

Factors Influencing Cloud Libraries Adoption for Information Service Delivery in University Libraries: The Study of Public University Libraries in Kano State

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Abstract:

Cloud libraries, also known as online libraries, consist of collections of digital resources and services that are stored, managed, and accessed through cloud computing infrastructure. This infrastructure includes the hardware, software, networking, storage, and other resources delivered over the internet to provide computing services. As a result, users can navigate and access a wealth of information without the need to for libraries to own or maintain physical servers, which traditionally limits close access to information service delivery. Instead, they benefit from the collaborative synergy of cloud technology and library management. Libraries play an active role in organizing, managing, and ensuring the accessibility of digital resources and services within this cloud-based environment, facilitated by cloud service providers. Cloud libraries help reduce costs while providing increased accessibility, reliability, and flexibility. This study employed a quantitative approach to identify the factors influencing the adoption of cloud libraries, utilizing a questionnaire survey developed by the researcher. Data were collected from 103 academic librarians across three public university libraries and analyzed using descriptive statistics and percentages. The results revealed a significant positive relationship between the attributes of innovation—specifically relative advantage and compatibility—and the adoption of cloud libraries. Conversely, complexity was found to have a negative relationship with adoption. Additionally, personal characteristics of librarians, such as their innovativeness, as well as positive attitudes towards information service delivery via cloud libraries, facilitated adoption. Finally, internal factors such as regulatory policies, budgetary allocations, technological readiness, management support, and the involvement of librarians in decision-making processes also significantly influenced the adoption of cloud libraries

Keywords: Cloud Libraries, Cloud Computing, Adoption, Factors facilitating, Universities Libraries & Information Services Delivery

Introduction

University libraries are crucial in supporting their institutions' goals of providing top-notch learning, teaching, research, and community services. Traditionally, libraries managed tasks such as collection development and reference services manually. The introduction of Information and Communication Technology (ICT) led to the adoption of Integrated Library Systems (ILS) or Library Management Systems (LMS), which streamline library operations by tracking items, orders, and patron records. While ILS/LMS systems have been effective for managing print resources, they struggle with electronic resources and often rely on local servers, which can be problematic due to issues like power outages and high costs in underdeveloped regions. As a result, cloud libraries, leveraging cloud computing, are emerging as a modern alternative to address these challenges and enhance library services.

A cloud library in general is a fundamental transformation of the entire brick-and-mortar library which offers an auspicious opportunity to introduce Web-based dynamic library services. In a Cloud library, services are consumed and delivered over the Internet. appropriate infrastructure to sustain large network of libraries, which share cataloguing records, digitized prints and digital repositories as a type of cloud service.

Universities libraries in Kano state like many educational institution's libraries worldwide, are constantly seeking ways to improve their information services and provide better access to resources for their students, faculty, and researchers, but the libraries in public universities in Kano face a lot of problems library systems, which rely on physical collections and on-premise computing. However, for these university libraries to be out of this menace, they have to go in line with new trend (cloud libraries). Cloud libraries, also called virtual libraries hosted in cloud environments, offer several advantages. These advantages include the ability to store, manage, and distribute a vast amount of digital resources such as e-books, journals, databases, and multimedia materials, all while improving accessibility and reducing the burden of physical space and maintenance. Moreover, the "change in users' perceptions and their preference for Internet tools and services such as web search engines, e-mail, blogs, and RSS news feeds needs to be studied and then redesign library services. Libraries are in a good position to choose for centralized cloud solution because they handle huge data but with limited finances to afford continuous upgrades of their own computing facilities. (Holt 2007)

In the cloud technology literature, little attention has been given to understand the adoption and essential benefit of the cloud computing paradigm. Besides that, there is also lack of contextualization of the key components that is crucial for the cloud technology implementation which become the gap of this study, Furthermore, there is an absence of in-depth exploratory studies in tracing attributes of innovation adoption in Nigerian university generally, which is contradicted to the rapidity of cloud technologies changes towards providing easy access to resources and convenient data management. In light of this, pointed out that there is a limited number of research that looked into the factors that facilitates the adoption of cloud libraries in educational establishments in Kano, particularly on the influence of the related contextual attributes of innovation.

