Investigation of Trends, Benefits and Challenges in the Adoption of Cloud Computing Application in E-Learning among Polytechnics in North-East, Nigeria

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Abstract:- The study examined the trends, significance and challenges of application of cloud computing in e-learning system. Data were collected through qualitative approach; five (5) Polytechnics are involved in data collection each from the North-East state. About 250 questionnaires were distributed among the Polytechnics. The findings of the research found that cloud computing play major role in enhancing teaching and learning activities. Also, the research discovered that there are security concerns that stand as barrier for successful implementation of cloud computing application. In addition, the study established that respondents have basic knowledge of cloud computing application and is getting acceptance in teaching and learning activities. The study recommended that compile version of cloud computing application should be adopted in e-learning system to avoid security threats.

Keywords:- Cloud Computing, E-Learning, Teaching, Learning and Challenges.

I. INTRODUCTION

There is a growing body of literature that recognizes the importance of cloud computing in education (khan *et al.,* 2016, Sultan, 2010, Mathew, 2015, Alam, 2013, Tsegay, *et al.,* 2014, and Oyerele*et al.*, 2016). Cloud computing is a large-scale distributed computing paradigm driven by economies of scale, in which a pool of abstracted, virtualized, dynamically-scalable, managed computing power, storage, platforms, and services are delivered on demand to customers over the Internet (Tsegay, *et al.,* 2014). Cloud computing have emerged as powerful platforms for teaching and learning activities in developed and developing countries. Knowledge is the backbone for economic development for sustaining self-reliance and stability for any society. For this reason, knowledge need to be improved at any point in time, adopting cloud computing in e-learning environment will facilitate impacting knowledge to younger generation. This proposal has been divided into six parts. The first part deals with problem statement/justification, second part deals with objectives of the study, third part deals with literature review, fourth parts deals with methodology, fifth part deals with result (expected output/result), sixth parts deals with work plant/time frame (Gantt chart), and the seventh parts deals with budget.

II. LITERATURE REVIEW

Mathew (2015) examined the trends, benefits and challenges being encountered for adopting cloud computing in Nigerian Universities. An empirical research via questionnaire was used to generate data for the study. A total of 10, 800 questionnaires were administered to 54 public universities across the 6 geo-political zones in Nigeria while 8756 copies were returned which represents a respondent rate of 81.1%. The analyzed data revealed that 92% of the total respondents are aware of cloud computing in education, 45 universities adopted the use of cloud. The study finds (found) that there is cost benefits, but the key constrain are data insecurity, regulatory compliance anxiety, lock-in and privacy worry. This result has been supported by Sultan, (2010) who reported that cloud computing has potential cost flexibility, but security, reliability and portability are the major concern of cloud adoption for education. Similarly, Alam, (2013) found that cloud computing offer flexibility cost benefits in education which agreed with (Mathew, 2015 and Sultan, 2010). Tsegay, *et al.* (2014) supported Alarm by revealing cloud benefits in education such as flexibility, opportunity, innovation, savings, accessibility and efficiency. Mathew, concluded by proposing a cloud archetype that could mitigate the challenges identified and offered improved agility, low cost adoption, access and use of sophisticated educational ICT infrastructures for Nigerian universities.

In a study conducted by Dahiru, *et al.* (2014) which explored the emergence and adoption of cloud computing by Small and Medium Sized Enterprises (SMEs). The Grounded Theory (GT) methodology was surveyed in conducting the study. SMEs in Nigeria was chosen as research sites. Data were collected through selection/sampling with use of open-ended and face-to-face semi-structured of the research sites, pieces of information gathered from initial research sites are used. The study found that there are some issues and challenges impede successful adoption of cloud computing in respect of SMEs such as security, privacy, trust issues, data loss concerns, awareness, top management support issues, availability of good internet connection and cost issues. These results are consistent with recent findings (khan *et al.,* 2016, Sultan, 2010 and Mathew, 2015). Khan revealed that lack of competency to manage the risk; compliance and security related to cloud issues are major hindrance of cloud adoption in many organizations.

Dahiru, *et al.* (2014) reported that there is limited number of reputable resources to consult issues concerning adoption of cloud computing by SMEs especially in sub-Saharan Africa. This means that the finding of this study is not dependable. According to the research, there is no direct impact of cloud computing to development, therefore, a generalized conclusion will not be accepted at this stage. However, the study acknowledged that cloud computing may offers potential opportunities to SMEs which are seemingly real.

