Cloud Computing Awareness and Adoption Among Small and Medium Scale Businesses (SMB) in Nigeria

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***Abstract*— Small and Medium scale Businesses (SMBs) have in the past added to the growth and development of many economies in the world. In time past, the information technology (IT) needs of these SMBs brought about an increase in requirements for enterprise IT solutions that are more efficient and have high availability and scalability over time. Cloud Computing offers such solutions that can be of immense benefit to SMBs. However, reports show that Cloud Computing has not been fully adopted in developing countries, Nigeria inclusive. Therefore, the aim of this research is to investigate the level of awareness and adoption of Cloud Computing in Nigeria and explicate why it is so. The mixed method approach was adopted i.e., both qualitative method (Interview) and quantitative method (Questionnaire) was used to collect data for analysis. The result of the research indicates that SMBs are adopting Cloud Computing services but there is still a need for massive awareness to be created by service providers and other recognized Information Technology bodies to enable SMBs to better utilize the benefits that Cloud Computing offers. The responses of the participants were analyzed using the Statistical Package for Social Sciences (SPSS). Based on the research findings, the main concern of users in the cloud environment is data security and privacy and this also serve as a hindrance for the SMBs who have not adopted the technology yet. These concerns could be lessened by ensuring that effective security policies are put in place by both parties i.e. the cloud service provider and the SMB. This research allows for knowledge-based decision to be made about the security risks and benefits of using Cloud Computing.**

***Keywords*– Cloud Computing, Benefits, Security, SMBs and Risks**

I. INTRODUCTION

Small and Medium scale Businesses (SMBs) have in the past played and continue to play important roles in the growth, development and industrialization of many economies in the world.

In their study, [13] asserted that small and Medium scale Businesses (SMBs) have been known as an essential component of national development in both developed and developing economies. For most small to medium businesses, the ability to scale up to meet customer demands or future growth aspirations is an important consideration. A key role is in turn played by Information Technology (IT). Most of them settled for the least expensive alternative because they believed that the company will still benefit if they chose the alternative.

Information Technology (IT) is now being recognized by a lot of entrepreneurs as a great tool in their business process. While some SMB owners still prefer the traditional methods of doing business such as face-to-face interaction, there is no doubt that Information Technology (IT) solutions are enhancing customer centricity and growth of business. The adoption of IT is crucial to SMBs as IT has become a major catalyst and enabler of organizational change [11].

The topic of this study is improving Small and Medium scale Business (SMB) through Cloud Computing. A new paradigm of computing, Cloud Computing has emerged to change the traditional ways of computing. According to [16], Cloud computing has emerged as one of the enabling technologies that allows the Information Technology (IT) world to use computer resources effectively and more efficiently.

Small and Medium scale Businesses (SMBs) that do not have the financial capability to capitalize in IT infrastructure can take advantage of the wide range of services that cloud computing offers.

II. LITERATURE REVIEW

A) Overview of Cloud Computing

The term “cloud” is analogical to “internet”. The term “Cloud Computing” is based on cloud drawings used in the past to depict telephone networks and later to depict internet.

According to [4], Cloud Computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the datacenters that provide those services.

There are numerous definitions of Cloud Computing but most researchers concur to [17] which defines Cloud Computing as “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 or service provider interaction. This definition describes the details of Cloud Computing, a more general description.

B) Characteristics of Cloud Computing

There are outstanding characteristics of Cloud Computing that distinguishes it from other Computing paradigms; here are five characteristics as stated by National Institute of Standards and Terminology (NIST):

- ***On-demand self-service:*** Cloud services are requested for as at when needed and its setting up needs little or no human intervention as it is automated and easy to call upon by the cloud customers. A cloud service here is defined as consumer and business products, services and solutions that are delivered and consumed in real-time over the Internet [10].
- ***Broad network access:*** Cloud Computing keys into the vision for global computing as capabilities are transmitted over the internet and can be accessed from various standardized platforms such mobile phones, laptops etc.
- ***Resource pooling:*** The cloud model has a multi-tenancy model such that many clients are serviced simultaneously this enables the provider's computing resources to be combined together in order to meet the clients' requests. Examples of such resources are virtual machines, storage and memory.
- ***Rapid elasticity:*** The Cloud is elastic which means that resources allocated can get bigger or smaller depending on demand. Elasticity of the resources provided via cloud is rapid as it is built on the utility model whereby consumers only pay for resources used up and the resources appear to be unlimited as the consumers can easily scale up or down as their computing need differs.
- ***Measured Service:*** Based on the utility computing model, cloud service has metering capability at different level of abstraction according to the type of service e.g. storage, number of machines, processing, and bandwidth. These resources are supervised, controlled, and reported which promotes accountability for both the provider and consumer of the service. This implies that just like air time, electricity or municipality water, IT services are charged per usage metrics, the concept: pay per use [12].

