ADDIS ABABA UNIVERSITY
COLLEGE OF NATURAL & COMPUTIONAL SCIENCE
SCHOOL OF INFORMATION SCIENCE

CLOUD COMPUTING READINESS ASSESSMENT FOR BANKING SECTOR IN ETHIOPIA

Lensa Begna Bekele

February, 2017

Addis Ababa, Ethiopia

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A Thesis Submitted to the School of Information Science

Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Information Science

Addis Ababa University
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Declaration

I declare that this thesis is my original work and has not been submitted for any Degree in any other University. I have undertaken the study independently with the guidance and support of the research advisor.

Signature: _____

Lensa Begna

This thesis has been submitted for examination with my approval as university advisor.

Advisor_____

Ato Getachew Jemaneh

Acknowledgement

I am truly thankful to my God for every success in my life. Next, I would like to express my heart-full gratitude to my advisor Ato Getachew Jemaneh for his supportive comments.

I add a special note of admiration and gratitude to my families without their moral support, it would have been impossible for me to go through this research work.

Last but not least, I would like to express my deep gratitude to the IT staffs and managers of the four banks who participated in this study during the data collection process.

Abstract

Cloud Computing is becoming popular because of its promises such as cost reduction, on demand self-service, broad access network, resource pooling , rapid elasticity , measured service, little or no set up capital and faster time to market. However, the adoption of such a technology should be planned ahead of time taking into consideration the various factors that make adoption successful. Proper understanding of barriers and coming up with ways to mitigate them will improve the Cloud Computing readiness level of organizations.

Since Cloud Computing is relatively new and is still in its early stages, not much work has been done to inform organizations about the barriers and enablers of Cloud Computing. Available guidelines to help organizations improve their Cloud Computing readiness level are also inadequate. This is risky for the banking sector that deal with sensitive customer information as the safety of that information is not guaranteed if a desired readiness level is not attained before implementation.

In order to assist the banking sector this research identified and discusses the barriers and enablers of Cloud Computing in order to be able to come up with solutions to the barriers.

The study was conducted based on the data gathered from four banks in Ethiopia; three private banks (NIB International bank, Oromia International bank and Wegagen bank) and one state owned bank (Commercial Bank of Ethiopia).

A mixed research approach was used to answer the research questions that emerge through the review of existing literature.

The result of the study indicated that, that Cloud Computing readiness level of Ethiopia banking sector is low.

To answer the research questions, the Cloud Computing readiness of Ethiopia banking sector is still in its early stages as most of the banking sector are not yet ready for Cloud Computing adoption. Some of the barriers of Cloud Computing adoption include security and privacy, governance issues, confidentiality, etc.

The enablers of Cloud Computing adoption include scalability and flexibility, broad network access, pay per use, economies of scale and cost effectiveness, reliability, increases speed of time to market, user centric interfaces, improved communication, improved focus on core business, scalability, cost reduction etc.
Keywords: Cloud Computing, cloud adoption, implementation, banking sector, readiness, Cloud Computing readiness Assessment.

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List of Abbreviations

ATM.....Automated Teller machine

DOI.....Diffusion of Innovation

EHEIs.....Ethiopia Higher Education Institutions

IaaS .....Infrastructure as a service

ICT.....Information Communication Technology

IS .....Information Systems

IT.....Information Technology

NBE.....National Bank of Ethiopia

NIST ..... National Institute of Standards and Technology

OS .....Operating System

PaaS .....Platform as a service

PEOU .....Perceived ease of use

POS.....Point of Sale

PU.....perceived usefulness

SaaS .....Software as a Service

SLA.....Service Level Agreement

SPSS.....Statistical Package for Social Science

SWIFT.....Society for Worldwide Interbank Financial Telecommunication

TAM.....Technology Acceptance Model

TOE.....Technology, Organization, Environment

URL.....Uniform Resource Locator

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CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The banking sector is facing many changes. Control is currently in the hands of the customer, instead of the bank. Customers are driving new business models. Technology changes the traditional business transformation. Banks got to react to this current customer-driven environment with innovation in business models, operations and IT. For banks, the value propositions for cloud computing affects the whole business. Cloud technology offers a brand new model for delivering innovative customer experiences, effective collaboration, and improved speed to market and enhanced IT efficiency (Sheel et al., 2014).

Cloud computing is “a pay-per-use” model for enabling available, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., network, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

Cloud computing is fast becoming a necessity for organizations to remain competitive and do their business faster with less resource than they would have used without cloud computing (Olumide, 2014). Cloud computing helps remove the cost of buying, installing, maintaining and upgrading hardware. Other benefits of cloud computing includes scalability, flexibility, and its deployment is quick and easy (Olumide, 2014).

This thesis assesses cloud computing readiness of the banking sector in Ethiopia. Readiness is the ability of an organization to successfully adopt, use, and benefit from a technology (Fathian et al., 2008).

