

Full Length Research

Data Security Factors Influencing the Adoption of Cloud Computing Services by Two Selected Nigerian Academic Libraries

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Cloud computing plays a significant role in academic libraries for improving the efficiency at which information services is handled, processed and delivered. Academic libraries in advance counties have already deployed their information resources to cloud environment and can be accessed by all authorized users any time- anywhere. However, one of the most debating issue discussed in the field of cloud technology is its security aspect; which influences the rate at which the cloud computing services are adopted by academic librarians in both developed and developing countries. Therefore, this study aims at investigating the data security aspect of cloud computing that influences the adoption of cloud computing in Abubakar Tafawa Balewa University Library, Bauchi and Ramat Library, University of Maiduguri, all located in the North-Eastern Nigeria. Quantitative technique using cross sectional survey design was adopted for this study and questionnaires was used as an instrument for data collection. Population of the study comprises all staff of the two libraries amounted to be 328 staff and only 144 sample size were drawn for this study using Krejci and Morgan Sampling table. 136 questionnaires were found to be correctly filled, returned and therefore used in the study. Statistical Package for Social Science version 2.0 was used in analysing the data for both descriptive and inferential statistics. Finding of the study revealed that data integrity, data availability, data confidentiality, perceived ease of use and perceived usefulness are statistically significant data security factors influencing the adoption of cloud computing in selected academic libraries. The study further recommended among others that those significant factors should be given more priority while making decision of cloud computing adoption. Similarly, other security factors associated with cloud computing should be explored in the future in order to have a comprehensive understanding of all the security issues of the cloud computing.

Key word: Cloud Computing, Academic Libraries, Data Integrity, Data Availability, Data Confidentiality, Perceived Ease of Use, Perceived Usefulness

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INTRODUCTION

Academic Libraries have been globally acknowledged to be one of the most important components that their parent institutions cannot do well without them. This is connected to the fact that their roles of providing support to the institution's community are inevitable and always on increasing. Academic libraries according to (Akpohonor, 2005) are libraries attached to tertiary institutions such as Universities, polytechnic, mono technics, colleges of education, and other research institutes. Singh and Kaur (2009) noted that the main mandate of academic libraries is to preserve and provide access to required knowledge and information, thereby supporting teaching and research activities which is the mission of their parent institutions.

However, library users are constantly expressing dismay with regard to the untimely services, frequent server down time due to electricity outage, uneven services to users, inability to access the library contents remotely etc using current on-premises ICT facilities (Hussaini et al., 2017; Iyal, 2018). These problems can only be solved if the librarians can adopt cloud computing which can offer them scalable, timely and everywhere services at a much-subsidised price when compared with on-premises computing and storage capabilities. Nandkishor. et al. (2012) acknowledge that the newest technology trend in library science is adoption of cloud computing for different intentions and for attaining economic benefits in library functions

Despite understanding that cloud computing adoption is the best option to mitigate such mentioned obstacles in libraries, it has been observed both from the literature (Comfort, 2018; Edwin, 2018; Gervasi et al., 2015; Muthanna & Sang, 2019) and practical point of view that most academic libraries especially in developing countries are not willing to adopt cloud computing in delivering their services to users which is largely attributed to some factors that always figure out data security as the first factor (Iyal, 2018; Mokhtar et al., 2017; Okike & Adetoro, 2019). Data security issues are associated with the confidentiality, integrity and availability of data. Denial of services, unauthorised access to information and meta data spoofing attack are frequently experienced by most libraries and organizations (Basu et al., 2018).

Similarly, Birje et al (2017) further acknowledge that other incidence related to web application and data security issues such as data phishing, data loss, downtime, password weakness etc are still occurring even in some high ranking/renowned companies like Google, Amazon, Microsoft and Twitter. Therefore, Aviamu et al. (2019) and Asadi et al. (2017) stress that investigating the data security factors influencing cloud computing adoption is necessary in order to provide librarians and cloud computing providers with relevant

information concerning such security issues, thereby enabling them to find solution to this security issues, hence increasing the rate of adoption which can eventually lead to improved services delivery that will satisfy the information need of library clients.

Base on this background, this study intends to examine the influence of data security factors on the adoption of cloud computing in some selected university libraries, using a theoretical base of technology acceptance model, which is a very powerful model for new technology adoption (Marangunić & Granić, 2015) like cloud computing.

