

**IMPROVING THE ADOPTION OF CLOUD COMPUTING BY
SMALL & MEDIUM SCALE ENTERPRISES (SMEs) IN
NIGERIA**

By

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of**

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In the subject of

Information Technology

at the

UNIVERSITY OF SOUTH AFRICA

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August 2015

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I declare that *____*Improving the Adoption of Cloud Computing by Small and Medium Scale Enterprises(SMEs) in Nigeria**____, a research dissertation is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

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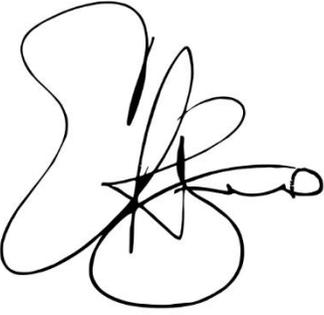
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ABSTRACT:

The objectives 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 semi-structured interview was conducted with a select number of SME operators and industry associates, 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 fully to 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.

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.

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Keywords

ATU, BIU, Cloud Adoption, Cloud Computing, Cloud End-user, Cloud Service Providers, Data Security, Microfinance, PU, PEOU, IT, Nigeria, SMEs, Vendors,

Abstract

In a traditional business environment, companies set up their organisation's IT data infrastructure, install their applications and carry out the maintenance and management of their infrastructures. Whereas Cloud computing removes the need for companies to set up own data centers and run enterprise applications. Cloud computing technology provides businesses with the advantage of on-demand access, agility, scalability, flexibility and reduced cost of computing. An appreciable increase is being observed in the acceptance and migration to this new IT model in developing economies. In Nigeria, it has been observed that there is a somewhat unimpressive rate of adoption of Cloud computing by the microfinance operators. This research investigates the reason for the slow adoption of Cloud computing by SMEs in Nigeria with special consideration to the Microfinance subsector and to develop a model for improving the adoption of cloud computing by microfinance organisations.

The research was conducted using a qualitative research design method. Interview was the main data collection instrument and data collected was analysed using thematic content analysis method.

The analysis of the study revealed that SMEs in Nigeria, with particular reference to microfinance subsector in Akwa Ibom State are yet fully to 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 computing by SMEs.

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List of Abbreviations

- SMEs** – Small and Medium Scale Enterprises
- SaaS** – Software as a service
- PaaS** – Platform as a service
- IaaS** – Infrastructure as a service
- CSP** – Cloud Service Provider
- CEUs** – Cloud End-Users
- CPN** – Computer Professionals Registration Council of Nigeria
- NCS** – Nigeria Computer Society
- ISPON** - Institute of Software Practitioners of Nigeria
- CBN** – Central Bank of Nigeria
- NIST** – National Institute of Standards and Technology
- CSA** – Cloud Security Alliance
- APIs** – Application Programming Interface
- ACL** – Total Cost of Ownership
- R&D** – Research & Development
- CAPEX** – Capital Investment
- OPEX** – Operating Expenditure
- IT** – Information Technology
- ATU** – Attitude Towards Usage
- ASU** – Actual System Use
- PU** – Perceived Usefulness
- PEOU** – Perceived Ease-of-Use
- BIU** – Behavioural Intention to Use

Statement of Original Authorship

STUDENT NUMBER: 50788841

I hereby certify that this research project:

“Improving the Adoption of Cloud Computing by Small and Medium Scale Enterprises (SMEs) in Nigeria”

constitutes my own intellectual investigation, the content and work presented in this research study is a genuine and original work done by me and has not been published or submitted to any institution for the award of any degree programme.

Any literature, data, or works done by others and cited in this research has been given appropriate acknowledgement and listed in the reference section.

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Signature

Date 31/06/2015

Acknowledgements

This Research was carried out as a precondition for the award of Master of Technology Degree (MTECH) in Information Technology (IT), a research degree at the University of South Africa. I have selected this research dissertation on Cloud Computing in Nigeria from the SMEs' perspective as it is my wish to play a role in the development of socio-economic condition of Nigeria via the promotion of adoption of best-in-class technology as I seek to become a Cloud Computing Evangelist.

In the course of this research, I have gather a great deal of understanding of Cloud Computing Technology and have 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 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. The author's greatest concern is omitting someone. I would like to thank you all. Please accept my apology if I have not mentioned your names.

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Kind regards,

YOUNG, DESTINY A

Chapter 1: INTRODUCTION

1.0 Background

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).

SMEs are said to be the engine room for the development of any economy because they form the bulk of business activities in a growing economy with the capacity to contribute at least 30 per cent to the Gross Domestic Product (GDP) and generate 58 percent of jobs of the working population (Ilegbinosa & Jumbo 2014). This has hardly been the case in Nigeria, with an estimated 170 million population, as operators in the SMEs sub-sector continue to lament their dwindling fortunes, blaming such problems as: inadequate and inefficient infrastructural facilities and technology, which tend to escalate the cost of operation (Sanusi 2003).

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)

According to Oyeyinka (2012) in his article presented at Financial System Strategy (FSS) 2020 International Conference organised by Central Bank of Nigeria, he submitted, “In the light of recent happening in the Nigerian macro-economic environment, SME have compelling growth potential and like other emerging economies are likely to constitute a significant portion of GDP in the near future”.

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”¹, 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*”²

According to Stanley Buzim, SMEs remain a critical segment whose potentials in the Nigerian economy have been severely limited due to lack of needed IT infrastructure coupled with absence of information as to the relevant technology that can be adopted to enable the subsector to leapfrog and break even³.

1 Uzor Jr. B. *BusinessDay Media Ltd Website*. [Online]. 2012 [cited 2013 August 03. Available from: <http://www.businessdayonline.com/NG/index.php/tech/telecoms/47059-why-fg-is-embracing-cloud-computing-commtech-minister>

2 Okonji E. *Thisdaylive News Website*. [Online], 2013 [cited 2013 July 04]
URL: <http://www.thisdaylive.com/articles/microsoft-announces-office-365-suite-in-africa/152344/>

3 <http://risenetworks.org/2013/06/18/nigerian-banks-can-do-better/>

This study investigated the reason for the slow adoption of cloud computing by Nigerian Microfinance operators and came up with an awareness model needed by the operators to encourage their adoption of cloud computing and to also boost the SMEs subsector.

In this research, the author looked at Cloud Computing; an emerging Information technology paradigm from the SMEs' Perspective. The author looked into some of the challenges being raised and presented a case for the adoption of Cloud technology by SMEs in Nigeria.

1.1 Cloud Computing Defined



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

Cloud computing is not a revolution in information technology but an evolution of existing technologies as the main revolution occurred long before the advent of cloud computing (Tjoa 2011).

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)⁴ 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 (Armbrust, *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).

1.1 Clarification of Concepts

The following are the key concepts/terms as used in this dissertation:

Cloud computing – *“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”* (NIST 2011).

Cloud Computing Services are grouped into three areas: software as a service (SaaS), platform as a service (PaaS) and Infrastructure as a service (IaaS) (Zhang *et al.*, 2010). These services are arranged in layers and they replace the traditional “in-premises” computing systems (Barnatt 2010).

Cloud Service Providers – Own and operate cloud computing systems used to render services to third parties cloud end-users. They are responsible for providing general maintenance and upgrade of the system, data security, and cloud computing service pricing

⁴ Mell, P and Grance T, 2011, Recommendations of the National Institute of Standards and Technology, US Department of Commerce Special Publication 800-145

and for the majority of CSP often have competency in different cloud deployment models (IaaS, PaaS, SaaS) as well as provide consultancy service to Cloud End-users(CEUs) (Dogo *et al.*, 2013).

Cloud End-Users (CEUs) – These are the consumers that subscribe to Cloud computing service that is offered by the CSPs. The consumer could be private or corporate users. (Dogo *et al.*, 2013).

Cloud Security - Cloud computing security refers to the set of procedures, processes and standards designed to provide information security assurance in a cloud computing environment. (*technopedia.com 2010*).

Computer Professionals Registration Council of Nigeria (CPN) - is a highest corporate body with perpetual succession and common seal, a legal entity charged with supervision and regulatory of the Computing Profession in the Nigeria (cpnf.gov.ng 2014).

Hybrid Cloud: The combination of private and public is called hybrid cloud (Peter *et al.*, 2009).

SMEs - *SMEs* are broadly *defined* as businesses with turnover of less than N100million per annum and/ or less than 300 employees (Oyeyinka 2012).

Nigeria Computer Society (NCS) - is the umbrella organisation of all Information Technology Professionals, Interest Groups and Stakeholders in Nigeria. Formed in 1978 as Computer Association of Nigeria (COAN); and Transformed into NCS in 2002 (ncs.org.ng 2014).

Institute of Software Practitioners of Nigeria (ISPON) - The Institute of Software Practitioners of Nigeria (ISPON) is the apex body of computer software and related services industry in Nigeria growth of the software-driven IT industry in Nigeria. It is a non-profit organization that serves as a single point of reference for any information on software industry in Nigeria (ispon.org 2014).

Private Cloud: Clouds that are used for specific organization providing more security and it may be managed by the organization or third party (Peter *et al.*, 2009).

Public Cloud: Public cloud is owned by specific cloud service provider. This public cloud infrastructure is available for large organizations and public and can be accessed from anywhere (Peter *et al.*, 2009).

Scalability: Maintaining the storage and traffic load in the peak load or high traffic for a site, cloud can handle easily without need of any additional hardware infrastructure or equipment and without disturbing user's normal work (Weiss, 2007).

Service Level Agreement (SLA): It is in general a legal binding agreement in the mutual understanding and acceptance about a service between a client who is buying the service and a Service Provider (David 2009).

1.2 Related Work

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, Abubakar 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.

1.3 Motivation

Cloud computing has been one of the most advancing technologies lately. Academic research on the adoption of cloud technology by Small and Medium Scale Enterprises (SMEs) in the context of Nigeria with particular reference to microfinance subsector has been minimal. Some work has been done by other researchers on the economic implications of cloud adoption by small organisations while others have researched on the inherent challenges of migrating to the cloud. Security of data and privacy concern are issues that are receiving increasing focus when adoption of cloud computing is considered.

Majority of industry publication points to the economic benefits of adopting cloud computing and the costs of migrating to cloud. There is little published work on the legal, regulatory, compliance considerations of adopting cloud computing, as well as, the organisational impact that cloud computing will have on the organisation (Shimba 2010).

Software experts under the umbrella of the Institute of Software Practitioners of Nigeria (ISPON) insisted that Cloud Computing would be the next technology revolution that would transform the Nigerian economy (ISPON Conference 2012).

According to ISPON, cloud computing providers will not exist if the users are not there to use the services. The force of interplay between the service providers and the consumers (in this case, the SMEs) will by extension stimulate a growth in the Nigerian economy, but the sad aspect of it is that most of the operators of SMEs have little or no knowledge about cloud computing to even consider its adoption. Consequently, there is a problem of *inadequate information about Cloud Computing* to properly guide the SMEs' operators regarding the relevant IT technology to adopt in order to propel their business growth.

This research therefore attempts to bridge the existing knowledge gap by putting together useful information that can serve as a handy reference guide for SMEs' operators to help broaden their knowledge about cloud computing, which will in turn accelerate the adoption

of cloud computing technology. This study is an attempt to provide answers to the critical issues surrounding cloud computing adoption in the context of Nigeria as it pertains to SMEs. Knowledge will be shared concerning the nature of the relationship existing between Cloud Service Providers (CSP) and the Cloud End-users (the SMEs). Besides, this study is one of the first sets of research geared primarily towards the microfinance institutions in Nigeria.

1.4 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.

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 research, 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 can be recommended.

Figure 1.2 depicts how actual system use affects BIU.

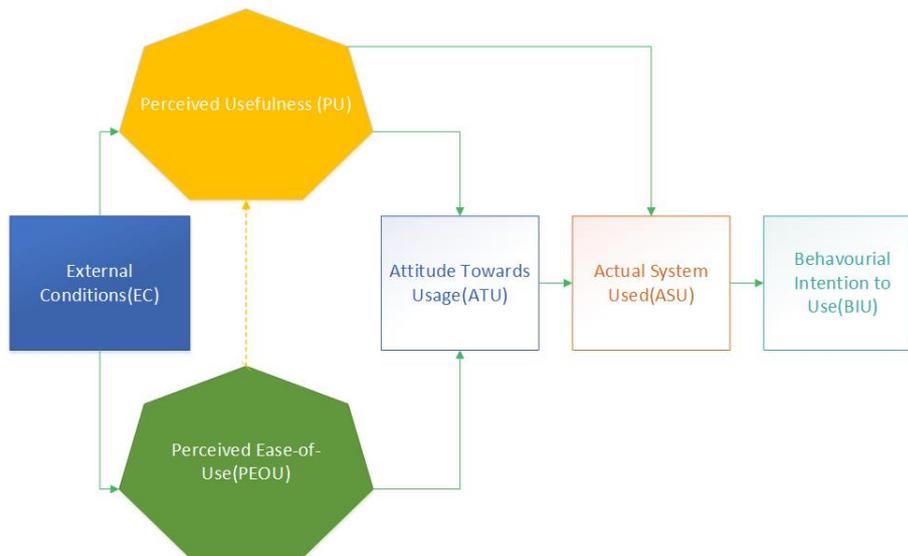


Figure 1.2: Research Framework: A Modified Technology Acceptance Model.

1.5 Aim and Objectives

The research aims at the strategic objective of addressing the issue of slow adoption of Cloud Computing by SMEs in Nigeria but organisations have to consider the cost implication, the benefits and risk associated with Cloud Computing before determining its adoption into its IT infrastructure strategy.

Within the above strategic boundary, the researcher's specific objectives are to:

1. To illuminate the concept of Cloud Computing adoption and further espouse the economic benefit accrue to embracing cloud technology and this objective will be implemented through a literature review, surveys and interviews;
2. To compare the issues or concerns associated with Cloud adoption against the its overall benefit. This objective will met by reviewing related documentation alongside interviewing IT professionals and industry associates;

3. To determine the various security measures developed against Cloud risk. This objective will be implemented by reviewing Cloud risk mitigation related articles and as well as the use and surveys;
4. To develop a model for creating awareness among SMEs and IT dependent enterprises in Nigeria to help their business executives make an informed decision about Cloud adoption, this important objective will be implemented following the analysis of the overall research findings.

1.6 Research Question

The research attempted to answer the following main question:

How can the slow trend of adoption of Cloud computing by SMEs in Nigeria be addressed and improved?

The following sub-questions are specifics that need further and more in-depth investigation, as it concerns the research statement:

RQ1. What are the economic benefits of migrating to the cloud?

Implementing cloud computing into the existing traditional system of an organisation is not all-comers affairs. It requires a complete review of the organisation's current IT system. More important is to implement and use it in such a way that provides economic benefits for the organisation compared with the existing mode of operation. In theory, it should offer a performance increase in the organisation which will in turn amount to monetary improvements. However, it is also important to take a look from the other perspective as cloud computing could also cause damage to an IT organisation if not properly implemented and managed. This takes us to the next sub-question.

RQ2. Are there associated risks when moving to the cloud?

The first sub-question focuses more on the economic importance of cloud computing whereas this question aims more at the possible issues that can occur with cloud computing. This implies that there are also arguments which can be against cloud computing in an organisation. It is important to know the risks associated with cloud computing in order to give a good conclusion about whether to use cloud computing or not. No technology is without risk, which gives rise to a new question to mind about security. It is important to compare the risks of cloud computing with the current situation of an organisation to see if it is really beneficial and also to determine the possible impact of these possible issues.

RQ3. Can the risks associated with cloud services be mitigated?

This question will show the possible risks associated with cloud and how the service providers respond to such scenarios. This would help an organisation determine whether this technology provides risk mitigation than their current systems.

RQ4. Do SMEs require cloud services?

Having considered all that is required to be considered, do the SMEs really need to migrate to the cloud? The answer to this question will be the hallmark of this research.

1.7 Scope of the Study

This research focused mainly on the specific Cloud End-users of cloud computing. Specific end-users are the SMEs sub-sector (Microfinance banks) which is expected to use a lot of IT services to gain business growth. Private users are not considered in this research. Even more specific, a select number microfinance banks will be interviewed. Cloud Service Providers are also in the scope of this research as they have to guarantee security of end-users' data. The focus lies on microfinance banks that are starting a business, expanding a business or temporarily could need extra IT services. The researcher expected that in these

cases, cloud computing is especially useful because it has financial benefits and it increases flexibility for smaller organisations.

Out of the study are the technical aspects of cloud computing as far as the researcher needed not to explain certain parts or “the black box” of cloud computing. They will be explained and briefly mentioned, however, this research did not touch such area, as it is not in the scope of this dissertation to research cloud computing itself. The focus lies on the adoption of cloud computing by SMEs.

1.8 Relevance of the Study

Although they have been an increasing number of exploratory studies about Cloud Computing in Nigeria, most of the research is centred on cloud adoption trend with no specific direction for a particular set of organisation. This study is directed at SMEs with a particular reference to microfinance subsector. The study will provide an in-depth insight into the concept of Cloud Computing. The overall benefit of this research lies on the premise that the result when put into use by SMEs and various IT dependent organisations in Nigeria, will help drive the business of such organisations while ensuring maximum return on investment. Metrics generated from this investigation will no doubt be self-evident to SME organisation in deciding to adopt Cloud Computing or stay on the sidelines.

1.9 Research Method and Design

1.9.1 Research Design

Chapter 3 describes the research design and specific methodology applied by this research to examine ways of improving the adoption of Cloud technology by SMEs in Nigeria. The purpose of this chapter is to describe the methodologies employed and their application. The chapter is presented in twelve main sections: Section 3.1 discusses the methodology to be used in the study and the rationale for that paradigm of choice; Section 3.2 explains qualitative research study, Section 3.3 – 3.5 discusses quantitative research method and outline the difference between qualitative and quantitative research method as well their respect strength and weakness, the design rationale and method selection including methodological assumptions. Section 3.6 explains the research instruments and the data collection process used; Section 3.7 talks about the research participants and Section 3.8 describes the sampling method; Section 3.9 discusses the research procedure and timeline;

Section 3.10 discuss data analysis method employed in the research and Section 3.11 discusses issues of validity and finally Section 3.12 discusses the ethical considerations applied during the research.

1.9.2 Methodology

The methodology that was used in this research was the qualitative approach because of the nature of the investigation made which requires asking questions.

1.9.3 Design Motivation

It is not ideal to place quantitative and qualitative paradigms against one another in a competing stance. Patton (1990) advocates a "paradigm of choices" that seeks "methodological appropriateness as the primary criterion for judging methodological quality." Some researchers are of the belief that qualitative and quantitative research can be effectively combined in the same research project (Strauss and Corbin, 1990; Patton, 1990).

The researcher wanted to conduct a research that will provide a more complete understanding while avoiding the complexities of collecting both quantitative and qualitative data, the researcher therefore conducted this research using the qualitative method research paradigm.

1.9.4 Research Questions Relation with Study Objective

Figure 1.3 explains how the research questions and objectives are connected. It equally explains how the research objectives are related to the research questions so as to allow for the achievement of the aims and guidelines for adoption of cloud computing into SMEs' operations.

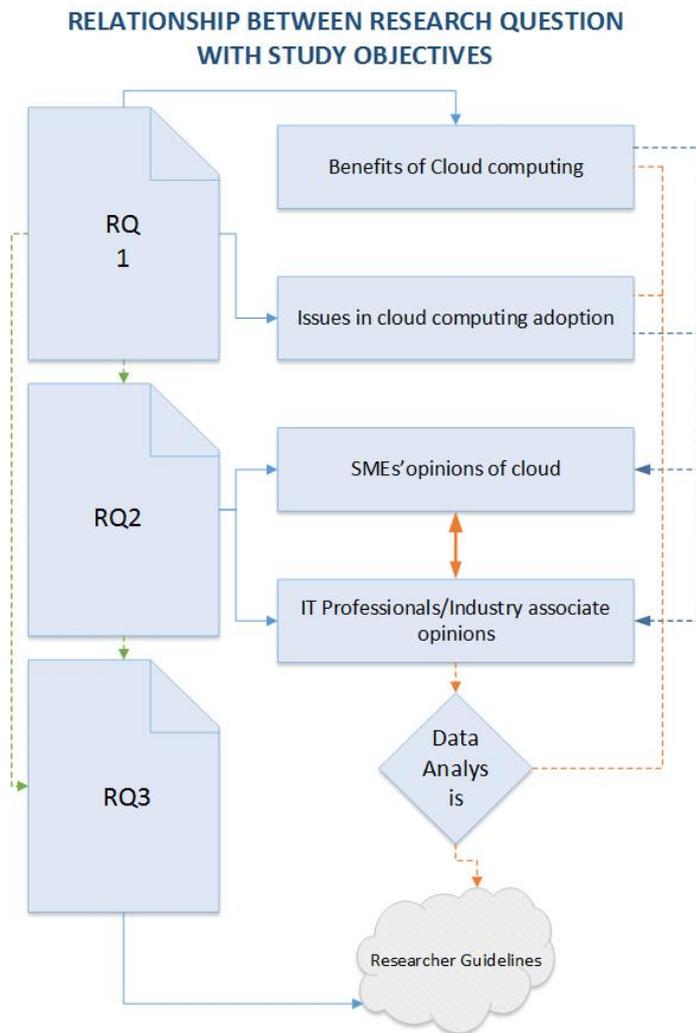


Figure 1. 3: Research questions relationship with study objectives

1.9.5 Method of Data Collection

To be able to conduct a research in a qualitative form it is essential to develop a structured question that meets the needs of the research. The author’s approach involves collecting data (interviewing the End-users).

1.9.5.1 Interview Method

The 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 this particular perspective” (King, 2004:11). The Researcher visited branches of microfinance banks within his locality and requested participation from the organisation’s designated representative. These representatives took part in a semi-structured interview which was conducted using

Skype and Google Hangout software depending on the ease of use by the participant. The interview was conducted by the researcher and the recorded session were replayed and transcribed. The interview questions were related to the factors of modified TAM framework as shown in Figure 1.2.

The interviews enable the researcher to obtain the participants' views about Cloud computing.

1.9.5.2 Research Population

Parahoo (1997:218) defines population as “the total number of units from which data can be collected”, such as individuals, artefacts, events or organisations. Burns and Grove (2003:213) describe population as all the elements that meet the criteria for inclusion in a study.

Burns and Grove (2003:234) define eligibility criteria as “a list of characteristics that are required for the membership in the target population”.

The important element that lends credence to a research study involves the validity of a data sample and sample selection (population).

The criteria for inclusion in this study were:

Cloud Service Providers (CSP)

All participants that are of theoretical interest to the study the Cloud End-Users (CEU) Professionals from associated industries which are considered key to the success of this research result.

The researcher considered only microfinance banks in this study. Because of budgetary constraint the researcher only restricted the study to Akwa Ibom State which is where the researcher resides. Only SMEs within this geographical location are considered in the study and to avoid the risk involved in travelling around to other parts of the country as a result of the insecurity currently experienced in some parts of Nigerian cities.

In addition to the aforementioned population sample, industry players from Computer Professional Registration Council (CPN) and Nigeria Computer Society (NCS) individually interviewed for peer review validation.

1.9.6 Sampling

Polit *et al* (2001:234) define a sample as “a proportion of a population”. A carefully selected sample can provide data representative of the population from which it is drawn. Our samples are the IT managers of these SMEs or their designated representatives.

1.9.7 Delimitation of the Investigation

A carefully select number of Cloud End-users (Micro-finance Banks) were studied. But those selected were proven to allow the author make generalization of the research result.

The delimitations of the study were the following:

- Research was limited to the Microfinance Subsector of SMEs in the Nigerian economy and it might be argued that micro business in other economic sector has different experiences with regard to Cloud adoption.
- Research was limited to microfinance institutions; therefore it might be argued that it does not apply to financial institutions not classified under SMEs by Central Bank of Nigeria.
- Research was limited geographically to Microfinance Banks located in Akwa Ibom State because of their proximity to where the researcher resides; therefore it might be contended that microfinances banks in others places may differ in their perceptions.

1.9.8 Ethical Measures

Research that has to do with people must be developed in such manner that Research Ethics are applied, particularly this includes the responsibility of the researcher to protect the

confidentiality of individual that participate in the study. This privacy protection had been extended to all classes of people involved in the study. This, the author did by designing the questionnaire and other data collection instrument in a way that the names of individuals were not indicated. This was also be clearly stated in our instrument to clear doubt.

1.9.8.1 Confidentiality

All data, whether collected electronically and otherwise, were handled in confidence in view of the sensitive nature of the information. The questionnaires used were developed by removing names and contact details of the respondent to ensure that no person can be identified by name.

1.9.8.2 Informed Consent

The research was conducted in such a way that any person who accepted our invitation to participate in responding to our questions does so voluntarily and gave their consent as well.

1.9.9 Dissertation Structure

The overall structure of this dissertation is outlined here as it would be seen in this research work with their respective contents.

An introduction to the study is discussed which includes a brief description of Cloud computing and the formulation of the research problem and sub-questions, the strategic objective and the significance of the research, the motivation for the study, the structure of the research and the research methods and design are all discussed here in chapter 1.

Chapter 2: LITERATURE REVIEW

Chapter 2 will entail a literature study on the concept of Cloud computing. The researcher will also study the SMEs in Nigeria's context and look at how the SMEs has impacted on the Nigerian economy.

Chapter 3: METHODOLOGY

In Chapter 3, a complete description of the methodology of this empirical study will be discussed. This will include the following: the aim of the investigation, the research design and method, the sampling population, data collection techniques and the method of data analysis including ethical issues

Chapter 4: METHOD OF DATA COLLECTION AND ANALYSIS

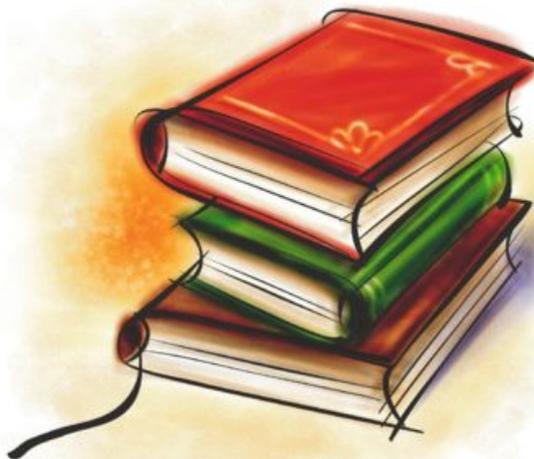
This chapter will contain the findings, discussion and analysis of the empirical research. The findings and discussion of the qualitative (interviews) studies will be dealt with in this chapter.

Chapter 5: EPILOGUE

This chapter will present the interpretation of the findings of both the literature and the empirical studies with regard to the sub-questions of the research. The Chapter will be ended up with a conclusion and recommendations will be provided specifically for Cloud Service Providers and End-user (SMEs) as well as for future research.

Chapter 2: LITERATURE REVIEW

“When I look back, I am so impressed again with the life-giving power of literature. If I were a young person today, trying to gain a sense of myself in the world, I would do that again by reading, just as I did when I was young.” — Maya Angelou, 2013



“I know nothing in the world that has as much power as a word. Sometimes I write one, and I look at it, until it begins to shine.” — Emily Dickinson, 1886

2.0 Introduction

A literature review is “a critical summary and assessment of the range of existing materials dealing with knowledge and understanding in a given field.... Its purpose is to locate the research project, to form its context or background, and to provide insights into previous work” (Blaxter *et al.*, 1998:110). Kurma (1996) argues that one of the essential initial responsibility of a researcher is to locate and review existing literature that pertains to a research topic. The purpose of this literature review is to integrate the researcher’s study into a broader framework of relevant theory and research.

This chapter will explore the concept of cloud computing and also look at SMEs in the context of Nigeria. It will be themed under the following headings:

- 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)

2.1 What is Cloud Computing?

As observed from some documentations, it appears that everyone in the cloud computing industry, from technology experts to cloud service providers, have their peculiar definition of cloud computing. It is discovered that there is not yet a generic definition for the term “Cloud Computing”

An examination of some existing definitions might help us to establish what cloud computing is all about (or what it might be involve).

The researcher has extrapolated six (6) definitions as quoted as below:

“Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services). Cloud computing is a disruptive technology that has the potential to enhance collaboration, agility, scaling, and availability, and provides the opportunities for cost reduction through optimized and efficient computing. The cloud model envisages a world where components can be rapidly orchestrated, provisioned, implemented and decommissioned, and scaled up or down to provide an on-demand utility-like model of allocation and consumption.” (Cloud Security Alliance v3 2011:12)

“Cloud computing is 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.” - Peter M & Timothy G., (2011:2) U.S. National Institute of Standards and Technology (NIST)

“A style of computing where massively scalable IT-enabled capabilities are delivered as a service to external customers using Internet technologies.” – (gartner.com 2009)

“A pool of abstracted, highly scalable, and managed compute infrastructure capable of hosting end-customer applications and billed by consumption” – (forrester.com 2011)

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 2.1

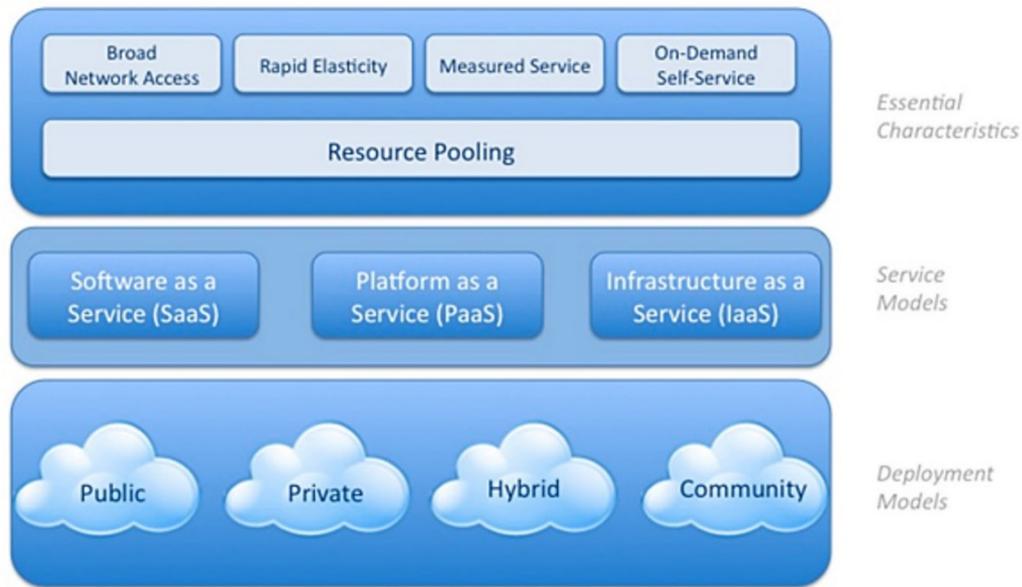


Figure 2.1: NIST Visual Model of Cloud Computing Definition (Cloud Security Alliance, 2011:15).

2.2 Essential Characteristics of Cloud Computing

The five (5) essential characteristics of cloud computing are explained as follows:

2.2.1 Service Based

A consumer can unilaterally provision computing capabilities such as server time and network storage as needed automatically, without requiring human interaction with a service provider. Consumer concerns are abstracted from provider concerns through service interfaces that are well-defined. The interfaces hide the implementation details and enable a completely automated response by the provider of the service to the consumer of the service. The service could be considered "ready to use" or "off the shelf" because the service is designed to serve the specific needs of a set of consumers, and the technologies are tailored to that need rather than the service being tailored to how the technology works. The articulation of the service feature is based on service levels and IT outcomes (availability, response time, performance versus price, and clear and predefined operational processes), rather than technology and its capabilities. In other words, what the service needs to do is more important than how the technologies are used to implement the solution (Cloud Security Alliance, 2011).

2.2.2 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. Many examples of Web technology exist as the foundation for Internet-based services. Google's Gmail, amazon.com's book buying, eBay auctions and Lolcats' picture sharing all exhibit the use of Internet and Web technologies and protocols (Cloud Security Alliance, 2011).

2.2.3 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).

2.2.4 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).

2.2.5 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).

It is important to recognize that cloud services are often but not always utilized in conjunction with, and enabled by, virtualization technologies. There is no requirement,

however, that ties the abstraction of resources to virtualisation technologies and in many offerings virtualization by hypervisor or operating system container is not utilized. Further, it should be noted that multi-tenancy is not called out as an essential cloud characteristic by NIST, but is often discussed as such in Fig 2.1 (Cloud Security Alliance, 2011:15).

2.3 Cloud Service Model



Figure 2.2: Cloud Service Model (Cloud Security Alliance, 2011:15).

2.3.1 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)

2.3.2 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)

2.3.3 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)

2.4 Cloud Deployment Model

2.4.1 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).

2.4.2 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).

2.4.3 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).

2.4.4 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).

2.4.5 Summary

It is important to note that there are derivative cloud deployment models emerging due to the maturation of market offerings and customer demand. An example of such is virtual private clouds — a way of utilizing public cloud infrastructure in a private or semi-private manner and interconnecting these resources to the internal resources of a consumers' datacenter, usually via virtual private network (VPN) connectivity. The architectural mindset used when designing solutions has clear implications on the future flexibility, security, and mobility of the resultant solution, as well as its collaborative capabilities. As a rule of thumb, perimeterised solutions are less effective than de-perimeterised solutions in each of the four areas. Careful consideration should also be given to the choice between proprietary and open solutions for similar reasons (Cloud Security Alliance, 2009:17).

2.5 Benefits of Cloud Computing

2.5.1 Drivers for Adoption and Economic Benefits 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 (Clouconomics, 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 (Clouconomics, 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 (Clouconomics, 2011:5). However, the benefits of cloud computing can be categorised under: Technical, User, Infrastructural, Companies and Environmental.

2.5.1.1 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). Applications in the cloud are so vital and these are available and reliable for all services. One of the cloud industry executives stated that —Any business leader worried about the security and reliability of their data in the cloud should remember that they’ve been trusting, saving, and storing their personal financial assets in an external, virtual banking cloud for years (Michael, 2010)

2.5.1.2 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.

2.5.1.3 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.

2.5.1.4 Environmental Benefits

It's Green: Cloud computing share the resources that is very good in the context of environment or going green as it reduce 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).

2.6 Limitations of Cloud Computing

Cloud computing technologies and business models have not yet reached maturity (Mardjan 2010:13).

It can be disclaimed that: all major cloud service providers (CSP) are still working on research and development to give customers the level of services and quality required for crucial business processes and the processes needed within CSP's and the IT technology used by CSP is growing towards a landscape of extreme complexity.

So what are the limitations of using cloud computing?

2.6.1 Security

No control over the business infrastructure. The major company assets are its data files with valuable customer information. Security, privacy and compliance are still difficult for cloud solutions mostly in a public cloud services. Physical location of hardware and software is not known. Audit and site inspection are very difficult. Availability in other words, constant connectivity is required. Risk of losing data due to improper backups or system failures in the cloud environment.

2.6.2 Cost and Flexibility

The technology innovation pace are dictated by CSP. Cost: Hidden cost. Non-transparent cost structure due to highly flexible usage of cloud services; Cost benefit is hard to obtain when using outsourcing for IT services in a traditional way (Hubert R. (2014).

2.6.3 Knowledge and Integration

More and deeper knowledge is required for implementing and managing SLA contracts with CSP's. Since all knowledge about the working of the cloud (e.g. hardware, software, virtualization, and deployment) is concentrated at the CSP, it is hard to get grip on the CSP. Integration: Integration with equipment hosted in other data centers is difficult to achieve e.g. access systems) and also (personal) USB devices or smart phones or groupware and email systems are difficult to integrate (JUCC, 2012).

2.6.4 Network

For the proper utilization of cloud computing application/services there is a need of high speed internet connection. Lack of speed and high bandwidth are the causes for not accessing the cloud services, so there are still a lot of questions regarding cloud computing. Similarly, network failures can result in a loss to the company by causing extensive time delays (Weiss, 2007). Constant Network access is possible in countries with advanced infrastructure, but this becomes a problem in most developing countries like Nigeria.

2.6.5 Data Segregation

As data of many users are stored in the same data center and same server or same hard disks it will raise the question from the users about the problem of mismatch i.e. How cloud securely isolate users and differentiate the memory and storage of each user as this failure could lead to leakage of information from one customer to another (Victor, 2010).

2.6.6 Dependency (Loss of data)

Privacy is one of the major issues in the cloud, as it needs a high degree of trust among the users and it is a fundamental human right not to break privilege granted by authority (Weiss, 2007). Users are always concerned about their data. To overcome this issue the provider should make sure that (John, 2010):

- Employees are aware of their responsibilities related to the confidentiality, integrity, availability of data and information systems.

- The confidential and/or personal client data, including system access credentials are protected (e.g. encrypted) from unauthorized interception.

2.6.7 Data Confidentiality and Auditability

This aspect concerns customers' worries that data kept in a public cloud are exposed to more attacks and could be intercepted by a third party to compromise data integrity in the absence of adequate security (Mather *et al.*, 2009). Similarly, auditability could be added as an additional layer providing facilities arguably more secure than those built into the applications themselves (Michael, 2009).

2.6.8 Latency

The inherent nature of cloud computing is accompanied by significant risk. Data becomes obscured in the cloud and may be hosted in multiple remote domains leading to questions about cloud security and compliance risks – risks that stand to delay the adoption of cloud services for anything beyond non mission critical applications and infrastructure. Latency represents another major issue. Concerns about intra-cloud often overshadow the performance and reliability of the overall application and content delivery chain from the cloud environment to the end user. It is this combined latency that can manifest itself as a simple echo on a VoIP call, or spell disaster for a Massive Multiplayer Online Game (MMOG) provider with thousands of users playing performance-sensitive games at any given time (Latency: The Achilles Hell of Cloud Computing).

2.6.9 Lack of Operation Control

Because in cloud, the IT infrastructure are built and managed by the service provider, organisations fear that they will have no control over their business since this hardware the hardware and software are located the provider's end. This fear is a great limitation to cloud computing adoption.

2.7 Service Level Agreements

A Service Level Agreement (SLA) is in general a legal binding agreement in the mutual understanding and acceptance about a service between a client who is buying the service and a Service Provider (SP). It is the serious issue to consider as it records a common understanding about services, priorities, responsibilities, guarantees, and warranties between

the cloud provider and the costumers. Failure to follow the agreement is usually followed by huge penalty, which should also be mentioned in the agreement (David, 2009; Weiss, 2007). According to SLA information zone (SLA-zone, 2009), a regular SLA usually includes:

- **Performance-** Performance of the system is measured by monitoring and measuring the services, which was offered whether it is as per the contract or not.
- **Problem management-** It explained how the unplanned or unexpected incidents can occur and how to solve and prevent the future occurrence of such events.
- **Customer duties** - It explains relationship the customer and provider has and also the responsibilities that the customer has to follow and bear in the service delivery process.
- **Warrant & remedies** - It covers topics such as service quality, third party claims and exclusions.
- **Security** - It is the most critical feature of any SLA where it is defined of which security approaches must be followed and respected.
- **Disaster recovery** - It is usually included in the security section and sometimes also in the problem management area.
- **Termination** – Termination at the end of the initial term after the contract period expires or if either the customer or provider violates the contract or not satisfied with the performance. Creating a good SLA is not a trivial task, but a task that is of utter importance when buying and providing services and also errors in SLAs could enforce legal penalties.
- **Service delivered** - It describes the services, how they are delivered and the possible or unexpected disturbance within the time frame or system. This information should be very detailed and accurate so all parties will get the information about what exactly is going to be delivered.

The dynamic nature of the cloud necessitates continuous monitoring of attributes to enforce SLAs. Consumers might not completely trust measurements provided solely by a service provider, which might require agreed-upon third-party mediators to measure the SLA's critical service parameters and report violations (Takabi *et al.*, 2010: 25).

2.8 Cloud Security

According to Pradnyesh Rane in his article published online in infosectoday.com, “over the past decade, computers have become widespread within enterprises, while IT services and computing has become a commodity. Enterprises today view data and business processes (transactions, records, pricing information, etc.) themselves as strategic and guard them with access control and compliance policies. However, in the SaaS model, enterprise data is stored at the SaaS provider’s data center, along with the data of other enterprises. Moreover, if the SaaS provider is leveraging a public cloud computing service, the enterprise data might be stored along with the data of other unrelated SaaS applications. The cloud provider might, additionally, replicate the data at multiple locations across countries for the purposes of maintaining high availability”.

Most enterprises are familiar with the traditional on-premise model, where the data continues to reside within the enterprise boundary, subject to their policies. Consequently, there is a great deal of discomfort with the lack of control and knowledge of how their data is stored and secured in the SaaS model. There are strong concerns about data breaches, application vulnerabilities and availability that can lead to financial and legal liabilities (Subashini & Kavistha: 2010:4).

Gartner 2008 identified seven security issues that need to be addressed before enterprises consider switching to the cloud computing model.

- 1. Privileged user access.** Sensitive data processed outside the enterprise brings with it an inherent level of risk, because outsourced services bypass the “physical, logical and personnel controls” IT shops exert over in-house programs. Get as much information as you can about the people who manage your data. “Ask providers to supply specific information on the hiring and oversight of privileged administrators, and the controls over their access,” Gartner says.
- 2. Regulatory compliance.** Customers are ultimately responsible for the security and integrity of their own data, even when it is held by a service provider. Traditional service providers are subjected to external audits and security certifications. Cloud

computing providers who refuse to undergo this scrutiny are “signalling that customers can only use them for the most trivial functions,” according to Gartner.