C) Cloud computing Service Models

Based on the different types of services offered by Cloud Computing, there are three major Cloud Computing services model namely; Software as a service (SaaS), Platform as a service (PaaS) and Infrastructure as a service (IaaS) proposed by NIST 2011.

- ***Software as a Service (SaaS)***

Software as a Service (SaaS) is the uppermost layer which features a complete application offered as service on demand [12]. In the SaaS layer, the Cloud service provider hosts the software upon their servers. It can be defined as a model in which applications and software are hosted upon the server and made accessible to customers over a network. Software as a Service (SaaS) is focused on renting out applications to

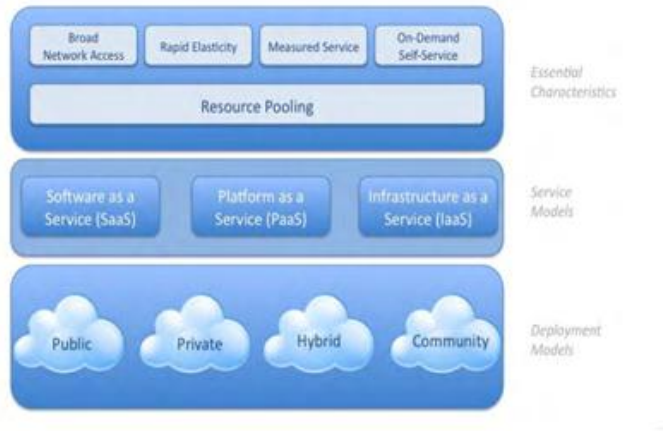

Fig. 1: Basic aspects of Cloud Computing Source: [17]

users that use it over a subscripted time. The application is not owned by the user, it is owned by the provider that makes the user pay for the amount of time they want to use it. The user is not responsible for the maintenance of the application.

According to [16], SaaS is the renting of both infrastructure and applications which are totally managed by the provider through a web client, for example a web based e-mail. The entire infrastructure is situated in datacenters. The only configuration that can be done by users is the settings for the application they rent [17].

Top SaaS Cloud Computing Companies: Amazon Web Services, AppScale, CA Technologies, Salesforce and Windows Azure.

- **Platform as a Service (PaaS)**

Platform as a Service (PaaS) layer is the middle layer, which offers platform-oriented services, besides providing the environment for hosting user's applications. The service provider rents dedicated resources to the client. Platform as a service (PaaS) is very similar to SaaS; it focuses on the rental of infrastructure so the user gets a platform to build their own applications with programming tools provided by the provider. The services include servers, operating systems or storage space and the help with building an application.

The main difference between SaaS and PaaS is that SaaS gives you little space to build something of your own while PaaS gives room for maintaining the application on your own terms [7].

This model offers some control to the deployed applications but not to the Cloud infrastructure [16].

Top PaaS Cloud Computing Companies: Salesforce.com, Google, Concur Technologies, Unisys and Cisco.

- **Infrastructure as a Service (IaaS)**

Infrastructure as a Service (IaaS) delivers basic storage and computing capabilities as standardized services over the network. Servers, storage systems, switches, routers, and other systems are combined and made available to handle workloads that range from application components to high-performance computing applications.

The IaaS layer is the lowest layer that offers storage and infrastructure resources that is needed to deliver the Cloud

services. It comprises only of the infrastructure or physical resource.

Infrastructure as a Service (IaaS) takes it one step further than SaaS and PaaS. IaaS is when providers are handling only the infrastructure for a user and the user can run and develop software within the hired cloud infrastructure which is situated in a datacenter often. IaaS have providers only maintaining the infrastructure and could also be referred to as Hardware as a Service (HaaS). Customers using IaaS have a limited control over the actual infrastructure, as their usage is based on pay-per-use only [8].

