

# Analysis of Cloud Computing Awareness and Adoption among Small and Medium Enterprises (SMEs) and Tertiary Institutions in Kebbi State.

Ajayi Olugbenga Akinbola<sup>1</sup>, Sulaiman Umar S.noma<sup>2</sup>, Salihu Alhassan<sup>3</sup>

Department of Computer Science, Kebbi State Polytechnic, Dakingari, Nigeria<sup>1,2,3</sup>.

## ABSTRACT

Recent researches have demonstrated that cloud computing is fast becoming the mainstream in computing technology and an effective tool for business enterprises and educational institutions. With the provision of computing utility market made available by cloud computing, companies may no longer build corporate data centers, purchase their application and licenses or have to run them locally. Benefits offered by cloud computing has been felt among SMEs and tertiary institutions in developed and developing countries across the globe. Although earlier researches have shown how enterprises from different sectors in Nigeria have benefited from this fast rising technology, more research is needed to reveal the response of some region in less developed states in Nigeria. This research investigates the level of awareness and the level of adoption among tertiary institutions and small and medium scale enterprises (SMEs) in Kebbi State, Nigeria. A mixed approach was used to achieve the target objectives. Statistical data collection and analysis were employed using self structured questionnaires and interviews where necessary to survey the awareness, acceptability, usage and adoption of cloud computing among respondents. Six research questions were raised. Our findings revealed that even though awareness is above average, adoption is still very low. This research also exposed the fact that most adopters in this region hardly use a paid version of cloud computing which will surely limit them from benefiting from the advanced technological provisions inherent in cloud computing. We also showed the potential factors hindering its adoption and made necessary recommendations to the relevant authorities.

**Keywords:** Cloud computing, Small and Medium Scale Enterprises, Tertiary Institutions, Cloud service providers. Kebbi State, Awareness, Adoption.

## 1. INTRODUCTION

The big mainframes era in which enterprise own their computing resources has already transitioned into a utility-driven paradigm, in which users do not need to own resources but hire it from a remote site and pay for the usage. This new computing paradigm is called cloud computing (Singh & Jangwal 2012). An evolving definition maintained by United States National Institute of Standards and Technology (NIST) seems to be the most comprehensive and widely accepted definition which defines cloud computing as a model for enabling 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 or service provider interaction. It is now a market where people buy and sell computing utility. Cloud service providers offer various service models depending on the enterprise's requirements such as Software-as-a-Service (SaaS), Platform-as-a-Service (PaaS) and Infrastructure-as-a-Service (IaaS) (El-gazzar, 2015; Turab, Abu & Shadi, 2013). SaaS applications run on a SaaS provider's server where the responsibility of managing access, security, and availability of software is with the service provider. Most popular cloud computing service providers are Salesforce.com, Amazon, Google and Microsoft (Sultan, 2011).

Actually it was other preexisting technologies that gave birth to cloud computing. These include virtualization, cluster computing, grid computing, broadband networking and large scale data centers centralized at low cost locations. Bayrak et al. (2011) have hailed the transformation of information technology to a market because of its similar characteristics with traditional market. These includes economies of scale through statistical multiplexing, virtualization and clustering that enable higher utilization rates of centralized computing resources. There are many opportunities of cloud computing that can be harnessed by these companies to improve their businesses (Seunghwan et al., 2012; Assante et al., 2016). However, it has also been established that enterprises have different view of the cloud computing and this is likely to impede its adoption (Khajeh-hosseini & Sommerville, 2016).

## 2. PROBLEM STATEMENT/JUSTIFICATION

Cloud computing is gaining popularity already. Market studies conducted around the world are showing a growing trend of organizations shifting their technology infrastructure to the cloud platform. Aiyebilehin and Makinde (2020) confirmed that with cloud computing service, it becomes easier to store and access data and even afford seemingly cumbersome and costly applications with several devices (PC or mobile device), the only thing needed is internet connection. Thus, several enterprises in the developed and developing world are fast adopting it and most educated individuals, students and researchers use one or more services in the cloud. This not only applies to large organizations, but also progressively more to small and medium-sized enterprises (Yunis & Zekri 2020). However deeper look at the available researches in the area of cloud computing regarding enterprise adoption in Nigeria has revealed that:

- i. Adoption is still very low and many factors are contributing to the slow to adoption of it.
- ii. Only large scale organization are already benefitting immensely from cloud based services.