- 3. Data location.** When you use the cloud, you probably won’t know exactly where your data is hosted. In fact, you might not even know what country it will be stored in. Ask providers if they will commit to storing and processing data in specific jurisdictions, and whether they will make a contractual commitment to obey local privacy requirements on behalf of their customers, Gartner advises.
- 4. Data segregation.** Data in the cloud is typically in a shared environment alongside data from other customers. Encryption is effective, but isn’t a cure-all. “Find out what is done to segregate data at rest,” Gartner advises. The cloud provider should provide evidence that encryption schemes were designed and tested by experienced specialists. “Encryption accidents can make data totally unusable, and even normal encryption can complicate availability,” Gartner says.
- 5. Recovery.** Even if you don’t know where your data is, a cloud provider should tell you what will happen to your data and service in case of a disaster. “Any offering that does not replicate the data and application infrastructure across multiple sites is vulnerable to a total failure,” Gartner says. Ask your provider if it has “the ability to do a complete restoration, and how long it will take.”
- 6. Investigative support.** Investigating inappropriate or illegal activity may be impossible in cloud computing, Gartner warns. “Cloud services are especially difficult to investigate, because logging and data for multiple customers may be co-located and may also be spread across an ever-changing set of hosts and data centers. If you cannot get a contractual commitment to support specific forms of investigation, along with evidence that the vendor has already successfully supported such activities, then your only safe assumption is that investigation and discovery requests will be impossible.”
- 7. Long-term viability.** Ideally, your cloud computing provider will never go broke or get acquired and swallowed up by a larger company. But you must be sure your data will remain available even after such an event. “Ask potential providers how you would get your data back and if it would be in a format that you could import into a replacement application,” Gartner says.

2.9 Cloud Risk (threats) and remediation

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 2.1 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.	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> 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	<p>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.</p>	<ul style="list-style-type: none"> ▪ 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	<p>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.</p> <p>Loss of core intellectual property could have competitive and financial implications. Worse still, depending upon the data that is lost or leaked, there might be compliance violations and legal ramifications.</p>	<ul style="list-style-type: none"> ▪ 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 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	<p>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)</p>	<ul style="list-style-type: none"> ▪ 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

		resulting from a breach.	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.	<ul style="list-style-type: none"> ▪ 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 2.1: Top Threats to Cloud (CSA 2010); adapted from CSA

2.10 Insight into Cloud Service Providers

“Switching to the cloud is a significant undertaking with major implications across the organisation. Cloud vendors (Service Providers) play a vital role in helping customers present a compelling commercial argument for cloud, and also in the whole migration and implementation process, as the cloud is not a simple off-the-shelf solution that can be easily bolted on”- Tom Lamoureux (KMPG Survey: 5)

KPMG Survey (2013) as part of their ongoing series of studies into Cloud adoption patterns, studied how Cloud Providers around the world are responding to rapid change to build a strong and compelling argument for their customers to migrate to the cloud and to increase the understanding of the current Cloud market.

The purpose of the research was to gain an insight into how Cloud Service Providers are addressing the following areas:

- Cloud adoption patterns
- Perceived barriers to customer adoption
- The customer's decision-making process
- Service level agreements (SLAs)

- Cloud deployment ecosystem

2.10.1 Adoption Pattern

Cloud Service Providers expect their share of revenues from cloud services to almost double within the next 2 years from 27 percent to 50 percent, as users migrate. The pace of cloud adoption shows no sign of slowing down, as more and more functions and areas move onto the cloud.

2.10.2 Perceived Barriers to Customers Adoption

The Executives involved in the survey say their customers' single biggest reason for using cloud services is to reduce costs, followed by speed to adoption and business process transformation. Consequently, Providers feel their top challenge is to demonstrate clear evidence of cost savings, along the development of usage-driven pricing and the creation of a realistic business case for the switch to cloud. Some of the respondents feel that loss of control is their customer's biggest concern, with additional worries over data security and the integration of cloud with existing architecture. Indeed, 42 percent expect the migration to cloud will lead to a downsizing of the entire IT function.

2.10.3 Customers Decision-Making Process

Fewer than half of the respondents believe that customers are well-informed about cloud computing, the cost of migration and subsequent data security. Fifty-three percent of respondents claim that cloud-based sales are initially driven by non-IT executives. However, the Chief Information Officer (CIO) and the Chief Technology Officer (CTO) have the greatest influence upon cloud purchase decisions, as they help the business understand the implications of service level agreements (SLAs) and the costs and implications of migration. Forty percent feel that IT's level of influence and control over technology decisions is decreasing due to cloud, as some functions may choose to migrate independently of IT.

2.10.4 Service Level Agreements

Data security and system availability are the two most important SLA parameters today, while data security will remain the number one issue in 3 years' time. Half of the providers are changing their licensing model to reflect the move away from traditional IT solutions. As cloud adoption increases, customers are seeking greater reassurance over cost-effectiveness

and security, leading to more tightly defined SLAs and a subsequent shift in the licensing model.

2.10.5 Cloud Deployment Ecosystem

As core systems and critical infrastructure move onto the cloud, 61 percent of respondents feel that customers will rely on a third party for technology implementation, business process transformation, information security assistance and strategy, which reflects the huge and multi-functional impact of cloud. In order to provide more strategic services and consulting to business users – and to service global customers – 48 percent of providers say they will form a partnership, and a similar proportion plan to expand capabilities or acquire a complementary provider.

2.11 CSP 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.

2.12 Cloud Prospect

According to KPMG survey, organisations are most likely to consider using cloud when they face major technology upgrades, or alternatively, when they're undergoing some form of business transformation. The survey shows that the prime attraction is to cut the cost of IT, but it can bring much more: 59 percent of providers say cloud is driving innovations in customers' products and services, while 54 percent feel cloud is driving innovation in processes.

The agility of cloud enables businesses to get products to market faster by joining up the different parts of the development chain. Sectors such as healthcare and financial services can connect customers and influencers within the business, to assess market needs and quickly translate this into new ideas and ultimately new products and services.

Without the need to invest in infrastructure such as servers and data centers, companies can move faster and take more risks. Setting up a new division overseas, or entering into a new product area is faster and cheaper when the IT backbone already exists on the cloud.

2.13 Cloud Adoption

Cloud Computing allows the use of information technology based on the on-demand utility. This technology can provide benefits to small and medium enterprises with limited capital, human resources, and access to marketing network (Surendro; Fardani, 2012:1).

The rapid growth of cloud shows no sign of abating. Estimates by Gartner suggest the worldwide market will exceed US\$109 billion in 2012,⁵ while a separate forecast by IDC predicts global spending on public cloud services alone will approach US\$100 billion in 2016⁶

In this study, the researcher narrowed SMEs adoption assessment to only the microfinance banks subsector. Microfinance banks were chosen because they seem to need more of IT services than any other small business segment in the SMEs' categories of enterprises. The study will reveal the pattern of adoption.

2.14 SMES in Nigeria

2.14.1 What is SMEs?

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 absorb. 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.

⁵ Gartner, *a survey on cloud adoption trend.*

⁶ IDC survey on Cloud

One crucial thing to observe about SMEs definition is that certain criteria have been used to define what SMEs stands for, most especially according to countries, sizes and sectors. Conrad and Darren (2009) explains that the main reason why SME definition varies particularly from industry to industry; county to country; size to size and number of employee to number of employee is to reflect industry, country, size and employment differences accurately. Baumbach (1983) defined SME in terms of employment, asset value and dollar sales. According to Jasra, Khan, Hunjra, Rehman and Azam (2011), Small and Medium Seized Enterprise (SMEs) represent a business and not a public limited company. They are businesses having not less than 250 workers in the case of manufacturing and service industries including trading businesses, and they should be able to meet any of the following conditions: 1. A trading / service concern having total assets at cost in which land and building up to Rs 50 million is not included. 2. A manufacturing unit having of total assets at cost up to Rs 100 million without land and building. 3. Any concern of service, trading or manufacturing with net sales less than Rs 300 million as per current financial statements.

The points highlighted above bear witness and demonstrate that the common criteria for defining SMEs include: employment, number of employees, size, industry, country, asset value etc. This is consistent with the findings of Darren *et al.*, (2009). They contended that the most valid measures for defining SME are number of employees and size.

Generally, SME sector is categorised into three: micro, small and medium enterprises or businesses. The micro SMEs are the smallest among the three categories. According to Darren *et al.*, (2009), they are the businesses that employ up to 9 employees in the UK while in Australia; they employ fewer than 5 employees including non-employing businesses. U.S. Census Bureau which tends to categorize business micro business as “SOHO (meaning small office- home office), non-employer business and non-employee business (including business less than 5 employees). Therefore, micro-business should be seen as the small type form of SME that may employ fewer than 9 employees or on the other hand may not have employees at all. The small businesses are business bigger than the micro-businesses in terms of size, number of employees, structure, capital investment and economic contributions.

With regard to small businesses, several definitions of small businesses have been advanced over the years. Alarape (2008) defines it as “an enterprise with a labour size of 11-100 employees or a total cost of not less than N50 million, including working capital but excluding cost of land”. The Nigerian industrial policy defined SMEs as industries with total investment of between N100, 000 and N2 million, exclusive of land but including working capital. One of the most popular definitions of SMEs is given by the American Small Business Administration (SBA) as that business or firm which is independently owned and operated; it is not dominant in its field and meets the criteria for the SME business administration sponsored loans programme (Arowomole, 2000).

The medium businesses as the name suggests are bigger than both micro and small businesses in terms of operations, manpower capacity or number of employees, structure, capital investment and size. According to Darren *et al.* (2009), they are the businesses that employ up to 249 employees in UK, in European Union, they employ up to 250 employees, in Australia, they employ up to 200 employees while in U.S.A, they accommodate up to 500 employees.

In Nigeria, much of the definitions on SMEs are concentrated on small firms leaving a gap in the definition of medium enterprises. Table 2.1 **below** demonstrates some of the definitions of small enterprises in Nigeria.

Authors	Definitions
Ogundele (2007)	<i>Minimum of 5 employees with minimum capital outlay of not less than N5000.00 (\$33).</i>
Osuagwu (2001)	<i>Less than 50 but not greeter than employees in any situation with not less than N150, 000(\$1000.00).</i>
Arowomole (2000) Central Bank of Nigeria (CBN, 1991)	<i>Capital investment not exceeding N5 million (\$33,333) excluding working capital with a turnover not more than N25 million (166,666) annually.</i>
Administrative Staff Cost of Land of Nigeria (ASCON)	<i>Whose total cost is not more than N750, 000.00 (\$5000. 00) Including the total cost of land.</i>
Obafemi Awolowo	<i>Whose total assets in capital equipment, plant and working capital are</i>

University	<i>less than N250, 000.00 (1666.00) with fewer than 50 full time employees.</i>
Nigeria Industrial Policy	<i>Those with total investment of between N100, 000.00 (\$666) and N2 million (\$13333. 00) Excluding land, but inclusive of working capital</i>

Table 2.2: Small Business Definitions in Nigeria adapted from Lucky E and Olusegun (2012)

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 (Abubakar *et al.*, 2014:1).

2.14.2 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 (SSICs), 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

The review and appraisal of some of these government initiatives and incentives are outlined as follows (Sanusi; 2003):

- **Central bank of Nigeria (CBN)**

The Central Bank of Nigeria has since its inception been instrumental to the promotion and development of Small and Medium Scale Enterprises. The CBN credit guidelines required that banks allocate a specified minimum percentage share of credit to important sectors including the SMEs at preferential interest rates. For instance, in 1979/80 the CBN directed that at least 10 per cent of the loans advanced granted to indigenous borrowers be allocated to the sector. This was subsequently raised to 16 and 20 per cent in April 1988 and 1990, respectively. Loans and advances to the SMEs as a percentage of total loans rose from 1.8 percent in 1980 to 9.3, 22.9, 40.0, 26.8, 6.6 and 8.6 per cent in 1986, 1990, 1992, 1996, 2001 and 2002, respectively. However, given the risks attendant to such loan and the high cost of its administration, banks preferred to pay prescribed penalties for non-compliance rather than give credit to the SMEs. The CBN reacted by transferring the shortfall taken from defaulting banks to NBCI for on-lending to the SMEs. This brought about a remarkable improved performance in compliance with bank lending to the SMEs. Because of the inherent weaknesses and inefficiency of direct credit control by the CBN, this practice was discontinued and replaced by a system of market mechanism, supported by moral suasion (Sanusi; 2003:5):

- **State Government**

Most State Governments, through their Ministries of Commerce and Industries as well as the state owned Finance and Investment Companies, provided technical and financial assistance to SMEs (Sanusi; 2003:7).

- **International Financial Assistance**

Governments have continued to approach international financial agencies such as the World Bank and its affiliates, United Nations Agencies and the African Development Bank (ADB) to source capital for the SMEs. The Federal Government often guarantees and agrees to monitor or co-finance the SMEs receiving such external financial support. For example, in 1988, the African Development Bank granted an export stimulation loan of US\$252 million repayable in 20 years with a concessionary interest rate of 7.3 per cent for SMEs in Nigeria (Sanusi; 2003:8).

2.15 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. In Nigeria – SMEs are the backbone of the economy. 97% of all businesses in Nigeria employ less than 100 employees (Federal Office of Statistics).

Taking a look at our previous definition of SMEs, it means that 97% of all businesses in Nigeria are “small businesses”. The SME sector provides, on average, 50% of Nigeria’s employment, and 50% of its industrial output (Muritala *et al.*, 2012).

In many of the developing economies, the private economy almost entirely comprises SMEs. In many cases, they are the only feasible employment opportunity for communities.

2.16 Summary and Conclusion

This chapter review has established the theory behind cloud computing and also have explained the various underlying concepts. The economic values of cloud computing to small business organisations are realised and key issues surrounding the deployment of cloud technology have been noted and various security mechanism put in place to cushion the effect of these issues where need arises have been outlined. The researcher has been able to establish that there are a lot of potential opportunities of business growth if appropriate selection of the technology is applied. The researcher contextually looked at the Small and Medium business organisations in Nigeria with particular reference to Microfinance banks. Government have actually given the SMEs sector a boost in the form of grants and favourable polices but appropriate technology selection seems lacking. On the whole, the future holds bright for the SMEs with cloud playing a critical role in changing the traditional ways of business operation. The adoption of Cloud technology will certainly transform the sector.

Chapter 3: RESEARCH DESIGN & METHODOLOGY

“It is the right time to start the journey to creative and innovative software ecosystem - even if the outcome can't compete with the likes of Google, Amazon and Microsoft. But, we need to know that we need a Nigeria cloud services &

application for Nigerians that are also developed by Nigerians”

- Tosin Akinwande, 2012



"Software Nigeria is software made by Nigerians for Nigeria without exchange of foreign currencies". Oracle of Nigeria 's Information Technology” - Dr Chris Uwaje, 2013

3.0 Introduction

This chapter describes in specific terms the research process that was applied in this research to examine ways of improving the adoption of cloud technology by SMEs in Nigeria. The purpose of this chapter is to explain the methodologies employed and their application. The overall aim of this study is:

- To investigate the cause of slow rate of adoption of cloud computing by SMEs in Nigeria;

- To illuminating the concept of cloud computing adoption and further espouse the benefit of embracing cloud technology and;
- To develop a model for creating awareness among SMEs and IT dependent enterprises most especially Microfinance Banks in Nigeria to help their managers make informed decision about cloud adoption.

This chapter contains seven sections. Section 3.1 explains the methodology used in this study and rationale for the paradigm of choice. Section 3.2 deals with the qualitative while quantitative research is dealt with on section 3.3. Section 3.4 outlines the differences that exist between qualitative and quantitative research and section 3.5 defines the strength and both research types. 3.6 lists the data collection instruments used and justifies their use; section 3.7 discusses and section 3.8 explains the sample. Section 3.9 outlines the procedure used and the timeline for the completion of each stage of the study. Section 3.10 discusses how data was analysed; section 3.11 explains the measures adopted to ensure reliability and validity of the research result; finally section 3.12 discusses the ethical issues considered in this research and the study limitations.

3.1 Methodology

The term methodology refers to the overall approaches and perspectives to the research process as a whole and is concerned with the following main issues (Collis & Hussey, 2003:55):

- **Why** you collected certain data?
- **What** data you collected?
- **Where** you collected it?
- **How** you collected it?
- **How** you analysed it?

On the other hand, a research method refers only to the various specific tools or ways data can be collected and analysed, for example, a questionnaire; interview checklist; data analysis software etc. The goal of the research process is to produce new knowledge or deepen understanding of a topic or issue.

Since the research subject has already been established and research questions identified, now the research design and the methods are to be matched to the problem statement and the research questions, in other words, research strategy. A research strategy is a step-by-step

approach or a scientific method that helps in answering the research questions. The researcher first observed the overall presentation of the strategy, with the research methods, the data collection analysis instruments, investigating tools, ethics and so on. As mentioned, the author identified the type of research in context, and chose the right research strategy. In this study, the researcher conducted a qualitative study via the use of interview for an in depth investigation into the findings. The themes from the qualitative investigation will broaden the findings. Emphasis will be on the *How* to improve the adoption rate of cloud computing among SMEs operators in Nigeria

To enable the researcher arrive at a suitable research method to use, the researcher needed to understand the two major types of research method, the qualitative and quantitative research.

3.2 Qualitative Research

A type of educational research in which the researcher relies on the views of participants; asks broad, general questions; collects data consisting largely of words (or text) from participants; describes and analyses these words for themes; and conducts the inquiry in a subjective, biased manner (Creswell 2012).

- Constructivism – multiple realities; biased; inductive

3.2.1 Qualitative Methodology

- Generally involves listening to the participants' voice and subjecting the data to analytic induction (e.g., finding common themes)
- More Exploratory in nature
- Examples of data collection methods are interviews, open ended questionnaire, focus group and observation

3.3 Quantitative Research

A type of educational research in which the researcher decides what to study; asks specific, narrow questions, collects quantifiable data from participants (a large number of participants); analyzes these numbers using statistics; and conducts the inquiry in an unbiased, objective manner (Creswell 2012).

- Postpositivism –singular reality; objective; deductive
- Generally attempts to quantify variables of interest; questions must be measurable.

3.3.1 Quantitative Methodology

- Generally attempts to quantify variables of interest; questions must be measurable.
- Generally involves collecting numerical data that can be subjected to statistical analysis
- Examples of data collection methodologies are, questionnaires (with closed-ended questions or open-ended but transferred to quadata), content analysis
- The data is generally referred to as “hard” data

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).

3.3.2 Design Rationale

It is not necessary to pit quantitative and qualitative paradigms against one another in a competing stance. Patton (1990:39) advocates a "paradigm of choices" that seeks "methodological appropriateness as the primary criterion for judging methodological quality." This will allow for a "situational responsiveness" that strict adherence to one paradigm or another will not. Furthermore, some researchers believe that qualitative and quantitative research can be effectively combined in the same research project (Strauss and Corbin, 1990; Patton, 1990).

For example, Russek and Weinberg (1993) claim that by using both quantitative and qualitative data, their study of technology-based materials for the elementary classroom gave insights that neither type of analysis could provide alone.

According to McMillan and Schumacher (2010:67), a research study can be both quantitative and qualitative. In such situation, the study starts with a general problem that provides context and background. In this study therefore the general problem is: "What is the causes of slow adoption of cloud computing by SMEs in Nigeria?" In the researcher's opinion more specific problems also need to be investigated regarding this problem namely:

- What is the economic benefit in using cloud computing?
- Are there risk associated with using cloud computing?
- Can the associated of risk of cloud computing be controlled?
- Do SMEs really have need for cloud computing?

To effectively and comprehensively answer the above questions, asking specific questions will be appropriate and qualitative research design methods fits in this context.

3.3.3 Method Selection

According to Lekwall and Wahlbin (2001), the method is a tool to generate solutions to problems and to derive new knowledge. As Marshall & Rossman present three conditions to choose any strategy either experiment, survey, archival analysis, history or case studies, the author have followed those three conditions i.e. a) the type of research questions posed, b) the extent of control an investigator has on actual behavioural events and c) degree of focus on contemporary events to choose a strategy (Marshall & Rossman 1989).

The nature of the research question was considered first to enable the researcher arrive at the kind of study to embark upon. A research question could be identified with purposes namely: explanatory, descriptive or exploratory (Marshall and Rossman, 1989:3). As Marshall, Rossman and Yin mentioned in their respective book, the "what" questions lead to exploratory studies and "how" and "why" questions calls for an explanatory studies (Marshall & Rossman, 1989:3-6). The question was find to answers to what could possibly be the reason for the slow adoption of Cloud technology by SMEs in Nigeria and how can we improve its adoption, so the study we will pursue an exploratory case study (Marshall & Rossman, 1989:6).

It was therefore established that a qualitative methods design will be deployed for the purpose of this study.

3.3.4 Methodological Assumptions

It was assumed that:

- The question will be responded to the CEO, or by a knowledgeable delegated person or the IT Manager, due to the fact that some questions will be based on value judgements by the CEO or IT Manager; answers by the wrong person might generate wrong answers affecting the outcome of the interview.
- Pressure in any way will not be placed on respondents to during the interview session; due to the sensitivity of issues surrounding customer's perspective about business organisation in Nigeria, the risk exists that respondents may be instructed by the organisation to answer the question to enhance the way in which their enterprise is evaluated or even causing a non-positive evaluation.
- The answers would be given truthfully; non-truthful answers might create a halo effect (Isham *et al.*, 1995). This may have a negative impact on the survey results as it might increase the chances of a positive impression even when it might not be true.

3.4 Research Instruments

3.4.1 Data Collection technique

According to McMillan and Schumacher (2010:187), Table 3.1 represent various collection technique can be used for data gathering for qualitative and study:

QUALITATIVE STUDY
Observation
Document and artefact collection
Field observations and supplementary techniques
In-depth interviews

Table 3.1: - Data Collection technique (McMillan, Schumacher 2010:187).

In this study, interviews were used in gathering data.

The following are the strength and weakness of the interviews as enumerated by McMillan and Schumacher (2010:187):

Strengths and weaknesses interview as a data-gathering technique

INTERVIEWS	
STRENGTH	WEAKNESSES
<ul style="list-style-type: none"> • Flexible • Adaptable • Ability to probe and clarify • Can include nonverbal behaviour • High response rate • Used with non-readers 	<ul style="list-style-type: none"> • Costly • Time-consuming • Interviewer bias • Not anonymous • Subject effects • Effect of interviewer characteristics • Requires training • Leading questions

Table 3.2: Strengths and weaknesses interview as a data-gathering technique (McMillan, Schumacher 2010:187).

3.4.2 Qualitative - Interview

A phenomenological qualitative study will be used in form of in-depth, semi-structured interviews. In semi-structured interview, the general direction is decided on in advance, but as the interview proceeds, the questioning is guided by the content of the respondent's answers (Dyer 2006:31-33).

The 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 this particular perspective” (King 2004:11). Nestor and Schutt (2012:358) averred that qualitative

interviewing relies on open-ended questions in which the interviewer allows the content and order of questions to vary from one interviewee to another. Interviewees are expected to respond to asked questions according to their perception and understanding. To achieve this, the interviews made room for organisation representatives to give their own input. A semi-structured interview was conducted with select number of IT professionals and industry players as well as microfinance associates using any of Google Hangout and Skype software. A sample of the interview question is attached as Appendix C

3.5 Participants

Parahoo (1997:218) defines population as “the total number of units from which data can be collected”, such as individuals, events or organisations. Burns and Grove (2003: 213) describe population as all the elements that meet the criteria for inclusion in a study. Burns and Grove (2003: 234) define eligibility criteria as “a list of characteristics that are required for the membership in the target population”. The important element that lends credence to a research study involves the validity of a data sample and sample selection (population).

The criteria for inclusion in this study are therefore:

- Cloud End-Users(CEU) or Consumers
- Professionals from associated industries which are considered key to the success of this research result.

Only SMEs within this geographical location were considered in the study and to avoid the risk involved in travelling around to other parts of the country as a result of the insecurity currently experienced in some parts of Nigerian cities.

3.6 Sample Size

Polit *et al.* (2001: 234) define a sample as “a proportion of a population”. A carefully selected sample can provide data representative of the population from which it is drawn. Samples from the primary source of data for this study were 7 carefully selected representatives. Five were representative of the SMEs and two were industry associates. In that order, the researcher had selected the under listed participants to take part in this research:

3.6.1 Cloud End-users (SMEs) - Microfinance banks

The following are the CEUs:

- University of Uyo Microfinance Bank
- Palmgrove Microfinance, Uyo, Akwa Ibom State
- Trans-Atlantic Microfinance Bank, Uyo Akwa Ibom State
- Gafunk Microfinance Bank, Uyo, Akwa Ibom State
- Prospect Microfinance Bank, Uyo, Akwa Ibom State

3.6.2 IT Professionals and Industry Associates

The following members were interviewed:

- Members of CPN
- Members of NCS

3.7 Research Procedure

This section describes the process involved in identifying and developing a topic for the research investigation. Having been suggested by the researcher's supervisor that several sources be consulted for potential ideas with respect to the research interest in question and a study to have a substantive worth to the understanding of the reader, a sequence of steps involved in the research has to be clearly defined and explained. Figure 3.1 below is the procedure used in the research.

Schematics of the Research Procedure

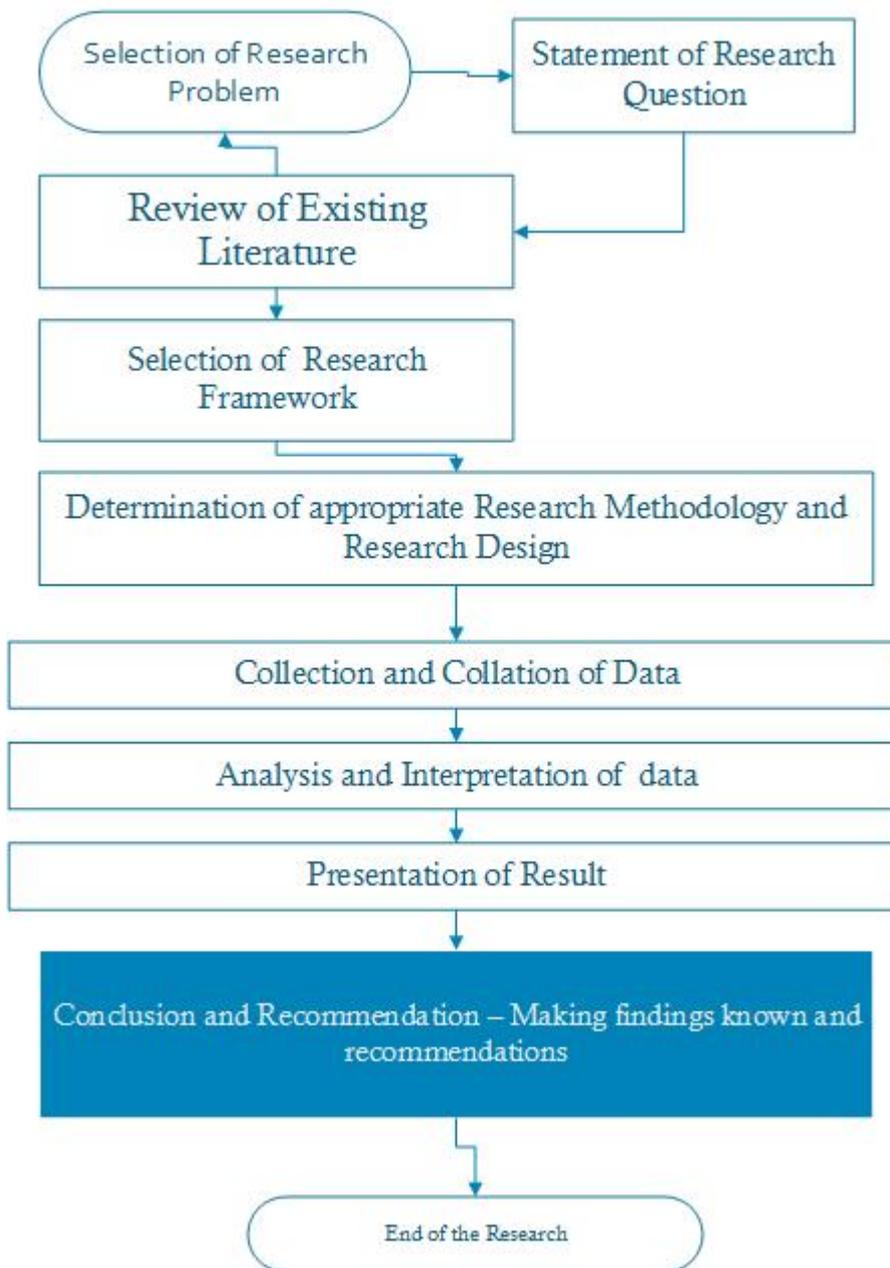


Figure 3. 1: Research Procedure

3.8 Data Analysis

The process of making data manageable for analysis and actually developing an analysis are two distinct activities, however the two sets of activities may become blurred in practice (Mason 2002). In qualitative studies research design, data collection and analysis are

simultaneous and continuous processes (Bryman & Burgess, 1994). There is a need to create clear links between theory and data collection and between data analysis and theory with the researcher dealing with method and theory concurrently rather than sequentially, that is, data collection and analysis is an iterative process (Hartley 2004). A danger inherent in this is that premature conclusions may be drawn, with the researcher having been unduly influenced by unusual or interesting data (Eisenhardt 1989). In order to guard against the above, the researcher employed techniques advised by Hartley (2004) that is, careful description of the data and development of categories in which to place behaviours, followed by examination to see how they fit or fail to fit these categories, being mindful that categories may need refining or events need to be interpreted differently.

In this research, there are several logical steps that can be distinguished. It first of all starts off with the collection of literature study material in the area of Cloud Computing not older than five years, a related study of SMEs within the context of Nigeria was done. Thereafter, a topic for this research was developed giving way for a frame of question arising from the preliminary study and the need to seek answers or solution to the evolving question. The literature study for both the Cloud Computing and the SMEs gave a general perspective of the thesis topic.

The author discovered that to obtain the best result in this investigation, questions need to be asked from the SMEs operators to enable a case to be established and compared with theory in order to analyse the cases and authoritatively say something useful about them. The data was collected via the interview with carefully structured questions from select IT professionals and industry players. The research data was the transcript of the interview, inductive data analysis was employed since important categories, patterns and relationships will be identified through a process of discovery (Nestor & Schutt 2012:372). The analysis was run concurrently as the data is being collected. The following qualitative data analysis steps were extracted from The Pell Institute and Pathway to College Network⁷ and was applied in this research:

STEP 1: Process and Record Data Immediately

⁷ <http://toolkit.pellinstitute.org/evaluation-guide/analyze/analyze-qualitative-data/>

As soon as data is collected it is critical that you immediately process the information and record detailed notes.

These notes could include:

- Things that stuck out to you
- Time/date details
- Other observations
- Highlights from the interaction

It is important to do this while the interaction is still fresh in your mind so that you can record your thoughts and reactions as accurately as possible.

It is helpful to make a reflection sheet template that you carry with you and complete after each interaction so that it is standardized across all data collection points.

STEP 2: Begin Analysing as Data is Being Collected

Qualitative data analysis should begin as soon as you begin collecting the first piece of information.

The moment the first pieces of data are collected you should begin reviewing the data and mentally processing it for themes or patterns that were exhibited. It is important to do this early so that you will be focused on these patterns and themes as they appear in subsequent data you collect.

STEP 3: Data Reduction

Qualitative studies generally produce a wealth of data but not all of it is meaningful. After data has been collected, you will need to undergo a data reduction process in order to identify and focus in on what is meaningful. This is the process of reducing and transforming your raw data.

It is your job as the evaluator to comb through the raw data to determine what is significant and transform the data into a simplified format that can be understood in the context of the research questions (Krathwohl, 1998; Miles & Huberman, 1994; NSF, 1997). When trying to discern what is meaningful data you should always refer back to your research questions and use them as your framework. Additionally, you should rely on your own intuition as the

evaluator and the expertise of other individuals with a thorough understanding of the program.

This step does not happen in isolation, it naturally occurs during the first two steps. You are already reducing data by not recording every single thing that occurs in your data collection interaction but only recording what you felt was most meaningful, usable, and relevant. You are also reducing data by looking for themes from the beginning. This process helps you hone in on specific patterns and themes of interest while not focusing on other aspects of the data.

The process of data reduction, however, must go beyond the data collection stage. Evaluators must take time to carefully review all of the data you have collected as a whole.

STEP 4: Identifying Meaningful Patterns and Themes

In order for qualitative data to be analysable it must first be grouped into the meaningful patterns and/or themes that you observed. This process is the core of qualitative data analysis.

This process is generally conducted in two primary ways:

- Content analysis
- Thematic analysis

The type of analysis is highly dependent on the nature of the research questions and the type(s) of data you collected. Sometimes a study will use one type of analysis and other times, a study may use both types

Content analysis is carried out by:

1. Coding the data for certain words or content
2. Identifying their patterns
3. Interpreting their meanings.

This type of coding is done by going through all of the text and labelling words, phrases, and sections of text (either using words or symbols) that relate to your research questions of interest.

After the data is coded you can sort and examine the data by code to look for patterns.

Thematic analysis – grouping the data into themes that will help answer the research question(s). These themes may be:

- Directly evolved from the research questions and were pre-set before data collection even began, or
- Naturally emerged from the data as the study was conducted.

Once your themes have been identified it is useful to group the data into thematic groups so that you can analyse the meaning of the themes and connect them back to the research question(s).

STEP 5: Data display

After identifying themes or content patterns, assemble, organize, and compress the data into a display that facilitates conclusion drawing. The display can be a graphic, table/matrix, or textual display.

- Regardless of what format you chose, it should be able to help you arrange and think about the data in new ways and assist you in identifying systematic patterns and interrelationships across themes and/or content (Miles and Huberman, 1994; NSF, 1997).
- Through this process you should be able to identify patterns and relationships observed within groups and across groups. For example, using our Summer Program study, you could examine patterns and themes both within a program city and across program cities.

STEP 6: Conclusion Drawing and Verification

Conclusion drawing and verification are the final step in qualitative data analysis.

To draw reasonable conclusions, you will need to (Kratwohl, 1998; Miles & Huberman, 1994; NSF, 1997):

- Step back and interpret what all of your findings mean
- Determine how your findings help answer the research question(s)
- Draw implications from your findings

To verify these conclusions, you must revisit the data (multiple times) to confirm the conclusions that you have drawn.

After this, the researcher was able to complete data analysis about the whole dissertation.

3.9 Issues of Validity

3.9.1 Strategies for Ensuring Trustworthiness of the Research

The trustworthiness of qualitative research generally is often questioned by positivists, perhaps because their concepts of validity and reliability cannot be addressed in the same way in naturalistic work (Shenton 2004). The concept of conformability is the qualitative researcher's comparable concern to objectivity. Here steps were taken to help ensure as far as possible that the work's findings are the result of the experiences and ideas of the informants, rather than the characteristics and preferences of the researcher. The following provisions were considered:

- Recognition of shortcomings in study's methods and their potential effects
- In-depth methodological description to allow integrity of research results to be scrutinised
- Use of diagrams to demonstrate "audit trail"

Credibility of the research was also made possible in the following ways:

- Examination of previous research to frame findings
- Tactics to help ensure honesty in informants
- Iterative questioning in data collection dialogues

3.9.2 Generalisation

It would not be appropriate to assume that results from this investigation could be generalised to other SMEs' subsector of the Nigerian economy, this study was mainly with the microfinance subsector of the SMEs. Therefore, this research case can only be generalised with all other microfinance banks not covered in this study. All other SMEs subsector may require further research.

3.10 Ethical Considerations

3.10.1 Confidentiality

Prior to the commencement of this study, ethics approval was obtained from the University of South Africa's Research Ethics Committee (ethics certificate included in the appendices). Participants were fully informed prior to the study about the potential risks and procedures involved. Written consent was obtained prior to participation in the interviews from respondents prior to commencing the interview. The data collection at all stages of the research project took place in participant's own environment with the researcher linked via technological means, for example Google Hangout or other internet connection.

Research that has to do with people has to be developed in such manner that research ethics are applied, particularly this includes the responsibility of the researcher to protect the confidentiality of individual that participate in the study. This privacy protection has had been extended to all classes of people involved in this study. The author has taken this ethics into consideration by not revealing the actual identities of the respondents in the research work.

3.10.2 Limitations

The limitations of this research may have been in the inherent design or methodology parameters that can restrict the scope of the research findings and might have been outside the control of the researcher. These reservations, qualifications or weaknesses arise when all variables cannot be controlled within a project design, or the optimum number of samples cannot be taken due to time/budgetary constraints. Therefore, these factors have the potential to interfere with the validity of results.

The following might be the limitations of the study:

- Research was limited to the Microfinance subsector of SMEs in Nigeria and it might be argued that micro business in other economic sector have different experiences with regards to Cloud adoption.
- Research was limited to microfinance banks; therefore it might be argued that it does not apply to all medium-sized organisations in Nigerian.

- Research was limited geographically to those Microfinance Banks located in Akwa Ibom State because of their proximity to where the researcher resides; therefore it might be contended that microfinances banks in others places may differ in their experiences and response.

At the conclusion of the research project all participants will be given a brief summary of findings for the purposes of informing practice in the use of professional learning networks (PLNs). Risks to participants are minimal and can be considered equivalent to the risks involved in their everyday work activities.

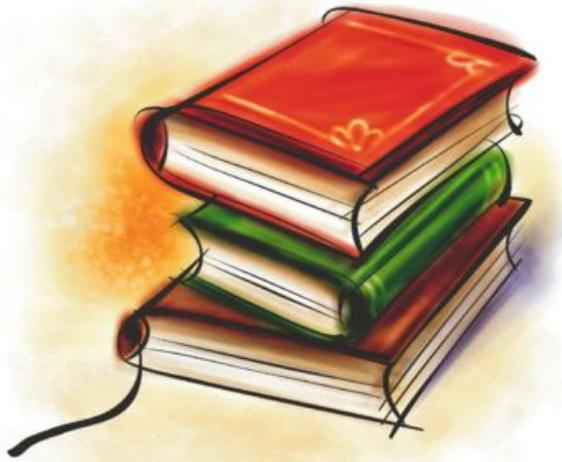
3.11 Chapter Summary

In this chapter, a detailed description of the research design and methodology have been given. Self-constructed questionnaire (quantitative study) and semi-structured interviews (qualitative study) are the data-collection instrument designed to elicit those responses essential to the research problem. The researcher had ensured that confidentiality was maintained within the life cycle of this research. The chapter was ended off with the ethical principles that will be applied when conducting this research.

Chapter 4: DATA COLLECTION AND METHOD OF ANALYSIS

“When I look back, I am so impressed again with the life-giving power of literature. If I were a young person today, trying to gain a sense of myself in the world, I would do that

again by reading, just as I did when I was young.” — Maya Angelou



“I know nothing in the world that has as much power as a word. Sometimes I write one, and I look at it, until it begins to shine.” — Emily Dickinson, 1886

4.0 Introduction

The methodology that was employed in this study was described in the previous chapter and that has provided the baseline upon which data-gathering for this study is based. To complete this study properly, it is important to analyse the data collected in order to provide answers to the research questions. In this chapter, the presentation will be systematically linked to the kind of questions asked in order for this research to be effectively conducted.

According to Vos (1998:203), data analysis involves the breaking down of data into constituent's parts to obtain answers to questions and to test hypotheses. The analysis of research data does not in itself provide answers to research questions. The analysis and interpretation of data is executed in two phases. The first part, which is based upon the results of the questionnaire, deals with a quantitative analysis of data. The second, which is based on the results of the interview and industry players, is a qualitative interpretation.

The essence for interpreting research data is to make it intelligent and interpretable so that the relations of research problems can be studied and tested, and conclusions established. When a researcher interprets the research results, he or she studies them for their meaning and implications (Vos 1998:203). The researcher will discuss the participants in this section in order for the findings to be understood clearly.

4.1 Description of Participants

As stated in the first chapter, the objective of the study is to conduct a research to understand the reason for the slow adoption of cloud computing technology by Small and Medium Scale Enterprises (SMEs) in Nigeria. The researcher used interview to collect data. The interviews were conducted using Google Hangout and physical contact where the participant organisation is situated in Uyo which is where the research resides. Prior to requesting participation, a covering letter (Appendix B) explaining the research intent and purpose was sent to the respondents to obtain consent before requesting for time for the interview.

A working data was provided as seven participants (industry associates) from seven organisations. Almost all participants were decision-makers (business managers, senior managers and executives) within their organisations. This group also contained participants from Microfinance banks. 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 where distance becomes an impediment during the first and second week of August 2014. Of the seven respondents, three were members of Nigeria Computer Society (NCS) and were members of Computer Professional Registration Council (CPN). For the purpose of clarity, these category of participants are summed up as IT Professionals (industry associates or players) in this research.

4.2 Interviews

An interview is a conversation method with an intent of achieving a purpose (extracting further information). Interview is mostly used to supplement and extend one's knowledge about individual's thought, feelings and behaviour, interpretations etc. The purpose in essence could therefore be:

- When a large amount of relevant information about one's experience is to be extracted by asking the person direct question.
- When some research questions are better answered in such manner.
- When a structured question or semi-structured is to allow for flexible response.

Interviews are categorised as structured and semi-structured. The key feature of the structured interview is that questions are pre-planned. Structured interviews also allow for exact replication of the interview with others. To some extent, it is possible to generalise what you find whereas a key feature of the semi-structured interview is in the partial pre-planning of the questions. Semi-structured interviews may be conducted in various modes: face-to-face, by telephone, videophone... but face-to face is probably best. A great deal of qualitative research (grounded theory, thematic analysis, etc) uses semi-structured interview material).