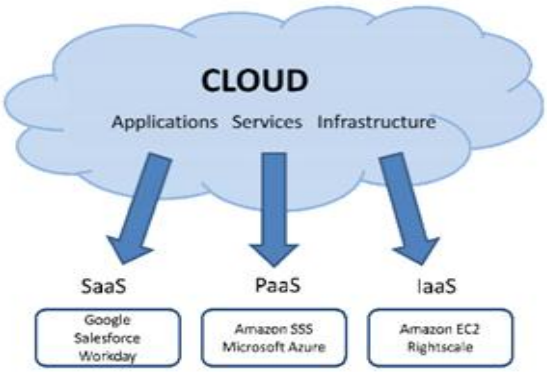

Fig. 2: Basic Cloud Computing Service Models Source: [8]

D) Overview of Small and Medium scale Businesses (SMBs)

For this study, our focus will be on Small and Medium Scaled Businesses (SMBs). This section covers the various definitions of SMB as well as the major characteristics that differentiate them from large enterprises/businesses.

The acronym SME is used in the European Union and by international organizations such as the World Bank, the United Nations and the World Trade Organizations (WTO).

The European Union has standardize the concept by categorizing enterprises with less than ten (10) employees as 'Micro', those with fewer than fifty (50) employees as 'Small' and those with fewer than two hundred and fifty (250) employees as "Medium". In the United States of America, any business with fewer than one hundred (100) employees is classified as "Small" while medium scale business refers to a business with fewer than five hundred (500) employees.

SME is a familiar acronym in most of the world and is recognized by most people. SMB (Small and medium business) is a common expression for the term in USA. Also in South Africa, the term Small, Medium and Micro Enterprises (SMMEs) is usually used, while in Nigeria, the term Small and Medium Scale Enterprises (SMEs) is generally used.

To know what organizations that can be counted as an SME, there are three criteria's that has to be evaluated. The staff headcount, balance sheet and the annual turnover of an organization takes into account when assessing whether it is an SME or not [9]. However, all these criteria were afforded equal consideration, attributes of a modern day small to medium sized firm argued to not be undertaken.

Although there is no internationally agreed definition of Small and Medium Scaled Businesses (SMBs), their small size and the number of employees is what differentiate these companies from large enterprises. In countries like the USA, Britain and other European countries, Small and medium scale enterprises are defined in terms of turnover and number of employees. The definition and classification of SMEs in Nigeria is in terms of capital employed, turnover and number of employees.

Here are some definitions proposed by various organizations;

Small and Medium Scale Enterprises (SMEs) as defined by the National Council of Industries (2009) refer to business enterprises whose total costs excluding land is not more than two hundred million naira (N200,000,000.00) only.

An SME has been defined by Central Bank of Nigeria (CBN) as an outfit with a total capacity outlay (excluding land) of between N2 million and N5 million, while Small and Medium Industries Equity Investment Scheme (SMIEIS) recognizes an SME as any industry with a maximum asset base of N200 million, excluding land and working capital, and with the number of staff employed by the enterprises not less than 10 and not more than 300 [14].

Small-scale industries as defined by the U. S. Small Business Administration (SBA) include everything from one-person cottage industries to businesses employing 1,500 or more employees, although most are in the 500-employee range. Businesses with more than 1,500 employees are usually categorized as medium-scale or large-scale industries.

However, they have often been classified or defined in terms of quantitative and/or qualitative variables or characteristics. The quantitative indicators include the number of employees, sales, and capital employed, while examples of the qualitative indicators are legal status, ownership structure, factor intensity and technology [14; 18].

The impact of Small and Medium Scale Businesses (SMBs) has been recognized as main sustenance of the economy because of its capacity in enhancing the economy output and human welfare in a country [3].

Small and Medium scale Businesses are a very important part of the Nigerian economy as a study by the IFC show that approximately 96% of Nigerian businesses are SMBs [19]. The SMBs represent about 90% of manufacturing/industrial sector in terms of number of enterprises in Nigeria. However, in spite of the fact that the SMBs constitute more than 90% of Nigerian businesses, their contribution to GDP is only about 1%.

E) Cloud Computing, its Adoption and Benefits to SMBs

Small Medium scaled Businesses (SMBs) frequently lack resources to invest in technologies due to their size and because of this they struggle to gain competitiveness and productivity in the market [6].

Technology for SMBs is not easy to implement as it is for large organizations. SMBs adopting technology gives good competitiveness and facilitates expansion to new markets with

new opportunities rising. Big organizations that do not fit in the SMB criteria often gain more from having on-premise solutions and do not adopt technology from outside as much.