Cloud computing readiness can therefore be defined as the ability of an organization to successfully adopt, use, and benefit from cloud computing. The lack of readiness for a technology before adoption has led to implementation failure of many technology initiatives (Snyder, 2001) and this shows that it is important for organizations to assess their readiness before adopting Cloud computing.

Banks around the world are progressively adopting cloud computing. Robeco Direct N.V., a Dutch bank currently manages over €8 billion in assets recently moved its entire retail banking platform to the cloud, the sixth largest bank in Spain, Bankinter, uses the Amazon cloud to run credit risk simulation, Suncorp Bank Australia placed an emphasis on innovation and launched a working virtual private cloud and virtual data center and Zitouna Bank in Tunisia has selected IBM's cloud capabilities to host its Temenos banking platform.

Adopting a cloud model will provide the bank with a platform that is scalable and can handle mission-critical workloads while offering greater flexibility and performance (Groenfeldt, 2014).

Regarding Ethiopian banks and the cloud computing practice, there is a community cloud use for swift operation. On Core banking, ATM, POS, internet banking and mobile banking operations the banks are hesitating to move to the cloud. Thus this research helps to identify all the necessary components of Cloud computing and suggest important steps to take before adopting and implementing cloud computing.

The aim of this study is to assess the cloud computing readiness level of the banking sector in Ethiopia, identify the barriers and enablers of cloud computing.

1.2 Statement of the Problem

Research on cloud computing readiness is minimal. This needs urgent attention because readiness is a phase before adoption and it is an essential factor in determining the success of adoption because lack of readiness has been found to account for majority of the failures in technology adoption.

Many organizations adopt technologies without considering their level of readiness for that technology and this result in weak implementation and sometimes failure. In the case of cloud computing, this is mostly as a result of lack of awareness and lack of a regulatory framework for cloud computing implementation (David, 2014).

In case of Ethiopia there are a few researches on the area of cloud computing but they are not directly related to the Cloud computing readiness in the banking sector

Sewale (2012) States the advantages of cloud computing for educational institutions, shows the limitations of current IT utilization in Ethiopian Higher Education institutions. Also proposes alternative solutions Hybrid Cloud Computing model to solve the current IT utilizations limitations in Ethiopian Higher Education Institutions.

Alemayehu (2014) study the advantages of cloud computing for banking sectors and their limitation of ICT usage and find an alternative solution for the usage of IT to deliver a scalable, efficient and flexible IT services for Ethiopian Banking Industries and proposed hybrid Cloud Computing model which can reduce IT investment cost and management complexity. The research does not asses the readiness level of banking sector for cloud computing.

Alemayehu (2015) investigates the readiness of 7 selected Organizations from four different sectors located in Ethiopia and produces a Strategic guideline that could be used by Ethiopian organizations for the successful adoption of cloud computing. The research does not specific for the banking sector.

Cloud Readiness Assessment Framework and Recommendation System were proposed (Fasil, 2015), use TAM, DOI and TOE as a conceptual framework to build the model. The research does not focus on banking sector and it doesn't tell whether the organization is ready or not.

Meskerem (2013) conducted a research in title "Cloud Computing Security Framework for Banking Industry" aimed to develop cloud security framework for banking industry. It is not focus on the readiness of the banking sector.

In order to avoid the problem of weak implementation and failure, there is an urgent need for researchers to asses cloud computing readiness level of the banking sector and find barriers and enablers to improve their cloud computing readiness level before they finally adopt cloud computing to ensure successful cloud computing implementation. Hence, the aim of this study was to answer the following research questions.

1. What is the level of Cloud computing readiness of the banking sector in Ethiopia?
2. What are the perceived barriers and enablers of Cloud computing readiness of the banking sector in Ethiopia?

1.3 Objectives of the Study

1.3.1 General Objective

The main objective of this research is to determine the level of cloud computing readiness of the banking sector in Ethiopia.

1.3.2 Specific Objective

- ✓ To assess the barriers and enablers of cloud computing readiness of the banking sector in Ethiopia

- ✓ To assess cloud computing readiness level of Ethiopian banking sector.
- ✓ Recommend appropriate actions to be taken to be ready for Cloud Computing for banking sector in Ethiopia.

1.4 Significance of the Study

The study aimed at assessing the level of awareness, willingness and readiness of cloud computing technology in the banking sector in Ethiopia which will help increase the chances of success for the banking sector with cloud computing implementation and the research community.

The outcomes and results of this research will have potential value to banks to understand the barriers and enablers of cloud computing readiness.

Bank management could use the information from the study to cultivate a culture that would help in change of attitude and alignment of their strategy so as to provide for cloud computing adoptability.

The research community will benefit from this research because it will contribute to the existing body of knowledge, especially in the area of cloud computing.