The major advantage of in-depth interviews is that they allow much more detailed information than what is available through other data collection methods, such as surveys.

- Replication is possible.

They also can allow a more relaxed condition in which to collect information—people may feel more comfortable having a conversation with you than filling out a survey.

With the advantage above, the researcher opted for a semi-structured interview. The summary of data collected from the interview is transcribed in Section 4.3.2.1 – 4.3.2.7

4.2.1 Approach to Analysing Qualitative Data

McMillan and Schumacher (2010:367) posit that qualitative data analysis is primarily an inductive process through which data is organised into categories and patterns and relationships are identified among the categories

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. This approach is comprehensive and therefore time-consuming and is most suitable where little or nothing is known about the study phenomenon. Inductive analysis is the most common approach used to analyse qualitative data and will therefore be advanced in this study.

Although there are many inductive approaches to analysing qualitative data, the method of analysis to be applied in this study is that of thematic content analysis, and is, of course, the most common method of data analysis used in qualitative work. However, the process of thematic content analysis is usually similar in all types of qualitative research, and the process involves analysing transcripts, identifying themes within those data and collecting together examples of those themes from the text.

Interview transcripts, field notes and observations provide a descriptive account of the study, but they do not provide explanations (Burnard *et al.*, 2008). It is the researcher who must make sense of the data that have been collected by exploring and interpreting them.

According to Burnard *et al.* (2008), in qualitative research, data analysis often begins during, or immediately after, the first data are collected, although this process continues and is modified throughout the study. Initial analysis of the data may also further inform subsequent data collection. For example, interview schedules may be slightly modified in light of emerging findings, where additional clarification may be required. 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.

4.2.2 Interviewee’s Profile

A total of eleven (11) persons participated in the interview conducted using Google Hangout while three interviews were conducted one-to-one with the respondent. Due to online network connectivity issues, some of the interviews were not completed so the researcher was only able to obtain complete responses from only seven persons. Table 4.1 below shows a summary of the respondent’s profile, his/her position, company and responsibilities.

S/No	Interviewee	Organisation	Current Position	Responsibilities	Interest
1	Interviewee A	Akwa Ibom State University(AKSU), Nigeria	Director, ICT	Managing AKSU IT services	Cloud Computing
2	Interviewee B	Nigerpet Construction, Uyo	IT Specialist	Managing IT infrastructure	Software Systems Design
3	Interviewee C	Establishment, AKSG	Permanent Secretary	Administration	Information Systems
4	Interviewee D	Zenith Bank, Uyo	IT Officer	Manages the IT systems for the of Bank in Uyo Branch	Database and networks
5	Interviewee E	Bosak Microfinance Bank Limited, Lagos	IT Manager	Manages Information systems of the bank	Software Development
6	Interviewee F	FinaTrust Microfinance Bank, Lagos	Database Manager	Manages the database of the organisation	Database and programming
7	Interviewee G	AB Microfinance	IT Support Manager	Manages the IT systems of the	System Management

		Bank, Lagos		bank	and Networks
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Table 4.1: Brief Introduction of the interviewees

The researcher chose IT professionals who have knowledge in cloud computing and also another set of associates in the microfinance sector but with some level of knowledge of the IT sector. These include IT officers and administrators who are also members of either NCS or CPN. Some are also business executive. The respondents were interviewed about their perception of services in cloud computing, advantages and disadvantages, challenges and the scope regarding trust, security and cost perspectives.

4.2.3 Interview Transcription and Findings

4.2.3.1 Interviewee A

Interview was conducted with Interviewee A on the 2nd August 2014. This was Google Hangout recorded interview. Interviewee A is responsible for the management of Akwa Ibom State Ministry of Information and Communication (AKSMinofInfo) information database and network systems. AKSMinofInfo is the Government of Akwa Ibom State Ministry in-charge of Information and Communications. His responsibility is to design an optimal ways of storing the ministry’s information using the latest and emerging technology platform.

In Interviewee A’s opinion, “*cloud computing is simply storing your information in someone else’s computer and accessing it from any remote location using internet access*”. He mentioned that it is very important to have a high level security strategy so the vendors need to develop and to ensure the privacy and security of data out-sourced to them by customers. To him, multiple measures are been taken in his department to guard against a breach in their data stored at an outside data center with certain authorisation implemented.

He identified security and privacy as the main challenges in adoption of cloud computing in government organisations coupled with the level of computing knowledge of higher executive in the ministry who rather want that their information be kept within a file cabinet within their offices.

For himself who has painstakingly convinced his boss to allow him adopt cloud computing by purchasing 100Gigabytes space with Dropbox to store important department information,

his only challenge is the cost of internet data bandwidth as he transfers large amount of important documents after converting them into electronic form to their dropbox data storage account. He said his boss is always worried each time he wants to convert an important document for storage in the dropbox space and would ask, “*how are you sure that that document is safe and can’t be accessed by internet hackers?*” Hence he said SLA is very crucial for any organisation and the vendor has to lay open and convince his clients that his services is hack-proof.

Respondent mentioned that the important benefits of cloud computing are the cost effectiveness and easy accessibility to data at any location with internet access. Besides, he mentioned that all have same level of benefits. For instance in google doc, you can update, share and collaborate document between multiple users remotely with latest updates.

He personally prefers the private cloud as a better tools to store data if we adopt cloud computing for storing government documents and data for easy collaboration.

4.2.3.1.1 Thematic Content of Interview A

Interviewee A – Findings

INTERVIEWEE A – THEMATIC CONTENT ANALYSIS			
Interview Question No (IQ)	Respondent’s opinion	Research Question(RQ)	Codes extracted
IQ03	Security of data must be maintained in the cloud to guard against breach of data	RQ03	Data security
IQ03 IQ06	Vendor must ensure privacy and confidentiality of user’s data	RQ03	Privacy and confidentiality
IQ06	Identified security and privacy as cloud main challenge	RQ02	Security of Data
IQ04 IQ06 IQ07 IQ13	Identified cost of bandwidth as a challenge to using cloud service	RQ02	Cost of services
IQ09	SLA is very important and vendor must be opened with it	RQ03	Service Level Agreement
IQ03	<i>“how are you sure that that document is safe and can’t be accessed by internet hackers?”</i>	RQ02	Security of data
IQ05	Cost reduction is an important benefit of cloud and easy data	RQ01	Cost Reduction as cloud benefit

	access		
IQ10	Private cloud is preferable in his opinion		Private Cloud

Table 4.2: Interviewee A – Thematic Content Analysis

4.2.3.2 Interviewee B

The researcher interviewed Interviewee B using Skype on the 4th August, 2014. Interviewee B is a Ph.D student with the Federal University of Technology, Owerri, Imo State and currently the Acting Director, ICT, Akwa Ibom State University (AKSU). He is responsible for the management of AKSU information systems and also direct on issues relating to information technology concerning the university. A professional member of Computer Professional Registration Council (CPN) with interest in software development and Geography Information Systems. The most important benefits of Cloud to any organisation using cloud are scalability and efficiency of data according to Interviewee B. He added that the cost reduction, increased speed, higher reliability and sufficient storage of data are other features.

He mentioned that storing all our data in the cloud is not ideal. As an example, he said, “if you store your data in google and something happened to your data, who is responsible?” Would google care? Probably google does not care. So his opinion was related to trust issue and he cannot trust cloud services fully so he recommended that we should not store all our sensitive and important data in cloud.

SLA has a very vital role to play according to him, in the sense that if you have critical application then you really need to have a good SLA’s with public cloud vendor. This SLA’s will play great role to build trust from the customers he said. Besides, the security of data, SLA’s and customer trust run parallel to one another. i.e good SLA’s gives enough security confidence that makes better services and consequently leads to more trust of the customers.

On the deployment models aspect he maintained that public cloud is for non-critical applications and private cloud is a good idea if you have the internal organisation and using traditional hardware. Different SLA’s can be provided to different customers and can guarantee data integrity.

He said there are many challenges which come with adopting cloud computing in financial sector. Among these, some of them are security of data, data sharing and most importantly trust of the customer. Similarly, legal issues which can play a vital role in the adoption of cloud computing in the microfinance sector. He added that customers banking data as secret information, confidential between the bank and the customers, putting these in cloud arises a question of availability and reliability because we do not know where these data are stored and who is accessing them.

He mentioned that the chief advantage of cloud computing that microfinance banks can benefit from is its efficiency and reliability. He opined that hybrid Cloud deployment model is best suited for micro finance sector. That is, a bank can hire the service of one cloud provider and also set up its own private cloud within the organisation to share data.

4.3.3.2.1 Thematic Content of Interview B

INTERVIEWEE B – THEMATIC CONTENT ANALYSIS			
Interview Question No (IQ)	Respondent’s opinion	Research Question(RQ)	Codes extracted
IQ05	Scalability and efficiency are most important cloud benefits, other are cost reduction, increased speed, higher reliability and sufficient storage of data	RQ1	Scalability, Cost Reduction, Speed, Reliability, Storage – Cloud benefits
IQ06	Trust issues with vendors	RQ2	Data loss
IQ06	SLA with a public vendor	RQ3	Good SLAs
IQ06	Trusted vendor guarantees security of data		Data security, Integrity of data
IQ06	Identified security of data, data sharing and trust as main cloud challenges	RQ2	Data security and trust
IQ06	Mentioned legal issues as factor in cloud adoption in microfinance banks	RQ2	Legal issue
IQ06	Banks’ customers data are critical, data availability and reliability are important	RQ2	Reliability of data, Availability of data
IQ05	Efficiency and reliability are most important advantage of cloud to microfinance banks	RQ1	Efficiency and reliability
IQ10	Hybrid Cloud model is suitable for microfinance organisation		Hybrid Cloud deployment model

Table 4.3: Interviewee B – Thematic Content Analysis

4.2.3.3 Interviewee C

The researcher interviewed Interviewee C on the 5th August, 2014 using Skype software and the interview lasted for just 50 minutes. Interviewee C was the former Head of Management Information Systems (MIS) Unit in Akwa Ibom Water Company Limited where the researcher currently works in his capacity after he left and joined the core Ministry where he served as the Director of Computer in the Civil Service under the Office of Accountant General of Akwa Ibom State before being appointed as the Permanent Secretary, Local Government Service Commission, a position where he currently holds. Interviewee C has a Masters Degree in Computer Science majoring in Information Systems. He is an NCS and CPN member.

He mentioned that before he left the Accountant General's Office, he had helped the department to migrate to cloud having secured a cloud services arrangement with a service provider to enable Akwa Ibom State Government seamlessly manage its payroll information/database properly.

He said he made series of presentations to the Account General for the need to embrace this shift in IT services, government finally adopted cloud storage and now, it is quite easier for workers' salaries to be paid with a click of the mouse and approval can be granted by the relevant officer anywhere in the world he/she might be.

He said, of course security of data has been the major concern of stakeholders but that their service providers has proved to them that their data is safe. Also, he said the SLA's with service provider is such that in the event of breach of agreement, the CSP shall oblige to entangle their services so they can source for a better providers without hitch.

He said economies of scale is the one major benefit from Cloud Computing to financial sector. Similarly, in order to use Cloud all legal issues have to be fulfilled especially at the SLA level, disaster recovery and data storage places.

In his opinion, private cloud is safe to store government employee's records because of security demands but the required technical know-how and manpower to manage same effectively is currently lacking in the government staffers.

4.2.3.3.1 Thematic Content of Interview C

INTERVIEWEE C – THEMATIC CONTENT ANALYSIS			
Interview Question No (IQ)	Respondent’s opinion	Research Question(RQ)	Codes extracted
IQ14	He had helped his former organisation to migrate to cloud	RO4	Cloud adoption
IQ05	Government seamlessly manage its payroll information/database properly	RO1	Efficiency and Speed of Cloud
IQ08 AND IQ12	He made series of presentations to the Account General for the need to embrace this shift in IT services	RO4	Enlightenment and Awareness
IQ05	Approval can be granted by the relevant officer anywhere in the world he/she might be	RO1	Data Availability
IQ03	Security of data has been the major concern of stakeholders	RO2	Data Security
IQ03 AND IQ09	Their service providers has proved to them that their data is safe	RO3	Cloud security
IQ09	He said the SLA’s with service provider is such that in the event of breach of agreement, the CSP shall oblige to entangle their services so they can source for a better providers without hitch.	RO3	Flexible SLAs, Good Vendor, Trusted Service Provider
IQ05	He said economies of scale is the one major benefit from Cloud Computing to financial sector.	RO1	Cost Reduction, Cloud benefit
IQ09	In order to use Cloud all legal issues have to be fulfilled especially at the SLA level, disaster recovery and data storage places	RO3	Legal issues, Disaster Recovery, Data Center location SLAs
IQ10	Private cloud is safe to store government employee’s records		Private Cloud Model is suitable
IQ12	Private Cloud requires technical know-how and manpower to manage same effectively is currently lacking in the government staffers.	RO4	Level of knowledge,

Table 4.4: Interviewee C – Thematic Content Analysis

4.2.3.4 Interviewee D

This interview was one-on-one with Interviewee D on 6th August, 2014 in his office at Plot 32 Unit G, Ewet Housing Estate, Uyo, and Akwa Ibom State. Dominic is the IT Specialist of Nigerpet Construction Nigeria (NPS), NPS is a construction firm engage in the construction of social infrastructure and has been involved the construction of major infrastructural works in Akwa Ibom State. He explained his role and responsibilities as the Head of IT and also a Programmer in his organisation. He has a B.Sc degree in Business Computing from Teeside University, UK and he is an NCS member.

His organisation use cloud computing and the reason behind adopting is to get some services that are already hosted in different companies so they do not have to create those services by themselves. He explained cost reduction is another major reason because after using cloud services there is no need for someone to monitor services regularly not only the software, hardware part but also servers running with application.

He said cost is the main aspect that many companies looking towards cloud since if we have to purchase all services and application by ourselves it is costly and later also need to be updated, same for hardware and server configuration too. Speed of these systems and network speed play a vital role in the adoption of cloud but it depends on geographical location, he said

To him, reliability and efficient storage of data is an issue of importance to both users and the company which gives the services to see how they have built their services.

Security is the issue which will always be attached to any software or system so is the case with cloud computing since no system can be 100% secure.

Interviewee D identified Knowledge; level of expertise of users (education of the users) and technology as major challenges in cloud computing since there are still some services which cannot operate through our network service. There are still issues of bandwidth i.e. the amount of information one can send or received by the user.

He pointed out that there still some unaddressed security issues inherent in cloud computing as security breach, hackers, and finally reliability and trust issues (entrusting your sensitive data in the cloud lead to security problems in both the provider and the customer then there come the issues of reliability and trust). Due to the above reasons, he predicted that it might takes years for some microfinance banks to embrace cloud technology except appropriate enlightenment is carried out to convince the would-be customers that the system is fully secured.

He said public cloud is not secured enough as most service providers usually use public cloud to test different configuration and different security measures and once convinced of

the safety of the system, they finally launch their applications in private cloud. Hence, he said private cloud has high security with strict SLA but still risk is there and 100% security cannot be guaranteed.

4.2.3.4.1 Thematic Content of Interview D

INTERVIEWEE D – THEMATIC CONTENT ANALYSIS			
Interview Question No (IQ)	Respondent’s opinion	Research Question(RQ)	Codes extracted
IQ05	Reason behind adopting is to get some services that are already hosted in different companies so they do not have to create those services by themselves.	RO1	Shared Services of Cloud
IQ05	Cost reduction is another major reason	RO1	Cost Reduction
IQ05	Speed of these systems and network speed play a vital role in the adoption of cloud	RO1	Speed
IQ05	Reliability and efficient storage of data is an issue of importance to both users and the company which gives the services to see how they have built their services.	RO1	Reliability, Efficiency
IQ03 AND IQ09	Security is the issue which will always be attached to any software or system so is the case with cloud computing since no system can be 100% secure.	RO2	Security of Cloud
IQ08 AND IQ12	Identified Knowledge; level of expertise of users (education of the users) and technology as major challenges in cloud computing	RO4	Knowledge level, Education
IQ04 AND IQ13	There are still issues of bandwidth	RO2	Cost of services
IQ03 AND IQ09	He pointed out that there still some unaddressed security issues inherent in cloud computing as security breach, hackers, and finally reliability and trust issues	RO2	Data Security, Privacy, Reliability, Trust issues
IQ14	Due to issues of data security and privacy, reliability and trust, he predicted that it might takes years for some microfinance banks to embrace cloud technology	RO2	Adoption concerns
IQ08	Except appropriate enlightenment is carried out to convince the would-be customers that the system is fully secured.		Education, Enlightenment, awareness
IQ10	He said public cloud is not secured enough as most service providers usually use public cloud to test		Public Cloud not suitable for Microfinance banks

	different configuration and different security measures		
IQ10 AND IQ09	He said private cloud has high security with strict SLA but still risk is there and 100% security cannot be guaranteed.		Private Cloud is desirable, Good SLAs
IQ08	Cloud vendors have to prepare the users to use cloud services by giving proper education and enlightenment to their users.		Education, Enlightenment, Awareness

Table 4.5: Interviewee D – Thematic Content Analysis

4.2.3.5 Interviewee E

This interview was conducted with Interviewee E on the 7th August 2014 via a Google Hangout. Interviewee E is the IT Manager of Bosak Microfinance Bank Limited, Lagos. His main responsibility in the organisation is overseeing the overall information system architecture of the bank. He said he has a dual degree in Banking and Finance as well as Computer Science with an M.Sc in Information Technology and has been working in the IT industry for 6 years before joining the bank last year. He is a member of both NCS and CPN. He particularly picked interest in discussing the questions with the researcher because he did his thesis on how IT can leverage the operations of microfinance banks.

He said most microfinance institutions in Nigeria are yet to derive the full benefits of IT in their business basically because they have not yet embrace the IT and more strongly that the most SMEs lack the needed manpower to brief the management on emerging technologies except where a such a bank has an exposed CEO who explore opportunities like his organisation. Quite frankly, he said emerging IT technologies education are not obtained from university curriculum as in the case with Nigeria because there are evolving technology that one needs to get abreast of by extensive research and investigation. In his word, he said: “my brother, our SMEs, most especially microfinance banks are not even aware of the technology called cloud computing let alone adopting it.”

According to him, the cloud service providers have a lot more role to play to drive the growth of Cloud adoption. SMEs need to know that cloud exist and they also need to know the economic benefits of using such technology over traditional IT.

He said the most important and appealing advantage of cloud environment is the reduction in cost of maintaining IT infrastructure which in turn reduces capital expenditure on IT

hardware and also the flexibility of service delivery. Among the issues with cloud that he mentioned included privacy and security of data, this he said is not really big threat as cloud providers also have measures to ensure data safety. He preferred private cloud for SMEs and maintained that SLA is very important and so vendors should do well to be open with their customers. He said their organisation is hosted on MTN platform and the services is wonderful but that it is costly though when compared to the returns on investment, it is worth it.

“For us to move up rapidly, government has make the auxiliary infrastructure that powers the network to be efficient e.g. power infrastructure and internet connectivity”, he ended.

4.2.3.5.1 Thematic Content of Interview E

INTERVIEWEE E – THEMATIC CONTENT ANALYSIS			
Interview Question No (IQ)	Respondent’s opinion	Research Question(RQ)	Codes extracted
IQ14	Most microfinance institutions in Nigeria are yet to derive the full benefits of IT in their business	RO4	Slow Adoption Rate
IQ08 AND IQ08	SMEs lack the needed manpower to brief the management on emerging technologies	RO4	knowledge about Cloud computing
IQ08 AND IQ12	SMEs, most especially microfinance banks are not even aware of the technology called cloud computing take more of adopting it.”	RO4	Most microfinance banks are unaware of cloud
IQ08 AND IQ12	Cloud service providers has a lot more role to play to drive the growth of Cloud adoption.	RO4	Cloud Education is necessary, Cloud Awareness crusade
IQ01	SMEs need to know the economic benefits of using such technology over traditional IT.	RO1	Cloud is beneficial
IQ05	The most important and appealing advantage of cloud environment is the reduction in cost of maintaining IT infrastructure which in turn reduce capital expenditure on IT hardwares and also the flexibility of service delivery	RO1	Cost Reduction, Flexibility
IQ03 AND IQ09	Among the issues with cloud that he mentioned included privacy and security of data, this he said is not really big threat as cloud providers also have measures to ensure data safety.	RO2 AND RO03	Issues of privacy, Security of data, Cloud has threats mitigations
IQ10	He preferred private cloud for SMEs and maintained that SLA is very important and so vendors		Private Cloud is preferable, SLAs are important

	should do well to be open with their customers.		
IQ05	He said their organisation is hosted on MTN platform and the services is wonderful	ROI	Efficiency
IQ04	But that it is costly though when compared to the returns on investment, it is worth it.		Cost of access to service is high but worth it
IQ04 AND IQ13	<i>“For us to move up rapidly, government has make the auxiliary infrastructure that powers the network to be efficient e.g. power infrastructure and internet connectivity”</i>		Power infrastructure, Bandwidth access are challenges against Cloud

Table 4.6: Interviewee E – Thematic Content Analysis

4.2.3.6 Interviewee F

Interviewee F was contacted on the 5th August 2014 and she agreed to be available for the interview on 8th August 2014 but she preferred chatting only. Interviewee F works with FinaTrust Microfinance Bank, Lagos as a Database Administrator and responsible for the management of the company’s database system.

She defined cloud computing as sharing of data or services from a centralised remote computer to users on demand. She said cloud computing has made her job a lot easier and so would say that its advantage is efficiency and reliability. She said she not really rooted in the security aspect of cloud but her concern as always been the integrity and confidentiality of their organisation’s customer data but that their service providers had a signed an agreement (SLA) with their organisation that guarantees data safety.

According to her, it was the service provider who came to discuss the new technology with their organisation and after a lot of presentations, it was accepted and they then deployed the services and trained her and other staff on the usage of the application.

Interestingly, she confirmed that more and more SMEs like hers need to be made aware of this technology and attributed the slow rate of adoption of this technology by some to high cost of ICT services.

4.2.3.6.1 Thematic Content of Interview F

INTERVIEWEE F – THEMATIC CONTENT ANALYSIS			
Interview Question No (IQ)	Respondent’s opinion	Research Question(RQ)	Codes extracted
IQ05	She defined cloud computing as sharing of data or services from a centralised remote computer to users on demand.	RO1	Data Sharing
IQ12	She said she not really rooted in the security aspect of cloud		Lack of cloud security knowledge
IQ06	Her concern as always been the integrity and confidentiality of their organisation’s customer data	RO3	Data security, Privacy and Confidentiality
IQ09	But that their service providers had a signed an agreement (SLA) with their organisation that guarantees data safety.	RO3	Good SLAs Data Protection
IQ08 AND IQ12	It was the service provider who came to discuss the new technology with their organisation and after a lot of presentations, it was accepted and they then deployed the services and trained her and other staff on the usage of the application.	RO4	Cloud Education, Awareness, Enlightenment, Knowledge
IQ08	She confirmed that more and more SMEs like hers need to be made aware of this technology	RO4	Cloud awareness programme
IQ13	She attributed the slow rate of adoption of this technology by some to high cost of ICT services.	RO1	Slow Adoption rate,
IO13	She attributed the slow rate of adoption of this technology by some to high cost of ICT services.	RO2	Cost of services

Table 4.7: Interviewee F – Thematic Content Analysis

4.2.3.7 Interviewee G

Interviewee G was interviewed using a Skype recorder application on the 11th August 2014. An IT System Support manager with AB Microfinance Bank responsible for the management of IT related services in the organisation, an MBA graduate in Business Information Technology.

He said it is very important for microfinance banks to all migrate to the cloud to achieve agility and operational efficiency and identified security and privacy as the main challenges in cloud computing considering the fact that SMEs still fear if their data will be safe in the cloud.

The fear with some organisation about cloud is where their data is taken to. *“mind you, we need to know where you are hosting our data and what will happen in the event that we choose to discontinue our services with you if you cannot satisfy us”*, he said. This brings us to the issue of vendor lock-in.

“CSP has to clearly spell out all these SLA’s components in their product agreement”, he said.

To him, multi-cloud is desirable since it allows for flexibility but a lot more awareness and education has to be mounted by the industry players to drive adoption as so many organisations are not aware of the existence of this kind of technology and still battling with the traditional method.

Of course, “another major factor affecting the rate of adoption is the cost inherent in the acquisition of the technology at first because of high cost of internet services since the cloud is powered by the internet”, he contended. Except government makes bandwidth affordable, some organisation might still fear risking the trail.

4.2.3.7.1 Thematic Content of Interview G

INTERVIEWEE G – THEMATIC CONTENT ANALYSIS			
Interview Question No (IQ)	Respondent’s opinion	Research Question(RQ)	Codes extracted
IQ05	He said it is very important for microfinance banks to all migrate to the cloud to achieve agility and operational efficiency	RO1	Cloud Agility, Efficiency
IQ06	Identified security and privacy as the main challenges in cloud computing considering the fact that SMEs still fear if their data will be safe in the cloud.	RO2	Security and privacy concerns
IQ6 AND IQ07	The fear with some organisation about cloud is where their data is taken to	RO2	Data Center location
IQ07	<i>“mind you, we need to know where you are hosting our data and what will happen in the event that we choose to discontinue our services with you if you cannot satisfy us”</i>	RO2	Data centre location issue, Migration of Data
	<i>“CSP has to clearly spell out all these SLA’s components in their product agreement”,</i>	RO3	Flexible SLAs, Trusted Vendor
IQ10	Multi-cloud is desirable since it allows for flexibility but a lot more awareness and education has to be mounted by the industry players to drive adoption	RO3 AND RO4	Multi-Cloud, Flexible SLA, Cloud Awareness
IQ13	<i>“another major factor affecting the rate of adoption is the cost inherent in the acquisition of the technology at first because of high cost of internet services since the cloud is powered by the internet”</i>	RO2	Cost of service
IQ13	Except government makes bandwidth affordable, some	RO2	Bandwidth issue

	organisation might still fear risking the trail.		
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Table 4.8: Interviewee G – Thematic Content Analysis

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 4.9: Interview Questions mapped against Research Objectives and Questions

4.2.4 Codification and Categorisation of themes

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).

Simply put, coding allow a researcher to categorise data or string of words into a family on grounds that they have similar characteristics.

The table 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 4.10: Mapping Interview Questions against Theme Category

4.2.5 Summary of Themes Extracted by Each Interviewee

The table below shows all themes extracted from each interviewee

SUMMARY OF THEMES EXTRACTED FROM EACH INTERVIEWEE RESPONSE	
INTERVIEWEE	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	<p>Shared Services of Cloud</p> <p>Cost Reduction</p> <p>Speed</p> <p>Reliability, Efficiency</p> <p>Security of Cloud</p> <p>Knowledge level, Education</p> <p>Cost of services</p> <p>Data Security, Privacy, Reliability, Trust issues</p> <p>Adoption concerns</p> <p>Education, Enlightenment, awareness</p> <p>Public Cloud not suitable for Microfinance banks</p> <p>Private Cloud is desirable, Good SLAs</p> <p>Education, Enlightenment, Awareness</p>
INTERVIEWEE E	<p>Slow Adoption Rate</p> <p>knowledge about Cloud computing</p> <p>Most microfinance banks are unaware of cloud</p> <p>Cloud Education is necessary, Cloud Awareness crusade</p> <p>Cloud is beneficial</p> <p>Cost Reduction, Flexibility</p> <p>Issues of privacy, Security of data, Cloud has threats mitigations</p> <p>Private Cloud is preferable, SLAs are important</p> <p>Efficiency</p> <p>Cost of access to service is high but worth it</p> <p>Power infrastructure, Bandwidth access are challenges against Cloud</p>
INTERVIEWEE F	<p>Data Sharing</p> <p>Lack of cloud security knowledge</p> <p>Data security, Privacy and Confidentiality</p> <p>Good SLAs</p> <p>Data Protection</p> <p>Cloud Education, Awareness, Enlightenment,</p>

	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 4.12: Themes Extracted from Interviewee’s Responses

4.3 Interview Findings

The seven (7) interviews are summarised and will be interpreted in the empirical data analysis section under the heading of each main theme as depicted in the table 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 4.13: Theme Category and sub-themes

4.4 Analysis of Empirical Data

This section contains the analysis of all literature review for this research from the point of view of the researcher as well as that of interviews conducted for the research. The researcher establish some of the benefits and issues of cloud computing and the main benefit and issues in adoption of cloud computing by SMEs.

4.4.1 Benefits of Cloud Computing

Cloud computing technology has some attractive benefits as deduced from the interviews. The following benefits were extracted from literature review and these are also confirmed by some interviewees. All the interviewees mentioned one form or the other how Cloud computing are beneficial to their organisations.

4.4.1.1 Reduction of Cost

Cost reduction is the main benefit of cloud computing and many organisations are adopting cloud computing to reduce their organisation's capital expenditure. For example, microfinance banks want to purchase all services and application by themselves, in the future there will be need to update all applications, services, servers and hardware, that will add more cost. If microfinance banks adopt cloud computing, they do not need to worry

about software and hardware upgrade as they can get the latest and upgraded resources in relatively less time and with ease since it will be the CSP that will handle that aspect on timely basis.

4.4.1.2 Scalability

From technical benefits point of view, 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. It will reduce the cost of additional servers on those that are not being in use because if the servers are not in use then these are automatically released from the application, it will then reduce the total cost because cloud computing applies utility based payment "Pay-as-You-Go" model.

4.4.1.3 Data Storage

It is easier storing their data in the Cloud as it makes it very easy for collaboration and retrieval and it is cheaper than storing in traditional storage facilities. For instance, storing data in Dropbox and Google Drive makes it easier for such data to be accessed anywhere as against when such data is carried about in a flashdrive or external disk drive. Data stored in the latter risk being lost in the event that anything happens to the storage medium whereas it is practical near impossible for data in Dropbox or Google Drive to be lost

4.4.1.4 Economies of Scale

Cloud computing not only provides cost advantages in procurement of hardware and software, it also provides cost advantages from improved productivity. Traditionally, lessons learned from one environment must be duplicated in other environments but, with cloud computing, once the best practices are applied they benefit all consumers.

4.4.1.5 Efficiency & Reliability

Efficiency and reliability are still benefits of the cloud. One respondent mentioned that reliability and efficient storage of data is an issue of importance to both users and the company which gives the services to see how they have built their services. Network and system will play a significant role in adoption of Cloud but it is also dependent on geographical location. Another respondent also said that the major advantage of Cloud Computing that microfinance banks can benefit from is its efficiency and reliability He opined that hybrid cloud deployment model is best suited for micro finance sector. That is, a bank can hire the service of one cloud vendor and also set up its own private cloud within the organisation to share data.

4.4.1.6 Summary

The economic benefit of cloud computing is very clear and compelling too. It is available at a fraction of the cost of traditional IT services, thereby eliminating upfront capital expenditures and drastically reduces administrative burden on IT resources. Cloud technology uses a pay- as- you- go model approach to IT that naturally requires a low initial investment—additional investment is incurred as system use increases, and costs can reduce if usage decreases. In this way, cash flow better competes with overall system cost.

4.4.2 Issues in Cloud Computing

The following issues and challenges of cloud computing are established from literature review. Along with these are new issues which to the researcher's point of view are peculiar to the Nigeria environment. In the interview (Appendix C), the researcher had asked questions 6 to establish the issues and challenges as it concerns cloud computing adoption.

4.4.2.1 Data Storage

Data in the cloud is typically in a shared environment alongside data from other customers. Encryption is effective but it cannot solve all data storage issues. “Find out what is done to segregate data at rest,” Gartner advises. The cloud provider should provide evidence that encryption schemes were designed and tested by experienced specialists. “Encryption accidents can make data totally unusable, and even normal encryption can complicate availability,” Gartner says. As data of many users are stored in same data center and same

server or same hard disks it will raise the question from the users about the problem of mismatch i.e. how cloud securely isolate users and differentiate the memory and storage of each users as this failure could lead to leakage of information from one customer to another

From interviews, researcher defines that cloud has many advanced security features but still all data cannot be stored in cloud because it depends on trusted service provider and deployment model we are adopting. Most of the interviewees highlighted concern about the location of data storage and its safety. For removing issues like data loss or unavailability of cloud, save the data in multi cloud i.e. at least we have to store in two datacenters ignoring the slight increase of cost since data security is more important than cost in many cases. When you use the cloud, you probably won't know exactly where your data is hosted. In fact, you might not even know what country it will be stored in. Ask providers if they will commit to storing and processing data in specific jurisdictions, and whether they will make a contractual commitment to obey local regulatory requirements on behalf of their customers, Gartner advises

4.4.2.2 Data Security

The security of data stored in cloud guarantees data privacy and confidentiality. Most users fear that data their might be compromised if stored in the cloud.

From interview, a respondent expressed his view that cloud security should be considered just as other security threat in a system that can be managed. He opined that some level of extra security measures must be put in place in both the service providers and even the customer's end to secure their data. Other respondents expressed the fear that security and hacking pose a major security issues in cloud computing.

4.4.2.3 Service Level Agreement(SLA)

Service Level Agreement (SLA) is in general a legal binding agreement in the mutual understanding and acceptance about a service between a client who is buying the service and a Service Provider (SP), who is giving the service. It is a serious issue to consider as it records a common understanding about services, priorities, responsibilities, guarantees, and warranties between the cloud provider and the consumers. Failure to comply with agreement usually invoke heavy penalty, which should also be spelt out in the agreement. An

interviewee said Data security and System availability are important SLA components while downtime guarantee was another issue raised by another respondents.

4.4.2.4 Reliability

Lack of speed and high bandwidth are the causes for not accessing the cloud services, hence there are still a lot of questions regarding cloud computing. From finding users are concerned as to whether they would be able to access their data as at when demand.

4.4.2.5 Knowledge and integration

Technical knowledge is required for implementing and managing SLA contracts with CSP's. Since all knowledge about the working of the cloud (e.g. hardware, software, virtualization, and deployment) is concentrated at the CSP, it is hard to understand what the CSP are doing. An interviewee mentioned his organization engaged a third party to handle SLAs aspect and even the integration as well.

One of the respondents in the interview mentioned knowledge, level of expertise of user's (education of the users) and technology are the major challenges in cloud computing so vendor have to explain to their customers about their system and its working procedure to convince them.

4.4.2.6 Migration of Data

The process of transitioning all or parts of a company's data, applications and services from on-site premises behind the firewall to the cloud, where the information can be provided over the Internet on an on-demand basis is cloud migration⁸. Migrating data from a traditional business environmental to cloud can pose enormous challenges and raises concern about the security of the data. Some organisation fear that in course of this migration, something might have gone awry and their data lost or compromised. This is an issue on itself to contend with.

⁸ http://www.webopedia.com/TERM/C/cloud_migration.html

4.4.3 Benefits of adoption of Cloud Computing by SMEs

In the interview question No 5 and 11, researcher asked questions bothering on the benefit of Cloud to SMEs, the responses to those 2 questions helped to establish the benefits of adopting Cloud Computing into SMEs' operations. These are outlined in this section.

4.4.3.1 Reduction of Cost

As described in section (2.4.1.1), cost reduction is the main advantage or main reason why organisations are going to apply cloud solutions as it saves the cost involved in building infrastructure and setting up a data centre. Even a small-scale business can adopt or go into the cloud. This allows SMEs to concentrate more on improvements of their core competencies. It certainly helps to be more advantageous in the longer run. There is no need to spend big money on hardware, software, or licensing fees. Interviewee A, B, C, D and E mentioned the reduction of cost of operation as one major advantage of deploying cloud computing in SMEs' operation.

4.4.3.2 Data sharing

Data sharing is one of the major benefits of Cloud to SMEs if adopted. For instance, in the case of a Microfinance bank, a customer that has an account with one bank and that account information is stored in a central server by service provider, such information can be shared under certain agreement or understanding (permission) with other banks. This process will make it more economical to simply obtain a customer's bank information seamlessly rather than the other creating a new database for the customer. Data of this nature can be remotely accessed from any location, no matter where the branch of the bank is.

4.4.3.3 Flexibility and Scalability of IT Resources

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. SME organisations can easily scale up and down their servers and hardware whenever they need it and this will reduce the cost of the unused servers and hardware. In this case, they simply pay for what services they use so it will reduce the cost inherent in the maintenance of hardware.

4.4.3.4 Greater Efficiency and Agility

Cloud computing delivers improved agility because it has on-demand self-service and rapid elasticity. IT resources can be acquired and deployed more quickly and, once deployed, they can be increased or decreased as needed to meet demand. This means that enterprises can innovate, introduce new products and services, enter new markets, and adapt to changing circumstances. Business agility requires the ability to create new business processes and change existing ones. This often means adding to or changing the supporting IT resources. The difficulty of doing this, and the time that it takes, can be a major barrier to innovation. Cloud computing can remove this barrier by enabling the enterprise to add to or change its IT resources quickly and easily.

4.4.3.5 Avoid Capital Expenditure in Hardware and Software

It helps SMEs maintain easy access to information with minimal upfront spending since cloud technology is operated on Pay-as-you-go (weekly, quarterly, yearly) basis.

4.4.3.6 Data Storage

Data storage is a major benefits of Cloud to microfinance institutions. These data are stored in the cloud by service providers at different data center locations around the world but here the issue would be storing these data outside the country home of the customer with its attendant legal implication that may arise if data is breached. Each country has her regulatory policy regarding data protection.

4.4.4 Issues in adopting Cloud Computing in SMEs

From respondent's point of view, following are the concerns for adopting cloud computing in SMEs operation.

4.4.4.1 Education and Awareness

Lack of awareness of cloud computing is traditionally a major concern of its own. Most organisations in Nigeria especially Small and Medium Scale (SMEs) organisations are not aware if cloud technology exist. For few organisations that are aware, data control and security are most critical. Interview question No 8 helped in giving further insight into this.

4.4.4.2 Data Security and Confidentiality

Because of the distributed network of cloud model, data are transmitted over networks, thus creating another challenging security risk. The privacy or confidentiality of customers' data must be guaranteed. This must apply to when the data is stored in the cloud as well as when the data is moved to and from the cloud. A system should be provided for where the owner of the data can verify the integrity and confidentiality status of its data. Data security in the cloud is one of the major challenges raised by prospective cloud users. Within the cloud data is vulnerable to threats during transmission, processing, storage and downloading stages. The lack of robust security mechanism within the cloud computing provides opportunities for cyber criminals. Secondly, the primary concern is the damage that a criminal can cause by planting a virus, from a normal desktop machine in an office using cloud services which could spread across the cloud and cause data damage. The inability of most organisations to store critical data on the cloud as a result of lack of guarantee mechanism to ensure data security by cloud vendors will also increase the cost of IT resources within the organization.

4.4.4.3 Availability and Reliability

Service disruption becomes a major source of concern to customers who have entrusted all their data in the cloud and might want to access it anytime. In the event that the customer management interfaces with the public clouds are accessible via the internet, there is an increased risk of failure when compared to the traditional services since there might be inherent weak interface in the chain of elements required to access the data or the application. For instance, a loss in network connectivity at the point of accessing the services could lead to service delivery failures. Another scenario, a vulnerability in the web browser used in access the hosting application could as well frustrate service delivery. A workable means to achieve a high degree of availability would be to use multiple CPS. Cloud Service Providers are aware of these scenarios and have built their system in such a way that if such situation occurs, there is an instantaneous remedy and this they have to let their customers to know.

4.4.4.4 Legal Issues

Most CSP fail to provide a guaranteed level of data security and for the cloud ‘users’ this compromises a basic requirement they are obligated to fulfil, inability to ensure a commensurate level of security. Hence, many cloud users are of the opinion that there are a lot of associated risks if data is accidentally lost or damage. There are clouds inside another cloud and CEUs may never be aware of their geographic location and knows whether a data protection privacy law is being honoured or not. For instance, Data stored in Cloud storage in one country could be subject to another country’s government regulation and legal affairs e.g. Personal information. The Patriot Act in the United State allows the government of US to subpoena all data stored within the country, this might not be acceptable to many organisations to know that their customer’s data can be compromised outside Nigeria for instance. Similarly, European Privacy Acts require that data be stored within the country of origin. Storing in the data center of out- of- country the Service Provider might not meet these requirements.

4.4.4.5 Service Level Agreement

As described in literature review (section 2.7), a Service Level Agreement (SLA) is in general a legal binding agreement in the mutual understanding and acceptance about a service between a client who is buying the service and a Service Provider (SP). It is the serious issue to consider as it records a common understanding about services, priorities, responsibilities, guarantees, and warranties between the cloud provider and the costumers. Failure to follow the agreement is usually followed by huge penalty, which should also be mentioned in the agreement.

4.4.4.6 Knowledge

In the interview section No 12, a respondent who works with a microfinance bank and also consulting as an IT specialist to other firms confirmed that he has discovered that most SMEs are not embracing cloud computing because they do not have knowledgeable staffers to handle that aspect of technology and do not want to run the risk of migrating to it at least for now. More and deeper knowledge is required for implementing and managing SLA contracts with CSP’s. Since all knowledge about the working of the cloud (e.g. hardware, software, virtualization, and deployment) is concentrated at the CSP, it is hard to get grip on

the CSP. Integration: Integration with equipment hosted in other data centres is difficult to achieve. Most SMEs do not know that cloud computing management requires an IT personnel knowledgeable in the workings of Cloud computing and not just an ordinary IT person.

4.4.4.7 Environmental Challenge

Due to some challenges confronting Nigeria's ICT industry, Nigeria small businesses have not been able to fully derive the benefit of cloud technology, Nigeria, like other developing countries, is still facing challenges in full adoption of cloud computing technology due specifically to the inadequate power and infrastructure, and cost of access to ICT products and services. These according to some respondents in the interview have affected the growth of the SMEs sector.