Nevertheless, the promise of cloud computing is to deliver all the functionality of existing information technology services, even as it dramatically reduces the upfront costs of computing that deter many organizations from deploying many cutting-edge IT services [2].

Cloud Computing for SMB could bring a significant advantage in cost reduction, depending on the type of Cloud services being deployed and the overall management and maintenance costs may also be reduced [1].

Cloud Computing can serve not only as a tool to decrease cost but also to increase profit, remain current on technological advances, and strengthen their business relations [5].

Cloud computing has created a technology revolution for small businesses, offering access to a range of capabilities that typically only larger companies can afford. Using an Internet connection and a web browser, small companies can tap into software and services as they need them and pay for what they use on a monthly basis, like utility services.

Cloud-based programs can be used at any time on almost any device with an Internet connection, a benefit that leads to greater collaboration, particularly for businesses with remote employees.

According to a 2010 survey by Microsoft, a growing percentage of Small and Medium sized Businesses (SMBs) consider the ability to be productive remotely as critical to their operations: 66 percent said they need to allow employees to work anywhere at any time.

With servers located off-site and their management left to an experienced provider, Cloud computing allows SMBs focus on running their business. Because resources in the Cloud can be accessed as needed, the time it takes to get started with these services shrinks from days to minutes. In addition, the cloud comes with high speed of implementation and ease of upgrading. Furthermore, cloud computing can enable SMBs to focus on innovation and creation of new business, thereby enhancing productivity without requiring frequent updates of IT resources, servers and software licenses.

III. METHODOLOGY

The study made use of a self-structured questionnaire to gather primary data. The questionnaire forms the major medium of obtaining data (primary) for this study.

The questionnaire for this study was designed with a set of pre-selected information or questions directed to the respondents.

The questionnaire for this study was divided into two major sections: Company profile section and the variable section. The variable section is further divided into four sub-sections.

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 the questionnaires by ticking the option they believe are closer to their opinion.

The setting for this research is the Small and Medium scale Businesses (SMBs) in Lagos. Lagos is Nigeria's chief commercial centre and home to almost all of the corporate business. It shares boundaries with Republic of Togo, Ogun state and the Atlantic Ocean. It has a population size estimated to be over 21 million. Major computer and ICT firms abound in the state. And the use of Cloud Computing is rising in the state. Being a cosmopolitan city, different types of small businesses exist in the state, ranging from commerce to trade, manufacturing to transportation, health care, finance, educational and food service units.

IV. DISCUSION OF FINDINGS

It can be observed that 60.7% of SMBs in Lagos State are aware of Cloud Computing while 39.3% of these SMBs are not aware of this technology. This shows a little above average on the level of awareness across the different SMBs in Lagos as shown in Table 1.

Table 1: Level of awareness of Cloud Computing

Question	SMBs Aware of Cloud Computing N (%)	SMBs Not Aware of Cloud Computing N (%)	Total N (%)
Are you aware of Cloud Computing?	182 (60.7%)	118 (39.3%)	300 (100.0%)

From Table 2, it can be observed that 201 (67.0%) SMBs have their Information Technology (IT) infrastructure on-premise, while 99 (33.0%) don't have theirs on-premise. 163 (54.3%) of these SMBs use Cloud Computing. Out of these SMBs that have adopted Cloud Computing, 188 (62.7%) of them use Software-as-a-Service, 216 (72.0%) of them use Infrastructure-as-a Service while 75 (25.0%) SMBs use Platform-as-a-Service.

The overall mean score for the level of adoption of Cloud Computing by SMBs was found to be 127, which represents 42.3%. This shows that the level of use or adoption of Cloud computing by SMBs in Lagos is rather low as shown in the Fig. 4.

From Table 3, it can be detected that out of the 300 SMBs, 280 (93.3%) found security in the Cloud as a major concern, 132 (44.3%) asserts that adoption is hindered by Lack of standards among the cloud service providers. 264 (88.0%) chose privacy, 187 (62.3%) chose Cost and difficulty of migrating to the cloud (legacy software etc.) as a hindrance.

