

Accelerating the Adoption of Cloud Technology by SMEs in Nigeria

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Abstract
The contentions for this study were to investigate the reason for the slow adoption of Cloud Computing by SME operators in Nigeria and to develop a suitable information model to guide the would-be users in making an informed decision regarding cloud adoption. A structured interview was conducted with a select number of SME operators and industry associates within the researcher's domain, and a reasonable number of valid responses were obtained. Technology Acceptance Model (TAM) was adapted as the research framework to qualitatively examine the conditions that affect the adoption of Cloud computing into microfinance business operations, within which a suitable model for improving the adoption of Cloud computing was recommended. The analysis of the study revealed that SMEs in Nigeria, with particular reference to microfinance subsector in Akwa Ibom State are yet to fully embrace Cloud technology. It was discovered that most of the SMEs studied, has some level of reservation about cloud computing, arising from not having appropriate education and enlightenment about the cloud economic offerings and potentials. From the outcome of the research, the researcher identified that most people's concerns are as a result of lack of knowledge about cloud computing and so the researcher concluded that appropriate enlightenment by industry stakeholders, cloud service providers, cloud enthusiasts and even the government on the risks and overwhelming economic incentives of cloud computing as well as the provision of a monitored free trial services will encourage the adoption of cloud technology by SMEs.
Index Terms - Cloud Adoption, Cloud Computing, Cloud End-user, Cloud Service Providers, Data Security, Microfinance, Nigeria, SMEs, Vendors,

1. INTRODUCTION

The role of Small and Medium Scale Enterprises (SMEs) as a catalyst for economic growth and development has been well documented in the economics literature and recognised in most countries (Sanusi 2003:2). This assertion is further supported by an article, "SMEs as a gateway to Economic Prosperity" written by Obinna Chima and published in *ThisDayLive Newspaper* online on December 11th, 2013. For instance, in many of the newly industrialised nations, more than 98 percent of all industrial enterprises belong to the SMEs sector and account for the bulk of the labour force (Sanusi 2003:2).

SMEs enjoy a competitive advantage over large enterprises in servicing dispersed local markets. Cognisant of this fact, programmes of assistance, especially, in the areas of finance, extension and advisory services, as well as the provision of infrastructure have been designed by the Nigerian government for the development of the SMEs (Sanusi, 2003:2).

Specifically, successive governments in Nigeria have in the last three decades shown much interest in ensuring adequate financing for Small and Medium Enterprises, by establishing various schemes and specialized financial institutions to provide appropriate financing to the subsector. The failure of most of these schemes revealed that the problem of SMEs in Nigeria is not limited to, lack of long-term financing, but also inadequate management skill, entrepreneurial capacity and above all, the application of suitable technology. (Report of the Vision 2020 National Technical Working Group on SMEs 2009).

Cognisant of the above fact, the government of Nigeria understands the need to support the SMEs to grow. Mrs Omobola Johnson, Nigeria's Honourable Minister of Communication Technology in an address she delivered at the Institute of Software Professionals of Nigeria (ISPON) Annual Conference held in Calabar, Cross Rivers State in Nigeria posited, "The federal government intends to cut down its spending on Information Communication Technologies (ICTs) by embracing cloud computing services". "Given our plans for e-Government and the increased use of ICT by government Ministries, Departments and Agencies (MDAs), this is an unsustainable practice that must be managed. A Government cloud will provide some economic savings", she said.

From the word of Marc Israel, Office Division Group Lead for Microsoft West Africa "One of the biggest challenges SMEs face in today's harsh economic conditions is finding technology that meets their needs without breaking the bank."

This study became necessary to assess the cloud adoption level by SMEs and which factors affect their Attitude Towards Usage (ATU) of cloud technology. Accordingly, the study focused on how to improve the operators' Behavioural Intention to (adopt) Use (BIU) to Cloud Computing.

2. RELATED WORKS

In the context of Nigeria, the researcher discovered that cloud computing is a relatively new research area, there are few number of research work in the field of cloud computing with regards to SMEs with a special consideration of the microfinance subsector until now. This section discussed related literature about cloud computing centered around SMEs.

Awosan (2014) in his paper titled, "Factor Analysis of the Adoption of Cloud Computing in Nigeria" published in African Journal of Computing and ICT carried out a research to investigate the perception of employees in IT & Telecommunication companies and users of devices that support cloud computing, regarding cloud computing, the extent of cloud adoption and to identify the motivating factors as well as current issues affecting the adoption of cloud computing in Nigeria. The researcher concluded that proper awareness by cloud service providers on the risk and benefits of cloud, availability of more cloud service providers and free trail of cloud services to clients for a stipulated period will encourage adoption of cloud computing.

Dogo et al. (2013) in their research paper "Feasibility Analysis of Critical Factors Affecting Cloud Computing" investigated cloud adoption among Nigerian IT organisations and government agencies. They discovered there is a high degree of enthusiasm for cloud adoption among Nigerian IT professionals, organisations and government agencies, but that there exist some challenges to its full adoption, these challenges range from ownership and security of information in the cloud, internet availability, unstable power supply, policy implication arising from implementation of cloud services, litigations and legislation on data ownership in the cloud and infringement of rights, interoperability and internal legislation. They said in spite of the plethora of challenges facing the adoption of cloud in Nigeria there are several opportunities that will favour the adoption of cloud and contended that these challenges are latent opportunities which must be exploited, transformed, and utilised together with existing supporting drivers for adoption by foreign-based and local players. Some of those opportunities as mobile phone revolution, skilled manpower, heightened research interest, energy renewability and sustainability and multinationals' search for opportunities were mentioned in their paper. Finally, they recommended implementation of effective regulatory process, maintaining regular watch on global trends in cloud computing, careful preparation of cloud computing, outsourcing contracts, conformity with provisions, establishment of quality datacenters, launching of training programmes and cross-border standardisation/regulations and concluded that if Nigeria really wants a maximum benefit from the cloud services it is important to strategically consider where it wants to play either as services providers, implements or on content creators levels. There is also a need to launch a national consciousness awareness initiative on Cloud computing as a new and innovative concept in IT with a clear strategic vision which is capable of transforming Nigeria to a Cloud computing hub in African continent in the nearest future.