In essence, for any library to have an effective and functional cloud library services in place, Nigeria library should take into consideration parameters such as policy formulation, technological readiness, top government support, relative advantage among others. The study assumes that the adoption of cloud libraries can be influence by the above parameters. Therefore, it is essential to get an indebt understanding of the effect of these factors and the adoption of cloud libraries. It is on this basis that this study examines factors that facilitate the adoption of cloud libraries in public universities in Kano for information service delivery. Therefore, the essence of this study is to fill the knowledge gap on the factors that facilitates the adoption of cloud libraries in public university libraries in Kano State

Objectives of the Study

The broad objective of the study is to examine factors influencing cloud libraries adoption for information service delivery in university libraries: the study of public university libraries in Kano State. However, the specific objectives are to:

1. Investigate librarians perceived attributes on the adoption of for information service delivery in terms of relative advantage, compatibility and complexity
2. To determine the factors facilitating the adoption of cloud libraries of cloud libraries for information service delivery

Review of Related Literature

The search and review indicate a growing body of literature, encompassing a case studies, empirical research, and surveys, predominantly addressing factor that facilitates the adoption of

cloud computing in organizations, including libraries. This literature explores various aspects such as attributes of innovation (cloud libraries) as well as institutional factors such as staffing, budgeting issues among others. These aspects are directly relevant to ongoing research, particularly in measuring factors for the adoption of cloud libraries, which was borne out from the broader field of cloud computing, as emphasized by Yuvaraj, (2015) that cloud computing enabled cloud libraries, it operates within the realm of cloud computing infrastructure, utilizing storage services provided by cloud service providers. Therefore, the incorporation or application of cloud computing in library operations and services is known as cloud libraries (Kamba and Abdul, 2016) Notably, the study did not find earlier research specifically examining the factors for adopting cloud libraries, both in Nigeria and globally. Consequently, the investigation into the association between the adoption of these variables and cloud libraries remains elusive. Accordingly, this study heavily relies on literature that delves into cloud computing, encompassing issues related to policy, staff expertise, training and retraining, procedures, technology, staffing, budgeting, and various models.

However, knowledge about the benefits of cloud libraries in libraries is not the only facilitating attributes for the adoption. There exist a host of other factors which is the attributes or characteristics of the innovation (cloud libraries) as states by Rogers (1983) He describes the innovation-decision process as “an uncertainty reduction process”, and proposes attributes of innovations that help to decrease uncertainty about the innovation. The attributes of innovations include five characteristics of innovations. This theory of perceived attributes of an innovation postulates that potential adopters of an innovation judge an innovation based on their perceptions of the characteristics or attributes of the innovation itself, for instance, librarians’ perceptions about the attributes of cloud libraries that would make it appropriate for adoption in information service delivery. These attributes are very crucial to the adoption of an innovation, because as Rogers states, the innovation-decision process is an uncertainty reduction process and one of the ways this uncertainty could be reduced is through positive perceptions of the attributes of the innovation. These attributes, which include relative advantage, compatibility, complexity, trial-ability and observability.

In summary, innovations that are perceived by individuals as having greater relative advantage, compatibility, trial-ability, observability, and less complexity of use will be adopted more rapidly than other innovations that have less of these attributes. However, among five different attributes

of innovation defined in Rogers' DOI, the two factors will be not used in this study; trialability and observability. In the context of this study trialability and observability are not an influential factor. The main reason is that the study aim at measuring factors as such libraries under study has not adopt the innovation whether to testify or reports on trialability of the innovation, despites that majority of the giant cloud providers offer a trial version of their service.

There are number of study conducted to test the relative advantage compatibility and complexity as attributes or factors that influence the adoption of innovation. Alghushimi, Zakari, and Aji (2020) investigated factors influencing cloud computing adoption in higher education institutions of least developed countries: evidence from republic of Yemen. They formulated hypothesis that relative Advantage compatibility and complexity has a positive effect on cloud computing adoption, after examining the influence of relative advantage, compatibility and complexity on cloud computing adoption the result revealed a significant positive relationship ($\beta = 0.131$, $t = 4.392$, $p < 0.000$). Hence, hypothesis is supported. The findings indicate that relative advantage, reliability, compatibility, security, technology readiness, top management support, regulatory policy and competitive pressure have positive significant impacts on the cloud computing adoption. Similarly, the study conducted by Li and Lu (2018) identified the factors that influence the adoption of electronic procurement in Chinese manufacturing enterprises. They proposed and tested a model based on TOE framework. They conducted a telephone interview with 120 managers. Reliability and validity of the model was tested. In order to analyze the data logistic regression was used. The results of their analysis support the research model. Their findings show that relative advantage, top management support, external pressure and external support determine e-procurement adoption.