242 (80.7%) sees Lack of liability of providers in case of security incidents as an hindrance while 213 (71.0%) SMBs do not see difficulty in finding a vendor with needed skill set/offerings as a hindrance. Similarly, 183 (61.0%) SMBs also rejected that deciding which applications to move to the

Table 2: Summary of the Extent of Adoption of Cloud Computing

S/N	Questions	Responses		Total
		Yes N (%)	Yes N (%)	N (%)
1	Does your company have its Information Technology (IT) infrastructure on-premise?	201(67.0)	99 (33.0)	**300(100.0)**
2	Does your company use Cloud Computing?	163(54.3)	137 (45.7)	**300(100.0)**
3	Does your company use Software-as-a-Service?	188(62.7)	112 (37.3)	**300(100.0)**
4	Does your company use Infrastructure-as-a-Service?	216(72.0)	84 (28.0)	**300(100.0)**
5	Does your company use Platform-as-a-Service?	75 (25.0)	225(75.0)	**300(100.0)**

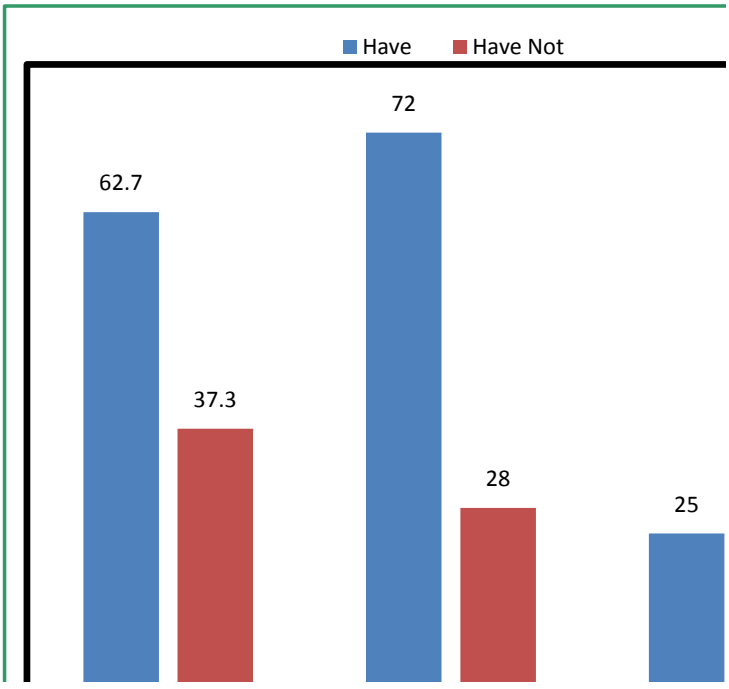

Fig. 3: Level of adoption of the various Cloud Computing service models

Table 3: Hindrances and Concerns associated with the adoption of Cloud Computing by SMBs in Nigeria

S/N	Questions	Responses		Total
		Yes N (%)	No N (%)	N (%)
1	Security concerns	280(93.3)	20 (6.7)	**300(100.0)**
2	Lack of standards among cloud service providers	132 (44.3)	168 (45.7)	**300(100.0)**
3	Privacy	264 (88.0)	36 (12.0)	**300(100.0)**
4	Cost and difficulty of migrating to the cloud (legacy software etc.)	187 (62.3)	113 (37.7)	**300(100.0)**
5	Lack of liability of providers in case of security incidents	242(80.7)	58 (19.3)	**300(100.0)**
6	Difficulty finding a vendor with needed skill set/offerings	87 (29.0)	213(71.0)	**300(100.0)**
7	Deciding which applications to move to cloud	117 (39.0)	183(61.0)	**300(100.0)**
8	Integration with current networks/applications/systems	198 (66.0)	102(34.0)	**300(100.0)**
9	Integrity of services and/or data	83 (27.7)	217(72.3)	**300(100.0)**

Fig. 4: Overall level of adoption of Cloud Computing

cloud was a hindrance to adoption of Cloud Computing. 198 (66.0%) cited that Integration with current networks/applications/systems was an obstacle in the adoption of Cloud Computing. 217 (72.3%) rejected the idea that integrity of services or data was a hindrance to Cloud Computing adoption.