4.4.4.8 Cost of Setup/Service

One of the challenges SMEs face is technology and is so expensive for them as individual companies to create a formal structure of payroll for proper accounting system, so the cost of doing that is inhibitive. Often SMEs keep themselves out of the formal environment because they have to invest (Obuh 2013). The initial acquisition cost of IT hardware and software is a bit expensive, and this scares most SMEs from thinking the cloud direction. Interviewee A, D, F and G raised these concerns.

4.5 Discussion and Validity Threats

4.5.1 Discussion

In order to establish an efficient and significant discussion on the economic incentives (benefits) of cloud computing as well as the challenges in adopting cloud technology for SME organisation specifically microfinance institutions, the researcher reviewed related literature and analysed the interview conducted for the research.

4.5.1.1 Benefits of Cloud Computing

In order to establish the economic benefits of Cloud computing, the researcher analysed literature as well as the opinion of the respondents from the interviews. Respondents explained in their own understanding how cloud computing is beneficial to their organisations. It was observed that many of the IT Professionals and associates mentioned cost reduction as the major economic benefits of cloud technology.

From the analysis of the opinions of associates, researcher identified some of the benefits of cloud computing as explained by the respondents. Cost reduction, scalability, data storage, resource sharing are some of them. All of the respondents said cost reduction is the major benefit of Cloud computing to organisations. They said cloud computing reduces capital investment to organisations since it reduces the cost of maintaining hardwares. While some respondents praised cloud computing for bringing scalability to the organisation since cloud can scale up network resources to handle high traffic without the need for additional hardware infrastructure and user's normal work is disturbed, other respondents said data storage is another significant benefit. Some also mentioned that resource sharing is an appealing feature since sharing can take place remotely from virtually anywhere in the world but that network and system speed will play a role to making this feasible. With these benefits and with awareness, organisations are beginning to move to the cloud.

4.5.1.2 Issues of Cloud Computing

To find out the challenges in cloud computing, researcher analysed literature as well as opinions from the interviews. Many respondents mentioned that at the heart of concerns about migrating to the cloud, security is the major contention why some organisations are still contemplating whether to adopt cloud technology or not.

From the analysis of the responses from the associates, researcher was able to identify that data security, data storage, SLAs, reliability and knowledge are some issues of cloud computing. Many of the respondents mentioned that data security is the major issue in cloud computing and real-time threat detection/encryption is the one basic mitigation measures to protect our data and servers from unauthorised persons. Respondents pointed out data storage as another issue why they could not store all data on the cloud because it is dependent on trusted service providers and deployment models that are adopted. And many

of them suggested that aside from issue like data loss, we need to store our data in multi cloud i.e. at least we have to store in two data centers or better still own a private cloud in conjunction with the public. Reliability is also another important issue and it is the key of trust. One respondent suggested that we should not trust the cloud services fully and not store our sensitive and important data on the cloud. Some of the respondents mentioned about migration of data from current system to cloud are one issue.

Many of respondents agreed that SLAs play vital role in Cloud computing in the sense that if organisation or users have critical application then it is very essential to have good Service Level Agreement.

4.5.1.3 (Perceived Usefulness) of Cloud Computing 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 4.5.1.4

4.5.1.4 (Perceived Ease-of-Use) of Cloud Computing in SMEs' operation

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 in 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.

4.5.1.5 Attitude Towards Usage (ATU)

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.

4.5.1.6 Actual System Usage (ASU)

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

4.5.1.7 Behavioural Intention to Use (BIU)

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.

4.5.1.8 Suitable deployment model for Cloud Computing

Having analysed the opinions of IT professionals and associates as well as the responses from the interview, the researcher concluded that private cloud is the best deployment model for microfinance institutions. Researchers identified the benefits and challenges of different deployment model. From the responses of the respondent, Private Cloud is more secure to store customer's sensitive information like customer's bio-data and transaction records and also it carries along with it, strict SLA's though a bit expensive to set up. Public Cloud is economical to set up, but it is less secure, reliable and flexible and has flexible SLA's. And finally Hybrid Cloud is beneficial in terms of its ability to communicate with other clouds, but its problem is setting up the connections. Out of the three deployment models, many associates suggested that private cloud is best to store customer banking information because customer's data transaction information must be confidential and kept secured with the bank.

4.5.1.9 Scenario 1: Data Sharing (Benefit of Cloud Computing)

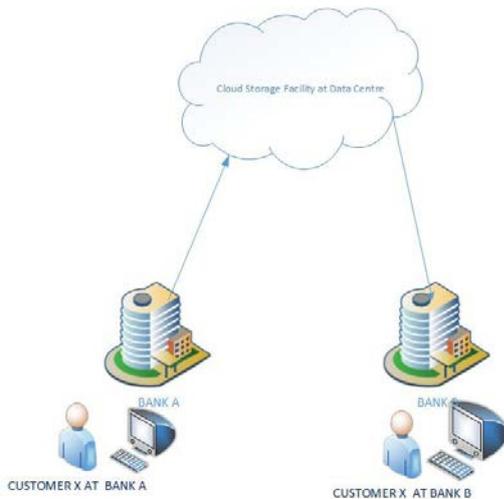


Figure 4.1: Scenario 1 - Data Sharing

Assumptions:

- Bank A and Bank B have all deployed cloud services
- That Bank A and Bank B are using the same cloud vendor
- That Bank A and Bank B have partnered under certain SLA agreement to share data
- Customers are mandatorily required to give his or her (1) Date of Birthday (2) Blood Group on opening account in any Microfinance Bank

The figure 4.1 above depicts a typical scenario where two different microfinance banks can use cloud services to share customer's data with each other seamlessly.

As of now:

- If a customer X goes to Bank A to open an account, his bio-data will be collected and it gets transmitted from the Bank A web browser to a cloud storage facility (datacenter) anywhere the vendor has contracted to host its client data.
- If that same customer X goes to Bank B to open another account, Bank B will collect the customer X's bio-data afresh and it gets transmitted from the Bank B's web browser to the same cloud storage.
- The 2 scenarios above will lead to a duplication process of data collection since the customer X cannot, for instance supply two different dates of birth and blood groups at the point of opening an account in each bank.

4.5.1.6.1 Data sharing in action

It would have been seamless if on opening account in Bank A, customer X was assigned a customer code from the Bank A and a CSP Code (where this typically is an identifier in the Cloud). When the customer X goes to Bank B to open account and he or she is requested to fill a form where there is a CPS Code option to fill. When the customer X fills his or her CPS Code, Bank B will be able retrieve customer X Date of Birth and Blood Group from the cloud without even the customer knowing. Of course, this can serve as a source of further authentication of the information the customer provides for account opening at the other bank. This idea can be duplicated on a number of different data needed from customers. This can help microfinance banks to tie customer's financial history together, regardless of the location of the banking transaction of the customer and the location of the bank branch. The only issue here is maintaining the trust, privacy and security of the data so accessed by the other bank, although these issues can be eliminated at the original data owner end by implementing Read/Write access permission, i.e. the bank accessing the data can only read the data but cannot alter it. Where the need arises for alteration, the customer applies to the original bank for such changes to be effected. Data location issues can also be eradicated if a community cloud (cloud set up solely for the purpose of sharing a particular kind of data or services under a private arrangement among the partnering institutions) for the purpose of this. If this scenario is implemented, it will minimise the time consuming process of creating duplicate records for a particular customer in all microfinance banks he or she transacts with. This scenario depicts a typical cloud data sharing ability, a potential benefit of using cloud.

4.5.1.9.2 Guidelines for Implementation for Data Sharing

- Vendor assigns a storage domain application interface to client (microfinance bank)
- The customer (the original microfinance bank) generates data and create an Access Control List (ACL) that will specific the login conditions (authentication) and other login parameters for other banks to have access to its data
- Sharing partner banks agree on terms about data-sharing via SLA's
- Owner assigns a unique identifier to each customer show who owns the data
- On breaching of any agreed SLA's component, data owner terminates sharing privilege granted the partner by removing the defaulter from the Access List.

4.5.1.10 Scenario 2: Data Storage (Benefit of Cloud Computing)

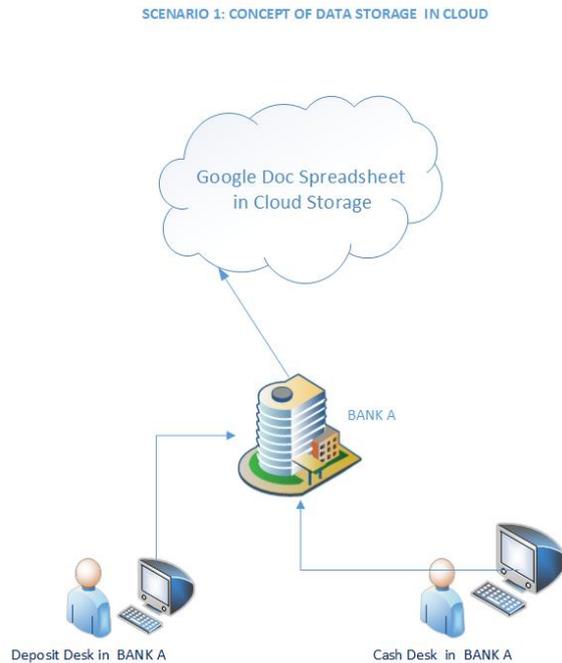


Figure 4.2: Scenario 2 - Data Storage

Assumptions:

- Bank A has deployed cloud service.
- Deposit Desk officer and Cash Desk officer all have Read/Write permission to the banks GoogleApp financial spreadsheet document.

Figure 4.2 above depicts a typical scenario where two different employees in same bank can work (collaborate) on a single document stored in the cloud using their separate personal computer and accessing the same spreadsheet document from their different offices.

As of now:

- If the bank A is not using cloud services as simple as GoogleApp, what happens in such scenario is a situation where the Desk Officer at the Deposit desk will have to send his or her record through paper documentation to the Cash Officer at Cask desk for such information to be used in completing the task of paying cash to the waiting customer.

4.5.1.10.1 Data Storage in action

The bank A has deployed cloud service and have its data and app hosted in the cloud. A simple GoogleApp can allow employees at different locations to access their data but the issue would be who access the data and what has changed and by who, this raises concern for data integrity because there is provision to monitor how changes are being made and who made such changes. If all users who access the GoogleApp document have a login ID and each computer is uniquely identified, it easier to know who changes what, where and when. With such audit facility, it can be guaranteed the storage system is secured and data is safe in it. This scenario can be extended to employees at different locations of the bank provided all branches share the same storage facility. The scenario explained above shows the data storage ability of the cloud, a useful benefit of cloud technology.

4.5.1.10.2 Guidelines for Implementation for Data Storage

- Each system user is assigned a unique identifier and all users of the system are assigned login ID and password.
- Audit is carried out periodically to make sure integrity of the system is maintained at all times.

4.5.1.11 Conclusion Validity

Conclusion validity is the extent to which conclusions made in a research study about relationships in the data used are reasonable to adjudge being valid. In other words, it can be considered as the validity process that has been done to the required results which are reliable and suitable enough to the researcher to establish an accurate conclusion in an on-going research

According to Wohlin *et al.* (2000), heterogeneity of subjects can cause a potential threat to conclusion validity of a research. The subjects involved in the research from different educational backgrounds and experiences then this situation is called heterogeneity. The researcher eliminated this threat by selecting the subjects from cloud computing domain, however some interviewees were selected from Microfinance subsector of the SMEs domain. Survey was sent to associates in cloud computing, associate of microfinance institutions. This research work mainly aimed at finding ways to encourage the adoption of cloud computing by microfinance banks in Nigeria.

4.5.1.12 Construct Validity

According to Trochim (2006), Construct validity refers to the degree to which inferences can legitimately be made from the operationalisations in your study to the theoretical constructs on which those operationalisations were based. In other words, it shows the relationship between theory and observation. Mono-operational bias and evaluation apprehension are threats to constructs validity.

Interviews based on interest was selected by the researcher to eliminate evaluation apprehension threat to the constructs validity of this research. The researcher first discussed the research intent with the interviewee before and the interview proper and that helped to reduce the threats to constructs validity. Names of the respondents were not collected to avoid creating apprehension which may make the respondent to respond in a manner that will cause a threat to the construct validity. Mono-operational bias threats was eliminated by interviewing only seven interviewees in this research. Respondents from Cloud computing and microfinance subsector of the SMEs were selected.

4.6 Conclusion

In this chapter, the presentation, the analysis and interpretation of the results of the empirical study were put forward. The quantitative research data was discussed and an analysis of the data that emanated from the qualitative research was presented.

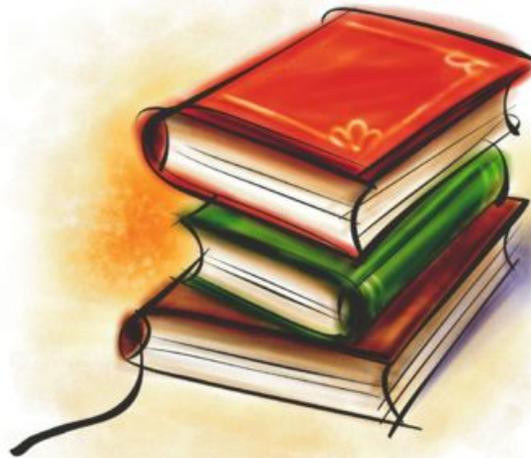
It was found that cloud computing has an appealing economic benefit if deployed by organisations such as the microfinance bank which the subsector of the SMEs in this study. Cloud computing being an emerging technology is still new and somewhat a myth to most operators of SMEs in that most operators of this organisations are not aware of the existence of this technology.

Cloud education, awareness and enlightenment are integral part of cloud adoption and should be not separated from each other if the rate of adoption of cloud computing by SMEs must be improved in Nigeria. Chapter 5 consists of a complete discussion of the above mentioned analysis. The central focus will be on the economic implications of cloud

adoption, the issues arising from using cloud and what mitigation measures are being put in place by cloud vendors to cushion the effect of such if need arises and the guidelines as well as steps for effective implementation of cloud will be advanced. Limitations of the study will also be discussed and recommendation for future research will be made.

Chapter 5: EPILOGUE

“When I look back, I am so impressed again with the life-giving power of literature. If I were a young person today, trying to gain a sense of myself in the world, I would do that again by reading, just as I did when I was young.” — Maya Angelou, 2014



“I know nothing in the world that has as much power as a word. Sometimes I write one, and I look at it, until it begins to shine.” — Emily Dickinson

5.0 Introduction

In this chapter, final overview of the study is presented. The central focus here will be on the extent to which the data is able to answer the research question and the specific research questions. Guidelines vendors how to improve cloud adoption as presented by researcher and steps towards effective implementation of cloud computing for would-be cloud users. Conclusions and future work in the areas of cloud computing that will specifically address the contemporary Nigeria situation will be put forward to industry players and future researchers.

5.1 Aim of the Investigation

The aim of the study was to investigate the reason for the slow adoption of Cloud computing technology in Nigeria. The intention of the researcher was to make a contribution to a holistic and better understanding of cloud computing by SMEs operators, specifically the microfinance institutions and to find ways of improving its adoption. An attempt to provide answers to issues concerning the cloud computing – the benefits, the challenges and the various mitigation measures in cloud technology against threats and risks that will be beneficial to the participants, the would-be cloud users and the industry players were integral to the aim of the study.

Specific questions needed to be investigated with regard to cloud computing adoption, which resulted in a specific purpose for the study. These specific research questions were:

- RQ1. What are the economic benefits of migrating to the cloud computing?**
- RQ2. Are there associated issues when migrating to cloud technology?**
- RQ3. Can the risks associated with cloud computing services be mitigated?**
- RQ4. Do SMEs require cloud computing services?**

In order to achieve the main research aim and to answer the specific research problems, a literature review of related study was conducted first and then secondly an empirical study. The empirical study was achieved with a qualitative study. In the discussion below, integration of these two studies' findings, as well as the conclusions, are offered.

5.2 Research Questions

5.2.1 RQ1 – What are the economic benefits of migrating to the Cloud?

The researcher answered RQ1 through the study of related literature and complimented the findings from interview conducted with industry associates. A literature review was conducted on the subject of Cloud Computing to establish the documented evidence of economic gains, organisation stand to benefits from migrating to cloud technology. A significant amount of documentations on the economic benefits of cloud computing was obtained; see Chapter 4 (Section 4.4.1.1 – 4.4.1.5). Specifically for SMEs, Chapter 4 (Section 4.4.3.1 – 4.4.3.6) outlined the peculiar benefits of cloud to the SMEs subsector. These benefits included cost reduction, flexibility and scalability of IT resources, greater efficiency and agility, data storage and a reduction in capital investment on hardware and software. In the interviews, IT professionals, industry players and associates (Cloud Computing experts and Microfinance Bankers) gave their opinions as to what they considered as the economic side of cloud computing as it applies to SMEs. This was combined and documented in Chapter 4 (Section 4.4.3.1 and Section 4.4.3.6) and they included data storage, data sharing, reduction of IT cost, flexibility and agility while others are themes that emerged from the interview under cloud benefits as depicted in Table 4.12.

5.2.2 RQ2 – Are there associated issues when moving to the cloud?

The researcher implemented a two-step approach to answering this research question. The researcher conducted a review of related literature (Section 2.0 – 2.13) and established some documented concerns regarding cloud computing. Based on the concerns found in the literature reviewed, the researcher conducted interviews as a second step with industry associates and IT professionals and was able to identify some of the issues involved in the adoption of cloud computing in SMEs' operations. Ultimately, the interviews gave an insight into the issues (Section 4.4.4.1 – 4.4.4.8) involved in the adoption of cloud computing in SMEs' operation. Of all the issues, education and awareness about the technology seem to be the pivot upon which other issues can be managed since knowledge of the technology in the first place will ultimately equip the consuming public with the right decision-making model. Some of the issues identified were data security related i.e. how secure is the data stored in the cloud? Is it safe to store all data

in the cloud?, data storage i.e. where data is stored, knowledge of the technology i.e. Cloud technology is an emerging technology and not too many organisations are aware of the technology let alone know how it works to warrant a decision to migrate to the cloud, SLA i.e. an agreement between the consumer(customer) of technology and the provider(vendor) of the service, the complex nature of the SLAs component requires a knowledgeable person in the consuming organisation and this lacking in most organisations and may require a third party which can add cost to the consumer, lack of operational control of their data since this data is stored and processed in a remote location legal, regulatory issues regarding the protection of customer’s data.

5.2.3 RQ3 – Can the risks (threats) associated with Cloud Services be mitigated?

RQ3 was answered by the researcher through literature documentation. In the literature chapter Section 2.9, the researcher identified various risks associated with Cloud Computing and some of these risks included abuse and nefarious use of cloud computing by employees in an organisation, insecure interfaces and APIs, malicious insider within the organisation, Shared technology issues, data loss or leakage, account or service hijack and unknown risk profile. The Table 5.1 below is a tabulation of the above mentioned threats and their respective mitigation methods:

S/No	Threats	Remediation
1	Abuse and Nefarious Use of Cloud Computing	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ Analyse the security model of cloud provider interfaces. ▪ Ensure strong authentication and access controls are implemented in concert with encrypted transmission.

		<ul style="list-style-type: none"> ▪ Understand the dependency chain associated with the API.
3	Malicious Insiders	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ Implement strong API access control. ▪ Encrypt and protect integrity of data in transit. ▪ Analyse data protection at both design and run time. ▪ Implement strong key generation, storage and 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	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ Disclosure of applicable logs and data. ▪ Partial/full disclosure of infrastructure details (<i>e.g.</i>, patch levels, firewalls, etc.). ▪ Monitoring and alerting on necessary information.

Table 5.1: Cloud Risks and Remediation Method

5.2.4 RQ4 – Do SMEs require Cloud Computing Services?

From the analysis of the research findings and related documentations, it has been established that cloud computing economic offerings for the SMEs is worth trying.

Nothing can be more appealing than incorporating a technology into business processes that in turn drive the business growth. YES! SMEs require Cloud Computing

5.3 Guidelines Presented by the Researcher

Cloud Computing is an evolving and new approach to IT service delivery and most people are not even aware of the existence of this technology, talk more of knowing its features. Consistent awareness about the technology has to be mounted to extract the needed impetus to drive its adoption. The following guidelines (Section 5.4.1 to 5.4.6) are therefore proposed to aid both the Service Provider and the Cloud End-users.

5.3.1 Education and Awareness

As with any new technology, people need to be aware of what the technology is all about before fully embracing it. Cloud Computing is a new IT approach to driving business growth and enhancing service delivery. In spite of this, most people are still unaware of this cloud computing features and are nursing certain fears about the confidentiality of their data and therefore reluctant to put their data in the cloud. In a developing economies like Nigeria, a lot of people working in the SMEs Subsector still lack basic computer knowledge so before planning to start adopting Cloud Computing, SMEs have has equip their staffers with the requisite IT knowledge needed to manage the cloud platform. The Cloud vendor has to adequately educate their would-be customers to increase their understanding of the cloud technology and demonstrate privacy and security capability of their system to increase the trust of the users.

Strategically, the Cloud Providers should consider the following:

- Ensure that the customer has a good understanding of cloud technology intricacies and that it is explained to the customer, existing IT costs and the true cost of migration, and build a strong argument for proposing a switch to the cloud. This should take into consideration cost savings as well as wider business benefits, such as faster speed to market and service delivery, improved productivity, and richer management information.
- Educate customers on cloud computing and its overall implications for their business operations. Recognise that the IT Officers or Managers, are bridges to senior management as well as decision-makers in their organisation so must be included. This means targeting the cloud message towards non-technical, management-level executives, aimed at solutions that recognise the motivations of the various players and take into consideration of the gradual homogenisation of the cloud environment.
- Dispel their fears over the potential downsizing of their Information Technology department and the loss of operational control over IT.
- Understand where customers stand in their business transformation/ IT upgrade journey, which will impact their willingness to migrate data intensive applications and activities to the cloud.

- Demonstrate in clear terms how you are applying industry-accepted standards and comply with regulations regarding data privacy and security. By showing that sufficient measures are in place, this would make customers get the same sense of security from the cloud that they get from their traditional IT environment

5.3.2 Service Provider Selection

Some of the IT professionals and associates interviewed mentioned that selecting a good vendor is a critical step for the microfinance institutions before adopting cloud computing. Choosing a service provider is an important step towards cloud adoption, failure of which can be very disastrous. At this point, the SMEs has to carry out background checks on the vendor to ascertain, (1.) the financial stability of the vendor (2.) for how long the vendor has been in the business of providing cloud services and (3.) what has been the vendor customer's rating in terms of service delivery and support. A good vendor of course will be open and will produce good SLA's to customers. A reliable vendor with a good customer relationship is desirable. A good vendor will be keen about delivering secure service and guaranteed down-time contingency plan.

5.3.3 Secure and Flexible SLAs

SLA is a legal contract and mutual business agreement between the service provider and the cloud end user for the provision of cloud services. It must therefore be designed the mutual understanding of business concern. As it is the case with microfinance institutions customers' data and banking history are supposed to be confidential and so SLAs must be formed in such a way as to guarantee that the customer's data privacy is upheld. A flexible SLAs is desirable because of the peculiar nature of Nigeria's business environment considering the fact that this is a new technology and users are yet to fully understand its intricacies. SLAs element must be made in such a way that there is room for periodic review if need arises to accommodate unpredicted incidentals, he will give the consumer a sense of confidence. Concerns like data security and data availability can be addressed by multi-cloud so they need to be included in the SLA's so customers would know ahead that if there is no problem with one cloud, their data is also stored in another cloud and would still be available for access with interruption of service.

5.3.4 Building trust for the user

The issue of trust is an important element that has to be built into SLA's to ignite confidence in the customer. As explained in data sharing scenario where Bank A who already has a customer's data stored in the cloud can simply share the data with Bank B. If Bank A and Bank B have a mutual sharing agreement, customers' data can be shared between the organisations. As important as customer's information is as well as his or her transaction history, it would be a serious breach of trust if the customer discovers that his or her bio-data or banking transaction history has been shared to unauthorised person e.g. where some organisation share customers email addresses to email marketing without the consent of the email owner. Customer should have the ability to check who accesses his or her information and from where. This can be prevented implementing user's authentication or ACL. The vendor has to explain and demonstrate its system performance to the customer to build trust and increase the confidence of customer that their privacy will be respected.

5.3.5 Data Center location

As discussed in scenario 2 – data storage, storing data in the cloud gives easy access to such data at any time and from anywhere. Another scenario may be depicted where an organisation's data is being stored at a location outside its territory and issues of legal implication arises, there is tendency therefore that data protection regulation in one territory might be different in another territory and so this has to be considered by storing data in the country where the customers are.

5.3.6 Selection of Suitable Deployment Model for Microfinance Institutions

Some of the IT professionals and associates mentioned that every cloud deployment model has their own benefits and challenges. The researcher analysed the opinions from associates and concluded that private cloud is the best deployment model for storing microfinance bank financial transaction and its customer's data. Private cloud is more secure with strict SLA's but still there is no 100% security in it and it is more expensive compared with public cloud. When using private cloud, tight security control should be implemented; if it is stored in public cloud it should be encrypted and the decryption rights should be given to only authorised person or user.

5.4 Steps for Effective Cloud Implementation

5.4.1 Make an Effective Business Case

"Strategic planning is worthless - unless there is first a strategic vision" - John Naisbitt

Before you put aside your existing traditional system and introduce your users to the cloud, it is important to strategically plan ahead. This planning should include defining a clear and concise business goal. What benefits you intend to derive from the new IT solution and how this change will help meet business objectives. Take time to understand the processes with your current system and what the future may require and make sure that the cloud solution can satisfy your desired capabilities. Determining why cloud computing should be deployed, what are the economic imports of deploying cloud technology and is it possible that these goals can be achieved. In this case, microfinance operators should consult industry experts and stakeholders both from the IT and the commercial banks operators who likely have already used the technology from the very beginning of conceiving the idea of migration, These should include legal advisors, CTOs of similar organisations, IT managers or possibly contract a third party with experience in cloud implementation to handle the planning phase to ensure successful implementation and that data protection is guaranteed while maintaining the confidentiality of customer's data.

5.4.2 Research the industry

"The more important reason is that the research itself provides an important long-run perspective on the issues that we face on a day-to-day basis." - Ben Bernanke

Any microfinance bank that considers migrating to the cloud needs to undergo a careful research process. Taking the time to acquaint yourself with the available solutions as there are a number of solutions designed to help banks comply with some regulations regarding cloud data. You will also discover that many of your bank's peers are successfully moving to the cloud, too -- if they are not there already.

5.4.3 Conduct Peer Review

One important and effective step towards successful cloud implementation will be to meet peers and listen to their own stories. Get to hear from them, “why they migrate to the cloud” or “why cloud solution is the way to go”. This will provide a good foundation for your cloud education. Ask to know what solutions they are deploying, how they are using them and what was involved in getting to that point. Doing so will give you an overview into what you should look for during this transition phase and what you can expect once you are ready to move to the cloud.

5.4.4 Determine Critical Data and Application

“The problem, simply put, is that we cannot choose everything simultaneously. So we live in danger of becoming paralysed by indecision, terrified that every choice might be the wrong choice.” – Elizabeth Gilbert

So long as moving to the cloud will displace some legacy hardware, your organisation will likely need to keep in place alternative existing on-premise solutions. In view of the volume of data that microfinance banks own, such as customer’s credit data and transaction history, it simply would not make sense for all of the data to be stored in the cloud. During the interview, some IT experts said it is safe to store all organisation’s data in the cloud and similarly, not all applications should be run from the cloud. Carefully determine what belongs in the cloud and what should not.

As a safe bet, organisation can first migrate less important data alongside less risky application for a test and observe the system performance before fully migrating all data and applications. The time within which unimportant data and application are worked with in the cloud would allow the organisation staffers to become familiar with the system preparatory to full scale migration.

5.4.5 Create the Right TCO Model

Notwithstanding that the bank has made significant investment in an infrastructure that the cloud will replace, there is need to justify the cost of not using this infrastructure. When the total cost of ownership deployment model is compared with that of the legacy infrastructure, do not underestimate the cost of managing that on-premise hardware. It is easy for an assumption that because you already have that hardware it is not costing you anything, have it in mind that the infrastructure requires heavy IT management and technical support as well as timely upgrades.

5.4.6 Select the Right Cloud Service Vendor

As with any business, dealing with a trusted and good partner is key to a successful business adventure. It is a key component in the cloud adoption process to select a trusted and reliable vendor to ensure long-term business relationship since cloud vendor will likely be hosting the organisation's data or application or both as the case may be. Cloud service providers will responsible for maintaining the organisation's data privacy and security within the cloud. It is therefore important that the right vendor be selected to entrust the organisation's IT services with and no compromise should be entertained at this point. There are a plethora of questions that you should ask the vendor to help you in making the right choice.

As the vendor the following questions:

5.4.6.1 How will I access my company's cloud?

In any business of this kind, there are government agencies regulating the sector. Ask the vendor to know if it is an approved or licensed company authorised to operate and offer cloud services. This is the step to ensure who are discussing with the right operator.

5.4.6.2 What Cloud services do you offer?

Knowing what your cloud computing needs are will help you in determining the kind of cloud services your organisation needs. Ask the vendor about the various kinds of cloud offerings the vendor provides.

5.4.6.3 What is the Structure of your Price?

You should only pay for the services used and for the amount of time the services are being used. Since cloud services allow for pay-as-you-use model, then it is preferable you opt for pay-as-you option. The pricing scheme should be pay-as-you go from the very beginning, with the ability to top up services as may be needed.

5.4.6.4 How secure is your Cloud?

Your organisation's data security should be of a major consideration when it comes to storing critical data in the cloud. Service providers should have several standard security measures and threat mitigations in place and constantly update them. Security measures to look for include firewalls/intrusion detection mechanism, anti-virus software, 2-way user authentication and data encryption, and routine security audits. It is also important to find out who at the vendor side will have access to your data in the cloud and whether the vendor carries out employee background verifications to put off potential cybercriminals or identity thieves.

5.4.6.5 Where is your Data Centre and how safe it is?

Data centre location and the security of servers where your organisation's information will be stored are as important as online security, Foreman says. To make sure that your organisation's data cannot be easily be accessed and compromised, ask the vendor how its data center are protected from natural disasters, including fires, floods, earthquakes and storms. Also, find out how their facilities are protected from intruders who could just walk away with your sensitive data. The vendor should prove it complies with the industry security standards for the protection of customer sensitive data.

5.4.6.6 What happens if you lose my data?

There is an unfortunate chance that cloud vendor can accidentally delete your data or an incidence could occur that make the provider lose your precious data, you need to find out how it will rectify the problem. Ensure you request to know, what provisions are in the vendor's Service Level Agreement (SLA) that address potential data losses. Is there any compensation for data loss? What data redundancies does it have in place to mitigate

the risks of data loss? It is also of equal importance to know if the service provider has experienced any significant issues resulting from the loss of customer data.

5.4.6.7 What Customers Support Service Do You offer?

Under normal business condition, technical support should be made available to you online or by phone 234, even on public holidays. Find out about the average response and resolution time, and if at all your organisation will be interacting with knowledgeable customer care engineers or consultant using a live chat feature or remote service terminal in the event that issues beyond your technical know-how arise.

5.4.6.8 Can your cloud scale up to meet my business needs?

As your business expands, so will your cloud storage needs increases. To ensure that you are choosing a flexible cloud service provider, get to know what additional storage capacity and other services can be offered over time and at what cost. If you intend to hire more your staff, you will need to ensure that you can easily add additional users to your account.

5.4.6.9 What's your downtime history?

Downtime is usually when a cloud service provider is inaccessible to customers via the internet for a period of time. Naturally, the best response to this question should never. However, even the well-established, best-known cloud service providers occasionally experience downtime. Because cloud outages can be disruptive and costly for business organisation such microfinance bank where customers are expecting to get their savings as when needed, it is best to choose a provider with as few as possible downtime history. Some service provider update their downtime history logs online to assure their customers of their service reliability. If not, ensure to ask for the cloud service provider's track record.

5.4.6.10 How will I get set up?

After you have selected the service provider best for fit for your business, you will sign up. Normally the next step will be to log in to your user dashboard (front-end) and begin configuring your account and adding employees as users. Some cloud vendors will walk

you through how to install and set up their services while others will simply give you an introductory guide. Depending on your knowledge level, insist to be given right head-start.

5.4.6.11 How will I access my company's cloud?

You should be able to access your organisation information in the cloud from anywhere at any time via the web simply by signing in to your provider's client login page. You can use any device to log in, including your laptop, smartphone or tablet. In this case, you must make sure your service provider is able to allow you access your information this way.

5.4.7 Implement a Pilot Cloud Programme

After you have selected a service provider and have identified the applications and data that will first be migrated to the cloud. You will need to test the cloud with a small amount of data and application by storing them in one server and incrementally adjusting the size of data and the application as you observe the stability and reliability of the system. Noting that data confidentiality and people privacy should be maintained, you should not immediately dump all your data and apps into cloud. While increasing the size and number of data, the performance of the system has to be monitored carefully and what happens when you exceed the limit of storing capacity of the server. Analyse how scalability features of the cloud computing handle this issue efficiently and effectively before getting fully committed. After the pilot program, an assessment has to be carried out on how the cloud and its features are working and then a feedback from all users regarding the performance, security and privacy of the system should be measured. Once everyone is comfortable with it, it is time to work with the cloud provider and begin a broader deployment. It should be noted that cloud is just a new way of using the IT deliver services faster while ensuring efficiency and quick access to market. Each organisation IT needs varies and so is cloud, organisation has to know that cloud implementation should be dependent on their individual IT needs rather than trying to imitate others.

5.5 Recommendation for Future Research

Cloud Computing is an evolving IT approach to business service delivery and a lot of people (business managers) are unaware of its features and potential economic benefit if adopted. In consideration of this fact, further research in areas that will make the cloud aligns to Nigeria's

specific business environment, for instance, cloud application development should be targeted by future researchers.

More efforts should be put into custom (local) development of cloud applications that best fit Nigeria's local market. Research and Development (R&D) grants should be set-up by the government in Nigeria's institutions of higher learning to spur our up student to research more into developing high end local market cloud application of international standard as against the current trend of procurement of foreign software.

More research should be carried out on other sectors of the SMEs as this study was mainly conducted with the microfinance subsector of the Nigerian SMEs, this will give further insights into the gradient of cloud computing adoption in those sectors which will in turn give room for further actions to be taken to encourage broad-based adoption of cloud computing across all SMEs sector in Nigeria.

5.6 Limitations of the Study

There was a limitation in the study and this discussed below:

- The study was mainly with the microfinance finance subsector of the SMEs and the banks selected for study was restricted to those with branches in Uyo. A generalisation of the findings can be made to all other microfinance banks operating within Nigeria since all of the banks are regulated by the same regulatory body, the CBN, and are also operating under the same economic condition. However, it will not be comprehensive to extend the same generalisation to other subsectors of the SMEs e.g. the manufacturing subsector.

5.7 Conclusions

Technology Acceptance Model (TAM) was adapted as a research framework to investigate the reason for the slow adoption of Cloud computing by Small and Medium Scale Enterprises'

operators in Nigeria. 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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Appendix A – Letter of Consent

Appendix C: Consent Letter

I hereby give my consent to:

being interviewed on the research topics: **“Improving the Adoption of Cloud Computing by Small and Medium Scale Enterprises (SMEs) in Nigeria”**

I also understand that:

- I am free to end my involvement or to cancel my consent to participate in the research at any time should I want to;
- information rendered up to the point of my termination of participation could, however, still be used by the researcher;
- anonymity is guaranteed by the researcher and data will under no circumstances be reported in such a way as to reveal my identity;
- I am free to determine that specific information that I reveal should not be recorded in writing;
- no reimbursement will be made by the researcher for information rendered or for my participation in this project;
- I will in no way derive any personal benefit from taking part in this research project;
- by signing this agreement I undertake to give honest answers to reasonable questions and not to mislead the researcher;
- I will receive the original copy of this agreement on signing it.

I hereby acknowledge that the researcher/interviewer:

- discussed the aims and objectives of this research project with me;
- informed me about the contents of this agreement;
- explained the implications of my signing this agreement;

In co-signing this agreement the researcher undertakes to:

- maintain confidentiality, anonymity, and privacy regarding the identity of the subject and information rendered by the interviewee.

(Interviewee signature)

(Interviewer signature)

(Date)

(Date)

I, (interviewer signature)_____ certify that I explained the contents of the above document.

Appendix B – Cover Letter

TO WHOM IT MAY CONCERN

I am currently a registered Post Graduate Research student in the School of Computing, University of South Africa (UNISA) studying for a Master of Technology (M.TECH) Degree in Information Technology,

I am conducting a Research on topic: ***“Improving the Adoption of Cloud Computing by Small and Medium Scale Enterprises (SMEs) in Nigeria”***

- to determine the causes of slow pace of adoption of Cloud Computing by SMEs in Nigeria;
- to illuminate the concept of Cloud Computing adoption and further espouse the benefit accrue to embracing cloud technology and;
- to develop a model for creating awareness among SMEs and IT dependent Enterprises in Nigeria to help their business executives make an informed decision about Cloud adoption.

Cloud computing is arguably one of the most significant technological shifts of our time. The mere idea of being able to use computing in a similar manner to using a utility, such as electricity, is revolutionizing the IT services world and holds great potential. Customers, whether large enterprises or small businesses, are drawn toward the cloud's promises of agility, reduced capital costs, and enhanced IT resources. IT companies are shifting from providing their own IT infrastructure to utilizing the computation services provided by the cloud for their information technology needs.

However, along with these benefits comes a security concern that has been raised by SMEs and industry associates and these have seriously contributed to the slow pace of adoption of Cloud Computing in Nigeria.

Information obtained from this research will be significant in addressing those concern and espousing the overall economic benefits of Cloud Computing.

Research information plays an increasingly important role not only for management decisions but also for decisions affecting the industry as a whole. Your participation in this study would therefore immeasurably add to the above research project, since the wider the participation the more enriched the collected data would be.

In the light of the above, I have developed a simple questionnaire to help me collect research information for the above study and therefore solicits your assistance to complete the questionnaire.

Please note that respondents are not required to identify themselves by name in anyway in the questionnaire. All responses are therefore completely confidential and will not be used in any way that may identify the participant.

If any verification is required you can contact my supervisor:
Prof Ernest Mnkandla, School of Computing, CSET, University of South Africa
mnkane@unisa.ac.za
Thank You,

YOUNG, DESTINY A,
50788841@mylife.unisa.ac.za
08067084586, 08094448347

Appendix C – Interview

Appendix E - Interview question to IT Professionals and industry associates

Introduction

- ❖ What is your name?

- ❖ What is the name of organisation?

- ❖ What is your current position in your organisation?

- ❖ What is your main Responsibilities or Role in the organisation?
- ❖ Are you a member of any of Nigeria Computer Society(NCS) or Computer Professional of Nigeria(CPN)

Interview questions:

- IQ01. How do you define Cloud Computing?
- IQ02. Does your organisation use Cloud Computing?
- IQ03. What measure are being taken in your organisation to safeguard data and ensure privacy are maintained?
- IQ04. How has the cost factor of maintaining data centers effect your system?
- IQ05. What do you think is the major benefit of Cloud Computing services?
- IQ06. In your opinion, what are the main issues and challenges with Cloud Computing?
- IQ07. 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?
- IQ08. 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?
- IQ09. Do you think there is a need of advanced level security measures (as in SLA) for Small and Medium organisations?
- IQ10. 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?

- IQ11. What are the main advantages of Cloud Computing in SMEs e.g Microfinance banks?
- IQ12. Do you think that not having personnel knowledgeable in Cloud Computing could hinder SMEs from adopting Cloud Computing?
- IQ13. Would you say that inadequate power, inefficient infrastructure and high cost of access to ICT services and product can hamper cloud adoption?
- IQ14. Is there any hope of improvement in the rate of adoption of Cloud technology by SMEs in Nigeria?



Mr Destiny Assian Young (50788841)
College of Science, Engineering and Technology
UNISA
Johannesburg

2014-05-08

Permission to conduct research project

Ref: 125/DAY/2014

The request for ethical approval for your MTech (Information Technology) research project entitled "Improving the Adoption of Cloud Computing by Medium and Small Scale Enterprises (SMEs) In Nigeria" refers.

The College of Science, Engineering and Technology's (CSET) Research and Ethics Committee (CREC) has considered the relevant parts of the studies relating to the abovementioned research project and research methodology and is pleased to inform you that ethical clearance is granted for your study as set out in your proposal and application for ethical clearance.

Therefore, involved parties may also consider ethics approval as granted. However, the permission granted must not be misconstrued as constituting an instruction from the CSET Executive or the CSET CREC that sampled interviewees (if applicable) are compelled to take part in the research project. All interviewees retain their individual right to decide whether to participate or not.

We trust that the research will be undertaken in a manner that is respectful of the rights and integrity of those who volunteer to participate, as stipulated in the UNISA Research Ethics policy. The policy can be found at the following URL:

http://cm.unisa.ac.za/contents/departments/res_policies/docs/ResearchEthicsPolicy_apprvCounc_21Sep07.pdf

Please note that if you subsequently do a follow-up study that requires the use of a different research instrument, you will have to submit an addendum to this application, explaining the purpose of the follow-up study and attach the new instrument along with a comprehensive information document and consent form.