Concept of Cloud Computing

Cloud computing is one of the most fastest growing technology in the 21st century that bring a lot of benefits though not without challenges (Kumar et al., 2018). Cloud computing is defined by different authors base on their different perspectives, however arriving at the same true concept of it. According to National Institute of Standards and Technology (NIST), "*Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort and or service provider interaction*" (NIST 2019). Similarly Cloud computing is defined by Gartner (2012) in Senarathna et al (2016) as "a style of computing in which massively client scalable and elastic IT-enabled capabilities are delivered as a service to external customers using internet technologies". Cloud computing has four deployment models that include private deployment model, community deployment model, public deployment model and hybrid deployment model. Similarly, it has three services models that include software as a services (SaaS), Platform as a services (PaaS) and Infrastructure as a service (IaaS) (Alqarni & Barnawi, 2019; Kumar et al., 2018; Oliveira et al., 2014)

Therefore, Kumar et al. (2018) stress that as a well-spread technology, cloud computing is being used by a number of individuals and organizations knowingly and unknowingly, they pointed out how people use Micro soft 365, Gmail, Drop Box etc in their daily routines as an example. Furthermore, attributed the use cloud computing in daily routines as a results of its (cloud computing) advantages associated with any time – anywhere accessibility, very wide geographic coverage at fasted rate and cost reduction in terms of infrastructural procurement (Kumar et al., 2018).

Similarly, librarians also tend to grasp the opportunities being provided by the cloud computing technology, Tuncay, Chao and Wu (2011) acknowledge that cloud computing has enhanced service delivery of libraries

through improved computing competences, provision of enormous storage capabilities, worldwide information accessibility, and drastic decreased in cost of incurring the ICT facilities. Cost minimization is one of the attributes that attract most organizations to adopt cloud computing. Likewise Cloud computing ensures improved productivity and efficiency in data management of organizations such as academic libraries as well as relieving them from owning and maintaining the necessary hardware and software facilities that are prerequisite for information services delivery (Yaokumah & Amponsah, 2017). Therefore, the need to adopt cloud computing is worthy enough to mention.

Concept of Data Security in Relation to Cloud Computing

The foundations of data security are based upon the confidentiality, integrity, availability and accountability (Senarathna et al., 2016). Cloud computing host users' data far away from the location of the users who subscribe to the cloud services. Therefore, trusting the cloud services providers is one of the most important consideration that cloud subscribers always make before adopting and integrating the cloud services in their services delivery (Basu et al., 2018). Subscribers always try to make sure that cloud services providers have taken care of all risk associated factors that can affect the users data confidentiality, integrity and availability (Basu et al., 2018). This can make the cloud subscribers to have peace of mind with the issues related to storing their data in cloud storage. Ahmed (2019) and Kumar et al (2018) stress that the three most fundamental cloud security factors associated with data in cloud are confidentiality, integrity and availability of the data and they are also the three attributes of data popularly known as CIA.

Kumar et al (2018) acknowledge that among all the challenges that cloud computing bring to subscribers, data security challenges are the most disturbing one as well as the most devastating factor that retarding the librarians to adopt the cloud in their services delivery as its loss can bring serious harm to the entire information services delivery processes. Basu et al. (2018) also acknowledge that virtualization leads to some security challenges that goes beyond the boundary of confidentiality, but include also the integrity and availability of data. Birje et al. (2017) concluded that not only on cloud computing, but on all computer related field in general, confidentiality, integrity and availability are the top most challenging factors on data being stored electronically. Therefore, this also motivated the need for exploring the influence of the data security on the adoption of cloud computing services by some academic libraries in Nigeria.

Hypotheses Development

Confidentiality is described as a privacy of data. Confidentiality are designed to prevent the sensitive information from unauthorized or wrong people (kaur. & Singh., 2015). That is, it ensures that sensitive information is made inaccessible to all unauthorized users (Basu et al., 2018). They further attested that organizations must ensure that the confidentiality of their data is fully enforced to restrict all the unauthorised users from gaining access, this can help to ensure secured cloud environment that can attract cloud subscribers. Similarly, geographical location also affects the confidentiality of data stored on the cloud especially when it crosses country boundary that have different laws governing the data storage services. Therefore, Aldossary and Allen (2016) stress the need to have and enforce confidentiality on all data being stored on the cloud in order to safe guard it, hence attract more cloud subscribers.