In a related research, Abubukar A. et al. (2014) in their investigation titled, "Cloud Computing: Adoption Issues for Sub-Saharan African SMEs", published in Electronic Journal of Information Systems in Developing Countries, they found out that, contrary to other literature on cloud computing adoption in the global north, these SMEs are less concerned with challenges like security, privacy and data loss rather; they continue to show optimism in using the potential opportunities that cloud computing presents to them. They envisage that as cloud computing evolves, more SMEs in sub-Saharan Africa will adopt it as an information technology strategy. This could positively contribute to the successes of these SMEs and consequently contribute to the economic growth desired by these developing countries. The focus of their investigation was on the implications of cloud technology paradigm on small and medium-sized enterprises (SMEs) in developing countries, specifically Sub-Saharan Africa and SMEs in the manufacturing, ICT and finance Subsector was studied. They viewed Nigeria as an early adopter and believed that examining SMEs in Nigeria will point to the future adoption trajectory in the region. They found out there is the need for awareness and support of the top management staff of SMEs regardless of the matrix hierarchy observed in the respective enterprises. They need to know what cloud computing is and what benefits their companies stand to gain by adopting this technology. Availability of good internet connection and cost issues will help to accelerate the adoption. They suggested that this lack of prior work geared towards the SMEs indicated a gap in the literature.

3. LITERATURE REVIEW

The purpose of the literature review was to integrate the researcher's study into a broader framework of relevant theory and research. This section will explore the concept of Cloud computing and also look at SMEs in the context of Nigeria and will be themed under the following heading:

- The theory of Cloud computing
- Technical and Economic Benefit of Cloud Computing
- Limitations of Cloud Computing
- Cloud Security/Privacy
- The Future of Cloud Computing
- Threat and Risks of Cloud

- Cloud Adoption
- Cloud Service Providers (CSP)
- Small and Medium Scale Enterprises (SMEs)

3.1 Definition of Cloud Computing

Figure 1.1: Diagram of Cloud computing concept (AG-Placid Limited 2013)

Cloud computing is a concept that is broadly recognised by Nigerian businesses and government agencies, but not always well understood in detail. To some degree, this is basically because of the continuing rapid evolution of cloud computing service offerings. "Cloud computing" is a technology term that is most often ambiguously defined. Although there are various definitions of cloud computing all aimed at giving understanding to the concept of cloud computing, the researcher has decided to use the definition of cloud computing by the U.S National Institute of Standards and Technology. NIST (2011)[1] 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.*

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 (Ambrust, *et al* 2009). The services themselves have long been referred to as Software as a Service (SaaS). The datacenter hardware and software is what is called a Cloud. When a Cloud is made available in a pay-as-you-go manner to the general public, it is called a Public Cloud; the service being sold is Utility Computing. The term Private Cloud refers to internal datacenters of a business or other organization, not made available to the general public. Thus, Cloud Computing is the sum of SaaS and Utility Computing. People can be users or providers of SaaS, or users or providers of Utility Computing (Armbrust *et al*., 2009:6).

NIST defines cloud computing architecture by describing five essential characteristics, three cloud service models and four cloud deployment models (Cloud Security Alliance, 2011: 12). They are summarized in visual form in Figure 1.2

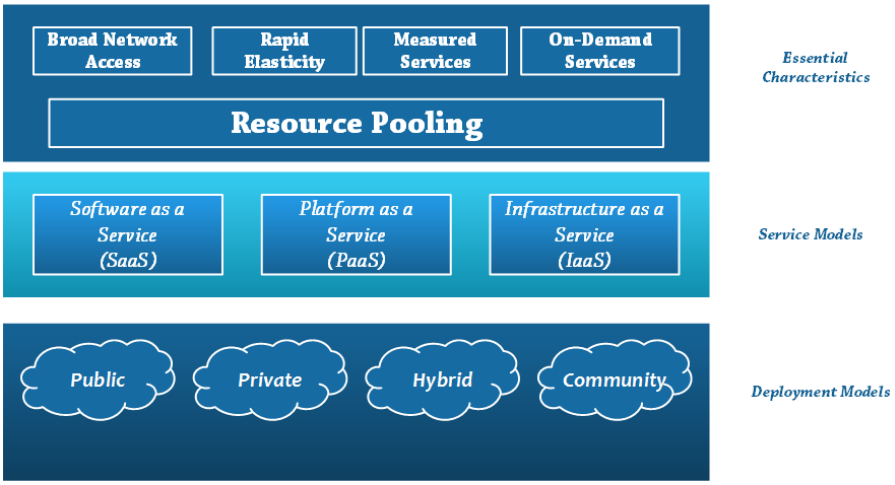

Figure 1.2: NIST Visual Model of Cloud Computing Definition (Cloud Security Alliance, 2011:15).

3.2 Five (5) Essential Characteristics of Cloud Computing

3.2.1 Service Based

A consumer can unilaterally provision computing capabilities such as server time and network storage as needed

[1] *Mell, P and Grance T, 2011, Recommendations of the National Institute of Standards and Technology, US Department of Commerce Special Publication 800-145*

automatically, without requiring human interaction with a service provider (Cloud Security Alliance, 2011).

3.2.2 Broad Network Access

The service is delivered using Internet identifiers, formats and protocols, such as URLs, HTTP, IP and representational state transfer Web-oriented architecture (Cloud Security Alliance, 2011).

3.2.3 Shared Services

Services share a pool of resources to build economies of scale. IT resources are used with maximum efficiency. The underlying infrastructure, software or platforms are shared among the consumers of the service (usually unknown to the consumers). This enables unused resources to serve multiple needs for multiple consumers, all working at the same time (Cloud Security Alliance, 2011).

3.2.4 Scalable and Elastic

The service can scale capacity up or down as the consumer demands at the speed of full automation (which may be seconds for some services and hours for others). Elasticity is a trait of shared pools of resources. Scalability is a feature of the underlying infrastructure and software platforms. Elasticity is associated with not only scale but also an economic model that enables scaling in both directions in an automated fashion. This means that services scale on demand to add or remove resources as needed (Cloud Security Alliance, 2011).

3.2.5 Metered by use

Services are tracked with usage metrics to enable multiple payment models. The service provider has a usage accounting model for measuring the use of the services, which could then be used to create different pricing plans and models. These may include pay-as-you go plans, subscriptions, fixed plans and even free plans. The implied payment plans will be based on usage, not on the cost of the equipment. These plans are based on the amount of the service used by the consumers, which may be in terms of hours, data transfers or other use-based attributes delivered (Gartner Inc, 2009).