In another study by Thong (2009) as cited by Cooper & Zmud, (2022) used Roger's DOI to develop a new model of information system adoption in the context of Small businesses. He argued that four categories of factors impact the decision to adopt a new IS; and the extent of IS adoption. Decision makers' characteristics, IS characteristics, organizational characteristics and environmental characteristics are determinants of IS adoption. In order to empirically test the model, a questionnaire survey was completed by 166 small businesses. In order to test the hypotheses, he used discriminant analysis. Their findings show that decision maker's innovativeness and IS knowledge, innovations' relative advantage, compatibility and complexity, business size and employees' IS knowledge have a positive impact on IS adoption. However, the

extent of IS adoption is significantly determined by organizational characteristics. Finally, he found environmental characteristics not to be influential in the adoption of IS by small businesses.

Another study which investigates the adoption of cloud computing is conducted by Low et al. (2021). They investigated the influence of eight factors in adoption of cloud computing in high tech industry in Taiwan. They try to identify the factors that distinguish cloud adopters from non-adopters. They ran a survey; and collected 111 usable responses. Their regression analysis shows that while relative advantage has a significant positive influence on adoption of cloud computing, top management support, firm size, competitive pressure, and trading partner pressure characteristics has a significant positive influence on diffusion of cloud computing. Compatibility and complexity were not significantly influencing the adoption of cloud computing. Similarly, Low et al. (2021). They investigated the influence of eight factors in adoption of cloud computing in high tech industry in Taiwan. They try to identify the factors that distinguish cloud adopters from non-adopters. They ran a survey; and collected 111 usable responses. Their regression analysis shows that while relative advantage and compatibility has a significant negative influence on adoption of cloud computing, top management support, firm size, competitive pressure, and trading partner pressure characteristics has a significant positive influence on diffusion of cloud computing. Complexity were not significantly influencing the adoption of cloud computing. Jafla and Zakaria (2021) in their study assessing the readiness for cloud computing in higher education institutions in the Kingdom of Bahrain: towards an education cloud computing strategy. The study found that there is a positive relationship between the compatibility and adoption of cloud technology in higher institution in the Kingdom of Bahrain. Similarly, Almubarak (2017) asserts that compatibility was one of the most critical factors affecting Saudi hospitals when deciding whether or not to adopt cloud computing. Additionally, there are several studies that were conducted and the findings revealed positive relationship between the compatibility and adoption, like (Maina and Muthee 2020; and Alam, Ali and Jami 2019).

Furthermore, as libraries leverage these services to improve efficiency, scalability, and innovation, regulatory policies play a crucial role in shaping the landscape of cloud adoption. Regulatory policies are essential to ensure that the adoption of cloud-based services in libraries complies with legal, ethical, and security standards. These policies are formulated by

governments, to address concerns related to data privacy, security, interoperability, and vendor lock-in. The dynamic nature of technology and the evolving digital landscape necessitate continuous updates and revisions to regulatory frameworks to keep pace with emerging challenges and opportunities. Regulatory policies play a strategic role in the effective execution of any activity. Similarly, the adoption of cloud libraries for information service delivery in libraries also calls for a proper regulatory policy or protocol (Rafiq and Muhammad, 2022) In essence regulatory policy is critical issue in cloud libraries adoption. Legal factors will be included in the theoretical model to predict whether there are enough legal protections to solve conflicts between cloud users and cloud providers when a problem such as a disaster or a hack occurs, equally whether country's laws and regulations facilitate the use of cloud libraries and are laws sufficient to protect the use of cloud technology etc.

ICTs stands for Information and Communication Technologies refers to the combination of technologies and tools used for collecting, processing, storing, retrieving, transmitting, and disseminating information through various forms of electronic communication. According to Ashikuzzaman, (2023) ICTs encompasses many technologies, including computers, software, networks, telecommunications, internet services, and digital devices. It plays a vital role in facilitating the creation, management, and exchange of information in personal and professional contexts. ICT has transformed how individuals and organizations interact, communicate, access information, and conduct business, leading to increased efficiency, productivity, and connectivity in various sectors of society. ICTs infrastructure in cloud-based services delivery plays a vital role in managing digital resources, supporting online discovery, automating administrative tasks, preserving and providing access to digital materials, facilitating online reference and support, fostering collaboration, promoting information literacy, and assisting researchers in data management. This was justified by Ashikuzzaman, (2023) while sharing his experience on the need to have ICTs in place for libraries to adopt cloud technology that ICTs infrastructure is a necessity for modern university libraries to deliver online services. The integration of ICT infrastructure in university libraries transforms them into dynamic and inclusive learning spaces that adapt to the needs of the academic community. As technology evolves, investing in robust ICT infrastructure is essential to ensure university libraries remain at the forefront of supporting learning, research, and innovation through providing effective cloud-based services.