H1: Confidentiality positively influence the acceptance of cloud computing by academic librarians

Integrity is the assurance given to the digital information is uncorrupted and can only be accessed by authorized users. Thus, integrity entails maintaining the utmost accuracy, consistency and trustworthiness of data throughout its whole life cycle (Kumar et al., 2018). The fundamental properties of data are always ensured and remain un-tempered by the integrity enforcement policy of cloud services providers (Birje et al., 2017). Therefore, if librarians believed that their quality of data stored in cloud will not be tempered by any un authorised party, they will be eager to accept the cloud computing and integrate it in their services delivery mode. Therefore, this study proposes that:

H2: Integrity is positively associated with cloud computing acceptance by academic librarians

Availability : Availability is defined as the strategy of ensuring the anytime – everywhere access to stored data by all intended users (kaur. & Singh., 2015). Basu et al. (2018) maintain that availability is one of the most important security aspects that requires the attention of cloud services providers for ensuring the full protection of cloud subscribers' data. This is because so many organizations stored their data with a single cloud provider and each client has different users that the data need to be made available to. With the enforcement of availability security policies, timely and reliably access to and use of information will be firmly ensured (Birje et al., 2017), hence increase organizations' readiness to move their data to cloud. Aldossary and Allen (2016) acknowledge that some organizations want their data to

be available all the time, because availability is important to them due to the criticality of services they offer. Furthermore, cloud computing ensure highly data retrieval and availability to all intended users without any restriction (Aldossary & Allen, 2016) . This has made it possible for most organization to consider cloud computing services as reliable. Therefore, this study proposes that:

H3: Availability has positive influence on the adoption of cloud computing by academic librarians

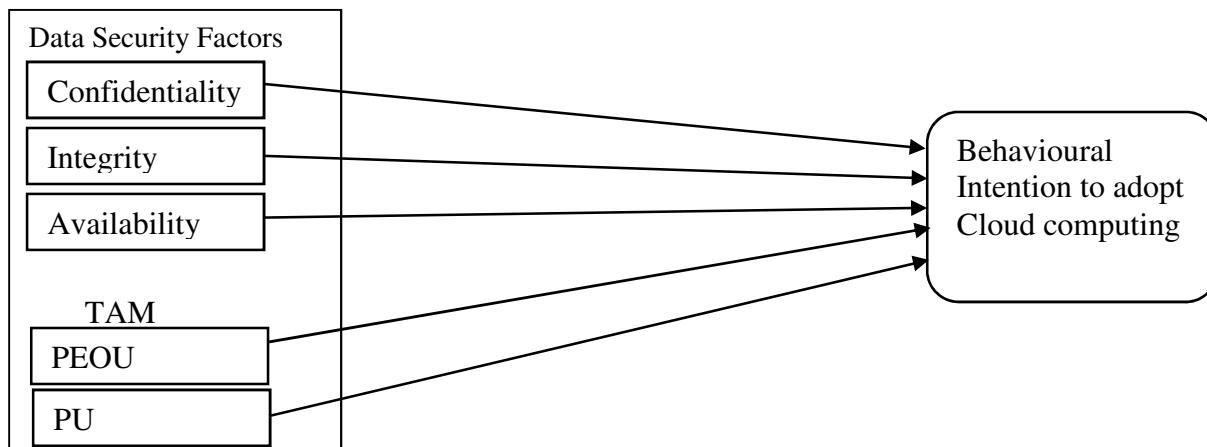
Perceived Ease of Use (PEOU): Two important variables are propounded as the basic for technology acceptance model (TAM), these are perceived ease of use (PEOU) and perceived usefulness (PU). PEOU has been describe as a believed a technology user has that using a given technology is simple, flexible and friendly (Marangunić & Granić, 2015; Park & Kim, 2014; Venkatesh et al., 2003). Therefore, for any technology or system to be fully accepted by users, it must be simple and easy to use. Several studies revealed that PEOU influences the adoption of new technology such as cloud technology. For example Tella et al (2020) found that PEOU is a significant factor in the adoption of cloud computing in academic libraries. Likewise Ali et al (2018) discover that PEOU has a positive effect on the adoption of cloud computing for universities services. Similarly, Oliveira et al. (2014), Lai (2017) and Davis et al. (1989) further attested the robustness influence of PEOU on the

intention to adopt cloud computing in organization. Szajna (1996) stated that if the technology to be adopted is simple to use, users will be hurry to adopt it without much delay. Meaning, if the cloud computing is simple and less complex, librarians will quickly adopt it in their services delivery. Base on this, this study proposes that