With the recent recession coupled with covid-19 effect on enterprises, the need for Small and Medium Scale Enterprises and Tertiary Institutions to adopt cloud computing cannot be overemphasized. Of course this will result in profit maximization and lots of economic advantages for them. What about in Kebbi state? There is yet to be a research that surveys and analyzes this subject matter. In line with this trend, this research focuses on the enterprise and tertiary institutions perspective of cloud computing specifically on the adoption of cloud-based services rather than technical issues. Even though the state as a whole has many SMEs and tertiary institutions, only few of these SMEs that are using computer power and energy and some selected institutions are our prime target. Hence, the **research questions** for this study are:

- i. What are the socio economic characteristics of the adopters among SMEs and tertiary institutions in Kebbi State?
- ii. What is the level of awareness of cloud computing amongst SMEs and tertiary institutions in Kebbi State?
- iii. What is the level of adoption of cloud computing amongst SMEs and tertiary institutions in Kebbi State?
- iv. What are the types of cloud computing services used?
- v. What is the mode of payment adopted?
- vi. What are the factors limiting its adoption?

## 3. OBJECTIVES OF THE STUDY

The aim of this study is to examine the adoption of cloud computing with respect to Kebbi state SMEs and tertiary institutions

The specific objectives of this study are to:

- i. Investigate the socio economic characteristics of the adopters of cloud computing among SMEs and Tertiary institutions in Kebbi State?
- ii. Examine the level of awareness of cloud computing amongst SMEs and Tertiary institutions in Kebbi State.
- iii. Examine the level of adoption of cloud computing amongst SMEs and Tertiary institutions in Kebbi State.
- iv. Expose the types of cloud computing services used by the SMEs and Tertiary institutions in Kebbi State.
- v. Investigate the mode of payment popular among adopters
- vi. Investigate the factors limiting its adoption

## 4. LITERATURE REVIEW

Cloud computing is undoubtedly a technology that has come to stay as several organizations, governments, and individuals were encouraged to key into this emerging smart technology. However, it is worthy of note that this technology is built upon already existing technologies. These technologies are: Mainframe Computing, Personal Computing, Network Computing, Internet Computing and Grid Computing.

### A. Definitions of Cloud Computing

Several definitions have been given on cloud computing by different authors. However, the word 'cloud computing' has become a popular marketing term that needs clarification through suitable definitions.

The vaguest definition of cloud computing is the one given by Landis et al., (2010) that defines it as "computing on the Internet, as opposed to computing on a desktop". This definition succeeds only on recognizing the dependency of cloud computing on the Internet. Kornevs *et al.*, (2012) in its own attempt defines cloud computing as "IT resources and services that are abstracted from the underlying infrastructure and provided "on-demand" and "at scale" in a multitenant environment". According to Caytiles *et al.*, (2012), Cloud computing is an internet-based computing, whereby shared

resources, software, and information are provided to computers and other devices on demand. Cloud computing has become a significant technology trend and many experts expect that cloud computing will reshape information technology (IT) processes and the IT marketplace. With the cloud computing technology, users use a variety of devices including PCs, laptops, smart phones and PDAs to access programs, storage and application-development platforms over the internet via services offered by cloud computing providers. Another way to think about it is that the cloud enables a user to expand and contract capacity and capabilities easily through self-service portals where catalogs enable simple configuration of the end service. In a nutshell, cloud computing: Started with applications in the cloud (e.g. Salesforce - customer relationship software), moved to Infrastructure in the cloud (e.g. Amazon web services – Infrastructure service through web service interface), and now there are application platforms in the cloud (e.g. Microsoft Azure, .net platform, SQL data services). All of these are different aspects of cloud computing. These aspects vary in the approach and implementation but they have one common model i.e. all need the presence of good internet service to work.