Equally, Implementing cloud-based services in libraries necessitates meticulous budgetary allocation to navigate various financial aspects of this transition comprehensively. The allocation should cover a spectrum of expenses, including subscription costs for cloud services based on usage patterns, initial setup expenditures for migration and integration, and investments in robust security measures such as encryption and access controls. Additionally, resources must be earmarked for custom application development or customization within the cloud environment to meet specific library needs. Budgetary provisions should extend to cover data storage costs, enabling libraries to plan for efficient storage and retrieval mechanisms while avoiding unexpected expenses. Staff training is a critical component, and a designated budget ensures that personnel can acquire the necessary skills to navigate and utilize cloud technologies effectively. Compliance with industry regulations demands a financial commitment, as does continuous improvement, including regular updates and upgrades to stay aligned with technological advancements. The budget also serves as a contingency plan for unforeseen circumstances and helps maintain positive vendor relationships by ensuring timely payments and adherence to contractual agreements. Krönung (2021) emphasize that a well-structured budget not only facilitates financial planning but also empowers libraries to transition seamlessly to the cloud, optimizing their operations in a scalable, secure, and up-to-date digital environment.

Budgetary allocation is one of the major issues faced by organizations in the implementation of cloud-based services including libraries. Libraries around the world are facing the issue of budget cuts. As emphasized by Oboite and Dorcas (2022) in Nigeria, a major challenge that faces libraries, irrespective of the type of library is reduced budgetary allocations. Without finance, subscription to the cloud services will not be possible. Poor network and high cost of subscription are other challenges that grossly affect the deployment and usage of cloud computing services in Nigerian libraries.

Methodology

Quantitative research methodology was adopted using cross sectional survey. Data was generated from the librarians in the libraries under study, which are academic libraries of universities in Kano state comprising of Bayero University Kano (BUK), Kano University of Science and Technology, Wudil (ADUST) and Yusuf Maitama Sule University Kano. The research design of the study was survey design using questionnaire as instrument for data collection. The quantitative study was a well-developed questionnaire that addressed all aspects

of the research questions that this study investigated. Data were analyzed using descriptive analysis. The population of the research comprises of 107 librarians from universities under study and 107 copies of questionnaires were administered to librarians by the researcher and out of which 103 representing 96.3 % of the total response were returned and found to be useful while 4 (3.9 %) were not returned. The high response rate generated in this study was attributed to the researcher's diligence and persistence in retrieving back as many copies of the questionnaires as possible. Data were analyzed using frequency tables and percentages.

Results and Discussion

Table 1: Attributes and Factors Facilitating Adoption of Cloud Libraries for Information Service Delivery in libraries

Facilitating Factors	Frequency (Percentage%)		Total
	Yes	No	
The use of cloud libraries services improves the quality of operations over existing practices	79(76.7%)	24(23.3%)	103(100%)
The use of cloud libraries technologies fits well with the way we operate	78(75.7%)	25(24.3%)	103(100%)
In general cloud libraries is very complex to use in libraries	25(24.3%)	78(75.7%)	103(100%)
Librarians' awareness about the benefits of cloud libraries adoption for information delivery to patrons in library	73(70.9%)	30(29.1%)	103(100%)
Personal innovativeness of librarians (librarians' willingness and earliness to try out new technologies)	92(89.3%)	11(10.7%)	103(100%)
Librarians' positive perceptions about the attributes of cloud libraries	90(87.4%)	13(12.6%)	103(100%)
Librarians' positive attitudes towards the information services delivery via cloud libraries	88(87.4%)	15(14.6%)	103(100%)
Adequate and necessary technical, managerial and other skilled personnel to support adoption of cloud libraries	94(91.3%)	9(8.7%)	103(100%)
Availability of ICT infrastructure that will support the	64(62.1%)	39(37.9%)	103(100%)

adoption of cloud libraries			
Training and retrainig of staff that will support adoption of cloud libraries for information services	79(76.7%)	24(23.3%)	103(100%)
Provision of budgetary allocation for deployment of cloud libraries for information services delivery.	91(88.3%)	12(11.7%)	103(100%)
Provision of laws and regulations that will regulates the adoption of cloud libraries	80(77.7%)	23(22.3%)	103(100%)
Involvement of librarians in decision-making in their respective libraries	81(78.6%)	22(21.4%)	103(100%)
Greater leadership/management support by the library management	79(76.7%)	24(23.3%)	103(100%)