H4: PEOU has a positive influence on the adoption of cloud computing in academic libraries

Perceived Usefulness (PU) is one of the powerful variable of TAM, which is explained as a user believed using a new technology is very important that can improve organizational performance (Ali et al., 2018; Venkatesh et al., 2003). Users most a times rush to accept a technology if the usefulness of the technology is high, and reject it if the usefulness is low. Studies such as (Alharbi, 2017; Alharbi, 2012; Szajna, 1996) propounded that PU is a significant factor that determine the adoption of new technology. Likewise Ali et al (2018) revealed that PU influences the adoption of cloud computing in universities. Similarly, Tella et al (2020) attested that cloud computing significantly influence the adoption of cloud computing in academic libraries. This revealed that once librarian realized that cloud computing offers enormous advantages to their services delivery, they will be eager to adopt it and use it libraries. Therefore, this study proposes that:

H5: PU has a positive influence on the adoption of cloud computing in academic libraries



Conceptual Frame Work for the Study

METHODOLOGY

The technique employed for this study is purely quantitative and the research design adopted for this study is cross sectional survey research design, which is suitable for gathering study data from one point in time and assesses the nature of the relationship between all the variables of the study. The total population of the study is 228 respondents, drawn from the two selected universities libraries in the North eastern Nigeria which are ATBU Bauchi and University of Maiduguri, where 143 library staff are from Ramat library university of Maiduguri and 85 library staff from A.T.B.U library. Krejci and Morgan sampling table was used to draw the sample size of the population amounted to 144 participants who represented the entire population. 144 sample size is approximately equal to 63.2% of the total population. and (Hair *et al* (2006) stressed that the appropriate sample size for questionnaire method should be 100 or above, therefore the sample size for this study amounted to 144 is adequate enough and satisfy the requirement. However, only 136 questionnaires were found to be useful. Considering the fact that the population of this study was drawn from two academic libraries, proportionate stratified random sampling technique is adopted in selecting the samples. The technique involves categorizing the selected elements into different groups then taking an element from each stratum by means of simple random method (Sekaran., 2006). The researcher therefore, classified the academic libraries under study as strata with samples drawn based on the population of each academic library. Base on that, 90 sample respondents were drawn from Ramat library university of Maiduguri and 54 sample respondents were drawn from A.T.B.U library.

The data collection instrument used in the study was structured questionnaire which was designed base on 5- points Likert scale, ranges from 1 (Strongly disagree) to 5 (strongly agree). Previously tested scales were adapted from related studies to measure all the constructs of the proposed model. Most of the scales were altered to suite the context of the cloud computing adoption in academic libraries. Items scales for confidentiality, integrity and availability were adapted from the work of (Kaur & Mustafa, 2013) while that of intention to adapted cloud computing construct ware adapted from the work of (Asadi et al., 2017). Similarly, the reliability of the constructs was determined using Cronbach alpha measures while the validity of the constructs was carried out by sending the questionnaire to the experts in the field and have all the errors and inconsistencies addressed

The data analysis involved both descriptive and inferential statistics. Furthermore, collected data were statistically analysed by means of percentage, mean score, standard deviation and multiple regressions using Statistical Package for Social Science (SPSS) version 2.0. The results were presented as appropriate as possible.

RESULTS AND DISCUSSION

Respondents Demographic Variables

Qualification of Respondents

Table 1 presented the qualifications of respondents who participated in this study. Most of the respondents of this study are Degree/HND holders which are represented by 54.4%, followed by Masters holders represented by 20.6%, then Diploma/NCE holders who are represented by 19.9%. Similarly, PhD holders and other qualification holders apart from the ones mentioned constituted 2.9% and 2.2% respectively. This implies that most of the respondents are suitable to participate in this study.