## B. Cloud Deployment Model

Deployment models define the type of access to the cloud, i.e., how the cloud is located? Cloud can have any of the four types of access: Public, Private, Hybrid and Community.

## C. Cloud Computing Relevance to SMEs

According to Tehrani and Shirazi (2014), Small and Medium sized Enterprises (SMEs) significantly contribute to each nation's Gross Domestic Product (GDP) and its labor market and cloud computing is a modern phenomenon that lets SMEs solve many sustainability problems, including cost and risk management. It uses services as a commodity and only pays for the resources it needs. Their work investigated the factors influencing cloud computing adoption in general without giving any attention to any geographic location. Devasena (2014) submitted that more businesses are running all kinds of applications in the cloud nowadays, like CRM, accounting, HR and custom-built applications. Cloud-based applications cost less, since the customer doesn't need to pay for all the hardware and software, facilities, or extensive configuration and maintenance of a full technology stack, to run them. Cloud provides more scalable, more reliable and more secure service. Upgrades are periodically completed by cloud providers to facilitate new features, security, performance enhancements automatically. With the ever increasing cloud services, enterprise both small and large can benefit from cloud computing which in turn can boost the economy. Some of the cloud services available for enterprises and tertiary institutions are presented in table 1.

**Table 1**

Some applications that can benefit tertiary Institutions and SMEs

Cloud Service providers	Cloud Services
Microsoft	Office 365 Exchange Office Web Apps CRM online Microsoft Dynamics
Google	Google Apps for Education: email, calendar, and documents for collaborative education Chromebooks
Amazon	AWS cloud: provides storage resources and IT infrastructure for institutions

Applications like these have made the use of cloud services indispensable for corporations, both small and large. Beside these ones, there are free cloud services provided by Google and Microsoft e.g. free online Microsoft office, Google form, Google docs, Google spreadsheets, Google contact lists, Google calendars and recently Google is working on machine learning sheet for non developers. All of these and many more can accelerate the output of SMEs and tertiary institutions and also help cut down both hardware and software development cost. Small and medium enterprises in Kebbi State The National survey of MSMEs 2017 as reported in Survey and Micro (2017) revealed that there are 73,081 SMEs in Nigeria. The standard measure of SMEs is according to the number of employees and assets excluding lands and buildings as can be seen in table 2.

**Table 2**

Classification adopted by National policy on MSMEs

S/N	Size Category	Employment	Assets (=N= Million) (excl. land and buildings) Less
1.	Micro enterprises	Less than 10	Less than 10
2.	Small enterprises	10 to 49	10 to less than 100
3.	Medium enterprises 50	50 to 199 10	100 to less than 1,000

According to Survey and Micro (2017), SMEs possess a large potential to aid the economic growth of the country. Even as Nigeria is still a developing country, SMEs is fast becoming a hub for employment generation, local technology improvement and development and output diversification. The report on SMEs distribution per state revealed that there are 815 SMEs in Kebbi state. There are various sectors and subsectors of enterprises in Kebbi State as can be seen in list below:

- i. Education
- ii. Entertainment and Recreation
- iii. Other Services Activities
- iv. Real Estate Activities
- v. Human Health and Social Works
- vi. Accommodation and Food service Activities
- vii. Mining and Quarrying
- viii. Construction
- ix. Water Supply; Sewage / Waste Management and Remediation
- x. Agriculture, Forestry, Fishing and Hunting
- xi. Transport and Storage
- xii. Information and Communication