3.3 Cloud Service Model

Cloud Service Model is depicted by the diagram below:

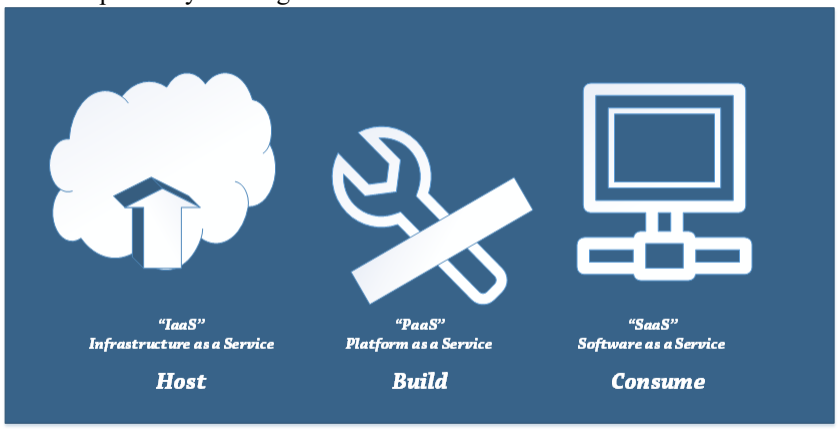

Figure 1.3: Cloud Service Model (Cloud Security Alliance, 2011:15).

3.3.1 Software as a Service

Software as a service (SaaS), sometimes referred to as "on-demand software," is a software delivery model in which software and its associated data are hosted centrally (typically in the (Internet) cloud) and are typically accessed by users using a thin client, normally using a web browser over the Internet (Cloud Security Alliance, 2011:15).

3.3.2 Platform as a Service

Platform as a service (PaaS), is the delivery of a computing platform and solution stack as a service. PaaS offerings facilitate deployment of applications without the cost and complexity of buying and managing the underlying hardware and software and provisioning hosting capabilities. This provides all of the facilities required to support the complete life cycle of building and delivering web applications and services entirely available from the Internet (Cloud Security Alliance, 2011:15).

3.3.3 Infrastructure as a Service

Infrastructure as a Service (IaaS), delivers computer infrastructure (typically a platform virtualization environment) as a service, along with raw storage and networking. Rather than purchasing servers, software, datacenter space, or network equipment, clients instead buy those resources as a fully outsourced service (Cloud Security Alliance, 2011:16).

3.4 Cloud Deployment Model

3.4.1 Public Cloud

The cloud infrastructure is made available to the general public or a large industry group and is owned by an organization selling cloud services (Cloud Security Alliance, 2009:17).

3.4.2 Private Cloud

The cloud infrastructure is operated solely for a single organization. It may be managed by the organization or a third party and may exist on-premises or off premises (Cloud Security Alliance, 2009:17).

3.4.3 Community Cloud

The cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns (e.g., mission, security requirements, policy, or compliance considerations). It may be managed by the organizations or a third party and may exist on-premises or off-premises (Cloud Security Alliance, 2009:17).

3.4.4 Hybrid Cloud

The cloud infrastructure is a composition of two or more clouds (private, community, or public) that remain unique entities, but are bound together by standardized or proprietary technology that enables data and application portability e.g., cloud bursting for load-balancing between clouds (Cloud Security Alliance, 2009:17).

3.5 Drivers for Adoption and Economic Benefit of Cloud

There are many fundamental reasons for organisations to move from traditional IT infrastructure to Cloud Computing. One of the most cited benefits is the economics of the Cloud (Cloudonomics, 2011:1). John Stuart Mill, a British Philosopher, developed the concept of Opportunity Cost – a basic economic premise that is concerned with the cost related to the choices not made by someone. Opportunity Cost:

"*the cost related to the next-best choice available to someone who has picked among severally mutually exclusive choices. It is a key concept in economics. Opportunity costs are not restricted to monetary or financial cost: the real cost of output forgone, lost time, pleasure or any other benefits that provides utility should also be considered opportunity costs*" – (Cloudonomics, 2011:5)

"Opportunity is an important concept when discussing the economics of Cloud Computing because it allows one to assess the true cost of any potential action. When choosing a particular direction for IT spend, for example, there may be no direct cost attached to maintaining the status quo – data centers have already been built, software purchased" However, by including opportunity costs in any calculation, an organization allows for a truer comparison between the various choices to be made" (Jackson, - 2011:1)

With this explanation of opportunity cost, we can now apply the concept to a decision to either retain on-premise IT or move to the Cloud (Cloudonomics, 2011:5). While opportunity cost, and the value to be gained by reducing that cost, is a compelling benefit of moving to Cloud Computing, many critical readers will want to see more concrete examples of the economics at work (Cloudonomics, 2011:5). To this end it is important to understand the gains to be made from a move away from capital expenditure, and over to operating expenditure (Cloudonomics, 2011:5). However, the benefits of cloud computing can be categorised under: Technical, User, Infrastructural, Companies and Environmental.

3.5.1 Technical Benefits

Following are the technical advantages of cloud computing (Weiss, 2007).

- **Power Management:** From the aspect of power management, it is easier to manage virtual server as compared to physical server.
- **Scalability:** It is one of the main positive aspects of cloud computing. If there is peak load or high traffic for a site, the cloud can handle it easily without the need of any additional hardware infrastructure or equipment and without disturbing user's normal work.
- **Data Storage:** There are various data centers spread throughout the world and it makes it easy for the businesses to choose the data center as per their convenience to get fast and easy access of services with unlimited data storage.
- **Trouble shooting and Backup (Disaster) recovery:** Hardware failure can also be easily traced out and rectified with ease. Similarly, the assessment of data can be done anytime and is highly beneficial for the IT industry in reducing workloads and whenever data needs to be recovered.
- **Efficiency and reliability:** To find efficiencies, many organizations are moving towards cloud and backup is another significant advantage to the cloud and it maintains backup for all remote sites and branch offices. It will remove many challenges like bandwidth allocation, security and disaster recovery (Corevault, 2011).

3.5.2 User Benefits

The following are the benefits of Cloud Computing from user's point of view (Weiss, 2007).

- **Achieve economies of scale**: increase volume output or productivity with fewer people. Cost per unit project or product plummets.
- **Reduce spending on technology infrastructure:** maintains easy access to your information with

minimal upfront spending. Pay as you go (weekly, quarterly, yearly). Based on demand.

- **Globalise your workforce on the cheap:** People worldwide can access the cloud, provided they have internet connection.
- **Streamline processes:** get more work done in less time with less people
- **Reduce Capital Cost:** there is no need to spend big money on hardware, software, or licensing fees.
- **Improve accessibility:** you have access anytime, anywhere, making life so much easier
- **Less personnel training is needed:** it takes fewer people to do more work on a cloud, with minimal learning curve on hardware and software issues.
- **Improve flexibility:** you change direction with serious "people" or "financial" issues at stake.