Oyerele *et al.* (2016) investigated M-Learning adoption as new paradigm of learning ICT in Nigeria. Questionnaire were administered to find out primary and secondary school students' readiness in Nigeria to adopt m-learning, with prediction to use specific m-learning devices and solutions in learning situations, as well as to obtain opinions regarding the suitability of m-learning for learning ICT-related subjects. The results confirmed that students have experience with the use of mobile devices. This experience can be utilized in adopting m-learning. It also showed that less than 13% of students who participated in the survey are yet to own a mobile device which could be attributed to lack of money and parental dissatisfaction. The study indicated that less than one fifth of the respondents are not specific whether to commence m-learning, while only 6 % of the respondents are completely unprepared for m-learning. The research concludes that possession of mobile phones by students and familiarity with it features such as social media forums, chatting, browsing the internet, e-book reading revealed by students in primary and secondary schools in Nigeria are good indicators to students' willingness for accepting the new learning paradigm.

Alabbadi (2011) discussed the use of cloud computing in the educational and learning platform, known as "Education and Learning as a Service" (ELaaS), with emphasis on likely benefits and contributions. The study proposes a Complete Cloud Computing Formation Model (C3F), based on the Cloud Cube Model (CCM) developed by the Jericho Forum. The IT activities in the educational and learning organizations will be classified with respect to the two measures: mission criticality and sensitivity. Both measures are categorized as Low and High. Each category of the IT activities will then be mapped into the appropriate position of in the C3F. The mapping will create "Education and Learning as a Service" (ELaaS). ELaaS is a hybrid approach, including cloud and non-cloud based solutions. This proposal was adopted by (Tsegay, *et al.,* 2014).

The study of Dahiru*et al.* (2014) revealed some issues and challenges militating against adoption of cloud in SMES. Nevertheless, the methodology adopted did not specify the actual size of the population and region covered during data collection. Accordingly, findings did not give through picture of cloud computing adoption on SMEs in Nigeria as Sub-Sahara region of Africa. The study also showed that there is no direct impact of cloud computing adoption in SMEs. This indicated the need to conduct another research to substantiate the adoption of cloud computing in SMEs and other areas such as e-learning in Africa Sub-Sahara, particularly Nigeria. The study proposed further work to develop a model on analytical framework of cloud computing adoption through ICT4D on issues like legal and regulatory issues, ICT policy issues and institution to determine how technology will impact on development in sub-Saharan Africa.

The investigation carried out by Oyerele*et al.* (2016) revealed the readiness of primary and secondary students for adopting m-learning as a new paradigm for ICT learning but the major limitation of the study is that, it did not cover tertiary institution. Khan *et al.* (2016) determined major impediments of cloud adoption in organization using case study methodology. The findings of this methodology cannot be generalized, hence a different methodology such as survey or otherwise may be applied to validate the argument. Also, a similar research on academic institution should be conducted for comparison with that of organization.

Alabbadi (2011), proposed Complete Cloud Computing Formation Model (C3F) for implementing cloud computing in education but the major drawback of the study it did not address the methodology adopted. In study conducted by Tsegay, *et al.* (2014) who reveals potential of cloud computing in education with a proposed model of implementing lacks introduction, abstract and adopted methodology.

A recent study conducted by Mathew (2015) revealed that financial benefit and some key challenges of adopting cloud computing in Nigerian universities. However, major predicament of Mathew, only 54 public out of more than 150 public and private universities were considered for the research. This finding cannot be generalized across the Nigerians universities and consequently, more research need to be conducted for trustworthiness. Moreover, the study recommended that future research work may investigate how the constraining factors to successful adoption of cloud computing in Nigeria universities can be managed easily without incurring additional overheads. Similarly, Sultan (2010) disclosed that flexibility of cost and some major challenges of adopting cloud computing in education. Main limitation of Sultan, the methodology adopted for the study was not clearly stated and more importantly, the research was conducted in UK, University of Westminster as a case study which may have different situation in Nigeria. Equally, this result cannot be generalized to developing countries, a similar research may be carried out in developing countries to substantiate some claims. The intended investigation will focus on Cloud Computing Adoption in E-learning Environment Among polytechnics in North-East.

III. MATERIALS AND METHOD

Qualitative approach has been employed since it underlines numerical analysis of data collected through polls, questionnaires, and surveys or objective measurements and statistical, mathematical, or by manipulating pre-existing statistical data using computational techniques. Collected data through quantitative research focuses on arithmetical data have been generalized across groups of people to explain a given phenomenon, which are categorized into descriptive, correlation, quasi-experimental and experimental quantitative research (Creswell, 2009). In quantitative research design is regularly used to recognize the associations between variables, test conceptual models, determine the opinion/view of a given group of samples. This indicate that a researcher may establish a measures of evaluations by means of quantitative research design (Christenson & Gutierrez, 2016). An extensive literature were reviewed through journals, textbooks and internet which assisted the conduct of the study in proffering appropriate solution to the identified challenges of cloud computing application in e-learning.