#### D. Cloud Computing as a Tool for Learning in Tertiary Institutions

Today education is fast evolving as technology is advancing. Since the advent of the internet, educational institute have benefited in various ways. The advantages brought about by cloud computing cannot be over emphasized. Advances in technology offers new opportunities in teaching and learning as presented in Yong and Huang (2012) brought about a research that provided a guideline or roadmap for the adoption of cloud computing in higher education, in their work, they listed the benefits of cloud computing to higher education as convenience, IT resource scalability, high availability, opportunities for virtual learning environment, interactive teaching and learning, store once and access anywhere anytime form of storage, large amount of processing power and cloud repository for version control system. The cloud provides several applications that have been adopted in various forms in higher institutions and are utilized for various assignments. Some are utilized specifically in the process of delivering knowledge while others are utilized for different exercises that help the process of teaching (Olanrewaju *et al.*, 2017). Also according to Attaran (2017), one of the biggest challenges colleges and universities face in providing education is the lack of infrastructure, maintenance of that infrastructure (if available) and maintaining a wide range of hardware and software equipment. Cloud computing can help provide those solutions at a reasonable price. All of these are proofs that higher institutions of learning have a lot to benefit from the adoption of cloud computing. Examining the level of awareness of the computer paradigm is important because it will go a long way to establish its adoption or lack of it.

#### 5. METHODOLOGY

This study adopted a descriptive design approach. We used a self-structured questionnaire to gather primary data. The population of the study comprises of 214 core IT users from tertiary institutions and SMEs in Kebbi State who served as respondents to the questionnaires. The questionnaire forms the major medium for obtaining data (primary) for this study. The questionnaire was designed with a set of pre-selected information or questions directed to the respondents. The questionnaire for this study was divided into four (4) major sections: the socio-economic characteristics of the respondents, awareness of cloud computing, types of cloud computing, adoption of cloud computing and reasons for non-adoption. The reliability of the questionnaire was tested by using the reliability analysis (Cronbach alpha). The Cronbach alpha for section challenges was 0.792 which indicated the instrument was reliable for data collection.

The questionnaires used are both in open and closed-ended format, dichotomous type (yes or no) and in a five-point likert scale structure. The scaling is as follows: 5 = Strongly Agree (SA), 4 = Agree (A), 3 = Undecided (U), 2 = Disagree (D) and 1 = Strongly Disagree (SD) in that order or in reverse order. The respondents are expected to fill out the questionnaires by ticking the option they believe are closer to their opinion.

The setting for this research is the small and medium scale enterprises (SMEs) and Tertiary institutions in Kebbi State. Kebbi State is a state in the north-western Nigeria which borders east and north of Sokoto and Zamfara states, and to the south by Niger state while its western border forms part of the national borders with Benin Republic and Niger.

## 6. RESULTS

### Research Question 1: What are the Socio-economic Characteristics of the Adopters among SMEs and Tertiary Institutions in Kebbi state?

From table 3, the majority (76.6%) of the respondents were male, while 23.4% of the respondents were female. This implies that we have more males than females using IT resources in the study area. For the ethnicity of our respondents, the majority of the respondents were Hausa (46.7%) of the total, while the Yoruba population is 23.4%, followed by the Igbo Tribe 15% while other tribes are just 15%. This implies that there are more Hausa-speaking persons in IT related businesses in Kebbi state than in all other tribes. For the age categories of our respondents, 66.4% of our samples were between the ages of 18 and 30 while people between the age of 31 and 40 represents 27.1% of our entire sample. The people between the ages of 41 and 50 represent 6.5% of our entire sample. This implies that we have more youths than the elderly ones. For the sector in which our respondents work, 77.6% of our respondents were from SMEs while 22.4% of the respondents were from tertiary institutions. This implies that there are more business owners than tertiary institution staff in our data set. The results for the level of education showed that the majority of the respondents have completed at least a polytechnic education (39.2%), while 33.2% of the respondents attained SSCE certification level, 12.4% had their MSc certification, 8.4% completed their diploma education, 3.7% completed their doctorates degrees, 2.8% of the respondents had completed their first degree. All of these imply that the majority of our respondents were educated.

The results for professional membership suggest that 88.3% of the respondents do not belong to any professional body while 11.7% of the respondents belong to one professional body or the other.

For the level of experience, 88.8% of the respondents have between 0 and 10 years of working experience, while 11.2% of the respondents have a working experience between 10-20 years.