3.5.3 Companies Benefits

The most important benefit of cloud computing as it pertains to company is cost (Weiss, 2007).

Cost Reduction: It is the main advantage or main reason why organizations are going to apply cloud solutions as it saves the cost involved in building infrastructure and setting up a Data Centre e.g. Capital Investment (CAPEX) and Operational Expenditure (OPEX). Even a small-scale business can adopt or go into the cloud. This allows a company to concentrate more on improvements of their core competencies. It certainly helps to be more advantageous in the long run.

3.5.4 Environmental Benefits

It's Green: Cloud computing share the resources that is very good in the context of environment or going green as it reduces many power-hungry carbon footprints data centers and reduces the need of more electric power for maintaining data centers. The work of continuous running servers within the organization is reduced if we start using cloud computing (David, 2009).

3.6 Cloud Risks (Threat) and Mitigations

According to Cloud Security Alliance (2010), cloud customers are both excited and nervous at the prospects of Cloud Computing. They are excited by the opportunities to reduce capital costs. They are excited about the opportunity provided by cloud which frees them from infrastructure management and focus more on their core competence area. Most of all, they are excited by the agility offered by the on-demand provisioning of computing and the ability to align IT with business strategies and needs more readily. However, customers are also worried about the threats cloud computing will pose if not properly secured, and the lack of operational control over systems for which they are nonetheless accountable.

To help both the Cloud Consumers and the Cloud Providers, CSA developed "Security Guidance for Critical Areas in Cloud Computing", initially released in April 2009, and revised in December 2009. This guidance has quickly become the industry standard catalogue of best practices to secure Cloud Computing, consistently lauded for its comprehensive approach to the problem, across 13 domains of concern. Numerous organisations around the world are incorporating the guidance to manage their cloud strategies.

It is incumbent upon cloud customers to understand organisational value of the system they seek to move into the cloud (CSA 2010:6).

In 2010, CSA developed, "*Top Threats to Cloud Computing"* a document to serve as a guide to assist organisations in making informed risk management decisions regarding their cloud adoption plans.

The document identified the following seven threats though not in order of severity:

- Threat #1: Abuse and Nefarious Use of Cloud Computing
- Threat #2: Insecure Interfaces and APIs
- Threat #3: Malicious Insiders
- Threat #4: Shared Technology Issues
- Threat #5: Data Loss or Leakage
- Threat #6: Account or Service Hijacking
- Threat #7: Unknown Risk Profile

The table 1.1 below is an adaption from the document, it consists of the threats, the impact and the remediation.

S/No	Threats	Impact	Remediation
1	Abuse and Nefarious Use of Cloud Computing	Criminals continue to leverage new technologies to improve their reach, avoid detection, and improve the effectiveness of their activities. Cloud Computing providers are actively being targeted, partially because their relatively weak registration systems facilitate anonymity, and providers' fraud detection capabilities are limited.	▪ Stricter initial registration and validation processes. ▪ Enhanced credit card fraud monitoring and coordination. ▪ Comprehensive introspection of customer network traffic. ▪ Monitoring public blacklists for one's own network blocks.
2	Insecure Interfaces and APIs	While most providers strive to ensure security is well integrated into their service models, it is critical for consumers of those services to understand the security implications associated with the usage, management, orchestration and monitoring of cloud services. Reliance on a weak set of interfaces and APIs exposes organizations to a variety of security issues related to confidentiality, integrity, availability and accountability.	▪ Analyse the security model of cloud provider interfaces. ▪ Ensure strong authentication and access controls are implemented in concert with encrypted transmission. ▪ Understand the dependency chain associated with the API.
3	Malicious Insiders	The impact that the insiders can have on an organization is considerable, given their level of access and ability to infiltrate organizations and assets. Brand damage, financial impact, and productivity losses are just some of the ways a malicious insider can affect an operation. As organizations adopt cloud services, the human element takes on an even more profound importance. It is critical therefore that consumers of cloud services understand what providers are doing to detect and defend against the malicious insider threat.	▪ Enforce strict supply chain management and conduct a comprehensive supplier assessment. ▪ Specify human resource requirements as part of legal contracts. ▪ Require transparency into overall information security and management practices, as well as compliance reporting. ▪ Determine security breach notification processes.
4	Shared Technology Issues	Attacks have surfaced in recent years that target the shared technology inside Cloud Computing environments. Disk partitions, CPU caches, GPUs, and other shared elements were never designed for strong compartmentalization. As a result, attackers focus on how to impact the operations of other cloud customers, and how to gain unauthorized access to data.	▪ Implement security best practices for installation/configuration. ▪ Monitor environment for unauthorized changes/activity. ▪ Promote strong authentication and access control for administrative access and operations. ▪ Enforce service level agreements for patching and vulnerability remediation. ▪ Conduct vulnerability scanning and configuration audits.
5	Data Loss or Leakage	Data loss or leakage can have a devastating impact on a business. Beyond the damage to one's brand and reputation, a loss could significantly impact employee, partner, and customer morale and trust. Loss of core intellectual property could have competitive and financial implications. Worse still, depending upon the data that is lost or	▪ Implement strong API access control. ▪ Encrypt and protect integrity of data in transit. ▪ Analyses data protection at both design and run time. ▪ Implement strong key generation, storage and

		leaked, there might be compliance violations and legal ramifications.	management, and destruction practices. ▪ Contractually demand providers wipe persistent media before it is released into the pool. ▪ Contractually specify provider backup and retention strategies.
6	Account or Service Hijacking	Account and service hijacking, usually with stolen credentials, remains a top threat. With stolen credentials, attackers can often access critical areas of deployed cloud computing services, allowing them to compromise the confidentiality, integrity and availability of those services. Organizations should be aware of these techniques as well as common defence in depth protection strategies to contain the damage (and possible litigation) resulting from a breach.	▪ Prohibit the sharing of account credentials between users and services. ▪ Leverage strong two-factor authentication techniques where possible. ▪ Employ proactive monitoring to detect unauthorized activity. ▪ Understand cloud provider security policies and SLAs.
7	Unknown Risk Profile	When adopting a cloud service, the features and functionality may be well advertised, but what about details or compliance of the internal security procedures, configuration hardening, patching, auditing, and logging? How are your data and related logs stored and who has access to them? What information if any will the vendor disclose in the event of a security incident? Often such questions are not clearly answered or are overlooked, leaving customers with an unknown risk profile that may include serious threats.	▪ Disclosure of applicable logs and data. ▪ Partial/full disclosure of infrastructure details (*e.g.,* patch levels, firewalls, etc.). ▪ Monitoring and alerting on necessary information.