1.5. Scope and Limitation of the Study

The objective of this research is to determine the level of cloud computing readiness of the banking sector in Ethiopia. Currently there are 19 banks (18 private and 1 publicly owned) in Ethiopia due to time and other limitations study focused on randomly selected four banks (one state owned bank and three private banks).

1.6 Organization of the Research

The study consists of six chapters. The first chapter is about the background of the study, statement of the problem, objective of the study and scope and limitation of the study. The second chapter is literature review related to Cloud Computing. The third chapter discusses research design and methodologies

used to collect, analyze and interpret the data. The fourth chapter presents the study findings, analysis, and presentation of the result. The Fifth chapter presents conclusion and recommendation.

CHAPTER TWO

2. LITERATURE REVIEW

2.1 Introduction

Every organization needs to begin to find out where Cloud computing is needed in their organization to remain competitive. A unique characteristic of Cloud computing is that it is based on a pay per use model which allow companies to pay for services on demand (Misra and Mondal, 2011).

A number of researchers and practitioners have attempted to define cloud computing in different ways. Here are some definitions.

Klems, et al., (2009), defines cloud computing as, "building on compute and storage virtualization technologies, and leveraging the modern Web, Cloud Computing provides scalable and affordable compute utilities as on-demand services with variable pricing schemes, enabling a new consumer mass market. It provides a service where consumers can rent (virtualized) infrastructure as needed, deploy applications and store data on the infrastructure and access the applications and data via Web protocols on a pay-per-use basis."

Another definition of Cloud computing (Khorshed et al., 2012)is that "Cloud computing is a system, where the resources of a data centre is shared using virtualization technology, which also provide elastic, on demand and instant services to its customers and charges customer usage as utility bill."

The National Institute of Standards and Technology (NIST) defined cloud computing as "a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (such as networks, servers, storage, applications, and services) that can be rapidly provisioned and

released with minimal management effort or service provider interaction" (Peter and Timothy, 2011).

The definition from NIST has been chosen as working definition for this research because this definition has gained in popularity and the definition captures the unique features of cloud computing.

2.2 Cloud Computing Characteristics

The NIST (Peter and Timothy, 2011) definition lists five essential characteristics of cloud computing:

- ✓ **On-demand self-service:** Computing capabilities, such as server time and network storage can be provided as needed automatically without requiring human interaction with each service provider.
- ✓ **Broad network access:** Cloud computing resources are available over the network, supporting heterogeneous client platforms such as mobile devices and workstations.
- ✓ **Resource pooling:** Service multiple customers from the same physical resources, by securely separating the resources on logical level.
- ✓ **Rapid elasticity:** Resources are provisioned and released on-demand, in some cases automatically, to scale rapidly outward and inward matching with demand.
- ✓ **Measured service:** Resource usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilized service.

2.3 Cloud Computing Models

Cloud Providers offer services that can be grouped into three categories.

- ✓ **Software as a service (SaaS)**

  Applications are accessed over the internet example Google provide word processor, spreadsheet and presentation web apps. SaaS application may be free or paid through subscription. These applications are

accessible from any computer connected to internet either through thin client interfaces like web browsers or program interfaces (Pandith et al., 2014).

The user uses an application, but does not control the operating system, hardware or network infrastructure on which it's running (Eludiora et al, 2011).

- ✓ **Platform as a Service (Paas)**

  A layer of software is encapsulated and offered as a service, upon which other higher levels of service can be built. The user has the freedom to build his own applications, which run on the provider's infrastructure. To meet manageability and scalability requirements of the applications, PaaS providers offer a predefined combination of OS and application servers, such as Linux, Apache, MySql and PHP. Google's App Engine, Force.com, etc are some of the popular PaaS examples (Naveen, 2013).

- ✓ **Infrastructure as a Service (Iaas)**

  Iaas allows running any existing application on cloud. The consumer uses computing resources such as processing power, storage, networking components or middleware. They can control the operating system, storage, deployed applications and networking components such as firewalls and load balancers, but not the cloud infrastructure. (Eludiora et al, 2011).

2.4 Deployment Model of Cloud Computing

The cloud computing environment can consist of multiple types of clouds based on their deployment and usage.

- ✓ **Public cloud** The cloud infrastructure service is open to use for the general public. Service provider makes resources available to the users over the internet. Services provided by this type of cloud may be free or paid depending on the type of the service they deliver (Pandith et al., 2014). It exists on the premises of the cloud provider and providing

public cloud services and brings economy of scale in pooling datacenter resources, virtualization and on demand provisioning allows outsourcing enterprise IT infrastructure addresses disaster recovery problem suitable for small and medium-sized enterprises and agile companies.