**Table 3: The socio-economic characteristics of the respondents**

Variable	Frequency	Percent
<b>Gender</b>		
Male	164	76.6
Female	50	23.4
<b>Ethnicity</b>		
Hausa	100	46.7
Igbo	32	15.0
Yoruba	50	23.4
Others	32	15.0
<b>Age Categories</b>		
below 20	71	33.2
21-30	71	33.2
31-40	58	27.1
41-50	14	6.5
<b>Sector</b>		
SME	166	77.6
Tertiary	48	22.4
<b>Level of Education</b>		
Diploma	18	8.4
SSCE	71	33.2
ND	42	19.6

HND	42	19.6
BSC	6	2.8
MSC	27	12.6
PHD	8	3.7

#### Professional Membership

Yes	25	11.7
No	189	88.3

#### Level of Experience

Above 20	24	11.2
Above 10	95	44.4
Above 5	95	44.4

### Research Question 2: What is the Level of Awareness of Cloud Computing Amongst SMEs and Tertiary Institutions in Kebbi State?

It can be observed in table 4, that 66.4% of SMEs and tertiary institution staff in Kebbi State are aware of Cloud Computing while 33.6% of these SMEs and tertiary institution staff were not aware of this technology. This shows that the level of awareness of cloud-based computing is above average among respondents in the study area.

**Table 4: Awareness of cloud computing**

Options	Frequency	Percent
Yes	142	66.4
No	72	33.6
Total	214	100.0

### Research Question 3: What is the Level of Adoption of Cloud Computing Amongst SMEs and Tertiary Institutions in Kebbi State?

It can be observed in table 5 that 25.7% of SMEs and tertiary institution staff in Kebbi State agreed to be using one or more cloud computing services while 74.2% of these SMEs and tertiary institution staff are not in any way using it. This shows that the level of adoption of cloud-based computing is very low in Kebbi State.

**Table 5: Adoption of cloud computing**

Options	Frequency	Percentage
Yes	55	25.7
No	159	74.2
Total	214	100.0

### Research Question 4: What are the Types of Cloud Computing Services Used?

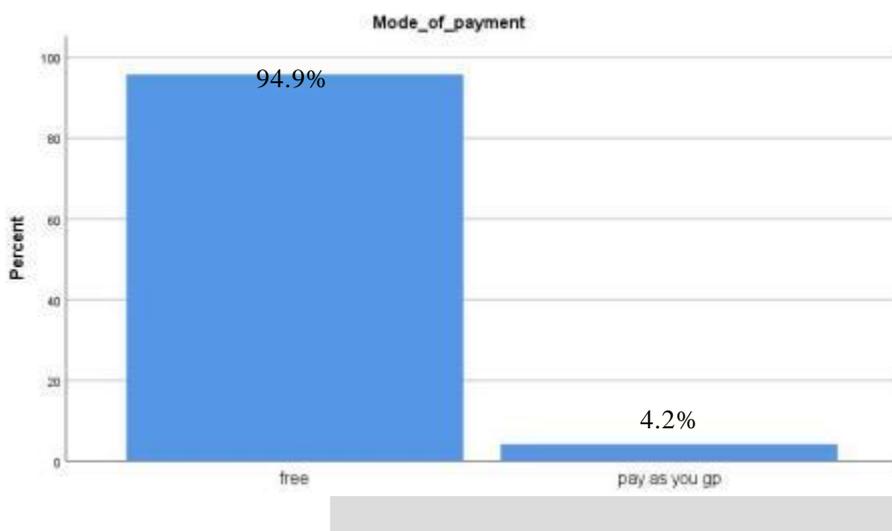
As reported in Table 6, Google cloud represents the service with the highest usage among the respondents (44.9%), followed by dropbox (40.7%), with AWS having a 9.3% use case, salesforce has a use case of 3.3%. This could be due to its multifunction and storage features and capabilities. Three items listed were not even chosen by the respondents.

**Table 6: Public cloud services (n = 214)**

Cloud Applications	Frequency	Percentage
AWS	20	9.3
Google cloud	96	44.9
Salesforce	7	3.3
Dropbox	87	40.7
Vmware	2	.9
Open Stack	1	.5
Terramark cloud	1	.5
<b>Total</b>	<b>214</b>	<b>100.0</b>

### Research Question 5: What is the Mode of Payment Adopted?

Figure 1 presents the mode of payment adopted by users. It revealed that the free service is by far more popular among adopters in the research area covering more than 94% whereas paid services is just 4.2% of the respondents.