Table 1.1: Top Threats to Cloud (CSA 2010); adapted from CSA

3.7 Cloud Service Provider Strategic Tips

The cloud market is at a pivotal point, as users become more comfortable with a variety of applications and start to have confidence in the cloud for their most critical, data-intensive functions and processes. As a strategic future plan, cloud providers should consider the following (KPMG, 2013):

- Ensure that you understand and explain customers' existing IT costs and the true cost of migration, and build a strong argument for switching to the cloud. This should take into consideration cost savings as well as wider business benefits, such as faster speed to market, improved management and information productivity.
- Educate customers on cloud and its implications for their businesses. Understand that Chief Information Officers and Chief Technology Officers are bridges to senior management as well as decision-makers in their own right. This means targeting the cloud sales crusade towards non-technical, management- level executives.
- Address concerns over the potential downsizing of the IT department and the loss of operational control over IT.
- Understand where customers tilt in their business transformation/IT upgrade journey, which will affect their willingness to move data intensive functions and applications to the cloud.
- Demonstrate clearly how you will apply industry-accepted standards and certification for data privacy and security. By showing that sufficient measures are in place, this may ensure customers get the same sense of security from the cloud that they do from their on-premise solutions.
- Introduce more comprehensive and flexible cloud SLAs and new licensing and pricing models to tighten up competitions
- Plan how you can assist your customers with strategic business process and consulting services, which may mean training or re-training of their employee and working more closely with third parties.

3.8 SMEs in Nigeria

According to Lucky and Olusegun (2012:2), SMEs are examined within the perspective of firms and businesses and not their sizes or their economy importance or how many employees they can absolve. The term SMEs is an abbreviation for "small and medium sized enterprises". From this perspective, there are firms or businesses which are small and medium in sizes. They are firms or businesses evolved from entrepreneurial activities of individuals.

Several definitions and meanings of SMEs exist. This is a result of their global diversity and characteristics (Darren *et al*., 2009). Arowomole (2000) affirmed that a single universally accepted definition of SMEs has not been easy as different countries have different criteria for defining SMEs, adding that many countries have defined it in terms of manpower, management structure and capital investment limit. He further noted that experts in this field have also contributed to the diversity in SMEs definitions.

The researcher has adopted the definition by the Central Bank of Nigeria since it is the only statutory government of Nigeria's agency that grant licenses for the operation of microfinance banks and also regulates its operations. This definition has put a limit to the amount of capital investment that must not be exceeded while setting up the SMEs and this is where microfinance banks fall into.

The Central Bank of Nigeria defines SMEs as any enterprise which employs fewer than 199 persons and with a maximum turnover of N500 million (approximately US$3.2 million) and assets of N50 million (approximately US$320, 000) excluding land and working capital (Abubukar et al., 2014:1).

3.9 National Strategy for SMEs

According to an extract from a presentation made by the then Central bank of Nigeria (CBN) Governor, Dr J.O. Sanusi at the National Summit on SMEs organised by Bankers' Committee and Lagos Chambers of Commerce and Industries (LCCI) on the 10th June, 2003, the Federal Government of Nigeria has taken various steps, including monetary, fiscal and industrial policy measures to promote the development of Small and Medium Scale Enterprises (SMEs).

Specifically, the Government has been active in the following areas (Sanusi; 2003:3):

- Funding and setting up of industrial estates to reduce overhead costs;
- Establishing specialized financial institutions, including the Small Scale Industry Credit Scheme (SSICSs), Nigerian Industrial Development Bank (NIDB), Nigerian Bank for Commerce and Industry (NBCI) to provide long-term credit;
- Facilitating and guaranteeing external finance from the World Bank, African Development Bank and other international financial institutions;
- Facilitating the establishment of the National Directorate of Employment (NDE), which also initiated the setting up of new SMEs;
- Establishment of the National Economic Reconstruction Fund (NERFUND) to provide medium to long-term local and foreign loans for small, and medium scale businesses, particularly those located in the rural areas; and
- Provision of technical training and advisory services through the Industrial Development Centers. The review and appraisal of some of these government initiatives and incentives are outlined as follows

3.10 SMEs Prospect

There will be a significant improvement in the SMEs sector when the right amount of economic initiative is applied. Successful case studies from the banking and telecom sectors show the growth potential inherent in this category of business sectors. Additional impetus within the broader Nigerian socioeconomic environment provides a compelling case for the SME sector growth potential, such as aforementioned initiatives driving growth and most importantly the national broadband penetration drive by the Federal Government of Nigeria.
Considering the enthusiasm shown by the government in activating various schemes to promote the success of the SMEs Subsector, the advantage such as the provision of financial advisory services, entrepreneurial management, and risk capital to the SMEs, as well as the progress made so far, there is an appealing prospect for the growth of the SMEs sector.

4. RESEARCH METHODOLOGY

In view of the nature of the research and in consideration of the research objectives, which was to examine the would-be cloud users of their perception about the cloud technology and the reason for the slow pace of adoption of cloud computing, the research opted for a qualitative research method.

In order to be able to gather enough facts to build an effective research consensus, a one-to-one interview was conducted using Google Hangout and Skype software where distance becomes an impediment. A carefully selected number of industry standard questions were prepared, and an interview conducted with some operators of SMEs as well as industry associates. The goal of qualitative research is to discover patterns which emerge

after close observation, careful documentation, and thoughtful analysis of the research topic. What can be discovered by qualitative research are not sweeping generalizations but contextual findings (Creswell 1994). This process of discovery is basic to the philosophic underpinning of the qualitative approach (Peter 2011).

In essence, a phenomenological qualitative study was used in form of in-depth, semi-structured interviews. In semi-structured interview, the general direction was decided on in advance, but as the interview proceeded, the questioning was guided by the content of the respondent's answers (Dyer 2006:31-33). Interview is the most common method of data gathering in qualitative research and the goal of any qualitative research interview is to "see the research topic from the perspective of the interviewee and to understand how and why they have come to a particular perception" (King 2004:11).

5. RESEARCH FRAMEWORK

Technology adoption is a process, with the adopter moving from a state of ignorance of the technology to considering and giving attention to such technology (Van Biljon & Renaud, 2008). Full progression can only take place if the adopter fully accepts the technology and if not, the adopter may likely not wholeheartedly adopt the technology or may remain a reluctant user or completely ignore the technology (Van Biljon & Renaud, 2008).