Respondents were asked about their perception on the attributes of innovation (cloud libraries) for information service delivery. The findings from Table 1 shows that majority of respondents believed librarians' positive perceptions about the attributes of cloud libraries such as its relative advantage, compatibility and complexity would likely facilitate its adoption in providing information services to their patrons. Low et al. (2021) found this to be true in their study where perceived usefulness (relative advantage) and compatibility has a significant positive influence on adoption of cloud computing. Complexity were not significantly influencing the adoption of cloud computing. This were found to be positively correlated with high tech industry in Taiwan to adopt cloud computing. Also, the finding shows that majority 73(70.9%) of the respondents considered librarians' awareness on the benefits of cloud libraries adoption for information service provision to librarians, patrons and the library to be one of the factors that would facilitate libraries' adoption of cloud libraries to provide services in their respective libraries. The table also show majority 92(89.3%) of the librarians in this study also identified librarians' positive attitude towards the information services delivery via cloud libraries. Also Majority 92(89.3%) of respondents also indicated as a facilitating factor, personal innovativeness of librarians (librarians' willingness and earliness to try out new technologies) Majority 92(89.3%) of respondents also indicated as a facilitating factor, personal innovativeness of librarians (librarians' willingness and earliness to try out new technologies).

Majority 90(87.4%) of the librarians in this study also identified librarians' positive attitude towards the provision of information services via cloud libraries to be one of the facilitating factors. Majority of the respondents 88(85.4%) also indicated Librarians' personal experiences and competences with technology (information communication technologies including cloud libraries) as a factor that would facilitate the

adoption of cloud libraries for information service delivery while less than half 15(14.6%) of the respondents did not. These factors have been found to be in line with the findings of studies by Aharony (2014) where it was shown that positive attitudes and experiences/competences with ICTS and cloud libraries respectively have a positive effect on librarians' behavioral intentions to use these ICTs.

The table further reveals that majority 94(91.3%) of the respondents indicated availability of necessary skill and technological resources will support cloud libraries in the library would facilitate its adoption in libraries. Majority of the respondents 91(88.3%) indicated that provision of budgetary allocation would serve as a factor facilitating the adoption of cloud libraries for information service delivery. These factors have been found to be in line with the findings of studies by Krönung (2021) emphasize that a well-structured budget not only facilitates financial planning but also empowers libraries to transition seamlessly to the cloud, optimizing their operations in a scalable, secure, and up-to-date digital environment.

The table above also shows that majority 81(78.6%) of respondents believed involvement of librarians in decision-making in their respective libraries would facilitate adoption of cloud libraries in their libraries .Majority 79(76.7%) of the respondents indicated that greater leadership/management support by the library management would be a facilitating factor to cloud libraries adoption service delivery while less than half 24(23.3%) did not. This findings is in line with the finding of Low et al. (2021) found this to be true in their study which indicated that top management support has positive significance in cloud technologies adoption.

Summary of Findings

Summary of the major findings are presented below:

In terms of factors, findings from the study also revealed these librarians' understanding of the factors that would likely facilitate the adoption of cloud libraries in their respective libraries and these ranged from attributes of innovation, awareness of librarians. Others include internal factors such as management support, budgetary allocation, technological readiness as well as regulatory policy. Personal characteristics of librarians such as librarians' own innovativeness in the university libraries under study has also been shown to facilitate adoption. Finally, librarians' perceived attributes cloud libraries in terms of relative advantage, compatibility and complexity have also been indicated to aid in the adoption of cloud libraries to provide information services in their libraries.

Conclusion

It could also be concluded from this study that librarians in the three universities have a fairly good idea of the factors that would facilitate the adoption of cloud libraries in their libraries as well as the challenges anticipated to pose a barrier to this adoption. This is a further evidence of the depth of their awareness and perceptions about cloud libraries adoption in the context of information service delivery in their respective libraries.

It could also be concluded that despite some of the perceived drawbacks of cloud libraries as a tool for providing information services in their libraries and despite the challenges that are anticipated in the adoption of such technology in their libraries, the librarians in this study hold firm, their positive perceptions about cloud libraries and also exhibit readiness to adopt this technology for information services delivery to their patrons

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