Yours sincerely

Deputy Chair, College of Science, Engineering and Technology Ethics Sub-Committee

Appendix D – Ethical Clearance

Keywords

ATU, BIU, Cloud Adoption, Cloud Computing, Cloud End-user, Cloud Service Providers, Data Security, Microfinance, PU, PEOU, IT, Nigeria, SMEs, Vendors,

Abstract

In a traditional business environment, companies set up their organisation's IT data infrastructure, install their applications and carry out the maintenance and management of their infrastructures. Whereas Cloud computing removes the need for companies to set up own data centers and run enterprise applications. Cloud computing technology provides businesses with the advantage of on-demand access, agility, scalability, flexibility and reduced cost of computing. An appreciable increase is being observed in the acceptance and migration to this new IT model in developing economies. In Nigeria, it has been observed that there is a somewhat unimpressive rate of adoption of Cloud computing by the microfinance operators. This research investigates the reason for the slow adoption of Cloud computing by SMEs in Nigeria with special consideration to the Microfinance subsector and to develop a model for improving the adoption of cloud computing by microfinance organisations.

The research was conducted using a qualitative research design method. Interview was the main data collection instrument and data collected was analysed using thematic content analysis method.

The analysis of the study revealed that SMEs in Nigeria, with particular reference to microfinance subsector in Akwa Ibom State are yet fully to 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 computing by SMEs.

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List of Abbreviations

- SMEs** – Small and Medium Scale Enterprises
- SaaS** – Software as a service
- PaaS** – Platform as a service
- IaaS** – Infrastructure as a service
- CSP** – Cloud Service Provider
- CEUs** – Cloud End-Users
- CPN** – Computer Professionals Registration Council of Nigeria
- NCS** – Nigeria Computer Society
- ISPON** - Institute of Software Practitioners of Nigeria
- CBN** – Central Bank of Nigeria
- NIST** – National Institute of Standards and Technology
- CSA** – Cloud Security Alliance
- APIs** – Application Programming Interface
- ACL** – Total Cost of Ownership
- R&D** – Research & Development
- CAPEX** – Capital Investment
- OPEX** – Operating Expenditure
- IT** – Information Technology
- ATU** – Attitude Towards Usage
- ASU** – Actual System Use
- PU** – Perceived Usefulness
- PEOU** – Perceived Ease-of-Use
- BIU** – Behavioural Intention to Use

Statement of Original Authorship

STUDENT NUMBER: 50788841

I hereby certify that this research project:

“Improving the Adoption of Cloud Computing by Small and Medium Scale Enterprises (SMEs) in Nigeria”

constitutes my own intellectual investigation, the content and work presented in this research study is a genuine and original work done by me and has not been published or submitted to any institution for the award of any degree programme.

Any literature, data, or works done by others and cited in this research has been given appropriate acknowledgement and listed in the reference section.

A handwritten signature in black ink, consisting of several loops and a long horizontal stroke extending to the right.

Signature

Date 31/06/2015

Acknowledgements

This Research was carried out as a precondition for the award of Master of Technology Degree (MTECH) in Information Technology (IT), a research degree at the University of South Africa. I have selected this research dissertation on Cloud Computing in Nigeria from the SMEs' perspective as it is my wish to play a role in the development of socio-economic condition of Nigeria via the promotion of adoption of best-in-class technology as I seek to become a Cloud Computing Evangelist.

In the course of this research, I have gather a great deal of understanding of Cloud Computing Technology and have 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 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. The author's 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 to Prof. Mnkandla Ernest and other faculty members of the School of Computing. Prof. Mnkandla Ernest was my supervisor during the course of writing this dissertation. Prof. Mnkandla Ernest also helped profoundly by providing important guidance whenever the need arises, he has 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 Obong Nsima Ekere, the former Deputy Governor of Akwa Ibom State and Obong Umana Okon Umana, the APC Governorship Candidate for Akwa Ibom 2015 Gubernatorial election 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,

YOUNG, DESTINY A

Chapter 1: INTRODUCTION

1.0 Background

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).

SMEs are said to be the engine room for the development of any economy because they form the bulk of business activities in a growing economy with the capacity to contribute at least 30 per cent to the Gross Domestic Product (GDP) and generate 58 percent of jobs of the working population (Ilegbinosa & Jumbo 2014). This has hardly been the case in Nigeria, with an estimated 170 million population, as operators in the SMEs sub-sector continue to lament their dwindling fortunes, blaming such problems as: inadequate and inefficient infrastructural facilities and technology, which tend to escalate the cost of operation (Sanusi 2003).

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)

According to Oyeyinka (2012) in his article presented at Financial System Strategy (FSS) 2020 International Conference organised by Central Bank of Nigeria, he submitted, “In the light of recent happening in the Nigerian macro-economic environment, SME have compelling growth potential and like other emerging economies are likely to constitute a significant portion of GDP in the near future”.

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”¹, 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*”²

According to Stanley Buzim, SMEs remain a critical segment whose potentials in the Nigerian economy have been severely limited due to lack of needed IT infrastructure coupled with absence of information as to the relevant technology that can be adopted to enable the subsector to leapfrog and break even³.

1 Uzor Jr. B. *BusinessDay Media Ltd Website*. [Online]. 2012 [cited 2013 August 03. Available from: <http://www.businessdayonline.com/NG/index.php/tech/telecoms/47059-why-fg-is-embracing-cloud-computing-commtech-minister>

2 Okonji E. *Thisdaylive News Website*. [Online], 2013 [cited 2013 July 04]
URL: <http://www.thisdaylive.com/articles/microsoft-announces-office-365-suite-in-africa/152344/>

3 <http://risenetworks.org/2013/06/18/nigerian-banks-can-do-better/>

This study investigated the reason for the slow adoption of cloud computing by Nigerian Microfinance operators and came up with an awareness model needed by the operators to encourage their adoption of cloud computing and to also boost the SMEs subsector.

In this research, the author looked at Cloud Computing; an emerging Information technology paradigm from the SMEs' Perspective. The author looked into some of the challenges being raised and presented a case for the adoption of Cloud technology by SMEs in Nigeria.

1.1 Cloud Computing Defined



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

Cloud computing is not a revolution in information technology but an evolution of existing technologies as the main revolution occurred long before the advent of cloud computing (Tjoa 2011).

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)⁴ 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 (Armbrust, *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).

1.1 Clarification of Concepts

The following are the key concepts/terms as used in this dissertation:

Cloud computing – “*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*” (NIST 2011).

Cloud Computing Services are grouped into three areas: software as a service (SaaS), platform as a service (PaaS) and Infrastructure as a service (IaaS) (Zhang *et al.*, 2010). These services are arranged in layers and they replace the traditional “in-premises” computing systems (Barnatt 2010).

Cloud Service Providers – Own and operate cloud computing systems used to render services to third parties cloud end-users. They are responsible for providing general maintenance and upgrade of the system, data security, and cloud computing service pricing

⁴ Mell, P and Grance T, 2011, Recommendations of the National Institute of Standards and Technology, US Department of Commerce Special Publication 800-145

and for the majority of CSP often have competency in different cloud deployment models (IaaS, PaaS, SaaS) as well as provide consultancy service to Cloud End-users(CEUs) (Dogo *et al.*, 2013).

Cloud End-Users (CEUs) – These are the consumers that subscribe to Cloud computing service that is offered by the CSPs. The consumer could be private or corporate users. (Dogo *et al.*, 2013).

Cloud Security - Cloud computing security refers to the set of procedures, processes and standards designed to provide information security assurance in a cloud computing environment. (*technopedia.com 2010*).

Computer Professionals Registration Council of Nigeria (CPN) - is a highest corporate body with perpetual succession and common seal, a legal entity charged with supervision and regulatory of the Computing Profession in the Nigeria (cpnf.gov.ng 2014).

Hybrid Cloud: The combination of private and public is called hybrid cloud (Peter *et al.*, 2009).

SMEs - *SMEs* are broadly *defined* as businesses with turnover of less than N100million per annum and/ or less than 300 employees (Oyeyinka 2012).

Nigeria Computer Society (NCS) - is the umbrella organisation of all Information Technology Professionals, Interest Groups and Stakeholders in Nigeria. Formed in 1978 as Computer Association of Nigeria (COAN); and Transformed into NCS in 2002 (ncs.org.ng 2014).

Institute of Software Practitioners of Nigeria (ISPON) - The Institute of Software Practitioners of Nigeria (ISPON) is the apex body of computer software and related services industry in Nigeria growth of the software-driven IT industry in Nigeria. It is a non-profit organization that serves as a single point of reference for any information on software industry in Nigeria (ispon.org 2014).

Private Cloud: Clouds that are used for specific organization providing more security and it may be managed by the organization or third party (Peter *et al.*, 2009).

Public Cloud: Public cloud is owned by specific cloud service provider. This public cloud infrastructure is available for large organizations and public and can be accessed from anywhere (Peter *et al.*, 2009).

Scalability: Maintaining the storage and traffic load in the peak load or high traffic for a site, cloud can handle easily without need of any additional hardware infrastructure or equipment and without disturbing user's normal work (Weiss, 2007).

Service Level Agreement (SLA): It is in general a legal binding agreement in the mutual understanding and acceptance about a service between a client who is buying the service and a Service Provider (David 2009).

1.2 Related Work

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, Abubakar 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.

1.3 Motivation

Cloud computing has been one of the most advancing technologies lately. Academic research on the adoption of cloud technology by Small and Medium Scale Enterprises (SMEs) in the context of Nigeria with particular reference to microfinance subsector has been minimal. Some work has been done by other researchers on the economic implications of cloud adoption by small organisations while others have researched on the inherent challenges of migrating to the cloud. Security of data and privacy concern are issues that are receiving increasing focus when adoption of cloud computing is considered.

Majority of industry publication points to the economic benefits of adopting cloud computing and the costs of migrating to cloud. There is little published work on the legal, regulatory, compliance considerations of adopting cloud computing, as well as, the organisational impact that cloud computing will have on the organisation (Shimba 2010).

Software experts under the umbrella of the Institute of Software Practitioners of Nigeria (ISPON) insisted that Cloud Computing would be the next technology revolution that would transform the Nigerian economy (ISPON Conference 2012).

According to ISPON, cloud computing providers will not exist if the users are not there to use the services. The force of interplay between the service providers and the consumers (in this case, the SMEs) will by extension stimulate a growth in the Nigerian economy, but the sad aspect of it is that most of the operators of SMEs have little or no knowledge about cloud computing to even consider its adoption. Consequently, there is a problem of *inadequate information about Cloud Computing* to properly guide the SMEs' operators regarding the relevant IT technology to adopt in order to propel their business growth.

This research therefore attempts to bridge the existing knowledge gap by putting together useful information that can serve as a handy reference guide for SMEs' operators to help broaden their knowledge about cloud computing, which will in turn accelerate the adoption

of cloud computing technology. This study is an attempt to provide answers to the critical issues surrounding cloud computing adoption in the context of Nigeria as it pertains to SMEs. Knowledge will be shared concerning the nature of the relationship existing between Cloud Service Providers (CSP) and the Cloud End-users (the SMEs). Besides, this study is one of the first sets of research geared primarily towards the microfinance institutions in Nigeria.

1.4 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.

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 research, 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 can be recommended.

Figure 1.2 depicts how actual system use affects BIU.

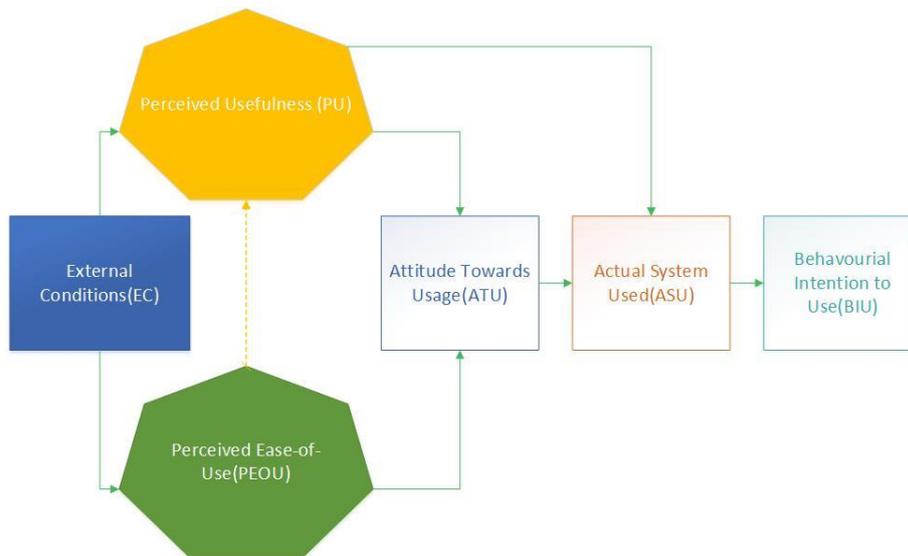


Figure 1.2: Research Framework: A Modified Technology Acceptance Model.

1.5 Aim and Objectives

The research aims at the strategic objective of addressing the issue of slow adoption of Cloud Computing by SMEs in Nigeria but organisations have to consider the cost implication, the benefits and risk associated with Cloud Computing before determining its adoption into its IT infrastructure strategy.

Within the above strategic boundary, the researcher’s specific objectives are to:

1. To illuminate the concept of Cloud Computing adoption and further espouse the economic benefit accrue to embracing cloud technology and this objective will be implemented through a literature review, surveys and interviews;
2. To compare the issues or concerns associated with Cloud adoption against the its overall benefit. This objective will met by reviewing related documentation alongside interviewing IT professionals and industry associates;

3. To determine the various security measures developed against Cloud risk. This objective will be implemented by reviewing Cloud risk mitigation related articles and as well as the use and surveys;
4. To develop a model for creating awareness among SMEs and IT dependent enterprises in Nigeria to help their business executives make an informed decision about Cloud adoption, this important objective will be implemented following the analysis of the overall research findings.

1.6 Research Question

The research attempted to answer the following main question:

How can the slow trend of adoption of Cloud computing by SMEs in Nigeria be addressed and improved?

The following sub-questions are specifics that need further and more in-depth investigation, as it concerns the research statement:

RQ1. What are the economic benefits of migrating to the cloud?

Implementing cloud computing into the existing traditional system of an organisation is not all-comers affairs. It requires a complete review of the organisation's current IT system. More important is to implement and use it in such a way that provides economic benefits for the organisation compared with the existing mode of operation. In theory, it should offer a performance increase in the organisation which will in turn amount to monetary improvements. However, it is also important to take a look from the other perspective as cloud computing could also cause damage to an IT organisation if not properly implemented and managed. This takes us to the next sub-question.

RQ2. Are there associated risks when moving to the cloud?

The first sub-question focuses more on the economic importance of cloud computing whereas this question aims more at the possible issues that can occur with cloud computing. This implies that there are also arguments which can be against cloud computing in an organisation. It is important to know the risks associated with cloud computing in order to give a good conclusion about whether to use cloud computing or not. No technology is without risk, which gives rise to a new question to mind about security. It is important to compare the risks of cloud computing with the current situation of an organisation to see if it is really beneficial and also to determine the possible impact of these possible issues.

RQ3. Can the risks associated with cloud services be mitigated?

This question will show the possible risks associated with cloud and how the service providers respond to such scenarios. This would help an organisation determine whether this technology provides risk mitigation than their current systems.

RQ4. Do SMEs require cloud services?

Having considered all that is required to be considered, do the SMEs really need to migrate to the cloud? The answer to this question will be the hallmark of this research.

1.7 Scope of the Study

This research focused mainly on the specific Cloud End-users of cloud computing. Specific end-users are the SMEs sub-sector (Microfinance banks) which is expected to use a lot of IT services to gain business growth. Private users are not considered in this research. Even more specific, a select number microfinance banks will be interviewed. Cloud Service Providers are also in the scope of this research as they have to guarantee security of end-users' data. The focus lies on microfinance banks that are starting a business, expanding a business or temporarily could need extra IT services. The researcher expected that in these

cases, cloud computing is especially useful because it has financial benefits and it increases flexibility for smaller organisations.

Out of the study are the technical aspects of cloud computing as far as the researcher needed not to explain certain parts or “the black box” of cloud computing. They will be explained and briefly mentioned, however, this research did not touch such area, as it is not in the scope of this dissertation to research cloud computing itself. The focus lies on the adoption of cloud computing by SMEs.

1.8 Relevance of the Study

Although they have been an increasing number of exploratory studies about Cloud Computing in Nigeria, most of the research is centred on cloud adoption trend with no specific direction for a particular set of organisation. This study is directed at SMEs with a particular reference to microfinance subsector. The study will provide an in-depth insight into the concept of Cloud Computing. The overall benefit of this research lies on the premise that the result when put into use by SMEs and various IT dependent organisations in Nigeria, will help drive the business of such organisations while ensuring maximum return on investment. Metrics generated from this investigation will no doubt be self-evident to SME organisation in deciding to adopt Cloud Computing or stay on the sidelines.

1.9 Research Method and Design

1.9.1 Research Design

Chapter 3 describes the research design and specific methodology applied by this research to examine ways of improving the adoption of Cloud technology by SMEs in Nigeria. The purpose of this chapter is to describe the methodologies employed and their application. The chapter is presented in twelve main sections: Section 3.1 discusses the methodology to be used in the study and the rationale for that paradigm of choice; Section 3.2 explains qualitative research study, Section 3.3 – 3.5 discusses quantitative research method and outline the difference between qualitative and quantitative research method as well their respect strength and weakness, the design rationale and method selection including methodological assumptions. Section 3.6 explains the research instruments and the data collection process used; Section 3.7 talks about the research participants and Section 3.8 describes the sampling method; Section 3.9 discusses the research procedure and timeline;

Section 3.10 discuss data analysis method employed in the research and Section 3.11 discusses issues of validity and finally Section 3.12 discusses the ethical considerations applied during the research.

1.9.2 Methodology

The methodology that was used in this research was the qualitative approach because of the nature of the investigation made which requires asking questions.

1.9.3 Design Motivation

It is not ideal to place quantitative and qualitative paradigms against one another in a competing stance. Patton (1990) advocates a "paradigm of choices" that seeks "methodological appropriateness as the primary criterion for judging methodological quality." Some researchers are of the belief that qualitative and quantitative research can be effectively combined in the same research project (Strauss and Corbin, 1990; Patton, 1990).

The researcher wanted to conduct a research that will provide a more complete understanding while avoiding the complexities of collecting both quantitative and qualitative data, the researcher therefore conducted this research using the qualitative method research paradigm.

1.9.4 Research Questions Relation with Study Objective

Figure 1.3 explains how the research questions and objectives are connected. It equally explains how the research objectives are related to the research questions so as to allow for the achievement of the aims and guidelines for adoption of cloud computing into SMEs' operations.

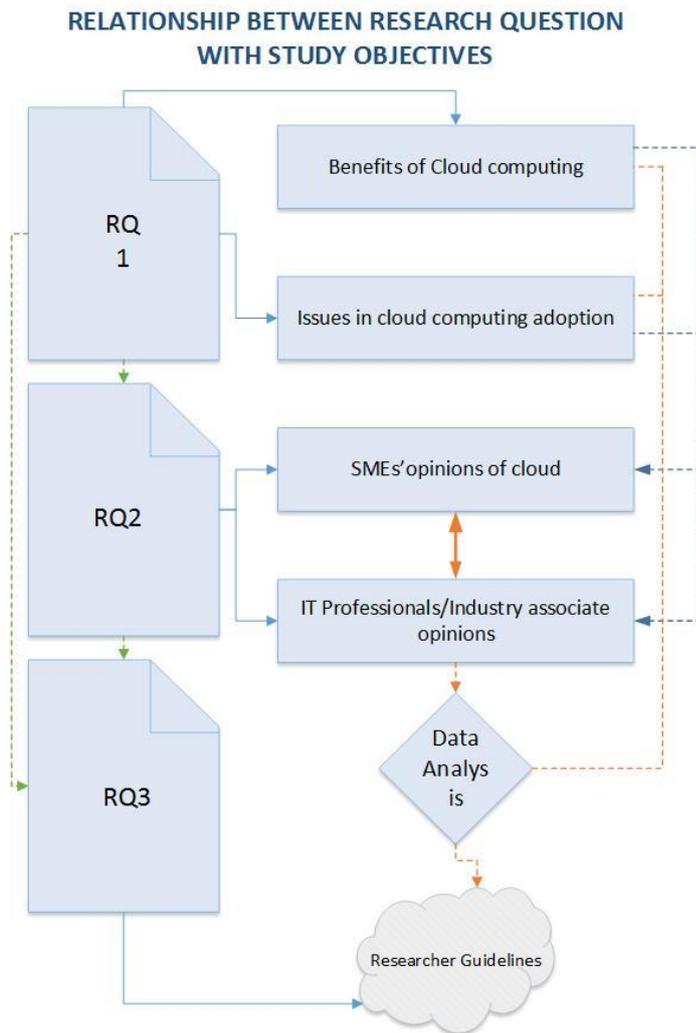


Figure 1. 3: Research questions relationship with study objectives

1.9.5 Method of Data Collection

To be able to conduct a research in a qualitative form it is essential to develop a structured question that meets the needs of the research. The author’s approach involves collecting data (interviewing the End-users).

1.9.5.1 Interview Method

The 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 this particular perspective” (King, 2004:11). The Researcher visited branches of microfinance banks within his locality and requested participation from the organisation’s designated representative. These representatives took part in a semi-structured interview which was conducted using

Skype and Google Hangout software depending on the ease of use by the participant. The interview was conducted by the researcher and the recorded session were replayed and transcribed. The interview questions were related to the factors of modified TAM framework as shown in Figure 1.2.

The interviews enable the researcher to obtain the participants' views about Cloud computing.

1.9.5.2 Research Population

Parahoo (1997:218) defines population as “the total number of units from which data can be collected”, such as individuals, artefacts, events or organisations. Burns and Grove (2003:213) describe population as all the elements that meet the criteria for inclusion in a study.

Burns and Grove (2003:234) define eligibility criteria as “a list of characteristics that are required for the membership in the target population”.

The important element that lends credence to a research study involves the validity of a data sample and sample selection (population).

The criteria for inclusion in this study were:

Cloud Service Providers (CSP)

All participants that are of theoretical interest to the study the Cloud End-Users (CEU) Professionals from associated industries which are considered key to the success of this research result.

The researcher considered only microfinance banks in this study. Because of budgetary constraint the researcher only restricted the study to Akwa Ibom State which is where the researcher resides. Only SMEs within this geographical location are considered in the study and to avoid the risk involved in travelling around to other parts of the country as a result of the insecurity currently experienced in some parts of Nigerian cities.

In addition to the aforementioned population sample, industry players from Computer Professional Registration Council (CPN) and Nigeria Computer Society (NCS) individually interviewed for peer review validation.

1.9.6 Sampling

Polit *et al* (2001:234) define a sample as “a proportion of a population”. A carefully selected sample can provide data representative of the population from which it is drawn. Our samples are the IT managers of these SMEs or their designated representatives.

1.9.7 Delimitation of the Investigation

A carefully select number of Cloud End-users (Micro-finance Banks) were studied. But those selected were proven to allow the author make generalization of the research result.

The delimitations of the study were the following:

- Research was limited to the Microfinance Subsector of SMEs in the Nigerian economy and it might be argued that micro business in other economic sector has different experiences with regard to Cloud adoption.
- Research was limited to microfinance institutions; therefore it might be argued that it does not apply to financial institutions not classified under SMEs by Central Bank of Nigeria.
- Research was limited geographically to Microfinance Banks located in Akwa Ibom State because of their proximity to where the researcher resides; therefore it might be contended that microfinances banks in others places may differ in their perceptions.

1.9.8 Ethical Measures

Research that has to do with people must be developed in such manner that Research Ethics are applied, particularly this includes the responsibility of the researcher to protect the

confidentiality of individual that participate in the study. This privacy protection had been extended to all classes of people involved in the study. This, the author did by designing the questionnaire and other data collection instrument in a way that the names of individuals were not indicated. This was also be clearly stated in our instrument to clear doubt.

1.9.8.1 Confidentiality

All data, whether collected electronically and otherwise, were handled in confidence in view of the sensitive nature of the information. The questionnaires used were developed by removing names and contact details of the respondent to ensure that no person can be identified by name.

1.9.8.2 Informed Consent

The research was conducted in such a way that any person who accepted our invitation to participate in responding to our questions does so voluntarily and gave their consent as well.

1.9.9 Dissertation Structure

The overall structure of this dissertation is outlined here as it would be seen in this research work with their respective contents.

An introduction to the study is discussed which includes a brief description of Cloud computing and the formulation of the research problem and sub-questions, the strategic objective and the significance of the research, the motivation for the study, the structure of the research and the research methods and design are all discussed here in chapter 1.

Chapter 2: LITERATURE REVIEW

Chapter 2 will entail a literature study on the concept of Cloud computing. The researcher will also study the SMEs in Nigeria's context and look at how the SMEs has impacted on the Nigerian economy.

Chapter 3: METHODOLOGY

In Chapter 3, a complete description of the methodology of this empirical study will be discussed. This will include the following: the aim of the investigation, the research design and method, the sampling population, data collection techniques and the method of data analysis including ethical issues

Chapter 4: METHOD OF DATA COLLECTION AND ANALYSIS

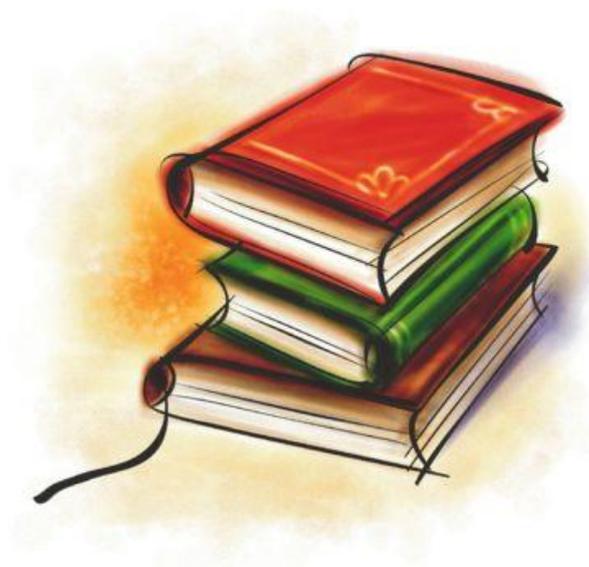
This chapter will contain the findings, discussion and analysis of the empirical research. The findings and discussion of the qualitative (interviews) studies will be dealt with in this chapter.

Chapter 5: EPILOGUE

This chapter will present the interpretation of the findings of both the literature and the empirical studies with regard to the sub-questions of the research. The Chapter will be ended up with a conclusion and recommendations will be provided specifically for Cloud Service Providers and End-user (SMEs) as well as for future research.

Chapter 2: LITERATURE REVIEW

“When I look back, I am so impressed again with the life-giving power of literature. If I were a young person today, trying to gain a sense of myself in the world, I would do that again by reading, just as I did when I was young.” — Maya Angelou, 2013



“I know nothing in the world that has as much power as a word. Sometimes I write one, and I look at it, until it begins to shine.” — Emily Dickinson, 1886

2.0 Introduction

A literature review is “a critical summary and assessment of the range of existing materials dealing with knowledge and understanding in a given field.... Its purpose is to locate the research project, to form its context or background, and to provide insights into previous work” (Blaxter *et al.*, 1998:110). Kurma (1996) argues that one of the essential initial responsibility of a researcher is to locate and review existing literature that pertains to a research topic. The purpose of this literature review is to integrate the researcher’s study into a broader framework of relevant theory and research.

This chapter will explore the concept of cloud computing and also look at SMEs in the context of Nigeria. It will be themed under the following headings:

- 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)

2.1 What is Cloud Computing?

As observed from some documentations, it appears that everyone in the cloud computing industry, from technology experts to cloud service providers, have their peculiar definition of cloud computing. It is discovered that there is not yet a generic definition for the term “Cloud Computing”

An examination of some existing definitions might help us to establish what cloud computing is all about (or what it might be involve).

The researcher has extrapolated six (6) definitions as quoted as below:

“Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services). Cloud computing is a disruptive technology that has the potential to enhance collaboration, agility, scaling, and availability, and provides the opportunities for cost reduction through optimized and efficient computing. The cloud model envisages a world where components can be rapidly orchestrated, provisioned, implemented and decommissioned, and scaled up or down to provide an on-demand utility-like model of allocation and consumption.” (Cloud Security Alliance v3 2011:12)

“Cloud computing is 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.” - Peter M & Timothy G., (2011:2) U.S. National Institute of Standards and Technology (NIST)

“A style of computing where massively scalable IT-enabled capabilities are delivered as a service to external customers using Internet technologies.” – (gartner.com 2009)

“A pool of abstracted, highly scalable, and managed compute infrastructure capable of hosting end-customer applications and billed by consumption” – (forrester.com 2011)

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 2.1

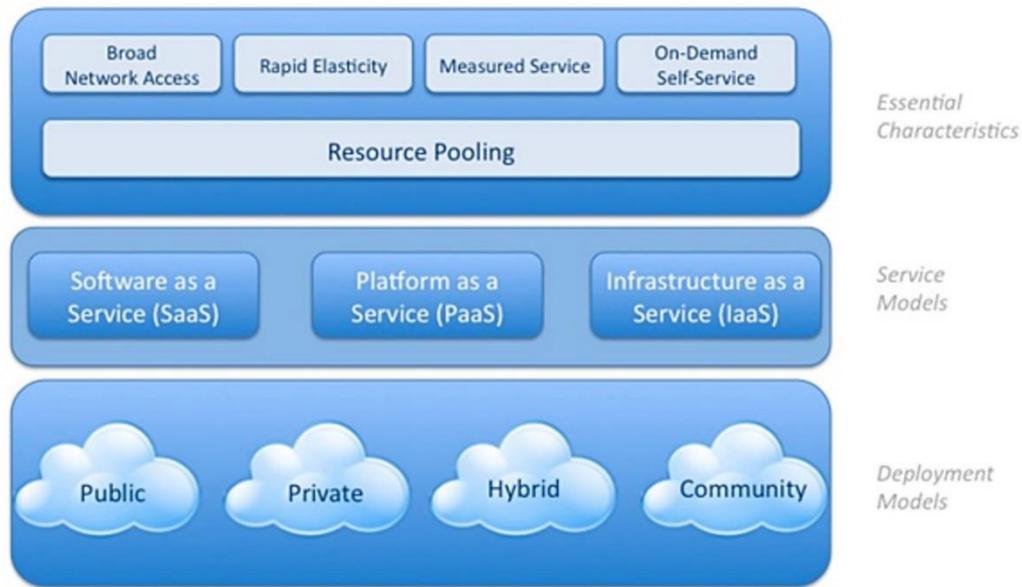


Figure 2.1: NIST Visual Model of Cloud Computing Definition (Cloud Security Alliance, 2011:15).

2.2 Essential Characteristics of Cloud Computing

The five (5) essential characteristics of cloud computing are explained as follows:

2.2.1 Service Based

A consumer can unilaterally provision computing capabilities such as server time and network storage as needed automatically, without requiring human interaction with a service provider. Consumer concerns are abstracted from provider concerns through service interfaces that are well-defined. The interfaces hide the implementation details and enable a completely automated response by the provider of the service to the consumer of the service. The service could be considered "ready to use" or "off the shelf" because the service is designed to serve the specific needs of a set of consumers, and the technologies are tailored to that need rather than the service being tailored to how the technology works. The articulation of the service feature is based on service levels and IT outcomes (availability, response time, performance versus price, and clear and predefined operational processes), rather than technology and its capabilities. In other words, what the service needs to do is more important than how the technologies are used to implement the solution (Cloud Security Alliance, 2011).

2.2.2 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. Many examples of Web technology exist as the foundation for Internet-based services. Google's Gmail, amazon.com's book buying, eBay auctions and Lolcats' picture sharing all exhibit the use of Internet and Web technologies and protocols (Cloud Security Alliance, 2011).

2.2.3 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).

2.2.4 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).

2.2.5 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).

It is important to recognize that cloud services are often but not always utilized in conjunction with, and enabled by, virtualization technologies. There is no requirement,

however, that ties the abstraction of resources to virtualisation technologies and in many offerings virtualization by hypervisor or operating system container is not utilized. Further, it should be noted that multi-tenancy is not called out as an essential cloud characteristic by NIST, but is often discussed as such in Fig 2.1 (Cloud Security Alliance, 2011:15).

2.3 Cloud Service Model



Figure 2.2: Cloud Service Model (Cloud Security Alliance, 2011:15).

2.3.1 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)

2.3.2 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)

2.3.3 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)

2.4 Cloud Deployment Model

2.4.1 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).

2.4.2 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).

2.4.3 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).

2.4.4 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).

2.4.5 Summary

It is important to note that there are derivative cloud deployment models emerging due to the maturation of market offerings and customer demand. An example of such is virtual private clouds — a way of utilizing public cloud infrastructure in a private or semi-private manner and interconnecting these resources to the internal resources of a consumers' datacenter, usually via virtual private network (VPN) connectivity. The architectural mindset used when designing solutions has clear implications on the future flexibility, security, and mobility of the resultant solution, as well as its collaborative capabilities. As a rule of thumb, perimeterised solutions are less effective than de-perimeterised solutions in each of the four areas. Careful consideration should also be given to the choice between proprietary and open solutions for similar reasons (Cloud Security Alliance, 2009:17).

2.5 Benefits of Cloud Computing

2.5.1 Drivers for Adoption and Economic Benefits 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 (Clouconomics, 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 (Clouconomics, 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 (Clouconomics, 2011:5). However, the benefits of cloud computing can be categorised under: Technical, User, Infrastructural, Companies and Environmental.

2.5.1.1 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). Applications in the cloud are so vital and these are available and reliable for all services. One of the cloud industry executives stated that —Any business leader worried about the security and reliability of their data in the cloud should remember that they’ve been trusting, saving, and storing their personal financial assets in an external, virtual banking cloud for years (Michael, 2010)

2.5.1.2 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.

2.5.1.3 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.

2.5.1.4 Environmental Benefits

It's Green: Cloud computing share the resources that is very good in the context of environment or going green as it reduce 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).

2.6 Limitations of Cloud Computing

Cloud computing technologies and business models have not yet reached maturity (Mardjan 2010:13).

It can be disclaimed that: all major cloud service providers (CSP) are still working on research and development to give customers the level of services and quality required for crucial business processes and the processes needed within CSP's and the IT technology used by CSP is growing towards a landscape of extreme complexity.

So what are the limitations of using cloud computing?

2.6.1 Security

No control over the business infrastructure. The major company assets are its data files with valuable customer information. Security, privacy and compliance are still difficult for cloud solutions mostly in a public cloud services. Physical location of hardware and software is not known. Audit and site inspection are very difficult. Availability in other words, constant connectivity is required. Risk of losing data due to improper backups or system failures in the cloud environment.

2.6.2 Cost and Flexibility

The technology innovation pace are dictated by CSP. Cost: Hidden cost. Non-transparent cost structure due to highly flexible usage of cloud services; Cost benefit is hard to obtain when using outsourcing for IT services in a traditional way (Hubert R. (2014).

2.6.3 Knowledge and Integration

More and deeper knowledge is required for implementing and managing SLA contracts with CSP's. Since all knowledge about the working of the cloud (e.g. hardware, software, virtualization, and deployment) is concentrated at the CSP, it is hard to get grip on the CSP. Integration: Integration with equipment hosted in other data centers is difficult to achieve e.g. access systems) and also (personal) USB devices or smart phones or groupware and email systems are difficult to integrate (JUCC, 2012).

2.6.4 Network

For the proper utilization of cloud computing application/services there is a need of high speed internet connection. Lack of speed and high bandwidth are the causes for not accessing the cloud services, so there are still a lot of questions regarding cloud computing. Similarly, network failures can result in a loss to the company by causing extensive time delays (Weiss, 2007). Constant Network access is possible in countries with advanced infrastructure, but this becomes a problem in most developing countries like Nigeria.

2.6.5 Data Segregation

As data of many users are stored in the same data center and same server or same hard disks it will raise the question from the users about the problem of mismatch i.e. How cloud securely isolate users and differentiate the memory and storage of each user as this failure could lead to leakage of information from one customer to another (Victor, 2010).

2.6.6 Dependency (Loss of data)

Privacy is one of the major issues in the cloud, as it needs a high degree of trust among the users and it is a fundamental human right not to break privilege granted by authority (Weiss, 2007). Users are always concerned about their data. To overcome this issue the provider should make sure that (John, 2010):

- Employees are aware of their responsibilities related to the confidentiality, integrity, availability of data and information systems.

- The confidential and/or personal client data, including system access credentials are protected (e.g. encrypted) from unauthorized interception.

2.6.7 Data Confidentiality and Auditability

This aspect concerns customers' worries that data kept in a public cloud are exposed to more attacks and could be intercepted by a third party to compromise data integrity in the absence of adequate security (Mather *et al.*, 2009). Similarly, auditability could be added as an additional layer providing facilities arguably more secure than those built into the applications themselves (Michael, 2009).

2.6.8 Latency

The inherent nature of cloud computing is accompanied by significant risk. Data becomes obscured in the cloud and may be hosted in multiple remote domains leading to questions about cloud security and compliance risks – risks that stand to delay the adoption of cloud services for anything beyond non mission critical applications and infrastructure. Latency represents another major issue. Concerns about intra-cloud often overshadow the performance and reliability of the overall application and content delivery chain from the cloud environment to the end user. It is this combined latency that can manifest itself as a simple echo on a VoIP call, or spell disaster for a Massive Multiplayer Online Game (MMOG) provider with thousands of users playing performance-sensitive games at any given time (Latency: The Achilles Hell of Cloud Computing).

2.6.9 Lack of Operation Control

Because in cloud, the IT infrastructure are built and managed by the service provider, organisations fear that they will have no control over their business since this hardware the hardware and software are located the provider's end. This fear is a great limitation to cloud computing adoption.

2.7 Service Level Agreements

A Service Level Agreement (SLA) is in general a legal binding agreement in the mutual understanding and acceptance about a service between a client who is buying the service and a Service Provider (SP). It is the serious issue to consider as it records a common understanding about services, priorities, responsibilities, guarantees, and warranties between

the cloud provider and the costumers. Failure to follow the agreement is usually followed by huge penalty, which should also be mentioned in the agreement (David, 2009; Weiss, 2007). According to SLA information zone (SLA-zone, 2009), a regular SLA usually includes:

- **Performance-** Performance of the system is measured by monitoring and measuring the services, which was offered whether it is as per the contract or not.
- **Problem management-** It explained how the unplanned or unexpected incidents can occur and how to solve and prevent the future occurrence of such events.
- **Customer duties** - It explains relationship the customer and provider has and also the responsibilities that the customer has to follow and bear in the service delivery process.
- **Warrant & remedies** - It covers topics such as service quality, third party claims and exclusions.
- **Security** - It is the most critical feature of any SLA where it is defined of which security approaches must be followed and respected.
- **Disaster recovery** - It is usually included in the security section and sometimes also in the problem management area.
- **Termination** – Termination at the end of the initial term after the contract period expires or if either the customer or provider violates the contract or not satisfied with the performance. Creating a good SLA is not a trivial task, but a task that is of utter importance when buying and providing services and also errors in SLAs could enforce legal penalties.
- **Service delivered** - It describes the services, how they are delivered and the possible or unexpected disturbance within the time frame or system. This information should be very detailed and accurate so all parties will get the information about what exactly is going to be delivered.

The dynamic nature of the cloud necessitates continuous monitoring of attributes to enforce SLAs. Consumers might not completely trust measurements provided solely by a service provider, which might require agreed-upon third-party mediators to measure the SLA's critical service parameters and report violations (Takabi *et al.*, 2010: 25).

2.8 Cloud Security

According to Pradnyesh Rane in his article published online in infosectoday.com, “over the past decade, computers have become widespread within enterprises, while IT services and computing has become a commodity. Enterprises today view data and business processes (transactions, records, pricing information, etc.) themselves as strategic and guard them with access control and compliance policies. However, in the SaaS model, enterprise data is stored at the SaaS provider’s data center, along with the data of other enterprises. Moreover, if the SaaS provider is leveraging a public cloud computing service, the enterprise data might be stored along with the data of other unrelated SaaS applications. The cloud provider might, additionally, replicate the data at multiple locations across countries for the purposes of maintaining high availability”.

Most enterprises are familiar with the traditional on-premise model, where the data continues to reside within the enterprise boundary, subject to their policies. Consequently, there is a great deal of discomfort with the lack of control and knowledge of how their data is stored and secured in the SaaS model. There are strong concerns about data breaches, application vulnerabilities and availability that can lead to financial and legal liabilities (Subashini & Kavistha: 2010:4).

Gartner 2008 identified seven security issues that need to be addressed before enterprises consider switching to the cloud computing model.

- 1. Privileged user access.** Sensitive data processed outside the enterprise brings with it an inherent level of risk, because outsourced services bypass the “physical, logical and personnel controls” IT shops exert over in-house programs. Get as much information as you can about the people who manage your data. “Ask providers to supply specific information on the hiring and oversight of privileged administrators, and the controls over their access,” Gartner says.
- 2. Regulatory compliance.** Customers are ultimately responsible for the security and integrity of their own data, even when it is held by a service provider. Traditional service providers are subjected to external audits and security certifications. Cloud

computing providers who refuse to undergo this scrutiny are “signalling that customers can only use them for the most trivial functions,” according to Gartner.