Technology Acceptance Model (TAM) appears to be a convenient model for understanding technology issues related to system use. It is a theoretical framework developed by Davis in 1989 which identifies perceived usefulness, ease of use, and cultural orientation of the decision maker as key drivers of technology adoption (Andrea & Alessandro 2008). It consists of two beliefs, the perceived use of technology and the perceived ease of use of technology, which determine attitudes to adopt new technologies. Users' perception towards adoption will influence the adopter's behaviour either positively or negatively in the future concerning the new technology. Figure 1.4 depicts how actual system use affects BIU.

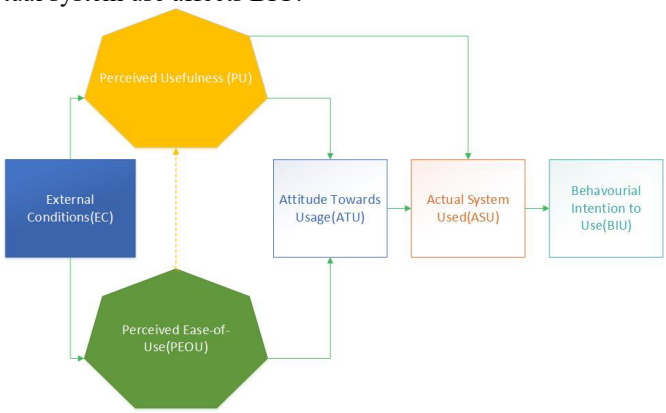

Figure 1.4: A Modified Technology Acceptance Model.

TAM opines that the success of a system can be evaluated by user acceptance, measured by three factors: Perceived Usefulness (PU), Perceived Ease-of-Use (PEOU), and Attitudes Towards Usage (ATU) of the system (Davis, 1989). A number of external conditions could affect PU and PEOU. PU is the extent to which a person believes that using a particular technology would improve his or her performance whilst PEOU refers to the degree to which a person believes that he or she could use the particular system effortlessly. According to TAM model, a user's perceptions of a system's usefulness and ease-of-use result in a Behavioural Intention to Use (BIU), or not to use, the system (Davis, Bagozzi, & Warshaw, 1989; Nov & Ye, 2008).

In this study, the researcher adapted TAM to qualitatively examine those conditions that affect the adoption of Cloud computing by small and medium-sized enterprise organisations in Nigeria, specifically the micro-finance organisations.

6. DATA COLLECTION AND ANALYSIS

6.1 Method of Data Collection

The researcher's primary source of data was extracted from the Cloud End-users i.e the SMEs and industry associates carefully selected, taking into consideration the location of the researcher. A total of 7 participants, of which 5 were representing the SMEs' and 2 representing industry associates were selected. A special consideration was made for the 5 representing the SMEs to come from Microfinance subsector of the SMEs. The purpose of the research was disclosed to participants to allay their fears and their consent was sought with the explanation that, their names will not any way be reflected in the research work, to guarantee confidentiality. Respondents were also asked to be open in their response and say clearly their perception about Cloud computing and state their fears. The interview questions were emailed to the participants ahead of the interview session to allow them enough time to understand the questions and also to seek clarification in any grey areas.

6.2 Data Analysis Technique

According to Burnard et al. (2008), there are two fundamental approaches to analysing qualitative data (although each can be handled in a variety of different ways): the deductive approach and the inductive approach. Deductive approaches involve using a structure or predetermined framework to analyse data. Basically, the researcher applies their own structure or theories on the data and then uses these to analyse the interview transcripts. However, while this approach is relatively quick and easy, it is inflexible and can potentially bias the whole analysis process as the coding framework has been decided in advance, which can severely limit theme and theory development. Conversely, the inductive approach involves analysing data with little or no predetermined theory, structure or framework and uses the actual data itself to derive the structure of analysis.
Although there are many inductive approaches to analysing qualitative data, the method of analysis that was applied in this study was that of thematic content analysis, and it is, of course, the most common method of data analysis used in qualitative work.

The process of thematic content analysis is essentially the same, in that it involves identifying themes and categories that 'emerge from the data'. This involves discovering themes in the interview transcripts and attempting to verify, confirm and qualify them by searching through the data and repeating the process to identify further themes and category.

The below depicts the mapping of interview questions against research objectives and question:

INTERVIEW QUESTIONS MAPPED AGAINST RESEARCH OBJECTIVES AND QUESTIONS			
IQ	QUESTION	RO	RQ
03	What measures are being taken in your organisation to safeguard data and ensure privacy are maintained?	R2 AND R3	RQ03
04	How has the cost factor of maintaining data centers affected your system?	R2	RQ02
05	What do you think is the major benefit of Cloud Computing services?	R1 AND R4	RQ01
06	In your opinion, what are the main issues and challenges with Cloud Computing?	R2	RQ02
07	One of the aspects that keep hindering SMEs from adopting Cloud solution is the unavailability (as they can be anywhere) of data center and servers, is this the main reason for delaying Cloud Computing adoption by SMEs or even your organisation as well?	R2 AND R3	RQ02 AND RQ03
08	Do you agree that awareness and education is another factor hindering the adoption of Cloud Computing by small organisations as it seems most organisations are not even in the know about the technology?	R4	RQ04
09	Do you think there is a need of advanced level security measures (as in SLA) for Small and Medium organisations?	R3	RQ03
10	If we want to adopt Cloud Computing to store customers' data and banking information (records), which deployment model do you prefer, Private, Public or Hybrid Cloud? Why?	R4	RQ04
11	What are the main advantages of Cloud Computing in SMEs e.g. Microfinance banks?	R1 AND R4	RQ01
12	Do you think that not having personnel knowledgeable in Cloud Computing could hinder SMEs from adopting Cloud Computing?		RQ02
13	Would you say that inadequate power, inefficient infrastructure and high cost of access to ICT services and product can hamper cloud adoption?		RQ02
14	Is there any hope of improvement in the rate of adoption of Cloud technology by SMEs in Nigeria?	R4	

Table 1.2: Interview Questions mapped against Research Objectives and Questions

6.2.1 Coding and Categorisation of theme

To code a theme is to arrange themes in a systematic order, to make it part of a system or classification to allow for categorisation. When codes are applied and reapplied to qualitative data, you are codifying – a process that permits data to be "segregated, grouped, regrouped and relinked in order to consolidate meaning and explanation" (Grbich, 2007: 21). Coding allowed a researcher to categorise data or string of words into a family on grounds that they have similar characteristics.

