agreed	Mean
Research	25	93	13	0	3.09
Learning	87	39	00	5	3.63
Publishing	87	39	5	0	3.63
Seminar Presentation	40	82	9	0	3.24
Teaching	79	39	13	0	3.40
Examinations	75	35	21	0	3.44
To Up Date	35	70	26	0	3.07

Aggregate Mean   3.35 Criterion Mean   2.50

Table 5 shows that with an aggregate mean of 3.35 which is more than the criterion mean of 2.50, it can be concluded that the Librarians in University libraries access e-resources databases through cloud computing for different purposes. The respondent's mostly access e-resources databases through cloud computing for learning (3.63) and publish (3.63). Research (3.09), teaching (3.40), examination (3.44), seminar presentation (3.24), etc. where also purpose for accessing e-resources databases from cloud computing. This conform to Mahalakshmi (2014) analytical study about the use of e-resources by faculty and students in higher education which revealed that (105%) of the respondents aware about the e-resources. Nearly (45.33%) of them use the e-resources for their subject purpose, (43%) of them use the e-resources for their education purpose, (15.42%) of them entertainment (33.18%) of them reference their subject work.

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Research Question Five: What are the benefits of accessing e-resources databases through cloud computing by Librarians in University Libraries in Niger Delta Region, Nigeria?

Table 6 : Benefits of accessing e-resources databases **through cloud computing by Librarians**

Benefits of accessing e-resources through cloud computing by Librarians	Strongly Agreed	Agreed	Disagreed	Strongly Agreed	Mean
Accuracy	76	34	21	0	3.43
Currency	49	43	39	0	3.08
Search Ability	29	89	13	0	3.12
Full-text Retrieval	29	89	13	0	3.12
Convenience	79	43	9	0	3.53
Link to Related Items	39	79	13	0	3.20
Credibility	66	21	44	0	3.17
Prompt Access	43	75	13	0	3.23
Multiuser Access	48	57	26	0	3.17
User-friendly Interface	69	62	0	0	3.53

Aggregate Mean/SD   3.26 Criterion Mean   2.50

Table 6 shows that there are lots of benefits derived from accessing e-resources databases through cloud computing with the aggregate mean of 3.26 which is greater than the criterion mean of 2.50. All respondents agreed to have benefited from cloud computing access of e-resources databases. Majority of the respondents most benefits derived from accessing e-resources databases through cloud computing was convenience to access e-resources databases (3.53), and user-friendly interface (3.53). Prompt access (3.23), Link to Related Items

(3.20), Credibility (3.17), Multiuser Access (3.17) were also benefits derived. This implies that librarians' benefits very much from accessing e-resources databases through cloud computing. This findings confirms that of Okoye and Ejikeme (2010) that stated, articles can be accessed online free of charge and that the advantage of open access journals is that the entire content is available to users everywhere.

Research Question Six: What are the challenges of cloud computing and access to e-resources databases by Librarians in University Libraries in Niger Delta Region, Nigeria

Table 7: Challenges of cloud computing and access to e-resources

challenges of cloud computing and access to e-resources databases	Strongly Agreed	Agreed	Disagreed	Strongly Disagreed	Mean
Network Problem	60	40	31	0	3.24
Low Bandwidth	69	41	31	0	3.24
Irregular Power Supply	60	38	33	0	3.21
Inadequate IT Facilities	27	57	47	0	2.85
Poor Infrastructure	9	40	58	24	2.26
Lack of Awareness	51	60	20	0	3.24
High Cost	69	40	22	0	3. 83
Lack of Search Skills	43	34	54	0	2.92
Download Delays	67	64	0	0	3.51

Aggregate Mean/SD 3.06 Criterion Mean   2.50

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Table 7 indicates that there are many problems related with cloud computing and access to e-resources databases by the respondent with aggregate mean of 3.82 which is greater than the criterion mean of 2.50. The major challenges as agreed by the respondents stated in the table 7 is High cost (3.83) followed by Download delays (3.51), Network problem (3.24) , and low bandwidth (3.24) while poor infrastructure (2.26) was less than 2.50 as the criterion mean because it was not considered as much a constrain. These constraints correspond with Okoye and Ejikeme (2010) who stated that inadequate skills to navigate the internet.

Conclusion

In conclusion, the study reveals that librarians in university libraries in the Niger Delta region of Nigeria possess knowledge of cloud computing and utilize it to access e-resources databases. The findings indicated that: Librarians access e-resources from various e-resources databases Research4life is the utilized database, while institutional e-repositories are not widely accessed, possibly due to most lack of awareness or availability, E-resources databases are accessed for research, publishing, teaching, and other purposes, with benefits including user-friendly interfaces, convenience, and prompt access. However, challenges persist, including download delays, network problems, irregular power supply, and inadequate IT facilities. Additional

constraints include lack of search skills, awareness, and high internet costs.

Generally, the study highlights the importance of addressing the challenges and constraints faced by librarians in accessing e-resources databases through cloud computing.

Recommendations

Based on the findings of this study, the following recommendations include training programs, infrastructure upgrades, and collaborative efforts to fully harness these technologies. Librarians should be assisted and encouraged to develop technical, social media, and computer literacy skills to enhance their search ability, institutions authorities and governments should provider internet, ICT facilities for all to enjoy free flow for effective and efficient cloud computing in accessing e-resources databases, Libraries should subscribe to e-resources databases, organize and grow their institutional e-repository to improve teaching and learning in the institutions and Libraries should have a strong network and bandwidth to access e-resources and to provide better automated services.

Contribution to knowledge

The study contributes to knowledge in the following ways:

i.   The study established that Librarians in University libraries in Niger Delta region of

Nigeria have knowledge of cloud computing to access e-resources

ii.   The study established that Librarians in University libraries in Niger Delta region of Nigeria have positive attitude towards cloud computing to access e-resources databases.

iii.   The study affirms that, Librarians in University libraries in Niger Delta region of Nigeria found out that cloud computing is user-friendly and convenient.

iv.   The study established that Librarians in University libraries in Niger Delta region of Nigeria can access e-resources databases for the purpose of teaching and learning.

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