- 3. Data location.** When you use the cloud, you probably won’t know exactly where your data is hosted. In fact, you might not even know what country it will be stored in. Ask providers if they will commit to storing and processing data in specific jurisdictions, and whether they will make a contractual commitment to obey local privacy requirements on behalf of their customers, Gartner advises.
- 4. Data segregation.** Data in the cloud is typically in a shared environment alongside data from other customers. Encryption is effective, but isn’t a cure-all. “Find out what is done to segregate data at rest,” Gartner advises. The cloud provider should provide evidence that encryption schemes were designed and tested by experienced specialists. “Encryption accidents can make data totally unusable, and even normal encryption can complicate availability,” Gartner says.
- 5. Recovery.** Even if you don’t know where your data is, a cloud provider should tell you what will happen to your data and service in case of a disaster. “Any offering that does not replicate the data and application infrastructure across multiple sites is vulnerable to a total failure,” Gartner says. Ask your provider if it has “the ability to do a complete restoration, and how long it will take.”
- 6. Investigative support.** Investigating inappropriate or illegal activity may be impossible in cloud computing, Gartner warns. “Cloud services are especially difficult to investigate, because logging and data for multiple customers may be co-located and may also be spread across an ever-changing set of hosts and data centers. If you cannot get a contractual commitment to support specific forms of investigation, along with evidence that the vendor has already successfully supported such activities, then your only safe assumption is that investigation and discovery requests will be impossible.”
- 7. Long-term viability.** Ideally, your cloud computing provider will never go broke or get acquired and swallowed up by a larger company. But you must be sure your data will remain available even after such an event. “Ask potential providers how you would get your data back and if it would be in a format that you could import into a replacement application,” Gartner says.

2.9 Cloud Risk (threats) and remediation

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 2.1 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.	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> 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	<p>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.</p>	<ul style="list-style-type: none"> ▪ 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	<p>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.</p> <p>Loss of core intellectual property could have competitive and financial implications. Worse still, depending upon the data that is lost or leaked, there might be compliance violations and legal ramifications.</p>	<ul style="list-style-type: none"> ▪ 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 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	<p>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)</p>	<ul style="list-style-type: none"> ▪ 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

		resulting from a breach.	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.	<ul style="list-style-type: none"> ▪ 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 2.1: Top Threats to Cloud (CSA 2010); adapted from CSA

2.10 Insight into Cloud Service Providers

“Switching to the cloud is a significant undertaking with major implications across the organisation. Cloud vendors (Service Providers) play a vital role in helping customers present a compelling commercial argument for cloud, and also in the whole migration and implementation process, as the cloud is not a simple off-the-shelf solution that can be easily bolted on”- Tom Lamoureux (KMPG Survey: 5)

KPMG Survey (2013) as part of their ongoing series of studies into Cloud adoption patterns, studied how Cloud Providers around the world are responding to rapid change to build a strong and compelling argument for their customers to migrate to the cloud and to increase the understanding of the current Cloud market.

The purpose of the research was to gain an insight into how Cloud Service Providers are addressing the following areas:

- Cloud adoption patterns
- Perceived barriers to customer adoption
- The customer's decision-making process
- Service level agreements (SLAs)

- Cloud deployment ecosystem

2.10.1 Adoption Pattern

Cloud Service Providers expect their share of revenues from cloud services to almost double within the next 2 years from 27 percent to 50 percent, as users migrate. The pace of cloud adoption shows no sign of slowing down, as more and more functions and areas move onto the cloud.

2.10.2 Perceived Barriers to Customers Adoption

The Executives involved in the survey say their customers' single biggest reason for using cloud services is to reduce costs, followed by speed to adoption and business process transformation. Consequently, Providers feel their top challenge is to demonstrate clear evidence of cost savings, along the development of usage-driven pricing and the creation of a realistic business case for the switch to cloud. Some of the respondents feel that loss of control is their customer's biggest concern, with additional worries over data security and the integration of cloud with existing architecture. Indeed, 42 percent expect the migration to cloud will lead to a downsizing of the entire IT function.

2.10.3 Customers Decision-Making Process

Fewer than half of the respondents believe that customers are well-informed about cloud computing, the cost of migration and subsequent data security. Fifty-three percent of respondents claim that cloud-based sales are initially driven by non-IT executives. However, the Chief Information Officer (CIO) and the Chief Technology Officer (CTO) have the greatest influence upon cloud purchase decisions, as they help the business understand the implications of service level agreements (SLAs) and the costs and implications of migration. Forty percent feel that IT's level of influence and control over technology decisions is decreasing due to cloud, as some functions may choose to migrate independently of IT.

2.10.4 Service Level Agreements

Data security and system availability are the two most important SLA parameters today, while data security will remain the number one issue in 3 years' time. Half of the providers are changing their licensing model to reflect the move away from traditional IT solutions. As cloud adoption increases, customers are seeking greater reassurance over cost-effectiveness

and security, leading to more tightly defined SLAs and a subsequent shift in the licensing model.

2.10.5 Cloud Deployment Ecosystem

As core systems and critical infrastructure move onto the cloud, 61 percent of respondents feel that customers will rely on a third party for technology implementation, business process transformation, information security assistance and strategy, which reflects the huge and multi-functional impact of cloud. In order to provide more strategic services and consulting to business users – and to service global customers – 48 percent of providers say they will form a partnership, and a similar proportion plan to expand capabilities or acquire a complementary provider.

2.11 CSP 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.

2.12 Cloud Prospect

According KPMG survey, organisations are most likely to consider using cloud when they face major technology upgrades, or alternatively, when they're undergoing some form of business transformation. The survey shows that the prime attraction is to cut the cost of IT, but it can bring much more: 59 percent of providers say cloud is driving innovations in customers' products and services, while 54 percent feel cloud is driving innovation in processes.

The agility of cloud enables businesses to get products to market faster by joining up the different parts of the development chain. Sectors such as healthcare and financial services can connect customers and influencers within the business, to assess market needs and quickly translate this into new ideas and ultimately new products and services.

Without the need to invest in infrastructure such as servers and data centers, companies can move faster and take more risks. Setting up a new division overseas, or entering into a new product area is faster and cheaper when the IT backbone already exists on the cloud.

2.13 Cloud Adoption

Cloud Computing allows the use of information technology based on the on-demand utility. This technology can provide benefits to small and medium enterprises with limited capital, human resources, and access to marketing network (Surendro; Fardani, 2012:1).

The rapid growth of cloud shows no sign of abating. Estimates by Gartner suggest the worldwide market will exceed US\$109 billion in 2012,⁵ while a separate forecast by IDC predicts global spending on public cloud services alone will approach US\$100 billion in 2016⁶

In this study, the researcher narrowed SMEs adoption assessment to only the microfinance banks subsector. Microfinance banks were chosen because they seem to need more of IT services than any other small business segment in the SMEs' categories of enterprises. The study will reveal the pattern of adoption.

2.14 SMES in Nigeria

2.14.1 What is SMEs?

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 absorb. 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.

⁵ Gartner, *a survey on cloud adoption trend.*

⁶ IDC *survey on Cloud*

One crucial thing to observe about SMEs definition is that certain criteria have been used to define what SMEs stands for, most especially according to countries, sizes and sectors. Conrad and Darren (2009) explains that the main reason why SME definition varies particularly from industry to industry; county to country; size to size and number of employee to number of employee is to reflect industry, country, size and employment differences accurately. Baumbach (1983) defined SME in terms of employment, asset value and dollar sales. According to Jasra, Khan, Hunjra, Rehman and Azam (2011), Small and Medium Scaled Enterprise (SMEs) represent a business and not a public limited company. They are businesses having not less than 250 workers in the case of manufacturing and service industries including trading businesses, and they should be able to meet any of the following conditions: 1. A trading / service concern having total assets at cost in which land and building up to Rs 50 million is not included. 2. A manufacturing unit having of total assets at cost up to Rs 100 million without land and building. 3. Any concern of service, trading or manufacturing with net sales less than Rs 300 million as per current financial statements.

The points highlighted above bear witness and demonstrate that the common criteria for defining SMEs include: employment, number of employees, size, industry, country, asset value etc. This is consistent with the findings of Darren *et al.*, (2009). They contended that the most valid measures for defining SME are number of employees and size.

Generally, SME sector is categorised into three: micro, small and medium enterprises or businesses. The micro SMEs are the smallest among the three categories. According to Darren *et al.*, (2009), they are the businesses that employ up to 9 employees in the UK while in Australia; they employ fewer than 5 employees including non-employing businesses. U.S. Census Bureau which tends to categorize business micro business as “SOHO (meaning small office- home office), non-employer business and non-employee business (including business less than 5 employees). Therefore, micro-business should be seen as the small type form of SME that may employ fewer than 9 employees or on the other hand may not have employees at all. The small businesses are business bigger than the micro-businesses in terms of size, number of employees, structure, capital investment and economic contributions.

With regard to small businesses, several definitions of small businesses have been advanced over the years. Alarape (2008) defines it as “an enterprise with a labour size of 11-100 employees or a total cost of not less than N50 million, including working capital but excluding cost of land”. The Nigerian industrial policy defined SMEs as industries with total investment of between N100, 000 and N2 million, exclusive of land but including working capital. One of the most popular definitions of SMEs is given by the American Small Business Administration (SBA) as that business or firm which is independently owned and operated; it is not dominant in its field and meets the criteria for the SME business administration sponsored loans programme (Arowomole, 2000).

The medium businesses as the name suggests are bigger than both micro and small businesses in terms of operations, manpower capacity or number of employees, structure, capital investment and size. According to Darren *et al.* (2009), they are the businesses that employ up to 249 employees in UK, in European Union, they employ up to 250 employees, in Australia, they employ up to 200 employees while in U.S.A, they accommodate up to 500 employees.

In Nigeria, much of the definitions on SMEs are concentrated on small firms leaving a gap in the definition of medium enterprises. Table 2.1 **below** demonstrates some of the definitions of small enterprises in Nigeria.

Authors	Definitions
Ogundele (2007)	<i>Minimum of 5 employees with minimum capital outlay of not less than N5000.00 (\$33).</i>
Osuagwu (2001)	<i>Less than 50 but not greeter than employees in any situation with not less than N150, 000(\$1000.00).</i>
Arowomole (2000) Central Bank of Nigeria (CBN, 1991)	<i>Capital investment not exceeding N5 million (\$33,333) excluding working capital with a turnover not more than N25 million (166,666) annually.</i>
Administrative Staff Cost of Land of Nigeria (ASCON)	<i>Whose total cost is not more than N750, 000.00 (\$5000. 00) Including the total cost of land.</i>
Obafemi Awolowo	<i>Whose total assets in capital equipment, plant and working capital are</i>

University	<i>less than N250, 000.00 (1666.00) with fewer than 50 full time employees.</i>
Nigeria Industrial Policy	<i>Those with total investment of between N100, 000.00 (\$666) and N2 million (\$13333. 00) Excluding land, but inclusive of working capital</i>

Table 2.2: Small Business Definitions in Nigeria adapted from Lucky E and Olusegun (2012)

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 (Abubakar *et al.*, 2014:1).

2.14.2 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 (SSICs), 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

The review and appraisal of some of these government initiatives and incentives are outlined as follows (Sanusi; 2003):

- **Central bank of Nigeria (CBN)**

The Central Bank of Nigeria has since its inception been instrumental to the promotion and development of Small and Medium Scale Enterprises. The CBN credit guidelines required that banks allocate a specified minimum percentage share of credit to important sectors including the SMEs at preferential interest rates. For instance, in 1979/80 the CBN directed that at least 10 per cent of the loans advanced granted to indigenous borrowers be allocated to the sector. This was subsequently raised to 16 and 20 per cent in April 1988 and 1990, respectively. Loans and advances to the SMEs as a percentage of total loans rose from 1.8 percent in 1980 to 9.3, 22.9, 40.0, 26.8, 6.6 and 8.6 per cent in 1986, 1990, 1992, 1996, 2001 and 2002, respectively. However, given the risks attendant to such loan and the high cost of its administration, banks preferred to pay prescribed penalties for non-compliance rather than give credit to the SMEs. The CBN reacted by transferring the shortfall taken from defaulting banks to NBCI for on-lending to the SMEs. This brought about a remarkable improved performance in compliance with bank lending to the SMEs. Because of the inherent weaknesses and inefficiency of direct credit control by the CBN, this practice was discontinued and replaced by a system of market mechanism, supported by moral suasion (Sanusi; 2003:5):

- **State Government**

Most State Governments, through their Ministries of Commerce and Industries as well as the state owned Finance and Investment Companies, provided technical and financial assistance to SMEs (Sanusi; 2003:7).

- **International Financial Assistance**

Governments have continued to approach international financial agencies such as the World Bank and its affiliates, United Nations Agencies and the African Development Bank (ADB) to source capital for the SMEs. The Federal Government often guarantees and agrees to monitor or co-finance the SMEs receiving such external financial support. For example, in 1988, the African Development Bank granted an export stimulation loan of US\$252 million repayable in 20 years with a concessionary interest rate of 7.3 per cent for SMEs in Nigeria (Sanusi; 2003:8).

2.15 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. In Nigeria – SMEs are the backbone of the economy. 97% of all businesses in Nigeria employ less than 100 employees (Federal Office of Statistics).

Taking a look at our previous definition of SMEs, it means that 97% of all businesses in Nigeria are “small businesses”. The SME sector provides, on average, 50% of Nigeria’s employment, and 50% of its industrial output (Muritala *et al.*, 2012).

In many of the developing economies, the private economy almost entirely comprises SMEs. In many cases, they are the only feasible employment opportunity for communities.

2.16 Summary and Conclusion

This chapter review has established the theory behind cloud computing and also have explained the various underlying concepts. The economic values of cloud computing to small business organisations are realised and key issues surrounding the deployment of cloud technology have been noted and various security mechanism put in place to cushion the effect of these issues where need arises have been outlined. The researcher has been able to establish that there are a lot of potential opportunities of business growth if appropriate selection of the technology is applied. The researcher contextually looked at the Small and Medium business organisations in Nigeria with particular reference to Microfinance banks. Government have actually given the SMEs sector a boost in the form of grants and favourable polices but appropriate technology selection seems lacking. On the whole, the future holds bright for the SMEs with cloud playing a critical role in changing the traditional ways of business operation. The adoption of Cloud technology will certainly transform the sector.

Chapter 3: RESEARCH DESIGN & METHODOLOGY

“It is the right time to start the journey to creative and innovative software ecosystem - even if the outcome can't compete with the likes of Google, Amazon and Microsoft. But, we need to know that we need a Nigeria cloud services &

application for Nigerians that are also developed by Nigerians”
- Tosin Akinwande, 2012



"Software Nigeria is software made by Nigerians for Nigeria without exchange of foreign currencies". Oracle of Nigeria 's Information Technology” - Dr Chris Uwaje, 2013

3.0 Introduction

This chapter describes in specific terms the research process that was applied in this research to examine ways of improving the adoption of cloud technology by SMEs in Nigeria. The purpose of this chapter is to explain the methodologies employed and their application. The overall aim of this study is:

- To investigate the cause of slow rate of adoption of cloud computing by SMEs in Nigeria;

- To illuminating the concept of cloud computing adoption and further espouse the benefit of embracing cloud technology and;
- To develop a model for creating awareness among SMEs and IT dependent enterprises most especially Microfinance Banks in Nigeria to help their managers make informed decision about cloud adoption.

This chapter contains seven sections. Section 3.1 explains the methodology used in this study and rationale for the paradigm of choice. Section 3.2 deals with the qualitative while quantitative research is dealt with on section 3.3. Section 3.4 outlines the differences that exist between qualitative and quantitative research and section 3.5 defines the strength and both research types. 3.6 lists the data collection instruments used and justifies their use; section 3.7 discusses and section 3.8 explains the sample. Section 3.9 outlines the procedure used and the timeline for the completion of each stage of the study. Section 3.10 discusses how data was analysed; section 3.11 explains the measures adopted to ensure reliability and validity of the research result; finally section 3.12 discusses the ethical issues considered in this research and the study limitations.

3.1 Methodology

The term methodology refers to the overall approaches and perspectives to the research process as a whole and is concerned with the following main issues (Collis & Hussey, 2003:55):

- **Why** you collected certain data?
- **What** data you collected?
- **Where** you collected it?
- **How** you collected it?
- **How** you analysed it?

On the other hand, a research method refers only to the various specific tools or ways data can be collected and analysed, for example, a questionnaire; interview checklist; data analysis software etc. The goal of the research process is to produce new knowledge or deepen understanding of a topic or issue.

Since the research subject has already been established and research questions identified, now the research design and the methods are to be matched to the problem statement and the research questions, in other words, research strategy. A research strategy is a step-by-step

approach or a scientific method that helps in answering the research questions. The researcher first observed the overall presentation of the strategy, with the research methods, the data collection analysis instruments, investigating tools, ethics and so on. As mentioned, the author identified the type of research in context, and chose the right research strategy. In this study, the researcher conducted a qualitative study via the use of interview for an in depth investigation into the findings. The themes from the qualitative investigation will broaden the findings. Emphasis will be on the *How* to improve the adoption rate of cloud computing among SMEs operators in Nigeria

To enable the researcher arrive at a suitable research method to use, the researcher needed to understand the two major types of research method, the qualitative and quantitative research.

3.2 Qualitative Research

A type of educational research in which the researcher relies on the views of participants; asks broad, general questions; collects data consisting largely of words (or text) from participants; describes and analyses these words for themes; and conducts the inquiry in a subjective, biased manner (Creswell 2012).

- Constructivism – multiple realities; biased; inductive

3.2.1 Qualitative Methodology

- Generally involves listening to the participants' voice and subjecting the data to analytic induction (e.g., finding common themes)
- More Exploratory in nature
- Examples of data collection methods are interviews, open ended questionnaire, focus group and observation

3.3 Quantitative Research

A type of educational research in which the researcher decides what to study; asks specific, narrow questions, collects quantifiable data from participants (a large number of participants); analyzes these numbers using statistics; and conducts the inquiry in an unbiased, objective manner (Creswell 2012).

- Postpositivism –singular reality; objective; deductive
- Generally attempts to quantify variables of interest; questions must be measurable.

3.3.1 Quantitative Methodology

- Generally attempts to quantify variables of interest; questions must be measurable.
- Generally involves collecting numerical data that can be subjected to statistical analysis
- Examples of data collection methodologies are, questionnaires (with closed-ended questions or open-ended but transferred to quadata), content analysis
- The data is generally referred to as “hard” data

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).

3.3.2 Design Rationale

It is not necessary to pit quantitative and qualitative paradigms against one another in a competing stance. Patton (1990:39) advocates a "paradigm of choices" that seeks "methodological appropriateness as the primary criterion for judging methodological quality." This will allow for a "situational responsiveness" that strict adherence to one paradigm or another will not. Furthermore, some researchers believe that qualitative and quantitative research can be effectively combined in the same research project (Strauss and Corbin, 1990; Patton, 1990).

For example, Russek and Weinberg (1993) claim that by using both quantitative and qualitative data, their study of technology-based materials for the elementary classroom gave insights that neither type of analysis could provide alone.

According to McMillan and Schumacher (2010:67), a research study can be both quantitative and qualitative. In such situation, the study starts with a general problem that provides context and background. In this study therefore the general problem is: "What is the causes of slow adoption of cloud computing by SMEs in Nigeria?" In the researcher's opinion more specific problems also need to be investigated regarding this problem namely:

- What is the economic benefit in using cloud computing?
- Are there risk associated with using cloud computing?
- Can the associated of risk of cloud computing be controlled?
- Do SMEs really have need for cloud computing?

To effectively and comprehensively answer the above questions, asking specific questions will be appropriate and qualitative research design methods fits in this context.

3.3.3 Method Selection

According to Lekwall and Wahlbin (2001), the method is a tool to generate solutions to problems and to derive new knowledge. As Marshall & Rossman present three conditions to choose any strategy either experiment, survey, archival analysis, history or case studies, the author have followed those three conditions i.e. a) the type of research questions posed, b) the extent of control an investigator has on actual behavioural events and c) degree of focus on contemporary events to choose a strategy (Marshall & Rossman 1989).

The nature of the research question was considered first to enable the researcher arrive at the kind of study to embark upon. A research question could be identified with purposes namely: explanatory, descriptive or exploratory (Marshall and Rossman, 1989:3). As Marshall, Rossman and Yin mentioned in their respective book, the "what" questions lead to exploratory studies and "how" and "why" questions calls for an explanatory studies (Marshall & Rossman, 1989:3-6). The question was find to answers to what could possibly be the reason for the slow adoption of Cloud technology by SMEs in Nigeria and how can we improve its adoption, so the study we will pursue an exploratory case study (Marshall & Rossman, 1989:6).

It was therefore established that a qualitative methods design will be deployed for the purpose of this study.

3.3.4 Methodological Assumptions

It was assumed that:

- The question will be responded to the CEO, or by a knowledgeable delegated person or the IT Manager, due to the fact that some questions will be based on value judgements by the CEO or IT Manager; answers by the wrong person might generate wrong answers affecting the outcome of the interview.
- Pressure in any way will not be placed on respondents to during the interview session; due to the sensitivity of issues surrounding customer's perspective about business organisation in Nigeria, the risk exists that respondents may be instructed by the organisation to answer the question to enhance the way in which their enterprise is evaluated or even causing a non-positive evaluation.
- The answers would be given truthfully; non-truthful answers might create a halo effect (Isham *et al.*, 1995). This may have a negative impact on the survey results as it might increase the chances of a positive impression even when it might not be true.

3.4 Research Instruments

3.4.1 Data Collection technique

According to McMillan and Schumacher (2010:187), Table 3.1 represent various collection technique can be used for data gathering for qualitative and study:

QUALITATIVE STUDY
Observation
Document and artefact collection
Field observations and supplementary techniques
In-depth interviews

Table 3.1: - Data Collection technique (McMillan, Schumacher 2010:187).

In this study, interviews were used in gathering data.

The following are the strength and weakness of the interviews as enumerated by McMillan and Schumacher (2010:187):

Strengths and weaknesses interview as a data-gathering technique

INTERVIEWS	
STRENGHT	WEAKNESSESS
<ul style="list-style-type: none"> • Flexible • Adaptable • Ability to probe and clarify • Can include nonverbal behaviour • High response rate • Used with non-readers 	<ul style="list-style-type: none"> • Costy • Time-consuming • Interviewer bias • Not anonymous • Subject effects • Effect of interviewer characteristics • Requires training • Leading questions

Table 3.2: Strengths and weaknesses interview as a data-gathering technique (McMillan, Schumacher 2010:187).

3.4.2 Qualitative - Interview

A phenomenological qualitative study will be used in form of in-depth, semi-structured interviews. In semi-structured interview, the general direction is decided on in advance, but as the interview proceeds, the questioning is guided by the content of the respondent's answers (Dyer 2006:31-33).

The 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 this particular perspective” (King 2004:11). Nestor and Schutt (2012:358) averred that qualitative

interviewing relies on open-ended questions in which the interviewer allows the content and order of questions to vary from one interviewee to another. Interviewees are expected to respond to asked questions according to their perception and understanding. To achieve this, the interviews made room for organisation representatives to give their own input. A semi-structured interview was conducted with select number of IT professionals and industry players as well as microfinance associates using any of Google Hangout and Skype software. A sample of the interview question is attached as Appendix C

3.5 Participants

Parahoo (1997:218) defines population as “the total number of units from which data can be collected”, such as individuals, events or organisations. Burns and Grove (2003: 213) describe population as all the elements that meet the criteria for inclusion in a study. Burns and Grove (2003: 234) define eligibility criteria as “a list of characteristics that are required for the membership in the target population”. The important element that lends credence to a research study involves the validity of a data sample and sample selection (population).

The criteria for inclusion in this study are therefore:

- Cloud End-Users(CEU) or Consumers
- Professionals from associated industries which are considered key to the success of this research result.

Only SMEs within this geographical location were considered in the study and to avoid the risk involved in travelling around to other parts of the country as a result of the insecurity currently experienced in some parts of Nigerian cities.

3.6 Sample Size

Polit *et al.* (2001: 234) define a sample as “a proportion of a population”. A carefully selected sample can provide data representative of the population from which it is drawn. Samples from the primary source of data for this study were 7 carefully selected representatives. Five were representative of the SMEs and two were industry associates. In that order, the researcher had selected the under listed participants to take part in this research:

3.6.1 Cloud End-users (SMEs) - Microfinance banks

The following are the CEUs:

- University of Uyo Microfinance Bank
- Palmgrove Microfinance, Uyo, Akwa Ibom State
- Trans-Atlantic Microfinance Bank, Uyo Akwa Ibom State
- Gafunk Microfinance Bank, Uyo, Akwa Ibom State
- Prospect Microfinance Bank, Uyo, Akwa Ibom State

3.6.2 IT Professionals and Industry Associates

The following members were interviewed:

- Members of CPN
- Members of NCS

3.7 Research Procedure

This section describes the process involved in identifying and developing a topic for the research investigation. Having been suggested by the researcher's supervisor that several sources be consulted for potential ideas with respect to the research interest in question and a study to have a substantive worth to the understanding of the reader, a sequence of steps involved in the research has to be clearly defined and explained. Figure 3.1 below is the procedure used in the research.

Schematics of the Research Procedure

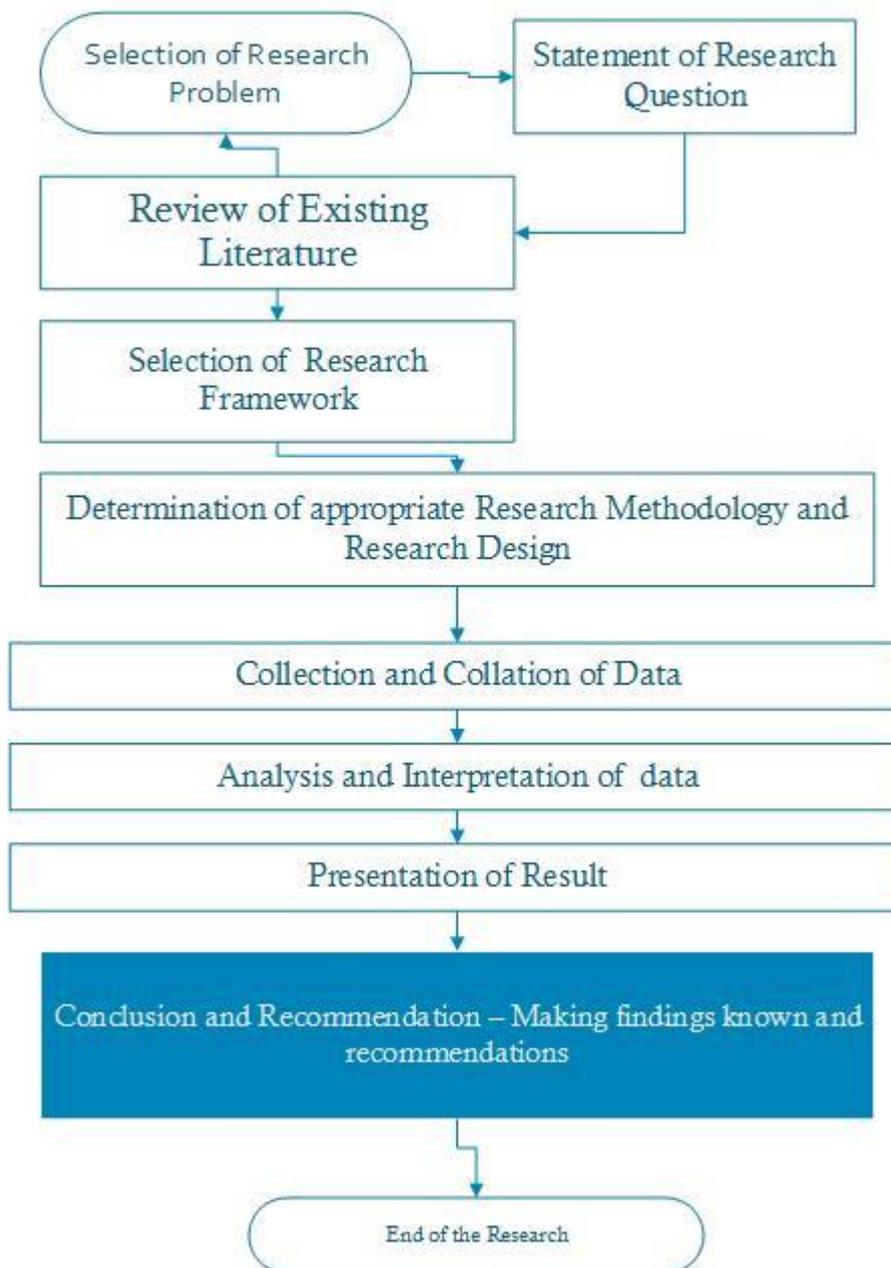


Figure 3. 1: Research Procedure

3.8 Data Analysis

The process of making data manageable for analysis and actually developing an analysis are two distinct activities, however the two sets of activities may become blurred in practice (Mason 2002). In qualitative studies research design, data collection and analysis are

simultaneous and continuous processes (Bryman & Burgess, 1994). There is a need to create clear links between theory and data collection and between data analysis and theory with the researcher dealing with method and theory concurrently rather than sequentially, that is, data collection and analysis is an iterative process (Hartley 2004). A danger inherent in this is that premature conclusions may be drawn, with the researcher having been unduly influenced by unusual or interesting data (Eisenhardt 1989). In order to guard against the above, the researcher employed techniques advised by Hartley (2004) that is, careful description of the data and development of categories in which to place behaviours, followed by examination to see how they fit or fail to fit these categories, being mindful that categories may need refining or events need to be interpreted differently.

In this research, there are several logical steps that can be distinguished. It first of all starts off with the collection of literature study material in the area of Cloud Computing not older than five years, a related study of SMEs within the context of Nigeria was done. Thereafter, a topic for this research was developed giving way for a frame of question arising from the preliminary study and the need to seek answers or solution to the evolving question. The literature study for both the Cloud Computing and the SMEs gave a general perspective of the thesis topic.

The author discovered that to obtain the best result in this investigation, questions need to be asked from the SMEs operators to enable a case to be established and compared with theory in order to analyse the cases and authoritatively say something useful about them. The data was collected via the interview with carefully structured questions from select IT professionals and industry players. The research data was the transcript of the interview, inductive data analysis was employed since important categories, patterns and relationships will be identified through a process of discovery (Nestor & Schutt 2012:372). The analysis was run concurrently as the data is being collected. The following qualitative data analysis steps were extracted from The Pell Institute and Pathway to College Network⁷ and was applied in this research:

STEP 1: Process and Record Data Immediately

⁷ <http://toolkit.pellinstitute.org/evaluation-guide/analyze/analyze-qualitative-data/>

As soon as data is collected it is critical that you immediately process the information and record detailed notes.

These notes could include:

- Things that stuck out to you
- Time/date details
- Other observations
- Highlights from the interaction

It is important to do this while the interaction is still fresh in your mind so that you can record your thoughts and reactions as accurately as possible.

It is helpful to make a reflection sheet template that you carry with you and complete after each interaction so that it is standardized across all data collection points.

STEP 2: Begin Analysing as Data is Being Collected

Qualitative data analysis should begin as soon as you begin collecting the first piece of information.

The moment the first pieces of data are collected you should begin reviewing the data and mentally processing it for themes or patterns that were exhibited. It is important to do this early so that you will be focused on these patterns and themes as they appear in subsequent data you collect.

STEP 3: Data Reduction

Qualitative studies generally produce a wealth of data but not all of it is meaningful. After data has been collected, you will need to undergo a data reduction process in order to identify and focus in on what is meaningful. This is the process of reducing and transforming your raw data.

It is your job as the evaluator to comb through the raw data to determine what is significant and transform the data into a simplified format that can be understood in the context of the research questions (Krathwohl, 1998; Miles & Huberman, 1994; NSF, 1997). When trying to discern what is meaningful data you should always refer back to your research questions and use them as your framework. Additionally, you should rely on your own intuition as the

evaluator and the expertise of other individuals with a thorough understanding of the program.

This step does not happen in isolation, it naturally occurs during the first two steps. You are already reducing data by not recording every single thing that occurs in your data collection interaction but only recording what you felt was most meaningful, usable, and relevant. You are also reducing data by looking for themes from the beginning. This process helps you hone in on specific patterns and themes of interest while not focusing on other aspects of the data.

The process of data reduction, however, must go beyond the data collection stage. Evaluators must take time to carefully review all of the data you have collected as a whole.

STEP 4: Identifying Meaningful Patterns and Themes

In order for qualitative data to be analysable it must first be grouped into the meaningful patterns and/or themes that you observed. This process is the core of qualitative data analysis.

This process is generally conducted in two primary ways:

- Content analysis
- Thematic analysis

The type of analysis is highly dependent on the nature of the research questions and the type(s) of data you collected. Sometimes a study will use one type of analysis and other times, a study may use both types

Content analysis is carried out by:

1. Coding the data for certain words or content
2. Identifying their patterns
3. Interpreting their meanings.

This type of coding is done by going through all of the text and labelling words, phrases, and sections of text (either using words or symbols) that relate to your research questions of interest.

After the data is coded you can sort and examine the data by code to look for patterns.

Thematic analysis – grouping the data into themes that will help answer the research question(s). These themes may be:

- Directly evolved from the research questions and were pre-set before data collection even began, or
- Naturally emerged from the data as the study was conducted.

Once your themes have been identified it is useful to group the data into thematic groups so that you can analyse the meaning of the themes and connect them back to the research question(s).

STEP 5: Data display

After identifying themes or content patterns, assemble, organize, and compress the data into a display that facilitates conclusion drawing. The display can be a graphic, table/matrix, or textual display.

- Regardless of what format you chose, it should be able to help you arrange and think about the data in new ways and assist you in identifying systematic patterns and interrelationships across themes and/or content (Miles and Huberman, 1994; NSF, 1997).
- Through this process you should be able to identify patterns and relationships observed within groups and across groups. For example, using our Summer Program study, you could examine patterns and themes both within a program city and across program cities.

STEP 6: Conclusion Drawing and Verification

Conclusion drawing and verification are the final step in qualitative data analysis.

To draw reasonable conclusions, you will need to (Kratwohl, 1998; Miles & Huberman, 1994; NSF, 1997):

- Step back and interpret what all of your findings mean
- Determine how your findings help answer the research question(s)
- Draw implications from your findings

To verify these conclusions, you must revisit the data (multiple times) to confirm the conclusions that you have drawn.

After this, the researcher was able to complete data analysis about the whole dissertation.

3.9 Issues of Validity

3.9.1 Strategies for Ensuring Trustworthiness of the Research

The trustworthiness of qualitative research generally is often questioned by positivists, perhaps because their concepts of validity and reliability cannot be addressed in the same way in naturalistic work (Shenton 2004). The concept of conformability is the qualitative researcher's comparable concern to objectivity. Here steps were taken to help ensure as far as possible that the work's findings are the result of the experiences and ideas of the informants, rather than the characteristics and preferences of the researcher. The following provisions were considered:

- Recognition of shortcomings in study's methods and their potential effects
- In-depth methodological description to allow integrity of research results to be scrutinised
- Use of diagrams to demonstrate "audit trail"

Credibility of the research was also made possible in the following ways:

- Examination of previous research to frame findings
- Tactics to help ensure honesty in informants
- Iterative questioning in data collection dialogues

3.9.2 Generalisation

It would not be appropriate to assume that results from this investigation could be generalised to other SMEs' subsector of the Nigerian economy, this study was mainly with the microfinance subsector of the SMEs. Therefore, this research case can only be generalised with all other microfinance banks not covered in this study. All other SMEs subsector may require further research.

3.10 Ethical Considerations

3.10.1 Confidentiality

Prior to the commencement of this study, ethics approval was obtained from the University of South Africa's Research Ethics Committee (ethics certificate included in the appendices). Participants were fully informed prior to the study about the potential risks and procedures involved. Written consent was obtained prior to participation in the interviews from respondents prior to commencing the interview. The data collection at all stages of the research project took place in participant's own environment with the researcher linked via technological means, for example Google Hangout or other internet connection.

Research that has to do with people has to be developed in such manner that research ethics are applied, particularly this includes the responsibility of the researcher to protect the confidentiality of individual that participate in the study. This privacy protection has had been extended to all classes of people involved in this study. The author has taken this ethics into consideration by not revealing the actual identities of the respondents in the research work.

3.10.2 Limitations

The limitations of this research may have been in the inherent design or methodology parameters that can restrict the scope of the research findings and might have been outside the control of the researcher. These reservations, qualifications or weaknesses arise when all variables cannot be controlled within a project design, or the optimum number of samples cannot be taken due to time/budgetary constraints. Therefore, these factors have the potential to interfere with the validity of results.

The following might be the limitations of the study:

- Research was limited to the Microfinance subsector of SMEs in Nigeria and it might be argued that micro business in other economic sector have different experiences with regards to Cloud adoption.
- Research was limited to microfinance banks; therefore it might be argued that it does not apply to all medium-sized organisations in Nigerian.

- Research was limited geographically to those Microfinance Banks located in Akwa Ibom State because of their proximity to where the researcher resides; therefore it might be contended that microfinances banks in others places may differ in their experiences and response.

At the conclusion of the research project all participants will be given a brief summary of findings for the purposes of informing practice in the use of professional learning networks (PLNs). Risks to participants are minimal and can be considered equivalent to the risks involved in their everyday work activities.

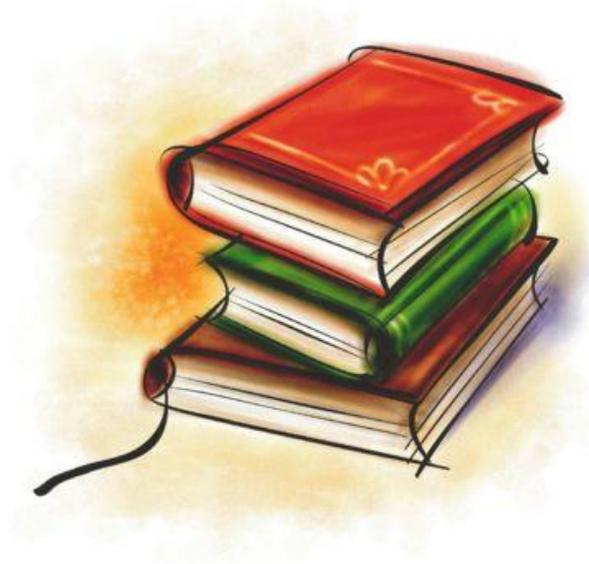
3.11 Chapter Summary

In this chapter, a detailed description of the research design and methodology have been given. Self-constructed questionnaire (quantitative study) and semi-structured interviews (qualitative study) are the data-collection instrument designed to elicit those responses essential to the research problem. The researcher had ensured that confidentiality was maintained within the life cycle of this research. The chapter was ended off with the ethical principles that will be applied when conducting this research.

Chapter 4: DATA COLLECTION AND METHOD OF ANALYSIS

“When I look back, I am so impressed again with the life-giving power of literature. If I were a young person today, trying to gain a sense of myself in the world, I would do that

again by reading, just as I did when I was young.” — Maya Angelou



“I know nothing in the world that has as much power as a word. Sometimes I write one, and I look at it, until it begins to shine.” — Emily Dickinson, 1886

4.0 Introduction

The methodology that was employed in this study was described in the previous chapter and that has provided the baseline upon which data-gathering for this study is based. To complete this study properly, it is important to analyse the data collected in order to provide answers to the research questions. In this chapter, the presentation will be systematically linked to the kind of questions asked in order for this research to be effectively conducted.

According to Vos (1998:203), data analysis involves the breaking down of data into constituent's parts to obtain answers to questions and to test hypotheses. The analysis of research data does not in itself provide answers to research questions. The analysis and interpretation of data is executed in two phases. The first part, which is based upon the results of the questionnaire, deals with a quantitative analysis of data. The second, which is based on the results of the interview and industry players, is a qualitative interpretation.

The essence for interpreting research data is to make it intelligent and interpretable so that the relations of research problems can be studied and tested, and conclusions established. When a researcher interprets the research results, he or she studies them for their meaning and implications (Vos 1998:203). The researcher will discuss the participants in this section in order for the findings to be understood clearly.

4.1 Description of Participants

As stated in the first chapter, the objective of the study is to conduct a research to understand the reason for the slow adoption of cloud computing technology by Small and Medium Scale Enterprises (SMEs) in Nigeria. The researcher used interview to collect data. The interviews were conducted using Google Hangout and physical contact where the participant organisation is situated in Uyo which is where the research resides. Prior to requesting participation, a covering letter (Appendix B) explaining the research intent and purpose was sent to the respondents to obtain consent before requesting for time for the interview.

A working data was provided as seven participants (industry associates) from seven organisations. Almost all participants were decision-makers (business managers, senior managers and executives) within their organisations. This group also contained participants from Microfinance banks. 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 where distance becomes an impediment during the first and second week of August 2014. Of the seven respondents, three were members of Nigeria Computer Society (NCS) and were members of Computer Professional Registration Council (CPN). For the purpose of clarity, these category of participants are summed up as IT Professionals (industry associates or players) in this research.

4.2 Interviews

An interview is a conversation method with an intent of achieving a purpose (extracting further information). Interview is mostly used to supplement and extend one's knowledge about individual's thought, feelings and behaviour, interpretations etc. The purpose in essence could therefore be:

- When a large amount of relevant information about one's experience is to be extracted by asking the person direct question.
- When some research questions are better answered in such manner.
- When a structured question or semi-structured is to allow for flexible response.

Interviews are categorised as structured and semi-structured. The key feature of the structured interview is that questions are pre-planned. Structured interviews also allow for exact replication of the interview with others. To some extent, it is possible to generalise what you find whereas a key feature of the semi-structured interview is in the partial pre-planning of the questions. Semi-structured interviews may be conducted in various modes: face-to-face, by telephone, videophone... but face-to face is probably best. A great deal of qualitative research (grounded theory, thematic analysis, etc) uses semi-structured interview material).