The table 1.3 below depict themes category as extracted from the inquiry and their corresponding sub-themes along with the interview questions those themes answered:

MAPPING INTERVIEW QUESTIONS AGAINST THEME CATEGORY		
Main theme	**Sub- theme**	**Interview Question No**
Cloud Security	Privacy and Confidentiality	**IQ03 AND IQ09**
	Security of data	
	Data Center location	
Cloud Benefits	Reliability	**IQ05**
	Availability	
	Efficiency	
	Agility	
	Cost of reduction	
	Flexibility	
	Data Availability	
Deployment Model	Hybrid Cloud	**IQ10**
	Private Cloud	
	Public Cloud	
	Multi-cloud	
Cloud Issues	Cost of services	**IQ04 AND IQ13**
	Cost of Bandwidth	
Service Level Agreement	Trust	**IQ09**
	Vendor	
	Flexibility SLAs	
Cloud Education	Enlightenment	**IQ08 AND IQ12**
	Knowledge/Integration	
	Awareness	
Cloud Adoption	Adoption Rate	**IQ14**

Table 1.3: Mapping Interview Questions against Theme Category

Summary of theme extracted from each participant: Table 1.4

○ SUMMARY OF THEMES EXTRACTED FROM EACH INTERVIEWEE RESPONSE	
○ **INTERVIEEE**	○ **EXTRACTED THEMES**
○ **INTERVIEWEE A**	○ Data security
	○ Privacy and confidentiality
	○ Security of Data
	○ Cost of services
	○ Service Level Agreement
	○ Security of data
	○ Cost Reduction as cloud benefit
	○ Private Cloud
	○
○	○
○ **INTERVIEWEE B**	○ Scalability, Cost Reduction, Speed, Reliability, Storage – Cloud benefits
	○ Data loss
	○ Good SLAs
	○ Data security, Integrity of data
	○ Data security and trust
	○ Legal issue
	○ Reliability of data, Availability of data
	○ Efficiency and reliability

	○ Hybrid Cloud deployment model
○	○
○ **INTERVIEWEE C**	○ Cloud adoption
	○ Efficiency and Speed of Cloud
	○ Enlightenment and Awareness
	○ Data Availability
	○ Data Security
	○ Cloud security
	○ Flexible SLAs, ○ Good Vendor, ○ Trusted Service Provider
	○ Cost Reduction, ○ Cloud benefit
	○ Legal issues, ○ Disaster Recovery, ○ Data Center location ○ SLAs
	○ Private Cloud Model is suitable
	○ Level of knowledge, ○
○	○
○ **INTERVIEWEE D**	○ Shared Services of Cloud
	○ Cost Reduction
	○ Speed
	○ Reliability, ○ Efficiency
	○ Security of Cloud
	○ Knowledge level, ○ Education
	○ Cost of services
	○ Data Security, ○ Privacy, ○ Reliability, ○ Trust issues
	○ Adoption concerns
	○ Education, ○ Enlightenment, ○ awareness
	○ Public Cloud not suitable for Microfinance banks
	○ Private Cloud is desirable, ○ Good SLAs
	○ Education, ○ Enlightenment, ○ Awareness
○	○
○ **INTERVIEWEE E**	○ Slow Adoption Rate
	○ knowledge about Cloud computing
	○ Most microfinance banks are unaware of cloud
	○ Cloud Education is necessary, ○ Cloud Awareness crusade
	○ Cloud is beneficial
	○ Cost Reduction, ○ Flexibility ○
	○ Issues of privacy, ○ Security of data, ○ Cloud has threats mitigations

	○ Private Cloud is preferable, ○ SLAs are important
	○ Efficiency
	○ Cost of access to service is high but worth it
	○ Power infrastructure, ○ Bandwidth access are challenges against Cloud
○	○
○ **INTERVIEWEE F**	○ Data Sharing
	○ Lack of cloud security knowledge
	○ Data security, ○ Privacy and Confidentiality
	○ Good SLAs ○ Data Protection
	○ Cloud Education, ○ Awareness, Enlightenment, Knowledge/Integration ○
	○ Cloud awareness programme
	○ Slow Adoption rate, ○
	○ Cost of services
○	○
○ **INTERVIEWEE G**	○ Cloud Agility, ○ Efficiency
	○ Security and privacy concerns
	○ Data Center location
	○ Data centre location issue, ○
	○ Flexible SLAs, ○ Trusted Vendor
	○ Multi-Cloud, ○ Flexible SLA, ○ Cloud Awareness
	○ Cost of service
	○ Bandwidth issue

Table 1.4: Themes Extracted from Interviewee's Responses

The seven (7) interviews are summarised in the table 1.5 below. Some aspects and findings of the literature study had been connected and linked to the findings that are extracted from the seven interviews.

THEME CATEGORY	
Main theme	**Sub- theme**
Cloud Benefits	Cost reduction
	Availability and Scalability
	Reliability & Efficiency
	Data Availability
	Data Storage
	Economies of Scale
Cloud Issues	Cost of services
	Cost of Bandwidth
	Reliability
	Disaster Recovery
	Knowledge/Integration
	Data Center location/ Data Storage
	Migration of Data
Cloud Security	Privacy
	Security of data
	Confidentiality

	SLAs
	Cloud Mitigations
Deployment Model	Hybrid Cloud
	Private Cloud
	Public Cloud
	Multi-cloud
Service Level Agreement	Trust
	Vendor
	Flexibility SLAs
Cloud Education	Enlightenment
	Awareness
	Knowledge
Cloud Adoption	Adoption Rate

Table 1.5: Summary of Themes Category and Sub-themes

7. FINDINGS AND DISCUSSION

For efficient and significant discussion on the economic incentives (Perceived Usefulness) of cloud computing as well as the challenges (Perceived Ease-of-Use) in adopting (Actual System Usage) cloud technology for SME organisation specifically microfinance institutions, a modified Technology Acceptance Model (TAM) was adapted to establish the adoption trend following the analysis of the responses from the participants.
According to TAM, the success of a system can be evaluated by user acceptance, measured by three factors: Perceived Usefulness (PU), Perceived Ease-of-Use (PEOU), and Attitudes Towards Usage (ATU) of the system (Davis, 1989).

7.1 Discussion

7.1.1 Perceived Usefulness (PU) of Cloud in SMEs

After analysing the associate's responses regarding cloud benefits, the researcher observed that there are some technical advantages of deploying cloud computing in SMEs' operation. Sharing customer's banking/bio data between different microfinance banks was an example mentioned as the major benefit of cloud computing in microfinance institutions. One respondent went as far as citing a scenario where one bank can share its customer's data with another bank under certain agreement to help other bank to simply obtain the data instead of creating a new database.