**Fig. 1: Mode of payment adopted**

### Research Question 6: What are the Factors Limiting its Adoption?

Table 7 present the descriptive statistic of the variables used in the study. All the constructs in the present study were measured using 5-point Likert-type scale. Consequently, both the mean and standard deviation of all of these latent constructs were computed based on the same 5-point Likert-type scale anchored as 1=strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly agree. The mean and the standard deviation of all the constructs are presented in table 6. Because I don't have access to high-speed internet to be able to use 'cloud computing', Because I always think internet failure can deny me access to my data when I need it most, Because I think using cloud computing' is expensive, Lack of know-how, Just don't feel OK about it (a general feeling of scepticism) are the major reason why respondents have not adopted cloud computing yet since the five constructs have the highest mean rankings. Because I don't trust 'cloud computing', Because I fear that internet-based services can be hacked and frankly I have never thought about using/not using 'cloud computing' are the next with mean ranking of 4.0. It is obvious from the study that most respondents agree to the importance of cloud computing since the mean ranking to the question is very low with  $x=3.63$ , same with issues regarding confidentiality which is also  $x = 3.63$ .

**Table 7: Reason for non-adoption**

Reasons for non-Adoption	N	Mean	Std. Deviation
1. Because I don't have access to high speed internet to be able to use 'cloud computing'	142	4.80	.399
2. Because I always think internet failure can deny me access to my data when I need it most	142	4.80	.399
3. Because I think using 'cloud computing' is expensive	142	4.80	.399
4. Lack of know how	142	4.80	.399
5. Just don't feel OK about it (a general feeling of skepticism)	142	4.80	.399
6. Because I don't trust 'cloud computing'	142	4.00	.000
7. Because I fear that Internet-based services can be hacked	142	4.00	.000
8. Frankly I have never thought about using/not using 'cloud computing'	142	4.00	.000
9. Because I don't need 'cloud computing'	142	3.63	1.371
10. Because data confidentiality can be compromised	142	3.63	1.371

1. Because I don't have access to high speed internet to be able to use 'cloud computing'			
2. Because I always think internet failure can deny me access to my data when I need it most			
3. Because I think using 'cloud computing' is expensive			
4. Lack of know how			
5. Just don't feel OK about it (a general feeling of skepticism)	142	4.80	.399
6. Because I don't trust 'cloud computing'	142	4.00	.000
7. Because I fear that Internet-based services can be hacked	142	4.00	.000
8. Frankly I have never thought about using/not using 'cloud computing'	142	4.00	.000
9. Because I don't need 'cloud computing'	142	3.63	1.371
10. Because data confidentiality can be compromised	142	3.63	1.371

## 7. DISCUSSION AND SUMMARY

This study has shown the socio economic distribution of people using cloud computing in the study area as well as the level of awareness and adoption of cloud computing. It has also revealed the factors limiting its adoption among the respondents. The result of the analysis has shown that people were very well aware of cloud computing amongst SMEs and tertiary institutions respondents in Kebbi State but due to some reasons adoption is very low. Staff of SMEs and tertiary institutions in Kebbi State that were reluctant to adopt cloud computing majorly complained of lack of technical know-how, lack of access to high-speed Internet, ignorance, skepticism, cost etc. However, for businesses that have adopted cloud computing, the benefit they derive from it is relatively very high. The work further showed that most of the adopters of cloud computing in the study area are mostly using the free services like dropbox and Google drive as only a few uses the major services that are paid for. This exposes that the SMEs and tertiary institutions in Kebbi State are yet to really benefit from cloud computing since the best chunk of its services are offered using pay as you go model.

## 8. RECOMMENDATION

The authors suggest the following recommendations based on the findings:

1. Government should collaborate with internet service providers to provide high speed internet service in both urban and rural part of the state.
2. Government should collaborate with cloud services provider to subsidize cost of using paid cloud services.
3. There should be adequate sensitizations from stakeholders on the benefits of cloud computing both to tertiary institutions and business organizations.

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