The major advantage of in-depth interviews is that they allow much more detailed information than what is available through other data collection methods, such as surveys.

- Replication is possible.

They also can allow a more relaxed condition in which to collect information—people may feel more comfortable having a conversation with you than filling out a survey.

With the advantage above, the researcher opted for a semi-structured interview. The summary of data collected from the interview is transcribed in Section 4.3.2.1 – 4.3.2.7

4.2.1 Approach to Analysing Qualitative Data

McMillan and Schumacher (2010:367) posit that qualitative data analysis is primarily an inductive process through which data is organised into categories and patterns and relationships are identified among the categories

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. This approach is comprehensive and therefore time-consuming and is most suitable where little or nothing is known about the study phenomenon. Inductive analysis is the most common approach used to analyse qualitative data and will therefore be advanced in this study.

Although there are many inductive approaches to analysing qualitative data, the method of analysis to be applied in this study is that of thematic content analysis, and is, of course, the most common method of data analysis used in qualitative work. However, the process of thematic content analysis is usually similar in all types of qualitative research, and the process involves analysing transcripts, identifying themes within those data and collecting together examples of those themes from the text.

Interview transcripts, field notes and observations provide a descriptive account of the study, but they do not provide explanations (Burnard *et al.*, 2008). It is the researcher who must make sense of the data that have been collected by exploring and interpreting them.

According to Burnard *et al.* (2008), in qualitative research, data analysis often begins during, or immediately after, the first data are collected, although this process continues and is modified throughout the study. Initial analysis of the data may also further inform subsequent data collection. For example, interview schedules may be slightly modified in light of emerging findings, where additional clarification may be required. 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.

4.2.2 Interviewee’s Profile

A total of eleven (11) persons participated in the interview conducted using Google Hangout while three interviews were conducted one-to-one with the respondent. Due to online network connectivity issues, some of the interviews were not completed so the researcher was only able to obtain complete responses from only seven persons. Table 4.1 below shows a summary of the respondent’s profile, his/her position, company and responsibilities.

S/No	Interviewee	Organisation	Current Position	Responsibilities	Interest
1	Interviewee A	Akwa Ibom State University(AKSU), Nigeria	Director, ICT	Managing AKSU IT services	Cloud Computing
2	Interviewee B	Nigerpet Construction, Uyo	IT Specialist	Managing IT infrastructure	Software Systems Design
3	Interviewee C	Establishment, AKSG	Permanent Secretary	Administration	Information Systems
4	Interviewee D	Zenith Bank, Uyo	IT Officer	Manages the IT systems for the of Bank in Uyo Branch	Database and networks
5	Interviewee E	Bosak Microfinance Bank Limited, Lagos	IT Manager	Manages Information systems of the bank	Software Development
6	Interviewee F	FinaTrust Microfinance Bank, Lagos	Database Manager	Manages the database of the organisation	Database and programming
7	Interviewee G	AB Microfinance	IT Support Manager	Manages the IT systems of the	System Management

		Bank, Lagos		bank	and Networks
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Table 4.1: Brief Introduction of the interviewees

The researcher chose IT professionals who have knowledge in cloud computing and also another set of associates in the microfinance sector but with some level of knowledge of the IT sector. These include IT officers and administrators who are also members of either NCS or CPN. Some are also business executive. The respondents were interviewed about their perception of services in cloud computing, advantages and disadvantages, challenges and the scope regarding trust, security and cost perspectives.

4.2.3 Interview Transcription and Findings

4.2.3.1 Interviewee A

Interview was conducted with Interviewee A on the 2nd August 2014. This was Google Hangout recorded interview. Interviewee A is responsible for the management of Akwa Ibom State Ministry of Information and Communication (AKSMinofInfo) information database and network systems. AKSMinofInfo is the Government of Akwa Ibom State Ministry in-charge of Information and Communications. His responsibility is to design an optimal ways of storing the ministry’s information using the latest and emerging technology platform.

In Interviewee A’s opinion, “*cloud computing is simply storing your information in someone else’s computer and accessing it from any remote location using internet access*”. He mentioned that it is very important to have a high level security strategy so the vendors need to develop and to ensure the privacy and security of data out-sourced to them by customers. To him, multiple measures are been taken in his department to guard against a breach in their data stored at an outside data center with certain authorisation implemented.

He identified security and privacy as the main challenges in adoption of cloud computing in government organisations coupled with the level of computing knowledge of higher executive in the ministry who rather want that their information be kept within a file cabinet within their offices.

For himself who has painstakingly convinced his boss to allow him adopt cloud computing by purchasing 100Gigabytes space with Dropbox to store important department information,

his only challenge is the cost of internet data bandwidth as he transfers large amount of important documents after converting them into electronic form to their dropbox data storage account. He said his boss is always worried each time he wants to convert an important document for storage in the dropbox space and would ask, “*how are you sure that that document is safe and can’t be accessed by internet hackers?*” Hence he said SLA is very crucial for any organisation and the vendor has to lay open and convince his clients that his services is hack-proof.

Respondent mentioned that the important benefits of cloud computing are the cost effectiveness and easy accessibility to data at any location with internet access. Besides, he mentioned that all have same level of benefits. For instance in google doc, you can update, share and collaborate document between multiple users remotely with latest updates.

He personally prefers the private cloud as a better tools to store data if we adopt cloud computing for storing government documents and data for easy collaboration.

4.2.3.1.1 Thematic Content of Interview A

Interviewee A – Findings

INTERVIEWEE A – THEMATIC CONTENT ANALYSIS			
Interview Question No (IQ)	Respondent’s opinion	Research Question(RQ)	Codes extracted
IQ03	Security of data must be maintained in the cloud to guard against breach of data	RQ03	Data security
IQ03 IQ06	Vendor must ensure privacy and confidentiality of user’s data	RQ03	Privacy and confidentiality
IQ06	Identified security and privacy as cloud main challenge	RQ02	Security of Data
IQ04 IQ06 IQ07 IQ13	Identified cost of bandwidth as a challenge to using cloud service	RQ02	Cost of services
IQ09	SLA is very important and vendor must be opened with it	RQ03	Service Level Agreement
IQ03	“ <i>how are you sure that that document is safe and can’t be accessed by internet hackers?</i> ”	RQ02	Security of data
IQ05	Cost reduction is an important benefit of cloud and easy data	RQ01	Cost Reduction as cloud benefit

	access		
IQ10	Private cloud is preferable in his opinion		Private Cloud

Table 4.2: Interviewee A – Thematic Content Analysis

4.2.3.2 Interviewee B

The researcher interviewed Interviewee B using Skype on the 4th August, 2014. Interviewee B is a Ph.D student with the Federal University of Technology, Owerri, Imo State and currently the Acting Director, ICT, Akwa Ibom State University (AKSU). He is responsible for the management of AKSU information systems and also direct on issues relating to information technology concerning the university. A professional member of Computer Professional Registration Council (CPN) with interest in software development and Geography Information Systems. The most important benefits of Cloud to any organisation using cloud are scalability and efficiency of data according to Interviewee B. He added that the cost reduction, increased speed, higher reliability and sufficient storage of data are other features.

He mentioned that storing all our data in the cloud is not ideal. As an example, he said, “if you store your data in google and something happened to your data, who is responsible?” Would google care? Probably google does not care. So his opinion was related to trust issue and he cannot trust cloud services fully so he recommended that we should not store all our sensitive and important data in cloud.

SLA has a very vital role to play according to him, in the sense that if you have critical application then you really need to have a good SLA’s with public cloud vendor. This SLA’s will play great role to build trust from the customers he said. Besides, the security of data, SLA’s and customer trust run parallel to one another. i.e good SLA’s gives enough security confidence that makes better services and consequently leads to more trust of the customers.

On the deployment models aspect he maintained that public cloud is for non-critical applications and private cloud is a good idea if you have the internal organisation and using traditional hardware. Different SLA’s can be provided to different customers and can guarantee data integrity.

He said there are many challenges which come with adopting cloud computing in financial sector. Among these, some of them are security of data, data sharing and most importantly trust of the customer. Similarly, legal issues which can play a vital role in the adoption of cloud computing in the microfinance sector. He added that customers banking data as secret information, confidential between the bank and the customers, putting these in cloud arises a question of availability and reliability because we do not know where these data are stored and who is accessing them.

He mentioned that the chief advantage of cloud computing that microfinance banks can benefit from is its efficiency and reliability. He opined that hybrid Cloud deployment model is best suited for micro finance sector. That is, a bank can hire the service of one cloud provider and also set up its own private cloud within the organisation to share data.

4.3.3.2.1 Thematic Content of Interview B

INTERVIEWEE B – THEMATIC CONTENT ANALYSIS			
Interview Question No (IQ)	Respondent’s opinion	Research Question(RQ)	Codes extracted
IQ05	Scalability and efficiency are most important cloud benefits, other are cost reduction, increased speed, higher reliability and sufficient storage of data	RQ1	Scalability, Cost Reduction, Speed, Reliability, Storage – Cloud benefits
IQ06	Trust issues with vendors	RQ2	Data loss
IQ06	SLA with a public vendor	RQ3	Good SLAs
IQ06	Trusted vendor guarantees security of data		Data security, Integrity of data
IQ06	Identified security of data, data sharing and trust as main cloud challenges	RQ2	Data security and trust
IQ06	Mentioned legal issues as factor in cloud adoption in microfinance banks	RQ2	Legal issue
IQ06	Banks’ customers data are critical, data availability and reliability are important	RQ2	Reliability of data, Availability of data
IQ05	Efficiency and reliability are most important advantage of cloud to microfinance banks	RQ1	Efficiency and reliability
IQ10	Hybrid Cloud model is suitable for microfinance organisation		Hybrid Cloud deployment model

Table 4.3: Interviewee B – Thematic Content Analysis

4.2.3.3 Interviewee C

The researcher interviewed Interviewee C on the 5th August, 2014 using Skype software and the interview lasted for just 50 minutes. Interviewee C was the former Head of Management Information Systems (MIS) Unit in Akwa Ibom Water Company Limited where the researcher currently works in his capacity after he left and joined the core Ministry where he served as the Director of Computer in the Civil Service under the Office of Accountant General of Akwa Ibom State before being appointed as the Permanent Secretary, Local Government Service Commission, a position where he currently holds. Interviewee C has a Masters Degree in Computer Science majoring in Information Systems. He is an NCS and CPN member.

He mentioned that before he left the Accountant General's Office, he had helped the department to migrate to cloud having secured a cloud services arrangement with a service provider to enable Akwa Ibom State Government seamlessly manage its payroll information/database properly.

He said he made series of presentations to the Account General for the need to embrace this shift in IT services, government finally adopted cloud storage and now, it is quite easier for workers' salaries to be paid with a click of the mouse and approval can be granted by the relevant officer anywhere in the world he/she might be.

He said, of course security of data has been the major concern of stakeholders but that their service providers has proved to them that their data is safe. Also, he said the SLA's with service provider is such that in the event of breach of agreement, the CSP shall oblige to entangle their services so they can source for a better providers without hitch.

He said economies of scale is the one major benefit from Cloud Computing to financial sector. Similarly, in order to use Cloud all legal issues have to be fulfilled especially at the SLA level, disaster recovery and data storage places.

In his opinion, private cloud is safe to store government employee's records because of security demands but the required technical know-how and manpower to manage same effectively is currently lacking in the government staffers.

4.2.3.3.1 Thematic Content of Interview C

INTERVIEWEE C – THEMATIC CONTENT ANALYSIS			
Interview Question No (IQ)	Respondent’s opinion	Research Question(RQ)	Codes extracted
IQ14	He had helped his former organisation to migrate to cloud	RO4	Cloud adoption
IQ05	Government seamlessly manage its payroll information/database properly	RO1	Efficiency and Speed of Cloud
IQ08 AND IQ12	He made series of presentations to the Account General for the need to embrace this shift in IT services	RO4	Enlightenment and Awareness
IQ05	Approval can be granted by the relevant officer anywhere in the world he/she might be	RO1	Data Availability
IQ03	Security of data has been the major concern of stakeholders	RO2	Data Security
IQ03 AND IQ09	Their service providers has proved to them that their data is safe	RO3	Cloud security
IQ09	He said the SLA’s with service provider is such that in the event of breach of agreement, the CSP shall oblige to entangle their services so they can source for a better providers without hitch.	RO3	Flexible SLAs, Good Vendor, Trusted Service Provider
IQ05	He said economies of scale is the one major benefit from Cloud Computing to financial sector.	RO1	Cost Reduction, Cloud benefit
IQ09	In order to use Cloud all legal issues have to be fulfilled especially at the SLA level, disaster recovery and data storage places	RO3	Legal issues, Disaster Recovery, Data Center location SLAs
IQ10	Private cloud is safe to store government employee’s records		Private Cloud Model is suitable
IQ12	Private Cloud requires technical know-how and manpower to manage same effectively is currently lacking in the government staffers.	RO4	Level of knowledge,

Table 4.4: Interviewee C – Thematic Content Analysis

4.2.3.4 Interviewee D

This interview was one-on-one with Interviewee D on 6th August, 2014 in his office at Plot 32 Unit G, Ewet Housing Estate, Uyo, and Akwa Ibom State. Dominic is the IT Specialist of Nigerpet Construction Nigeria (NPS), NPS is a construction firm engage in the construction of social infrastructure and has been involved the construction of major infrastructural works in Akwa Ibom State. He explained his role and responsibilities as the Head of IT and also a Programmer in his organisation. He has a B.Sc degree in Business Computing from Teeside University, UK and he is an NCS member.

His organisation use cloud computing and the reason behind adopting is to get some services that are already hosted in different companies so they do not have to create those services by themselves. He explained cost reduction is another major reason because after using cloud services there is no need for someone to monitor services regularly not only the software, hardware part but also servers running with application.

He said cost is the main aspect that many companies looking towards cloud since if we have to purchase all services and application by ourselves it is costly and later also need to be updated, same for hardware and server configuration too. Speed of these systems and network speed play a vital role in the adoption of cloud but it depends on geographical location, he said

To him, reliability and efficient storage of data is an issue of importance to both users and the company which gives the services to see how they have built their services.

Security is the issue which will always be attached to any software or system so is the case with cloud computing since no system can be 100% secure.

Interviewee D identified Knowledge; level of expertise of users (education of the users) and technology as major challenges in cloud computing since there are still some services which cannot operate through our network service. There are still issues of bandwidth i.e. the amount of information one can send or received by the user.

He pointed out that there still some unaddressed security issues inherent in cloud computing as security breach, hackers, and finally reliability and trust issues (entrusting your sensitive data in the cloud lead to security problems in both the provider and the customer then there come the issues of reliability and trust). Due to the above reasons, he predicted that it might takes years for some microfinance banks to embrace cloud technology except appropriate enlightenment is carried out to convince the would-be customers that the system is fully secured.

He said public cloud is not secured enough as most service providers usually use public cloud to test different configuration and different security measures and once convinced of

the safety of the system, they finally launch their applications in private cloud. Hence, he said private cloud has high security with strict SLA but still risk is there and 100% security cannot be guaranteed.

4.2.3.4.1 Thematic Content of Interview D

INTERVIEWEE D – THEMATIC CONTENT ANALYSIS			
Interview Question No (IQ)	Respondent’s opinion	Research Question(RQ)	Codes extracted
IQ05	Reason behind adopting is to get some services that are already hosted in different companies so they do not have to create those services by themselves.	RO1	Shared Services of Cloud
IQ05	Cost reduction is another major reason	RO1	Cost Reduction
IQ05	Speed of these systems and network speed play a vital role in the adoption of cloud	RO1	Speed
IQ05	Reliability and efficient storage of data is an issue of importance to both users and the company which gives the services to see how they have built their services.	RO1	Reliability, Efficiency
IQ03 AND IQ09	Security is the issue which will always be attached to any software or system so is the case with cloud computing since no system can be 100% secure.	RO2	Security of Cloud
IQ08 AND IQ12	Identified Knowledge; level of expertise of users (education of the users) and technology as major challenges in cloud computing	RO4	Knowledge level, Education
IQ04 AND IQ13	There are still issues of bandwidth	RO2	Cost of services
IQ03 AND IQ09	He pointed out that there still some unaddressed security issues inherent in cloud computing as security breach, hackers, and finally reliability and trust issues	RO2	Data Security, Privacy, Reliability, Trust issues
IQ14	Due to issues of data security and privacy, reliability and trust, he predicted that it might takes years for some microfinance banks to embrace cloud technology	RO2	Adoption concerns
IQ08	Except appropriate enlightenment is carried out to convince the would-be customers that the system is fully secured.		Education, Enlightenment, awareness
IQ10	He said public cloud is not secured enough as most service providers usually use public cloud to test		Public Cloud not suitable for Microfinance banks

	different configuration and different security measures		
IQ10 AND IQ09	He said private cloud has high security with strict SLA but still risk is there and 100% security cannot be guaranteed.		Private Cloud is desirable, Good SLAs
IQ08	Cloud vendors have to prepare the users to use cloud services by giving proper education and enlightenment to their users.		Education, Enlightenment, Awareness

Table 4.5: Interviewee D – Thematic Content Analysis

4.2.3.5 Interviewee E

This interview was conducted with Interviewee E on the 7th August 2014 via a Google Hangout. Interviewee E is the IT Manager of Bosak Microfinance Bank Limited, Lagos. His main responsibility in the organisation is overseeing the overall information system architecture of the bank. He said he has a dual degree in Banking and Finance as well as Computer Science with an M.Sc in Information Technology and has been working in the IT industry for 6 years before joining the bank last year. He is a member of both NCS and CPN. He particularly picked interest in discussing the questions with the researcher because he did his thesis on how IT can leverage the operations of microfinance banks.

He said most microfinance institutions in Nigeria are yet to derive the full benefits of IT in their business basically because they have not yet embrace the IT and more strongly that the most SMEs lack the needed manpower to brief the management on emerging technologies except where a such a bank has an exposed CEO who explore opportunities like his organisation. Quite frankly, he said emerging IT technologies education are not obtained from university curriculum as in the case with Nigeria because there are evolving technology that one needs to get abreast of by extensive research and investigation. In his word, he said: “my brother, our SMEs, most especially microfinance banks are not even aware of the technology called cloud computing let alone adopting it.”

According to him, the cloud service providers have a lot more role to play to drive the growth of Cloud adoption. SMEs need to know that cloud exist and they also need to know the economic benefits of using such technology over traditional IT.

He said the most important and appealing advantage of cloud environment is the reduction in cost of maintaining IT infrastructure which in turn reduces capital expenditure on IT

hardware and also the flexibility of service delivery. Among the issues with cloud that he mentioned included privacy and security of data, this he said is not really big threat as cloud providers also have measures to ensure data safety. He preferred private cloud for SMEs and maintained that SLA is very important and so vendors should do well to be open with their customers. He said their organisation is hosted on MTN platform and the services is wonderful but that it is costly though when compared to the returns on investment, it is worth it.

“For us to move up rapidly, government has make the auxiliary infrastructure that powers the network to be efficient e.g. power infrastructure and internet connectivity”, he ended.

4.2.3.5.1 Thematic Content of Interview E

INTERVIEWEE E – THEMATIC CONTENT ANALYSIS			
Interview Question No (IQ)	Respondent’s opinion	Research Question(RQ)	Codes extracted
IQ14	Most microfinance institutions in Nigeria are yet to derive the full benefits of IT in their business	RO4	Slow Adoption Rate
IQ08 AND IQ08	SMEs lack the needed manpower to brief the management on emerging technologies	RO4	knowledge about Cloud computing
IQ08 AND IQ12	SMEs, most especially microfinance banks are not even aware of the technology called cloud computing take more of adopting it.”	RO4	Most microfinance banks are unaware of cloud
IQ08 AND IQ12	Cloud service providers has a lot more role to play to drive the growth of Cloud adoption.	RO4	Cloud Education is necessary, Cloud Awareness crusade
IQ01	SMEs need to know the economic benefits of using such technology over traditional IT.	RO1	Cloud is beneficial
IQ05	The most important and appealing advantage of cloud environment is the reduction in cost of maintaining IT infrastructure which in turn reduce capital expenditure on IT hardwares and also the flexibility of service delivery	RO1	Cost Reduction, Flexibility
IQ03 AND IQ09	Among the issues with cloud that he mentioned included privacy and security of data, this he said is not really big threat as cloud providers also have measures to ensure data safety.	RO2 AND RO03	Issues of privacy, Security of data, Cloud has threats mitigations
IQ10	He preferred private cloud for SMEs and maintained that SLA is very important and so vendors		Private Cloud is preferable, SLAs are important

	should do well to be open with their customers.		
IQ05	He said their organisation is hosted on MTN platform and the services is wonderful	ROI	Efficiency
IQ04	But that it is costly though when compared to the returns on investment, it is worth it.		Cost of access to service is high but worth it
IQ04 AND IQ13	<i>“For us to move up rapidly, government has make the auxiliary infrastructure that powers the network to be efficient e.g. power infrastructure and internet connectivity”</i>		Power infrastructure, Bandwidth access are challenges against Cloud

Table 4.6: Interviewee E – Thematic Content Analysis

4.2.3.6 Interviewee F

Interviewee F was contacted on the 5th August 2014 and she agreed to be available for the interview on 8th August 2014 but she preferred chatting only. Interviewee F works with FinaTrust Microfinance Bank, Lagos as a Database Administrator and responsible for the management of the company’s database system.

She defined cloud computing as sharing of data or services from a centralised remote computer to users on demand. She said cloud computing has made her job a lot easier and so would say that its advantage is efficiency and reliability. She said she not really rooted in the security aspect of cloud but her concern as always been the integrity and confidentiality of their organisation’s customer data but that their service providers had a signed an agreement (SLA) with their organisation that guarantees data safety.

According to her, it was the service provider who came to discuss the new technology with their organisation and after a lot of presentations, it was accepted and they then deployed the services and trained her and other staff on the usage of the application.

Interestingly, she confirmed that more and more SMEs like hers need to be made aware of this technology and attributed the slow rate of adoption of this technology by some to high cost of ICT services.

4.2.3.6.1 Thematic Content of Interview F

INTERVIEWEE F – THEMATIC CONTENT ANALYSIS			
Interview Question No (IQ)	Respondent’s opinion	Research Question(RQ)	Codes extracted
IQ05	She defined cloud computing as sharing of data or services from a centralised remote computer to users on demand.	RO1	Data Sharing
IQ12	She said she not really rooted in the security aspect of cloud		Lack of cloud security knowledge
IQ06	Her concern as always been the integrity and confidentiality of their organisation’s customer data	RO3	Data security, Privacy and Confidentiality
IQ09	But that their service providers had a signed an agreement (SLA) with their organisation that guarantees data safety.	RO3	Good SLAs Data Protection
IQ08 AND IQ12	It was the service provider who came to discuss the new technology with their organisation and after a lot of presentations, it was accepted and they then deployed the services and trained her and other staff on the usage of the application.	RO4	Cloud Education, Awareness, Enlightenment, Knowledge
IQ08	She confirmed that more and more SMEs like hers need to be made aware of this technology	RO4	Cloud awareness programme
IQ13	She attributed the slow rate of adoption of this technology by some to high cost of ICT services.	RO1	Slow Adoption rate,
IO13	She attributed the slow rate of adoption of this technology by some to high cost of ICT services.	RO2	Cost of services

Table 4.7: Interviewee F – Thematic Content Analysis

4.2.3.7 Interviewee G

Interviewee G was interviewed using a Skype recorder application on the 11th August 2014. An IT System Support manager with AB Microfinance Bank responsible for the management of IT related services in the organisation, an MBA graduate in Business Information Technology.

He said it is very important for microfinance banks to all migrate to the cloud to achieve agility and operational efficiency and identified security and privacy as the main challenges in cloud computing considering the fact that SMEs still fear if their data will be safe in the cloud.

The fear with some organisation about cloud is where their data is taken to. *“mind you, we need to know where you are hosting our data and what will happen in the event that we choose to discontinue our services with you if you cannot satisfy us”*, he said. This brings us to the issue of vendor lock-in.

“CSP has to clearly spell out all these SLA’s components in their product agreement”, he said.

To him, multi-cloud is desirable since it allows for flexibility but a lot more awareness and education has to be mounted by the industry players to drive adoption as so many organisations are not aware of the existence of this kind of technology and still battling with the traditional method.

Of course, “another major factor affecting the rate of adoption is the cost inherent in the acquisition of the technology at first because of high cost of internet services since the cloud is powered by the internet”, he contended. Except government makes bandwidth affordable, some organisation might still fear risking the trail.

4.2.3.7.1 Thematic Content of Interview G

INTERVIEWEE G – THEMATIC CONTENT ANALYSIS			
Interview Question No (IQ)	Respondent’s opinion	Research Question(RQ)	Codes extracted
IQ05	He said it is very important for microfinance banks to all migrate to the cloud to achieve agility and operational efficiency	RO1	Cloud Agility, Efficiency
IQ06	Identified security and privacy as the main challenges in cloud computing considering the fact that SMEs still fear if their data will be safe in the cloud.	RO2	Security and privacy concerns
IQ6 AND IQ07	The fear with some organisation about cloud is where their data is taken to	RO2	Data Center location
IQ07	<i>“mind you, we need to know where you are hosting our data and what will happen in the event that we choose to discontinue our services with you if you cannot satisfy us”</i>	RO2	Data centre location issue, Migration of Data
	<i>“CSP has to clearly spell out all these SLA’s components in their product agreement”,</i>	RO3	Flexible SLAs, Trusted Vendor
IQ10	Multi-cloud is desirable since it allows for flexibility but a lot more awareness and education has to be mounted by the industry players to drive adoption	RO3 AND RO4	Multi-Cloud, Flexible SLA, Cloud Awareness
IQ13	<i>“another major factor affecting the rate of adoption is the cost inherent in the acquisition of the technology at first because of high cost of internet services since the cloud is powered by the internet”</i>	RO2	Cost of service
IQ13	Except government makes bandwidth affordable, some	RO2	Bandwidth issue

	organisation might still fear risking the trail.		
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Table 4.8: Interviewee G – Thematic Content Analysis

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 4.9: Interview Questions mapped against Research Objectives and Questions

4.2.4 Codification and Categorisation of themes

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).

Simply put, coding allow a researcher to categorise data or string of words into a family on grounds that they have similar characteristics.

The table 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 4.10: Mapping Interview Questions against Theme Category

4.2.5 Summary of Themes Extracted by Each Interviewee

The table below shows all themes extracted from each interviewee

SUMMARY OF THEMES EXTRACTED FROM EACH INTERVIEWEE RESPONSE	
INTERVIEWEE	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	<p>Shared Services of Cloud</p> <p>Cost Reduction</p> <p>Speed</p> <p>Reliability, Efficiency</p> <p>Security of Cloud</p> <p>Knowledge level, Education</p> <p>Cost of services</p> <p>Data Security, Privacy, Reliability, Trust issues</p> <p>Adoption concerns</p> <p>Education, Enlightenment, awareness</p> <p>Public Cloud not suitable for Microfinance banks</p> <p>Private Cloud is desirable, Good SLAs</p> <p>Education, Enlightenment, Awareness</p>
INTERVIEWEE E	<p>Slow Adoption Rate</p> <p>knowledge about Cloud computing</p> <p>Most microfinance banks are unaware of cloud</p> <p>Cloud Education is necessary, Cloud Awareness crusade</p> <p>Cloud is beneficial</p> <p>Cost Reduction, Flexibility</p> <p>Issues of privacy, Security of data, Cloud has threats mitigations</p> <p>Private Cloud is preferable, SLAs are important</p> <p>Efficiency</p> <p>Cost of access to service is high but worth it</p> <p>Power infrastructure, Bandwidth access are challenges against Cloud</p>
INTERVIEWEE F	<p>Data Sharing</p> <p>Lack of cloud security knowledge</p> <p>Data security, Privacy and Confidentiality</p> <p>Good SLAs</p> <p>Data Protection</p> <p>Cloud Education, Awareness, Enlightenment,</p>

	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 4.12: Themes Extracted from Interviewee’s Responses

4.3 Interview Findings

The seven (7) interviews are summarised and will be interpreted in the empirical data analysis section under the heading of each main theme as depicted in the table 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 4.13: Theme Category and sub-themes

4.4 Analysis of Empirical Data

This section contains the analysis of all literature review for this research from the point of view of the researcher as well as that of interviews conducted for the research. The researcher establish some of the benefits and issues of cloud computing and the main benefit and issues in adoption of cloud computing by SMEs.

4.4.1 Benefits of Cloud Computing

Cloud computing technology has some attractive benefits as deduced from the interviews. The following benefits were extracted from literature review and these are also confirmed by some interviewees. All the interviewees mentioned one form or the other how Cloud computing are beneficial to their organisations.

4.4.1.1 Reduction of Cost

Cost reduction is the main benefit of cloud computing and many organisations are adopting cloud computing to reduce their organisation's capital expenditure. For example, microfinance banks want to purchase all services and application by themselves, in the future there will be need to update all applications, services, servers and hardware, that will add more cost. If microfinance banks adopt cloud computing, they do not need to worry

about software and hardware upgrade as they can get the latest and upgraded resources in relatively less time and with ease since it will be the CSP that will handle that aspect on timely basis.

4.4.1.2 Scalability

From technical benefits point of view, 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. It will reduce the cost of additional servers on those that are not being in use because if the servers are not in use then these are automatically released from the application, it will then reduce the total cost because cloud computing applies utility based payment "Pay-as-You-Go" model.

4.4.1.3 Data Storage

It is easier storing their data in the Cloud as it makes it very easy for collaboration and retrieval and it is cheaper than storing in traditional storage facilities. For instance, storing data in Dropbox and Google Drive makes it easier for such data to be accessed anywhere as against when such data is carried about in a flashdrive or external disk drive. Data stored in the latter risk being lost in the event that anything happens to the storage medium whereas it is practical near impossible for data in Dropbox or Google Drive to be lost

4.4.1.4 Economies of Scale

Cloud computing not only provides cost advantages in procurement of hardware and software, it also provides cost advantages from improved productivity. Traditionally, lessons learned from one environment must be duplicated in other environments but, with cloud computing, once the best practices are applied they benefit all consumers.

4.4.1.5 Efficiency & Reliability

Efficiency and reliability are still benefits of the cloud. One respondent mentioned that reliability and efficient storage of data is an issue of importance to both users and the company which gives the services to see how they have built their services. Network and system will play a significant role in adoption of Cloud but it is also dependent on geographical location. Another respondent also said that the major advantage of Cloud Computing that microfinance banks can benefit from is its efficiency and reliability He opined that hybrid cloud deployment model is best suited for micro finance sector. That is, a bank can hire the service of one cloud vendor and also set up its own private cloud within the organisation to share data.

4.4.1.6 Summary

The economic benefit of cloud computing is very clear and compelling too. It is available at a fraction of the cost of traditional IT services, thereby eliminating upfront capital expenditures and drastically reduces administrative burden on IT resources. Cloud technology uses a pay- as- you- go model approach to IT that naturally requires a low initial investment—additional investment is incurred as system use increases, and costs can reduce if usage decreases. In this way, cash flow better competes with overall system cost.

4.4.2 Issues in Cloud Computing

The following issues and challenges of cloud computing are established from literature review. Along with these are new issues which to the researcher's point of view are peculiar to the Nigeria environment. In the interview (Appendix C), the researcher had asked questions 6 to establish the issues and challenges as it concerns cloud computing adoption.

4.4.2.1 Data Storage

Data in the cloud is typically in a shared environment alongside data from other customers. Encryption is effective but it cannot solve all data storage issues. “Find out what is done to segregate data at rest,” Gartner advises. The cloud provider should provide evidence that encryption schemes were designed and tested by experienced specialists. “Encryption accidents can make data totally unusable, and even normal encryption can complicate availability,” Gartner says. As data of many users are stored in same data center and same

server or same hard disks it will raise the question from the users about the problem of mismatch i.e. how cloud securely isolate users and differentiate the memory and storage of each users as this failure could lead to leakage of information from one customer to another

From interviews, researcher defines that cloud has many advanced security features but still all data cannot be stored in cloud because it depends on trusted service provider and deployment model we are adopting. Most of the interviewees highlighted concern about the location of data storage and its safety. For removing issues like data loss or unavailability of cloud, save the data in multi cloud i.e. at least we have to store in two datacenters ignoring the slight increase of cost since data security is more important than cost in many cases. When you use the cloud, you probably won't know exactly where your data is hosted. In fact, you might not even know what country it will be stored in. Ask providers if they will commit to storing and processing data in specific jurisdictions, and whether they will make a contractual commitment to obey local regulatory requirements on behalf of their customers, Gartner advises

4.4.2.2 Data Security

The security of data stored in cloud guarantees data privacy and confidentiality. Most users fear that data their might be compromised if stored in the cloud.

From interview, a respondent expressed his view that cloud security should be considered just as other security threat in a system that can be managed. He opined that some level of extra security measures must be put in place in both the service providers and even the customer's end to secure their data. Other respondents expressed the fear that security and hacking pose a major security issues in cloud computing.

4.4.2.3 Service Level Agreement(SLA)

Service Level Agreement (SLA) is in general a legal binding agreement in the mutual understanding and acceptance about a service between a client who is buying the service and a Service Provider (SP), who is giving the service. It is a serious issue to consider as it records a common understanding about services, priorities, responsibilities, guarantees, and warranties between the cloud provider and the consumers. Failure to comply with agreement usually invoke heavy penalty, which should also be spelt out in the agreement. An

interviewee said Data security and System availability are important SLA components while downtime guarantee was another issue raised by another respondents.

4.4.2.4 Reliability

Lack of speed and high bandwidth are the causes for not accessing the cloud services, hence there are still a lot of questions regarding cloud computing. From finding users are concerned as to whether they would be able to access their data as at when demand.

4.4.2.5 Knowledge and integration

Technical knowledge is required for implementing and managing SLA contracts with CSP's. Since all knowledge about the working of the cloud (e.g. hardware, software, virtualization, and deployment) is concentrated at the CSP, it is hard to understand what the CSP are doing. An interviewee mentioned his organization engaged a third party to handle SLAs aspect and even the integration as well.

One of the respondents in the interview mentioned knowledge, level of expertise of user's (education of the users) and technology are the major challenges in cloud computing so vendor have to explain to their customers about their system and its working procedure to convince them.

4.4.2.6 Migration of Data

The process of transitioning all or parts of a company's data, applications and services from on-site premises behind the firewall to the cloud, where the information can be provided over the Internet on an on-demand basis is cloud migration⁸. Migrating data from a traditional business environmental to cloud can pose enormous challenges and raises concern about the security of the data. Some organisation fear that in course of this migration, something might have gone awry and their data lost or compromised. This is an issue on itself to contend with.

⁸ http://www.webopedia.com/TERM/C/cloud_migration.html

4.4.3 Benefits of adoption of Cloud Computing by SMEs

In the interview question No 5 and 11, researcher asked questions bothering on the benefit of Cloud to SMEs, the responses to those 2 questions helped to establish the benefits of adopting Cloud Computing into SMEs' operations. These are outlined in this section.

4.4.3.1 Reduction of Cost

As described in section (2.4.1.1), cost reduction is the main advantage or main reason why organisations are going to apply cloud solutions as it saves the cost involved in building infrastructure and setting up a data centre. Even a small-scale business can adopt or go into the cloud. This allows SMEs to concentrate more on improvements of their core competencies. It certainly helps to be more advantageous in the longer run. There is no need to spend big money on hardware, software, or licensing fees. Interviewee A, B, C, D and E mentioned the reduction of cost of operation as one major advantage of deploying cloud computing in SMEs' operation.

4.4.3.2 Data sharing

Data sharing is one of the major benefits of Cloud to SMEs if adopted. For instance, in the case of a Microfinance bank, a customer that has an account with one bank and that account information is stored in a central server by service provider, such information can be shared under certain agreement or understanding (permission) with other banks. This process will make it more economical to simply obtain a customer's bank information seamlessly rather than the other creating a new database for the customer. Data of this nature can be remotely accessed from any location, no matter where the branch of the bank is.

4.4.3.3 Flexibility and Scalability of IT Resources

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. SME organisations can easily scale up and down their servers and hardware whenever they need it and this will reduce the cost of the unused servers and hardware. In this case, they simply pay for what services they use so it will reduce the cost inherent in the maintenance of hardware.

4.4.3.4 Greater Efficiency and Agility

Cloud computing delivers improved agility because it has on-demand self-service and rapid elasticity. IT resources can be acquired and deployed more quickly and, once deployed, they can be increased or decreased as needed to meet demand. This means that enterprises can innovate, introduce new products and services, enter new markets, and adapt to changing circumstances. Business agility requires the ability to create new business processes and change existing ones. This often means adding to or changing the supporting IT resources. The difficulty of doing this, and the time that it takes, can be a major barrier to innovation. Cloud computing can remove this barrier by enabling the enterprise to add to or change its IT resources quickly and easily.

4.4.3.5 Avoid Capital Expenditure in Hardware and Software

It helps SMEs maintain easy access to information with minimal upfront spending since cloud technology is operated on Pay-as-you-go (weekly, quarterly, yearly) basis.

4.4.3.6 Data Storage

Data storage is a major benefits of Cloud to microfinance institutions. These data are stored in the cloud by service providers at different data center locations around the world but here the issue would be storing these data outside the country home of the customer with its attendant legal implication that may arise if data is breached. Each country has her regulatory policy regarding data protection.

4.4.4 Issues in adopting Cloud Computing in SMEs

From respondent's point of view, following are the concerns for adopting cloud computing in SMEs operation.

4.4.4.1 Education and Awareness

Lack of awareness of cloud computing is traditionally a major concern of its own. Most organisations in Nigeria especially Small and Medium Scale (SMEs) organisations are not aware if cloud technology exist. For few organisations that are aware, data control and security are most critical. Interview question No 8 helped in giving further insight into this.

4.4.4.2 Data Security and Confidentiality

Because of the distributed network of cloud model, data are transmitted over networks, thus creating another challenging security risk. The privacy or confidentiality of customers' data must be guaranteed. This must apply to when the data is stored in the cloud as well as when the data is moved to and from the cloud. A system should be provided for where the owner of the data can verify the integrity and confidentiality status of its data. Data security in the cloud is one of the major challenges raised by prospective cloud users. Within the cloud data is vulnerable to threats during transmission, processing, storage and downloading stages. The lack of robust security mechanism within the cloud computing provides opportunities for cyber criminals. Secondly, the primary concern is the damage that a criminal can cause by planting a virus, from a normal desktop machine in an office using cloud services which could spread across the cloud and cause data damage. The inability of most organisations to store critical data on the cloud as a result of lack of guarantee mechanism to ensure data security by cloud vendors will also increase the cost of IT resources within the organization.

4.4.4.3 Availability and Reliability

Service disruption becomes a major source of concern to customers who have entrusted all their data in the cloud and might want to access it anytime. In the event that the customer management interfaces with the public clouds are accessible via the internet, there is an increased risk of failure when compared to the traditional services since there might be inherent weak interface in the chain of elements required to access the data or the application. For instance, a loss in network connectivity at the point of accessing the services could lead to service delivery failures. Another scenario, a vulnerability in the web browser used in access the hosting application could as well frustrate service delivery. A workable means to achieve a high degree of availability would be to use multiple CPS. Cloud Service Providers are aware of these scenarios and have built their system in such a way that if such situation occurs, there is an instantaneous remedy and this they have to let their customers to know.

4.4.4.4 Legal Issues

Most CSP fail to provide a guaranteed level of data security and for the cloud ‘users’ this compromises a basic requirement they are obligated to fulfil, inability to ensure a commensurate level of security. Hence, many cloud users are of the opinion that there are a lot of associated risks if data is accidentally lost or damage. There are clouds inside another cloud and CEUs may never be aware of their geographic location and knows whether a data protection privacy law is being honoured or not. For instance, Data stored in Cloud storage in one country could be subject to another country’s government regulation and legal affairs e.g. Personal information. The Patriot Act in the United State allows the government of US to subpoena all data stored within the country, this might not be acceptable to many organisations to know that their customer’s data can be compromised outside Nigeria for instance. Similarly, European Privacy Acts require that data be stored within the country of origin. Storing in the data center of out- of- country the Service Provider might not meet these requirements.

4.4.4.5 Service Level Agreement

As described in literature review (section 2.7), a Service Level Agreement (SLA) is in general a legal binding agreement in the mutual understanding and acceptance about a service between a client who is buying the service and a Service Provider (SP). It is the serious issue to consider as it records a common understanding about services, priorities, responsibilities, guarantees, and warranties between the cloud provider and the costumers. Failure to follow the agreement is usually followed by huge penalty, which should also be mentioned in the agreement.

4.4.4.6 Knowledge

In the interview section No 12, a respondent who works with a microfinance bank and also consulting as an IT specialist to other firms confirmed that he has discovered that most SMEs are not embracing cloud computing because they do not have knowledgeable staffers to handle that aspect of technology and do not want to run the risk of migrating to it at least for now. More and deeper knowledge is required for implementing and managing SLA contracts with CSP’s. Since all knowledge about the working of the cloud (e.g. hardware, software, virtualization, and deployment) is concentrated at the CSP, it is hard to get grip on

the CSP. Integration: Integration with equipment hosted in other data centres is difficult to achieve. Most SMEs do not know that cloud computing management requires an IT personnel knowledgeable in the workings of Cloud computing and not just an ordinary IT person.

4.4.4.7 Environmental Challenge

Due to some challenges confronting Nigeria's ICT industry, Nigeria small businesses have not been able to fully derive the benefit of cloud technology, Nigeria, like other developing countries, is still facing challenges in full adoption of cloud computing technology due specifically to the inadequate power and infrastructure, and cost of access to ICT products and services. These according to some respondents in the interview have affected the growth of the SMEs sector.