It was also realised from the associate's responses that other benefits of cloud computing to SMEs include reduction of cost of operation, scalability, efficiency, reliability and data storage. Researcher identified that if resources are shared, it will reduce the cost and microfinance institution can concentrate on their core operational area and entrust the IT component to a trusted cloud service provider while assigning their IT officer to monitor it, and this will save cost which would have been incurred in spending on IT infrastructure. Reliability and efficiency can be a good advantage to microfinance institutions and efficiency is equally helpful in speeding up the services and guaranteeing faster results. From Scalability standpoint, microfinance institutions can scale up and down, their servers and hardwares when the need arises and it will reduce the cost of unused servers and hardwares since cloud fundamentally operates a Pay-as-Use scheme.

From researcher's point of view, cloud computing is a suitable technology for adoption in SMEs' operation. Specifically, microfinance institutions can give better service delivery to customers and of course efficient customer's support is guaranteed. In spite of these benefits of cloud technology, there are still some issues with this technology with respect to their use in SMEs' operation and these are presented in section 7.1.2

7.1.2 Perceived Ease-of-Use (PEU) of Cloud Computing by SMEs' Operators

From the analysis of the interview, researcher observed that data security, privacy of customer's data, availability of data and SLA and loss of operational control are the major issues, but many of the associates and IT professionals interviewed identified SLA as the backbone upon which all other issues from service provider's end can be addressed. They said major components of the issues can usually be addressed when the vendor is open and can be trusted. A trusted vendor should discuss every aspect of the services offered and its related expectations and also outline areas of deficit where any, to properly guide the consumer in making an informed decision as it concerns adoption.

Since cloud technology is an emerging and evolving technology, knowledge of the use of this technology is of equal concern. Awareness and education are very paramount because you cannot use what you do not know anything about.

One respondent mentioned the cost of access to ICT services and products as one hindrance, he suggested that government should assist is providing the needed auxiliary infrastructure such as telecom to boost bandwidth and power infrastructure to guarantee uninterrupted service to drive the cloud environment because private concern will not be able to procure these highly expensive infrastructures.

7.1.3 Attitude Towards Usage (ATU) – Adoption of Cloud Computing into SMEs' Operations

When participants were asked to mention the benefit of Cloud computing they know, they thought the main advantage of Cloud computing were their operational cost reduction. Some of them thought that Cloud-based business process were convenient and more flexible. Whereas one organisation out of the five organisations used Cloud in their business operation, others expressed reservations about moving to cloud environment basically because it will require another level of training for them to get used to it. The explanation given to all participants about Cloud computing was well understood. Regarding feelings about Cloud computing adoption, all remaining four participants had positive intentions.

7.2 Findings

7.2.1 Actual System Usage (ASU) – Cloud adoption trend by SMEs

Investigation revealed that only one out of the five microfinance organisations studied actually deployed Cloud computing, an indication that the ASU is affected by PEOU.

7.2.2 Behavioural Intention to Use (BIU) – Willingness to adopt Cloud computing

One notable advantage of Cloud computing is cost reduction. Reducing the cost of business operation is the attracting feature of Cloud computing that tends to swing Behavioural Intention of SMEs operators to use (adopt) Cloud technology. ATU has a direction relationship with BIU, as organisation who showed positive ATU planned to adopt Cloud technology.

8. CONCLUSION AND RECOMMENDATION

The objectives of the study were to determine current level of Cloud computing adoption by SMEs operators in Nigeria and to seek ways for improving the rate of adoption by developing an information guide for the would-be Cloud End-users to make an informed decision about cloud adoption.

The study provided evidence that Cloud technology represents one of the most important information technology revolution that has taken place in the history of computing.

The responses from participants indicated that Attitude Towards Usage (ATU) had a direct relationship on Behavioural Intention to Use (BIU) the technology. Moreover, Perceived Usefulness (PU) of Cloud computing in SMEs' operation was the determining factor for those organisation with no strong Attitude Towards Usage (ATU).

In the context of SMEs, it is realised that there are seeming apprehension by SME organisations in Nigeria towards adopting Cloud technology because of some perceived challenges (PEOU) that come with it.

Of all the major challenges, security of data is discovered to be the paramount concern of the operators.

Having established that awareness and education about Cloud Computing contributed to the slow rate of adoption of Cloud technology, the research provided valuable information regarding the economic benefits of cloud adoption in SME as well as how the issues of security of data are better managed in cloud environment, thus answering the primary research question.

This study also offered insight into other specific research questions and provided guidelines and recommendations into complex issues in a language that is easier for SME operators to understand.

Hopefully the contribution made by this study will be valuable in assisting the would-be users as well as managers of SMEs in shaping their Behavioural Intention to adopt (Use) Cloud computing.

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Table 1.5: Summary of Themes Category and Sub-themes – 23

ACKNOWLEDGMENT

This Research was conducted as a precondition for the award of Master of Technology Degree (MTECH) in Information Technology at the University of South Africa. I had selected this research on Cloud technology adoption in Nigeria from the Small and Medium Scale Enterprises' perspective, as it was my wish to play a role in the growth of the SME's sector in Nigeria via the promotion of adoption of best-in-class technology as I seek to become a Cloud Computing Evangelist.

During the course of this research, I have gathered a great deal of understanding of Cloud Computing Technology and have also equally improved my research and communication skills.

Knowledge they say is power, I am of the same belief that business decision makers within the SMEs subsector who read this research work would be better informed to make the right and appropriate technology selection as it regards outsourcing their business IT infrastructure services.

Making an acknowledgement is not an easy ride. This is more so because so many people who might have assisted you in one way or the other will be left out. My greatest concern is omitting someone. I would like to thank you all. Please accept my apology if I have not mentioned your names.

I want to specifically start by saying a big thank you to Prof. Mnkandla Ernest and other faculty members of the School of Computing at the University of South Africa as well as other faculty members who assisted me. Prof. Mnkandla Ernest was my research supervisor during writing this conducting. Prof. Ernest also helped profoundly by providing important guidance whenever the need arises, he had done what was needed to be done (If this research becomes a mess, the blame is solely mine and on me alone). I will like also to thank Mr Umana Okon Umana, the Managing Director of Oil and Gas Free Zones Authority of Nigeria (OGFZA) for his fatherly disposition and help. Worthy of mention is His Excellency, Mr Nsima Ekere, the Managing Director of Niger Delta Development Authority (NDDC) whose financial assistance at the nick of this research work completion gave it the needed impetus.

Of importance also are various organisations who made time available for my interviews and also responded to my questionnaires. For confidentiality sake, I will not mention the names of those I interviewed.

Finally, I would like to thank my family members and friends who understood that I was going through a phase in life where pains will give birth to gains. Your understanding and encouragement during the period of my study was exemplary.

Kind regards,

Destiny Young

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