➤ *Population/Sample Size*

The study has considered population size of five (5) Polytechnics. Simple random sampling techniques have been conducted within the selected Polytechnics. About two hundred and fifty (250) prepared questionnaires were distributed to the targeted audiences within ICT staff managers and lecturers from representative sample of Polytechnics in the North-East. Simple random sampling offers an effective way of minimizing sampling error, and in quantitative research, it focuses sample from the larger population.

➤ *Study Area*

The study considered five (5) Polytechnics in the North-East, at least one from each state. In Taraba state, Federal Polytechnic Bali; in Adamawa state, Federal Polytechnic Mubi; in Borno state, Ramat State Polytechnic Maiduguri; in Yobe State, Federal Polytechnic Damaturu and in Buachi state, Federal Polytechnic Bauchi.

➤ *Data collection*

Data were gathered using questionnaires encountered in the selected Polytechnics within five (5) in the North-East.

IV. RESULT AND DISCUSSION

The scales used to carry out the research were represented as follows: Y (Yes), N (No), SA (Strongly Agree), A (Agree), D (Disagree) and SD (Strongly Disagree). About two hundred and fifty (250) questions were distributed among five Polytechnics in the North-East and average of two hundred and twenty (220) was responded. The scales used in obtaining responses were coded as follows: Y and SA = 4, N and A = 3, D = 2 and SD = 1. The tables below indicate average coded from responses obtained.

➤ *Basic Knowledge of Cloud Computing Application in E-learning*

From the responses obtained in table 1, it has been indicated that the respondents are familiar with application of cloud computing in e-learning which facilitate teaching and learning activities by sharing information over the internet. These findings was supported by Cutkosky *et al.* (1996) in their study that e-learning collaboration tools enabled sharing information, both asynchronously via email and real-time. Also, the result of the study is in accordance with Geissbuhler & Ly (2007), who emphasized that knowledge sharing get across professionals in different countries through internet connection.

Basic Knowledge of Cloud Computing	Y	N	Coded Total	Total Observed Frequency	Average of Coded Total
Online assessing and evaluating learning activities is an application of cloud computing in E-learning	156	3	633	159	3.98
Cloud computing allows sharing of information over the internet	135	19	597	154	3.88
Application of Cloud computing in e-learning enhances teaching and learning activities	150	3	609	153	3.98

Table 1:- Average of coded total for basic knowledge

➤ *Benefits of Cloud Computing Adoption in E-learning System*

In table 2, the research revealed that the responses of the respondents are significant as shown by the average coded total. Consequently, cloud computing application is very essential in enhancing e-learning system. These results correspond with the study of Nayar, & Kumar (2015) that revealed cloud computing allows taking daily backup of documents which reduces (security challenge and disaster) and this minimizes operation cost. Also, according to their findings cloud computing offers better storage, enhances the productivity, and reduces the IT management work. Furthermore, the study conducted by Sultan (2010), found that cloud computing technology enables sharing responsibilities over multiple computers which can be spread over large geographical areas. Likewise, the findings of Chandra & Borah (2012) supported the above results that cloud computing provides benefits of easy maintenance of computing infrastructure, increases

availability and integrity of data, applications and research materials, improves data storage capacity, delivery of study materials, enables departments to create custom images independently. Also, their study discovered that Singapore Polytechnic is utilizing the benefits of cloud computing to realize cost savings, energy efficiency and dynamic scalability which is in accordance with Nayar, & Kumar (2015). Similarly, Al Noor *et al.*, (2010) established that cloud computing provides more legitimate version of software at low price. Equally, in a study conducted by Mathew (2012) recognized that cloud computing enable educational institutions to save cost and take advantage of emerging technology. Accordingly, Alabbadi (2011), stated that cloud computing offered an immense benefits due to its flexibility and pay-per-use cost structure operation. From the recent studies carried out it is clearly proven that cloud computing offers a lot of benefits in e-learning system despite the fact that one cannot rule out the challenges associated with it.