Table 1: Qualification of the Respondents

qualifications	Frequency	Percent	Valid Percent	Cumulative Percent
Others	3	2.2	2.2	2.2
Diploma/NCE	27	19.9	19.9	22.1
Degree/HND	74	54.4	54.4	76.5
Masters	28	20.6	20.6	97.1
PhD	4	2.9	2.9	100.0
Total	136	100.0	100.0	

Source: Field Survey 2020

Respondents Years of Experience

As indicated in table two below, the respondent's years of experience reported 11-15 years as the highest which was represented by 37.5%, followed by 16-20 years represented by 26.5%, then 6-10 years which are represented by 16.2%. Equally, respondents who spent 20 and above years in service are represented by 11.8% and those with 1-5 years are represented by 8.1%. This result indicated that the respondents who participated in this study have much years of experience and as such they can appropriately respond to the questionnaires given to them

Table 2: Years of Experience of the Respondents

Years of Experience	Frequency	Percent	Valid Percent	Cumulative Percent
1-5 years	11	8.1	8.1	8.1
6-10 years	22	16.2	16.2	24.3
11-15 years	51	37.5	37.5	61.8
Valid 16-20 years	36	26.5	26.5	88.2
20 years and above	16	11.8	11.8	100.0
Total	136	100.0	100.0	

Source: Field Survey 2020

Assessing Factorability of the Constructs

Table 3 below aimed at presenting the results of factor analysis. Kaiser-Meyer-Olkin's measure of Sampling Adequacies (KMO), the Bartlett's Test of Sphericity and anti-image correlation results of all the variables meets the requirement. This is because all KMO-MSA values of this research study are greater than 0.5 and Kaiser (1974) recommended that KMO values greater than 0.5 is acceptable. Similarly, results for the Bartlett's Test of Sphericity also revealed 0.000 for all the constructs which is very good and reliable

Table 3: Accessing Factorability of the Constructs

Constructs	KMO-MSA	BTS Sig	Minimum anti image
Confidentiality	0.717	0.000	0.654
Integrity	0.755	0.000	0.660
Availability	0.746	0.000	0.721
Perceived Ease of Use	0.834	0.000	0.784
Perceived Usefulness	0.738	0.000	0.690
Intention to Adopt Cloud	0.836	0.000	0.805

Source: Field Survey 2020

Eigenvalues, Range of Factor Loading, % of Variance Explained and Cronbach's Alpha

From table 4 below, the reliability of constructs items was checked using factor loading and Cronbach alpha values. All the loading factor found in this study revealed a factor loading greater than 5, and (Hair *et al* (2006) suggested that any construct item that has a factor loading greater than 5 is considered as good and appropriate. Likewise, all the 1st eigen values of the construct items revealed values greater than 1, which is quite good and met the requirement. Similarly, the % of variance explained except for Availability revealed the needed requirement as stated by and (Hair *et al* (2006). furthermore, the results of Cronbach alpha revealed the needed requirement, as all the results are greater than 0.6 and (Nnually, 1978). stated that any Cronbach alpha value greater than 0.6 is considered acceptable. Base on this therefore, all the construct of the study are normal and can be statistically regressed as they are all reliable

Table 4: Eigenvalues, Range of Factor Loading, % of Variance Explained and Cronbach's Alpha

Constructs	1st (factor) eigenvalues	2nd(factor) eigenvalues	Ratio	Range of factor loading	% of variance explained	Cronbach's Alpha
Confidentiality	2.476	0.802	3.093	0.568-0.780	58%	0.710
Integrity	3.117	0.972	3.210	0.498-0.812	69%	0.804
Availability	2.674	0.941	2.839	0.503-0.590	45%	0.743
Perceived Ease of Use	3.279	0.760	4.309	0.512-0.708	54%	0.822
Perceived Usefulness	2.538	0.914	2.779	0.562-0.604	52%	0.724
Intention to Adopt Cloud	3.201	0.853	3.756	0.526-0.618	54%	0.708

Source: Field Survey 2020

Multiple Regression Analysis

Model Evaluation and ANOVA Results

Model summary table is the first table of interest in multiple regression analysis which produces R, R², adjusted R² and the standard error of the estimate. This table is used to determine the fitness of the regression model in relation to the data. Therefore, from the model summary here, the results revealed that collectively the 5 independents variables (confidentiality, integrity, availability, perceived ease of use and perceived usefulness) explained 35.4% of the dependent variable (cloud computing adoption). Meaning, the independent variables were able to explain the variance of 35.4% in the dependent variable.