4.4.4.8 Cost of Setup/Service

One of the challenges SMEs face is technology and is so expensive for them as individual companies to create a formal structure of payroll for proper accounting system, so the cost of doing that is inhibitive. Often SMEs keep themselves out of the formal environment because they have to invest (Obuh 2013). The initial acquisition cost of IT hardware and software is a bit expensive, and this scares most SMEs from thinking the cloud direction. Interviewee A, D, F and G raised these concerns.

4.5 Discussion and Validity Threats

4.5.1 Discussion

In order to establish an efficient and significant discussion on the economic incentives (benefits) of cloud computing as well as the challenges in adopting cloud technology for SME organisation specifically microfinance institutions, the researcher reviewed related literature and analysed the interview conducted for the research.

4.5.1.1 Benefits of Cloud Computing

In order to establish the economic benefits of Cloud computing, the researcher analysed literature as well as the opinion of the respondents from the interviews. Respondents explained in their own understanding how cloud computing is beneficial to their organisations. It was observed that many of the IT Professionals and associates mentioned cost reduction as the major economic benefits of cloud technology.

From the analysis of the opinions of associates, researcher identified some of the benefits of cloud computing as explained by the respondents. Cost reduction, scalability, data storage, resource sharing are some of them. All of the respondents said cost reduction is the major benefit of Cloud computing to organisations. They said cloud computing reduces capital investment to organisations since it reduces the cost of maintaining hardwares. While some respondents praised cloud computing for bringing scalability to the organisation since cloud can scale up network resources to handle high traffic without the need for additional hardware infrastructure and user's normal work is disturbed, other respondents said data storage is another significant benefit. Some also mentioned that resource sharing is an appealing feature since sharing can take place remotely from virtually anywhere in the world but that network and system speed will play a role to making this feasible. With these benefits and with awareness, organisations are beginning to move to the cloud.

4.5.1.2 Issues of Cloud Computing

To find out the challenges in cloud computing, researcher analysed literature as well as opinions from the interviews. Many respondents mentioned that at the heart of concerns about migrating to the cloud, security is the major contention why some organisations are still contemplating whether to adopt cloud technology or not.

From the analysis of the responses from the associates, researcher was able to identify that data security, data storage, SLAs, reliability and knowledge are some issues of cloud computing. Many of the respondents mentioned that data security is the major issue in cloud computing and real-time threat detection/encryption is the one basic mitigation measures to protect our data and servers from unauthorised persons. Respondents pointed out data storage as another issue why they could not store all data on the cloud because it is dependent on trusted service providers and deployment models that are adopted. And many

of them suggested that aside from issue like data loss, we need to store our data in multi cloud i.e. at least we have to store in two data centers or better still own a private cloud in conjunction with the public. Reliability is also another important issue and it is the key of trust. One respondent suggested that we should not trust the cloud services fully and not store our sensitive and important data on the cloud. Some of the respondents mentioned about migration of data from current system to cloud are one issue.

Many of respondents agreed that SLAs play vital role in Cloud computing in the sense that if organisation or users have critical application then it is very essential to have good Service Level Agreement.

4.5.1.3 (Perceived Usefulness) of Cloud Computing 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 4.5.1.4

4.5.1.4 (Perceived Ease-of-Use) of Cloud Computing in SMEs' operation

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 in 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.

4.5.1.5 Attitude Towards Usage (ATU)

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.

4.5.1.6 Actual System Usage (ASU)

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

4.5.1.7 Behavioural Intention to Use (BIU)

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.

4.5.1.8 Suitable deployment model for Cloud Computing

Having analysed the opinions of IT professionals and associates as well as the responses from the interview, the researcher concluded that private cloud is the best deployment model for microfinance institutions. Researchers identified the benefits and challenges of different deployment model. From the responses of the respondent, Private Cloud is more secure to store customer's sensitive information like customer's bio-data and transaction records and also it carries along with it, strict SLA's though a bit expensive to set up. Public Cloud is economical to set up, but it is less secure, reliable and flexible and has flexible SLA's. And finally Hybrid Cloud is beneficial in terms of its ability to communicate with other clouds, but its problem is setting up the connections. Out of the three deployment models, many associates suggested that private cloud is best to store customer banking information because customer's data transaction information must be confidential and kept secured with the bank.

4.5.1.9 Scenario 1: Data Sharing (Benefit of Cloud Computing)

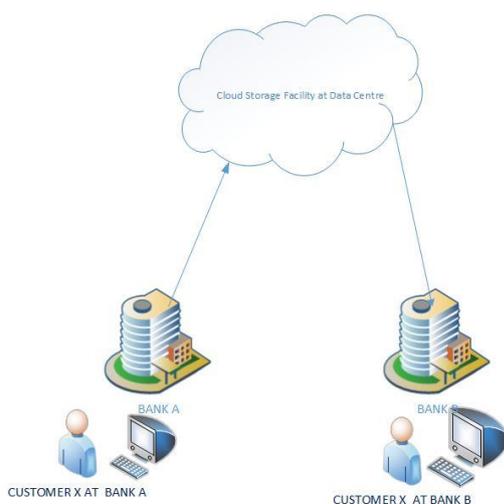


Figure 4.1: Scenario 1 - Data Sharing

Assumptions:

- Bank A and Bank B have all deployed cloud services
- That Bank A and Bank B are using the same cloud vendor
- That Bank A and Bank B have partnered under certain SLA agreement to share data
- Customers are mandatorily required to give his or her (1) Date of Birthday (2) Blood Group on opening account in any Microfinance Bank

The figure 4.1 above depicts a typical scenario where two different microfinance banks can use cloud services to share customer's data with each other seamlessly.

As of now:

- If a customer X goes to Bank A to open an account, his bio-data will be collected and it gets transmitted from the Bank A web browser to a cloud storage facility (datacenter) anywhere the vendor has contracted to host its client data.
- If that same customer X goes to Bank B to open another account, Bank B will collect the customer X's bio-data afresh and it gets transmitted from the Bank B's web browser to the same cloud storage.
- The 2 scenarios above will lead to a duplication process of data collection since the customer X cannot, for instance supply two different dates of birth and blood groups at the point of opening an account in each bank.

4.5.1.6.1 Data sharing in action

It would have been seamless if on opening account in Bank A, customer X was assigned a customer code from the Bank A and a CSP Code (where this typically is an identifier in the Cloud). When the customer X goes to Bank B to open account and he or she is requested to fill a form where there is a CPS Code option to fill. When the customer X fills his or her CPS Code, Bank B will be able retrieve customer X Date of Birth and Blood Group from the cloud without even the customer knowing. Of course, this can serve as a source of further authentication of the information the customer provides for account opening at the other bank. This idea can be duplicated on a number of different data needed from customers. This can help microfinance banks to tie customer's financial history together, regardless of the location of the banking transaction of the customer and the location of the bank branch. The only issue here is maintaining the trust, privacy and security of the data so accessed by the other bank, although these issues can be eliminated at the original data owner end by implementing Read/Write access permission, i.e. the bank accessing the data can only read the data but cannot alter it. Where the need arises for alteration, the customer applies to the original bank for such changes to be effected. Data location issues can also be eradicated if a community cloud (cloud set up solely for the purpose of sharing a particular kind of data or services under a private arrangement among the partnering institutions) for the purpose of this. If this scenario is implemented, it will minimise the time consuming process of creating duplicate records for a particular customer in all microfinance banks he or she transacts with. This scenario depicts a typical cloud data sharing ability, a potential benefit of using cloud.

4.5.1.9.2 Guidelines for Implementation for Data Sharing

- Vendor assigns a storage domain application interface to client (microfinance bank)
- The customer (the original microfinance bank) generates data and create an Access Control List (ACL) that will specific the login conditions (authentication) and other login parameters for other banks to have access to its data
- Sharing partner banks agree on terms about data-sharing via SLA's
- Owner assigns a unique identifier to each customer show who owns the data
- On breaching of any agreed SLA's component, data owner terminates sharing privilege granted the partner by removing the defaulter from the Access List.

4.5.1.10 Scenario 2: Data Storage (Benefit of Cloud Computing)

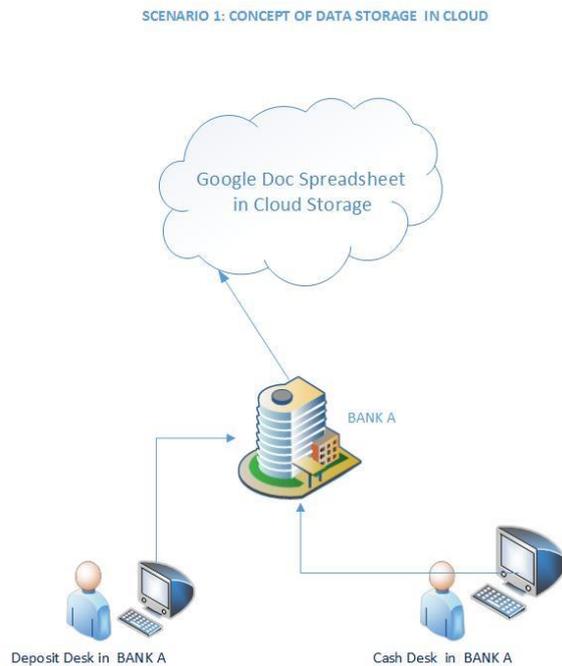


Figure 4.2: Scenario 2 - Data Storage

Assumptions:

- Bank A has deployed cloud service.
- Deposit Desk officer and Cash Desk officer all have Read/Write permission to the banks GoogleApp financial spreadsheet document.

Figure 4.2 above depicts a typical scenario where two different employees in same bank can work (collaborate) on a single document stored in the cloud using their separate personal computer and accessing the same spreadsheet document from their different offices.

As of now:

- If the bank A is not using cloud services as simple as GoogleApp, what happens in such scenario is a situation where the Desk Officer at the Deposit desk will have to send his or her record through paper documentation to the Cash Officer at Cask desk for such information to be used in completing the task of paying cash to the waiting customer.

4.5.1.10.1 Data Storage in action

The bank A has deployed cloud service and have its data and app hosted in the cloud. A simple GoogleApp can allow employees at different locations to access their data but the issue would be who access the data and what has changed and by who, this raises concern for data integrity because there is provision to monitor how changes are being made and who made such changes. If all users who access the GoogleApp document have a login ID and each computer is uniquely identified, it easier to know who changes what, where and when. With such audit facility, it can be guaranteed the storage system is secured and data is safe in it. This scenario can be extended to employees at different locations of the bank provided all branches share the same storage facility. The scenario explained above shows the data storage ability of the cloud, a useful benefit of cloud technology.

4.5.1.10.2 Guidelines for Implementation for Data Storage

- Each system user is assigned a unique identifier and all users of the system are assigned login ID and password.
- Audit is carried out periodically to make sure integrity of the system is maintained at all times.

4.5.1.11 Conclusion Validity

Conclusion validity is the extent to which conclusions made in a research study about relationships in the data used are reasonable to adjudge being valid. In other words, it can be considered as the validity process that has been done to the required results which are reliable and suitable enough to the researcher to establish an accurate conclusion in an on-going research

According to Wohlin *et al.* (2000), heterogeneity of subjects can cause a potential threat to conclusion validity of a research. The subjects involved in the research from different educational backgrounds and experiences then this situation is called heterogeneity. The researcher eliminated this threat by selecting the subjects from cloud computing domain, however some interviewees were selected from Microfinance subsector of the SMEs domain. Survey was sent to associates in cloud computing, associate of microfinance institutions. This research work mainly aimed at finding ways to encourage the adoption of cloud computing by microfinance banks in Nigeria.

4.5.1.12 Construct Validity

According to Trochim (2006), Construct validity refers to the degree to which inferences can legitimately be made from the operationalisations in your study to the theoretical constructs on which those operationalisations were based. In other words, it shows the relationship between theory and observation. Mono-operational bias and evaluation apprehension are threats to constructs validity.

Interviews based on interest was selected by the researcher to eliminate evaluation apprehension threat to the constructs validity of this research. The researcher first discussed the research intent with the interviewee before and the interview proper and that helped to reduce the threats to constructs validity. Names of the respondents were not collected to avoid creating apprehension which may make the respondent to respond in a manner that will cause a threat to the construct validity. Mono-operational bias threats was eliminated by interviewing only seven interviewees in this research. Respondents from Cloud computing and microfinance subsector of the SMEs were selected.

4.6 Conclusion

In this chapter, the presentation, the analysis and interpretation of the results of the empirical study were put forward. The quantitative research data was discussed and an analysis of the data that emanated from the qualitative research was presented.

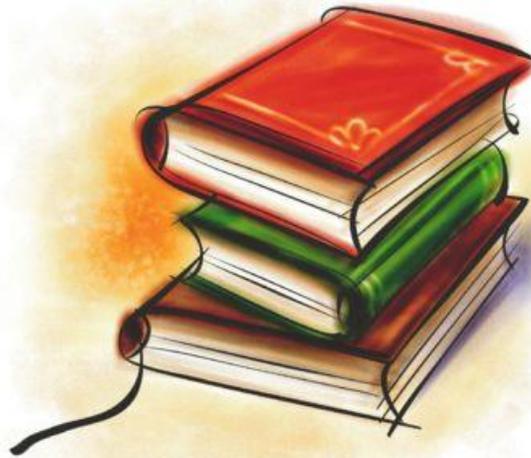
It was found that cloud computing has an appealing economic benefit if deployed by organisations such as the microfinance bank which the subsector of the SMEs in this study. Cloud computing being an emerging technology is still new and somewhat a myth to most operators of SMEs in that most operators of this organisations are not aware of the existence of this technology.

Cloud education, awareness and enlightenment are integral part of cloud adoption and should be not separated from each other if the rate of adoption of cloud computing by SMEs must be improved in Nigeria. Chapter 5 consists of a complete discussion of the above mentioned analysis. The central focus will be on the economic implications of cloud

adoption, the issues arising from using cloud and what mitigation measures are being put in place by cloud vendors to cushion the effect of such if need arises and the guidelines as well as steps for effective implementation of cloud will be advanced. Limitations of the study will also be discussed and recommendation for future research will be made.

Chapter 5: EPILOGUE

“When I look back, I am so impressed again with the life-giving power of literature. If I were a young person today, trying to gain a sense of myself in the world, I would do that again by reading, just as I did when I was young.” — Maya Angelou, 2014



“I know nothing in the world that has as much power as a word. Sometimes I write one, and I look at it, until it begins to shine.” — Emily Dickinson

5.0 Introduction

In this chapter, final overview of the study is presented. The central focus here will be on the extent to which the data is able to answer the research question and the specific research questions. Guidelines vendors how to improve cloud adoption as presented by researcher and steps towards effective implementation of cloud computing for would-be cloud users. Conclusions and future work in the areas of cloud computing that will specifically address the contemporary Nigeria situation will be put forward to industry players and future researchers.

5.1 Aim of the Investigation

The aim of the study was to investigate the reason for the slow adoption of Cloud computing technology in Nigeria. The intention of the researcher was to make a contribution to a holistic and better understanding of cloud computing by SMEs operators, specifically the microfinance institutions and to find ways of improving its adoption. An attempt to provide answers to issues concerning the cloud computing – the benefits, the challenges and the various mitigation measures in cloud technology against threats and risks that will be beneficial to the participants, the would-be cloud users and the industry players were integral to the aim of the study.

Specific questions needed to be investigated with regard to cloud computing adoption, which resulted in a specific purpose for the study. These specific research questions were:

- RQ1. What are the economic benefits of migrating to the cloud computing?**
- RQ2. Are there associated issues when migrating to cloud technology?**
- RQ3. Can the risks associated with cloud computing services be mitigated?**
- RQ4. Do SMEs require cloud computing services?**

In order to achieve the main research aim and to answer the specific research problems, a literature review of related study was conducted first and then secondly an empirical study. The empirical study was achieved with a qualitative study. In the discussion below, integration of these two studies' findings, as well as the conclusions, are offered.

5.2 Research Questions

5.2.1 RQ1 – What are the economic benefits of migrating to the Cloud?

The researcher answered RQ1 through the study of related literature and complimented the findings from interview conducted with industry associates. A literature review was conducted on the subject of Cloud Computing to establish the documented evidence of economic gains, organisation stand to benefits from migrating to cloud technology. A significant amount of documentations on the economic benefits of cloud computing was obtained; see Chapter 4 (Section 4.4.1.1 – 4.4.1.5). Specifically for SMEs, Chapter 4 (Section 4.4.3.1 – 4.4.3.6) outlined the peculiar benefits of cloud to the SMEs subsector. These benefits included cost reduction, flexibility and scalability of IT resources, greater efficiency and agility, data storage and a reduction in capital investment on hardware and software. In the interviews, IT professionals, industry players and associates (Cloud Computing experts and Microfinance Bankers) gave their opinions as to what they considered as the economic side of cloud computing as it applies to SMEs. This was combined and documented in Chapter 4 (Section 4.4.3.1 and Section 4.4.3.6) and they included data storage, data sharing, reduction of IT cost, flexibility and agility while others are themes that emerged from the interview under cloud benefits as depicted in Table 4.12.

5.2.2 RQ2 – Are there associated issues when moving to the cloud?

The researcher implemented a two-step approach to answering this research question. The researcher conducted a review of related literature (Section 2.0 – 2.13) and established some documented concerns regarding cloud computing. Based on the concerns found in the literature reviewed, the researcher conducted interviews as a second step with industry associates and IT professionals and was able to identify some of the issues involved in the adoption of cloud computing in SMEs' operations. Ultimately, the interviews gave an insight into the issues (Section 4.4.4.1 – 4.4.4.8) involved in the adoption of cloud computing in SMEs' operation. Of all the issues, education and awareness about the technology seem to be the pivot upon which other issues can be managed since knowledge of the technology in the first place will ultimately equip the consuming public with the right decision-making model. Some of the issues identified were data security related i.e. how secure is the data stored in the cloud? Is it safe to store all data

in the cloud?, data storage i.e. where data is stored, knowledge of the technology i.e. Cloud technology is an emerging technology and not too many organisations are aware of the technology let alone know how it works to warrant a decision to migrate to the cloud, SLA i.e. an agreement between the consumer(customer) of technology and the provider(vendor) of the service, the complex nature of the SLAs component requires a knowledgeable person in the consuming organisation and this lacking in most organisations and may require a third party which can add cost to the consumer, lack of operational control of their data since this data is stored and processed in a remote location legal, regulatory issues regarding the protection of customer's data.

5.2.3 RQ3 – Can the risks (threats) associated with Cloud Services be mitigated?

RQ3 was answered by the researcher through literature documentation. In the literature chapter Section 2.9, the researcher identified various risks associated with Cloud Computing and some of these risks included abuse and nefarious use of cloud computing by employees in an organisation, insecure interfaces and APIs, malicious insider within the organisation, Shared technology issues, data loss or leakage, account or service hijack and unknown risk profile. The Table 5.1 below is a tabulation of the above mentioned threats and their respective mitigation methods:

S/No	Threats	Remediation
1	Abuse and Nefarious Use of Cloud Computing	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ Analyse the security model of cloud provider interfaces. ▪ Ensure strong authentication and access controls are implemented in concert with encrypted transmission.

		<ul style="list-style-type: none"> ▪ Understand the dependency chain associated with the API.
3	Malicious Insiders	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ Implement strong API access control. ▪ Encrypt and protect integrity of data in transit. ▪ Analyse data protection at both design and run time. ▪ Implement strong key generation, storage and 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	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ Disclosure of applicable logs and data. ▪ Partial/full disclosure of infrastructure details (<i>e.g.</i>, patch levels, firewalls, etc.). ▪ Monitoring and alerting on necessary information.

Table 5.1: Cloud Risks and Remediation Method

5.2.4 RQ4 – Do SMEs require Cloud Computing Services?

From the analysis of the research findings and related documentations, it has been established that cloud computing economic offerings for the SMEs is worth trying.

Nothing can be more appealing than incorporating a technology into business processes that in turn drive the business growth. YES! SMEs require Cloud Computing

5.3 Guidelines Presented by the Researcher

Cloud Computing is an evolving and new approach to IT service delivery and most people are not even aware of the existence of this technology, talk more of knowing its features. Consistent awareness about the technology has to be mounted to extract the needed impetus to drive its adoption. The following guidelines (Section 5.4.1 to 5.4.6) are therefore proposed to aid both the Service Provider and the Cloud End-users.

5.3.1 Education and Awareness

As with any new technology, people need to be aware of what the technology is all about before fully embracing it. Cloud Computing is a new IT approach to driving business growth and enhancing service delivery. In spite of this, most people are still unaware of this cloud computing features and are nursing certain fears about the confidentiality of their data and therefore reluctant to put their data in the cloud. In a developing economies like Nigeria, a lot of people working in the SMEs Subsector still lack basic computer knowledge so before planning to start adopting Cloud Computing, SMEs have has equip their staffers with the requisite IT knowledge needed to manage the cloud platform. The Cloud vendor has to adequately educate their would-be customers to increase their understanding of the cloud technology and demonstrate privacy and security capability of their system to increase the trust of the users.

Strategically, the Cloud Providers should consider the following:

- Ensure that the customer has a good understanding of cloud technology intricacies and that it is explained to the customer, existing IT costs and the true cost of migration, and build a strong argument for proposing a switch to the cloud. This should take into consideration cost savings as well as wider business benefits, such as faster speed to market and service delivery, improved productivity, and richer management information.
- Educate customers on cloud computing and its overall implications for their business operations. Recognise that the IT Officers or Managers, are bridges to senior management as well as decision-makers in their organisation so must be included. This means targeting the cloud message towards non-technical, management-level executives, aimed at solutions that recognise the motivations of the various players and take into consideration of the gradual homogenisation of the cloud environment.
- Dispel their fears over the potential downsizing of their Information Technology department and the loss of operational control over IT.
- Understand where customers stand in their business transformation/ IT upgrade journey, which will impact their willingness to migrate data intensive applications and activities to the cloud.

- Demonstrate in clear terms how you are applying industry-accepted standards and comply with regulations regarding data privacy and security. By showing that sufficient measures are in place, this would make customers get the same sense of security from the cloud that they get from their traditional IT environment

5.3.2 Service Provider Selection

Some of the IT professionals and associates interviewed mentioned that selecting a good vendor is a critical step for the microfinance institutions before adopting cloud computing. Choosing a service provider is an important step towards cloud adoption, failure of which can be very disastrous. At this point, the SMEs has to carry out background checks on the vendor to ascertain, (1.) the financial stability of the vendor (2.) for how long the vendor has been in the business of providing cloud services and (3.) what has been the vendor customer's rating in terms of service delivery and support. A good vendor of course will be open and will produce good SLA's to customers. A reliable vendor with a good customer relationship is desirable. A good vendor will be keen about delivering secure service and guaranteed down-time contingency plan.

5.3.3 Secure and Flexible SLAs

SLA is a legal contract and mutual business agreement between the service provider and the cloud end user for the provision of cloud services. It must therefore be designed the mutual understanding of business concern. As it is the case with microfinance institutions customers' data and banking history are supposed to be confidential and so SLAs must be formed in such a way as to guarantee that the customer's data privacy is upheld. A flexible SLAs is desirable because of the peculiar nature of Nigeria's business environment considering the fact that this is a new technology and users are yet to fully understand its intricacies. SLAs element must be made in such a way that there is room for periodic review if need arises to accommodate unpredicted incidentals, he will give the consumer a sense of confidence. Concerns like data security and data availability can be addressed by multi-cloud so they need to be included in the SLA's so customers would know ahead that if there is no problem with one cloud, their data is also stored in another cloud and would still be available for access with interruption of service.

5.3.4 Building trust for the user

The issue of trust is an important element that has to be built into SLA's to ignite confidence in the customer. As explained in data sharing scenario where Bank A who already has a customer's data stored in the cloud can simply share the data with Bank B. If Bank A and Bank B have a mutual sharing agreement, customers' data can be shared between the organisations. As important as customer's information is as well as his or her transaction history, it would be a serious breach of trust if the customer discovers that his or her bio-data or banking transaction history has been shared to unauthorised person e.g. where some organisation share customers email addresses to email marketing without the consent of the email owner. Customer should have the ability to check who accesses his or her information and from where. This can be prevented implementing user's authentication or ACL. The vendor has to explain and demonstrate its system performance to the customer to build trust and increase the confidence of customer that their privacy will be respected.

5.3.5 Data Center location

As discussed in scenario 2 – data storage, storing data in the cloud gives easy access to such data at any time and from anywhere. Another scenario may be depicted where an organisation's data is being stored at a location outside its territory and issues of legal implication arises, there is tendency therefore that data protection regulation in one territory might be different in another territory and so this has to be considered by storing data in the country where the customers are.

5.3.6 Selection of Suitable Deployment Model for Microfinance Institutions

Some of the IT professionals and associates mentioned that every cloud deployment model has their own benefits and challenges. The researcher analysed the opinions from associates and concluded that private cloud is the best deployment model for storing microfinance bank financial transaction and its customer's data. Private cloud is more secure with strict SLA's but still there is no 100% security in it and it is more expensive compared with public cloud. When using private cloud, tight security control should be implemented; if it is stored in public cloud it should be encrypted and the decryption rights should be given to only authorised person or user.

5.4 Steps for Effective Cloud Implementation

5.4.1 Make an Effective Business Case

"Strategic planning is worthless - unless there is first a strategic vision" - John Naisbitt

Before you put aside your existing traditional system and introduce your users to the cloud, it is important to strategically plan ahead. This planning should include defining a clear and concise business goal. What benefits you intend to derive from the new IT solution and how this change will help meet business objectives. Take time to understand the processes with your current system and what the future may require and make sure that the cloud solution can satisfy your desired capabilities. Determining why cloud computing should be deployed, what are the economic imports of deploying cloud technology and is it possible that these goals can be achieved. In this case, microfinance operators should consult industry experts and stakeholders both from the IT and the commercial banks operators who likely have already used the technology from the very beginning of conceiving the idea of migration, These should include legal advisors, CTOs of similar organisations, IT managers or possibly contract a third party with experience in cloud implementation to handle the planning phase to ensure successful implementation and that data protection is guaranteed while maintaining the confidentiality of customer's data.

5.4.2 Research the industry

"The more important reason is that the research itself provides an important long-run perspective on the issues that we face on a day-to-day basis." - Ben Bernanke

Any microfinance bank that considers migrating to the cloud needs to undergo a careful research process. Taking the time to acquaint yourself with the available solutions as there are a number of solutions designed to help banks comply with some regulations regarding cloud data. You will also discover that many of your bank's peers are successfully moving to the cloud, too -- if they are not there already.

5.4.3 Conduct Peer Review

One important and effective step towards successful cloud implementation will be to meet peers and listen to their own stories. Get to hear from them, “why they migrate to the cloud” or “why cloud solution is the way to go”. This will provide a good foundation for your cloud education. Ask to know what solutions they are deploying, how they are using them and what was involved in getting to that point. Doing so will give you an overview into what you should look for during this transition phase and what you can expect once you are ready to move to the cloud.

5.4.4 Determine Critical Data and Application

“The problem, simply put, is that we cannot choose everything simultaneously. So we live in danger of becoming paralysed by indecision, terrified that every choice might be the wrong choice.” – Elizabeth Gilbert

So long as moving to the cloud will displace some legacy hardware, your organisation will likely need to keep in place alternative existing on-premise solutions. In view of the volume of data that microfinance banks own, such as customer’s credit data and transaction history, it simply would not make sense for all of the data to be stored in the cloud. During the interview, some IT experts said it is safe to store all organisation’s data in the cloud and similarly, not all applications should be run from the cloud. Carefully determine what belongs in the cloud and what should not.

As a safe bet, organisation can first migrate less important data alongside less risky application for a test and observe the system performance before fully migrating all data and applications. The time within which unimportant data and application are worked with in the cloud would allow the organisation staffers to become familiar with the system preparatory to full scale migration.

5.4.5 Create the Right TCO Model

Notwithstanding that the bank has made significant investment in an infrastructure that the cloud will replace, there is need to justify the cost of not using this infrastructure. When the total cost of ownership deployment model is compared with that of the legacy infrastructure, do not underestimate the cost of managing that on-premise hardware. It is easy for an assumption that because you already have that hardware it is not costing you anything, have it in mind that the infrastructure requires heavy IT management and technical support as well as timely upgrades.

5.4.6 Select the Right Cloud Service Vendor

As with any business, dealing with a trusted and good partner is key to a successful business adventure. It is a key component in the cloud adoption process to select a trusted and reliable vendor to ensure long-term business relationship since cloud vendor will likely be hosting the organisation's data or application or both as the case may be. Cloud service providers will responsible for maintaining the organisation's data privacy and security within the cloud. It is therefore important that the right vendor be selected to entrust the organisation's IT services with and no compromise should be entertained at this point. There are a plethora of questions that you should ask the vendor to help you in making the right choice.

As the vendor the following questions:

5.4.6.1 How will I access my company's cloud?

In any business of this kind, there are government agencies regulating the sector. Ask the vendor to know if it is an approved or licensed company authorised to operate and offer cloud services. This is the step to ensure who are discussing with the right operator.

5.4.6.2 What Cloud services do you offer?

Knowing what your cloud computing needs are will help you in determining the kind of cloud services your organisation needs. Ask the vendor about the various kinds of cloud offerings the vendor provides.

5.4.6.3 What is the Structure of your Price?

You should only pay for the services used and for the amount of time the services are being used. Since cloud services allow for pay-as-you-use model, then it is preferable you opt for pay-as-you option. The pricing scheme should be pay-as-you go from the very beginning, with the ability to top up services as may be needed.

5.4.6.4 How secure is your Cloud?

Your organisation's data security should be of a major consideration when it comes to storing critical data in the cloud. Service providers should have several standard security measures and threat mitigations in place and constantly update them. Security measures to look for include firewalls/intrusion detection mechanism, anti-virus software, 2-way user authentication and data encryption, and routine security audits. It is also important to find out who at the vendor side will have access to your data in the cloud and whether the vendor carries out employee background verifications to put off potential cybercriminals or identity thieves.

5.4.6.5 Where is your Data Centre and how safe it is?

Data centre location and the security of servers where your organisation's information will be stored are as important as online security, Foreman says. To make sure that your organisation's data cannot be easily be accessed and compromised, ask the vendor how its data center are protected from natural disasters, including fires, floods, earthquakes and storms. Also, find out how their facilities are protected from intruders who could just walk away with your sensitive data. The vendor should prove it complies with the industry security standards for the protection of customer sensitive data.

5.4.6.6 What happens if you lose my data?

There is an unfortunate chance that cloud vendor can accidentally delete your data or an incidence could occur that make the provider lose your precious data, you need to find out how it will rectify the problem. Ensure you request to know, what provisions are in the vendor's Service Level Agreement (SLA) that address potential data losses. Is there any compensation for data loss? What data redundancies does it have in place to mitigate

the risks of data loss? It is also of equal importance to know if the service provider has experienced any significant issues resulting from the loss of customer data.

5.4.6.7 What Customers Support Service Do You offer?

Under normal business condition, technical support should be made available to you online or by phone 234, even on public holidays. Find out about the average response and resolution time, and if at all your organisation will be interacting with knowledgeable customer care engineers or consultant using a live chat feature or remote service terminal in the event that issues beyond your technical know-how arise.

5.4.6.8 Can your cloud scale up to meet my business needs?

As your business expands, so will your cloud storage needs increases. To ensure that you are choosing a flexible cloud service provider, get to know what additional storage capacity and other services can be offered over time and at what cost. If you intend to hire more your staff, you will need to ensure that you can easily add additional users to your account.

5.4.6.9 What's your downtime history?

Downtime is usually when a cloud service provider is inaccessible to customers via the internet for a period of time. Naturally, the best response to this question should never. However, even the well-established, best-known cloud service providers occasionally experience downtime. Because cloud outages can be disruptive and costly for business organisation such microfinance bank where customers are expecting to get their savings as when needed, it is best to choose a provider with as few as possible downtime history. Some service provider update their downtime history logs online to assure their customers of their service reliability. If not, ensure to ask for the cloud service provider's track record.

5.4.6.10 How will I get set up?

After you have selected the service provider best for fit for your business, you will sign up. Normally the next step will be to log in to your user dashboard (front-end) and begin configuring your account and adding employees as users. Some cloud vendors will walk

you through how to install and set up their services while others will simply give you an introductory guide. Depending on your knowledge level, insist to be given right head-start.

5.4.6.11 How will I access my company's cloud?

You should be able to access your organisation information in the cloud from anywhere at any time via the web simply by signing in to your provider's client login page. You can use any device to log in, including your laptop, smartphone or tablet. In this case, you must make sure your service provider is able to allow you access your information this way.

5.4.7 Implement a Pilot Cloud Programme

After you have selected a service provider and have identified the applications and data that will first be migrated to the cloud. You will need to test the cloud with a small amount of data and application by storing them in one server and incrementally adjusting the size of data and the application as you observe the stability and reliability of the system. Noting that data confidentiality and people privacy should be maintained, you should not immediately dump all your data and apps into cloud. While increasing the size and number of data, the performance of the system has to be monitored carefully and what happens when you exceed the limit of storing capacity of the server. Analyse how scalability features of the cloud computing handle this issue efficiently and effectively before getting fully committed. After the pilot program, an assessment has to be carried out on how the cloud and its features are working and then a feedback from all users regarding the performance, security and privacy of the system should be measured. Once everyone is comfortable with it, it is time to work with the cloud provider and begin a broader deployment. It should be noted that cloud is just a new way of using the IT deliver services faster while ensuring efficiency and quick access to market. Each organisation IT needs varies and so is cloud, organisation has to know that cloud implementation should be dependent on their individual IT needs rather than trying to imitate others.

5.5 Recommendation for Future Research

Cloud Computing is an evolving IT approach to business service delivery and a lot of people (business managers) are unaware of its features and potential economic benefit if adopted. In consideration of this fact, further research in areas that will make the cloud aligns to Nigeria's

specific business environment, for instance, cloud application development should be targeted by future researchers.

More efforts should be put into custom (local) development of cloud applications that best fit Nigeria's local market. Research and Development (R&D) grants should be set-up by the government in Nigeria's institutions of higher learning to spur our up student to research more into developing high end local market cloud application of international standard as against the current trend of procurement of foreign software.

More research should be carried out on other sectors of the SMEs as this study was mainly conducted with the microfinance subsector of the Nigerian SMEs, this will give further insights into the gradient of cloud computing adoption in those sectors which will in turn give room for further actions to be taken to encourage broad-based adoption of cloud computing across all SMEs sector in Nigeria.

5.6 Limitations of the Study

There was a limitation in the study and this discussed below:

- The study was mainly with the microfinance finance subsector of the SMEs and the banks selected for study was restricted to those with branches in Uyo. A generalisation of the findings can be made to all other microfinance banks operating within Nigeria since all of the banks are regulated by the same regulatory body, the CBN, and are also operating under the same economic condition. However, it will not be comprehensive to extend the same generalisation to other subsectors of the SMEs e.g. the manufacturing subsector.

5.7 Conclusions

Technology Acceptance Model (TAM) was adapted as a research framework to investigate the reason for the slow adoption of Cloud computing by Small and Medium Scale Enterprises'

operators in Nigeria. 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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Appendix A – Letter of Consent

Appendix C: Consent Letter

I hereby give my consent to:

being interviewed on the research topics: **“Improving the Adoption of Cloud Computing by Small and Medium Scale Enterprises (SMEs) in Nigeria”**

I also understand that:

- I am free to end my involvement or to cancel my consent to participate in the research at any time should I want to;
- information rendered up to the point of my termination of participation could, however, still be used by the researcher;
- anonymity is guaranteed by the researcher and data will under no circumstances be reported in such a way as to reveal my identity;
- I am free to determine that specific information that I reveal should not be recorded in writing;
- no reimbursement will be made by the researcher for information rendered or for my participation in this project;
- I will in no way derive any personal benefit from taking part in this research project;
- by signing this agreement I undertake to give honest answers to reasonable questions and not to mislead the researcher;
- I will receive the original copy of this agreement on signing it.

I hereby acknowledge that the researcher/interviewer:

- discussed the aims and objectives of this research project with me;
- informed me about the contents of this agreement;
- explained the implications of my signing this agreement;

In co-signing this agreement the researcher undertakes to:

- maintain confidentiality, anonymity, and privacy regarding the identity of the subject and information rendered by the interviewee.

(Interviewee signature)

(Interviewer signature)

(Date)

(Date)

I, (interviewer signature)_____ certify that I explained the contents of the above document.

Appendix B – Cover Letter

TO WHOM IT MAY CONCERN

I am currently a registered Post Graduate Research student in the School of Computing, University of South Africa (UNISA) studying for a Master of Technology (M.TECH) Degree in Information Technology,

I am conducting a Research on topic: ***“Improving the Adoption of Cloud Computing by Small and Medium Scale Enterprises (SMEs) in Nigeria”***

- to determine the causes of slow pace of adoption of Cloud Computing by SMEs in Nigeria;
- to illuminate the concept of Cloud Computing adoption and further espouse the benefit accrue to embracing cloud technology and;
- to develop a model for creating awareness among SMEs and IT dependent Enterprises in Nigeria to help their business executives make an informed decision about Cloud adoption.

Cloud computing is arguably one of the most significant technological shifts of our time. The mere idea of being able to use computing in a similar manner to using a utility, such as electricity, is revolutionizing the IT services world and holds great potential. Customers, whether large enterprises or small businesses, are drawn toward the cloud's promises of agility, reduced capital costs, and enhanced IT resources. IT companies are shifting from providing their own IT infrastructure to utilizing the computation services provided by the cloud for their information technology needs.

However, along with these benefits comes a security concern that has been raised by SMEs and industry associates and these have seriously contributed to the slow pace of adoption of Cloud Computing in Nigeria.

Information obtained from this research will be significant in addressing those concern and espousing the overall economic benefits of Cloud Computing.

Research information plays an increasingly important role not only for management decisions but also for decisions affecting the industry as a whole. Your participation in this study would therefore immeasurably add to the above research project, since the wider the participation the more enriched the collected data would be.

In the light of the above, I have developed a simple questionnaire to help me collect research information for the above study and therefore solicits your assistance to complete the questionnaire.

Please note that respondents are not required to identify themselves by name in anyway in the questionnaire. All responses are therefore completely confidential and will not be used in any way that may identify the participant.

If any verification is required you can contact my supervisor:
Prof Ernest Mnkandla, School of Computing, CSET, University of South Africa
mnkane@unisa.ac.za
Thank You,

YOUNG, DESTINY A,
50788841@mylife.unisa.ac.za
08067084586, 08094448347

Appendix C – Interview

Appendix E - Interview question to IT Professionals and industry associates

Introduction

- ❖ What is your name?

- ❖ What is the name of organisation?

- ❖ What is your current position in your organisation?

- ❖ What is your main Responsibilities or Role in the organisation?
- ❖ Are you a member of any of Nigeria Computer Society(NCS) or Computer Professional of Nigeria(CPN)

Interview questions:

- IQ01. How do you define Cloud Computing?
- IQ02. Does your organisation use Cloud Computing?
- IQ03. What measure are being taken in your organisation to safeguard data and ensure privacy are maintained?
- IQ04. How has the cost factor of maintaining data centers effect your system?
- IQ05. What do you think is the major benefit of Cloud Computing services?
- IQ06. In your opinion, what are the main issues and challenges with Cloud Computing?
- IQ07. 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?
- IQ08. 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?
- IQ09. Do you think there is a need of advanced level security measures (as in SLA) for Small and Medium organisations?
- IQ10. 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?

- IQ11. What are the main advantages of Cloud Computing in SMEs e.g Microfinance banks?
- IQ12. Do you think that not having personnel knowledgeable in Cloud Computing could hinder SMEs from adopting Cloud Computing?
- IQ13. Would you say that inadequate power, inefficient infrastructure and high cost of access to ICT services and product can hamper cloud adoption?
- IQ14. Is there any hope of improvement in the rate of adoption of Cloud technology by SMEs in Nigeria?



Mr Destiny Asslan Young (50788841)
College of Science, Engineering and Technology
UNISA
Johannesburg

2014-05-08

Permission to conduct research project

Ref: 125/DAY/2014

The request for ethical approval for your MTech (Information Technology) research project entitled "Improving the Adoption of Cloud Computing by Medium and Small Scale Enterprises (SMEs) in Nigeria" refers.

The College of Science, Engineering and Technology's (CSET) Research and Ethics Committee (CREC) has considered the relevant parts of the studies relating to the abovementioned research project and research methodology and is pleased to inform you that ethical clearance is granted for your study as set out in your proposal and application for ethical clearance.

Therefore, involved parties may also consider ethics approval as granted. However, the permission granted must not be misconstrued as constituting an instruction from the CSET Executive or the CSET CREC that sampled interviewees (if applicable) are compelled to take part in the research project. All interviewees retain their individual right to decide whether to participate or not.

We trust that the research will be undertaken in a manner that is respectful of the rights and integrity of those who volunteer to participate, as stipulated in the UNISA Research Ethics policy. The policy can be found at the following URL:

http://com.unisa.ac.za/contents/departments/res_policies/docs/ResearchEthicsPolicy_apprvCounc_21Sept07.pdf

Please note that if you subsequently do a follow-up study that requires the use of a different research instrument, you will have to submit an addendum to this application, explaining the purpose of the follow-up study and attach the new instrument along with a comprehensive information document and consent form.

Yours sincerely

Deputy Chair: College of Science, Engineering and Technology Ethics Sub-Committee

Appendix D – Ethical Clearance