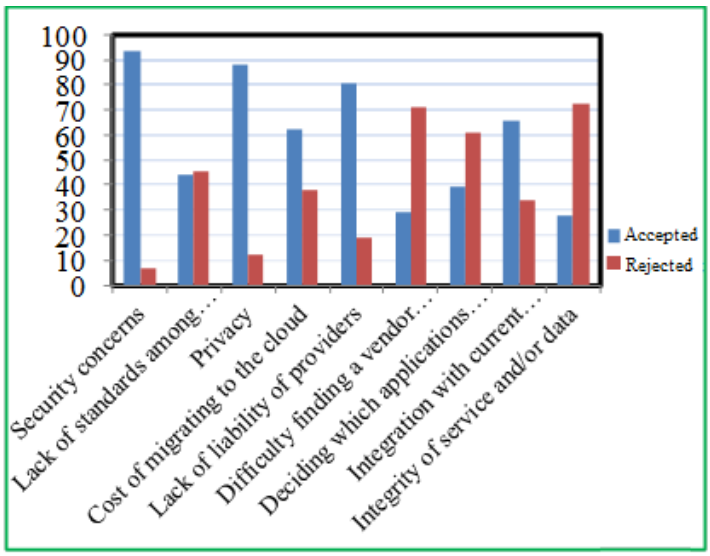

Fig. 5: Factors affecting the adoption of Cloud Computing

The factors that have the most effect on the adoption of Cloud Computing are Security 280 (93.3%), Privacy264 (88.0%), and Lack of liability of providers in case of security incidents 242 (80.7%).

The overall mean score for factors hindering the adoption of Cloud Computing by SMBs in Nigeria is 176 (58.9%). This 58.9% translates to an average impact of obstacles towards the adoption of Cloud Computing by Nigerian SMBs.

A) Benefits of Cloud Computing to SMBs

The result of the analysis showed that 160 (98.1%) SMBs accepted that Cloud Computing improves data backup services/disaster recovery, 3 (1.8%) was neutral. 158 (96.9%) accepted that Cloud Computing improves productivity, while 5 (3.1%) was neutral. It can also be observed that 144 (88.3%) accepted that Cloud Computing reduces the on-site infrastructure needed, while 8 (4.9) rejected that Cloud Computing reduces the on-site infrastructure needed. The proportions of those that were undecided are 11 (6.7%). When the respondents were asked whether Cloud Computing reduces workload for the internal IT department, 157 (96.3%) accepted that Cloud Computing reduces workload for the internal IT department while 6 (3.7%) were undecided. 163 (100.0%) accepted that Cloud Computing saves hardware cost. This was followed by 158 (96.9%) that accepted that Cloud Computing allows the company to focus on its core business objectives, in this respect 5 (3.1%) were undecided. 153 (93.9%) of the respondents said that Cloud Computing provides more storage capacity, 10 (6.1%) were undecided about Cloud Computing providing more storage capacity. 159 (97.6%) said that Cloud Computing provides the ability to immediately tap computing power and software, 4 (2.5%) were undecided. The proportion of those that accepted that Cloud Computing improves collaboration with others were 160 (98.1%) while 3 (1.8) were undecided. 151 (92.6%) accepted that Cloud Computing is reliable, while 9 (5.6%) rejected that Cloud Computing is reliable. The study also found out that 151 (92.7%) agreed that Cloud Computing provides scalability/flexibility in the amount of capacity needed and paid for while 12 (7.4%) rejected the idea that Cloud Computing provides scalability/flexibility in the amount of capacity needed and paid for. 155 (95.1%) of the respondents accepted that Cloud Computing improves efficiency. This same view was rejected by 8 (4.9%) of the respondents. 161 (98.8%) accepted that Cloud Computing reduces upfront costs, but 2 (1.2%) were undecided. The proportion of those who said that Cloud Computing saves software cost was 134 (82.2%) while those that rejected the statement that Cloud Computing saves software cost were 19 (11.6%). The number of undecided respondents was 10 (6.1%).

Thus, Cloud Computing has 90% positive impact (benefit) on the productivity of SMBs in Lagos.

V. SUMMARY AND CONCLUSION

The summary to this study is as thus:

- The result of the analysis showed that 60.7% of SMBs in Lagos State are aware of Cloud Computing.
- The result of the extent of adoption of Cloud Computing showed that 42.3 % of SMBs in Lagos have adopted Cloud Computing.
- The result of the risks/concerns of Cloud Computing that hinders its adoption by SMBs in Lagos was 58.9%.
- The result of the analysis of benefits of Cloud Computing to SMBs showed that the level of benefits of Cloud Computing on the productivity of SMBs is as high as 90%.

Based on the summary of findings and discussion, this study concludes that many operators of SMBs in Nigeria are not aware of the existence of Cloud Computing. Among those who are aware only a limited number have adopted Cloud Computing. SMBs that are reluctant to adopt Cloud Computing complain of the issue of security, privacy, lack of liability of providers in case of security incidents, and difficulty of migrating to the cloud (legacy software). However, for businesses that have adopted Cloud Computing, the benefit they derive from it is relatively very high.

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