Benefits of Cloud Computing Application in E-learning System	SA	A	D	SD	Coded Total	Total Observed Frequency	Average of Coded Total
Cloud computing is cost effective	320	315	52	8	695	219	3.17
Cloud computing has high computing capability (effective and efficient)	336	381	30	5	752	231	3.26
It posses global scale (deliver the right amount of IT resources)	320	351	56	4	731	229	3.19
Cloud computing improve learning productivity	316	345	26	8	695	215	3.23
It support good performance (it reduces network latency for applications)	312	315	64	0	691	215	3.21
It support security tolerance (some cloud providers offer good level of data protection)	292	396	52	4	744	235	3.17
It enhances learning collaboration	300	333	36	11	680	215	3.16
Cloud computing support data portability (users can access their data from anywhere, if there is internet connectivity)	448	255	42	3	748	221	3.38
Cloud computing sustain unlimited storage of data	388	321	46	11	766	238	3.22
It promote global sharing of knowledge	300	264	22	8	594	182	3.26
It provides effective monitoring and controlling of learning activities	264	336	66	5	671	216	3.11

Table 2:- Average of coded total benefits of cloud computing application in e-learning system

➤ *Challenges of Cloud Computing Application in E-learning System*

Responses obtained in table 3 shown that, the average coded total is significant and for that reason, cloud computing application has a lot of challenges concern that need to be addressed for proper acceptability. These concern challenges include delay/denial of service, compatibility issue, ICT infrastructure, lack of train personnel, breach of trust, poor policy, managerial issue, confidentiality, integrity, and user access. These findings corroborate with the assertion of Sultan (2010) that there are inadequate IT resources to carryout test before moving new application into production. The findings of Alabbadi (2011), revealed that cloud computing has five main challenges: security, interoperability, availability, performance, and data migration which is accordance with above results. Masud (2012,) also reported that latency and networked throughput affect e-learning system which is in line with the above results. This study realized that challenges of Cloud computing cannot be avoided completely but can be managed effectively.

Challenges of Cloud Computing Application in E-learning System	SA	A	D	SD	Coded Total	Total Observed Frequency	Average of Coded Total
Inadequate ICT infrastructure (eg internet bandwidth and others)	404	159	14	0	577	161	3.58
Inadequate training of IT personnel	248	225	48	1	522	162	3.22
Poor policy to manage IT crime issues between cloud providers and their clients	216	162	44	1	423	131	3.23
Breach of trust between client and cloud providers	156	228	60	4	448	149	3.01
Non-cha-lant attitude by management towards adopting e-learning system.	204	225	50	0	479	151	3.17
Insufficient access to client information	132	258	76	6	472	163	2.90
Uncertainty of data confidentiality and integrity	180	243	58	5	486	160	3.04
Insufficient policy to handle security challenges	204	192	64	5	465	152	3.06
Cloud compatibility/upgrade issues (replacement of existing IT infrastructure to make system compatible on cloud)	224	267	48	1	540	170	3.18
Delay or denial of service due to technological bottle neck. (	204	210	70	1	485	157	3.09

Table 3:- Average coded total of challenges of cloud computing application in e-learning system

➢ *Trends towards Adopting of Cloud Computing Application*

The findings in table 4 below, disclosed that trends towards adopting of cloud computing is very significant. Many recent researchers (Al Noor *et al.,* 2010, Sultan, 2010, Alabbadi, 2011, Mathew 2012, Masud 2012, Nayar, & Kumar 2015,) are consistent with the above findings. Therefore, cloud computing application is gaining more attention in teaching and learning activities.

Trends towards Adopting of Cloud Computing	SA	A	D	SD	Coded Total	Total Observed Frequency	Average of Coded Total
Learning activities is moving towards cloud computing	344	198	22	0	564	163	3.46
Educators and learners accept cloud computing	148	255	56	1	460	151	3.05
Educators and learners have key interest in cloud computing	128	282	42	1	453	148	3.06

Table 4:- Average of coded total trends towards adopting of cloud computing

V. CONCLUSION

This research is aimed to investigate cloud computing adoption in e-learning environment among Polytechnics in the North-East. It was exposed that cloud computing application play significant role in enhancing teaching and learning activities. Also, the research discovered that there are security concerns that stand as impediment for successful implementation of cloud computing application. Furthermore, the study found that respondents have basic knowledge of cloud computing application and the trends of teaching and learning activities is moving towards cloud computing application.

VI. RECOMMENDATION

It is timely that all tertiary institution should adopt application of cloud computing in teaching and learning activities for enhancing knowledge dissemination. Due to challenges associated with cloud computing application the study recommend using compile application (user will not have access to address). Further research should be carried out in other zone of the country for comparison analysis.

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