ANOVA which tests whether the overall regression model is a good fit for the data is found to be statistically significant by revealing the results of F- value 19.533; meaning that the F- test is statistically Significant, thus we assumed that there is linear relationship between the variables in the model under study

Table 5: Model Summary and ANOVA Results

Model	R	R ²	Adjusted R ²	Standard error of the estimate	Sig. F-change	ANOVA F-change	ANOVA Sig.
1	0.593 ^a	0.352	0.334	0.445	0.000	19.533	0.000

a. Predictors: (constant), Con, Intgr, Avai, PEOU, PU

b. Dependent Variable: CCAD

Coefficient Analysis

From table 6 is indicated that four independent variables (integrity, availability, perceived ease of use and perceived usefulness) of the five are statistically significant in influencing the adoption of cloud computing of the selected academic libraries. This is indicated by the P Value in table 6 below where the variables' values are <0.5, While confidentiality is not statistically significant according to the results. Likewise, the individual contribution of each variable is also revealed with varying contributions toward influencing the adoption of cloud computing in academic libraries as can be seen in Beta (β) column of table 6. Beta (β) values are primarily used to indicate the relative percentage of contribution given by each independent variable as against the collective contribution.

Table 6: Regression / Coefficient Analysis Results of the Constructs

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Standard Error	Beta	T	Sig.	Tolerance	VIP
1	(Constant)	1.032	0.515		1.98	0.046		
	Conf	0.027	0.064	0.026	0.431	0.667	0.971	1.030
	Intgr	0.254	0.078	0.301	3.254	0.001	0.421	2.374
	Avail	0.182	0.071	0.223	0.548	0.014	0.708	1.413
	PEOU	0.189	0.076	0.233	2.501	0.013	0.418	2.392
	PU	0.243	0.096	0.165	2.540	0.012	0.856	1.168

a. *Dependent variable: CCAD*

Hypotheses Testing

Table 7: Hypotheses Testing

	Hypotheses Statement	P Value	Decision
H1	<i>Confidentiality positively influences the acceptance of cloud computing by academic librarians</i>	0.667	Rejected
H2	<i>Integrity is positively associated with cloud computing acceptance by academic librarians</i>	0.001	Accepted
H3	<i>Availability has positive influence on the adoption of cloud computing by academic librarians</i>	0.014	Accepted
4	<i>Perceived ease of use has positive influence on the adoption of cloud computing by academic librarians</i>	0.013	Accepted
5	<i>Perceived usefulness has positive influence on the adoption of cloud computing by academic librarians</i>	0.012	Accepted

DISCUSSION OF FINDINGS

From all the result of this study, it is now discovered that data integrity and data availability are very important factors that influences the adoption of cloud computing in the selected academic libraries by having a significant influence level. This is in line with the findings of Basu et al (2018) who also stated that data integrity and availability significantly influence the adoption of cloud computing by organizations. They further stated that once organizations believed that their data integrity and availability will be ensured by the cloud services providers, the organizations will be eager to adopt and place their data on cloud computing environment. Likewise, perceived ease of use and perceived usefulness are reported to be very important in the adoption of cloud computing in academic libraries. Once academic libraries believed that the cloud system is very easy, friendly and flexible to use, they will be easily influenced by that and adopt the cloud computing for their services delivery. Equally, if the cloud computing is considered to be useful enough in discharging information services, libraries will surely use it. Tella et al (2020). stated that perceived ease of use and perceived

usefulness have been found to be statistically significant predictors of cloud computing adoption in academic libraries.

RECOMMENDATIONS / SUGGESTION FOR FURTHER STUDY

Base on the findings of this study, the following recommendations are made:

1. The selected academic libraries are to put more attentions on the data integrity and availability being them a data security factors, as they possess a significant influential power on the adoption of cloud computing. Which in turn will escalate the level at which the cloud computing will be adopted among the academic libraries
2. The easiness and usefulness of the cloud computing should be taken into consideration as they significantly influence the adoption of the cloud computing. Necessary mechanisms that will ensure friendliness and simplicity of the cloud as well as attribute that can poster its usefulness should be

integrated in the cloud computing system by the cloud services providers.

3. This study further recommended that similar study should be conducted using more other variables as well as inclusion of more academic libraries across the North-eastern Nigeria and beyond.

CONCLUSION

data security factors have been considered as a serious matter that affect the users of cloud computing in various organizations, therefore exploring such factors is a key to the success of cloud computing adoptions by organizations including libraries. Academic libraries should continue to develop more strategic skills and technique on how to tackle all issues related to data security on the cloud.

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