- ✓ **Private Cloud** data is stored on site at the company, although services and resources are delivered through a network, these services and resources are generally accessible only through a private company intranet (Naveen, 2013). Private clouds are a choice for companies that already own datacenter and developed IT infrastructure and have particular needs around security or performance.
- ✓ **A community cloud** is controlled by a specific community of consumers from organizations that have shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It could be owned, managed, and operated by one or more of the organizations in the community, a third party, or some combination of them and the members of the community share access to the data and applications in the cloud (Eludiora et al, 2011). The Community Cloud then involves cooperation and integration of IT infrastructure and resources from multiple organizations It May serve large inter-organizational projects.
- ✓ **Hybrid Cloud** is comprised of two or more different cloud deployment models. A cloud user may choose to deploy cloud services processing sensitive data to a private cloud and other, less sensitive cloud services to a public cloud. (Naveen, 2013). It also combines benefits of the controlled environment in private clouds and rapid elasticity of public clouds.

2.5 Cloud Computing Benefits

Some of the typical benefits of cloud computing is listed below:

- ✓ **Cost Savings and Usage-based billing**

With cloud computing, organization can turn a large up-front capital expenditure into a smaller, ongoing operational cost. There is no need for

heavy investments in new hardware and software. Additionally, the unique nature of cloud computing allows organization to pick and choose the services required on a pay-as-you-go basis (Sriram, 2011)

- ✓ **Increased Storage**

With the very big Infrastructure that is offered by Cloud providers today, storage and maintenance of huge volumes of data is a reality.
Unexpected workload spikes are also managed effectively and efficiently, since the cloud can scale dynamically with additional pay (Naveen, 2013).

- ✓ **Business Agility and Focus**

The flexibility of cloud-based operating models lets organization experience shorter development cycles for new products. This supports a faster and more efficient response to the needs of customer. Since the cloud is offered on-demand, less infrastructure investments are required, saving initial set-up time. Cloud computing also allows new product development to move forward without capital investment (Sriram, 2011).

2.6 Issue with Cloud Computing

- ✓ **Security**

  Security is a great concern when moving data to the cloud.
  The confidentiality of financial data, personal data and mission-critical applications is vital. Banks cannot afford the risk of a security violation (Sriram, 2011).

- ✓ **Service Delivery and Billing**

  It is difficult to assess the costs of cloud computing service due to the on-demand nature of the services. Budgeting and assessment of the cost will not be easy unless the provider has some excellent and comparable benchmarks to offer. The service-level agreements (SLAs)

of the provider are not sufficient to guarantee the availability and scalability (Naveen, 2013).

- ✓ **Regulatory and Compliance**

  Many banking sector regulators require that financial data for banking customers keep on in their home country. Some compliance regulations require that data not be intermixed with other data, such as on shared servers or databases. As a result, banks should have a clear understanding of where their data resides in the cloud (Sriram, 2011).

2.7 Banking Sector and Cloud Computing

Cloud computing adoption rate of the banking sector is low because of issues such as security, loss of control over data, data privacy, lack of standard SLA's and the fear that the banking sector will be dependent on the service provider is another reason why the banking sector have been slow in the adoption of cloud computing.

Although the adoption of Cloud computing by the banking sector has been slow, Cloud computing is not new to the banking sector. Many banks sector have adopted some form of Cloud computing but they have been selective in their choice of Cloud Computing service.

In order to maximize the benefits of Cloud Computing, the banking sector needs to select the right operating service, and deployment models to resolve security and compliance issues.

2.8 Benefit of Cloud Computing for Banking Sector

- ✓ **Cut costs:** Banks will not have to spend a lot in dedicated hardware, software and related manpower. It is much easier for them to update their IT infrastructure and the cloud's modular, pay-on-demand model means they pay only for the hardware and software they need which will

help to reduce this cost as it will eliminate the need for purchase and maintenance of these resources (Sharma, 2012).

- ✓ **Improve flexibility and scalability:** The cloud gives banks the capability to react rapidly to changing market, customer and technological needs. Cloud computing allows business to easily upscale or downscale IT requirements when required. (Sharma, 2012).

- ✓ **Serve clients faster:** Cloud computing makes new products and services easier to develop and launch, either on a stand-alone basis or in partnership. It eliminates procurement delays for hardware and software. Corporate will be able to access bank systems using web browsers from anywhere at any time.
- ✓ **Create stronger client relationships:** Cloud computing also improves customer satisfaction because it allows staffs to have quick access to information which helps them in answering customers' questions effectively and on time (Sharma, 2012)

2.9 Challenge of Cloud Computing for Banking Sector

- ✓ **Security and compliance:** Banks need to demand strict safety measures from suppliers and ensure new applications meet the latest and most accurate security standards. Service Level Agreements (SLAs) are a must.
- ✓ **Reliability:** Applications and data are always accessible in the event of a natural disaster or an unpredictable event. Banks need to have strict SLAs in place, complete with guarantees, and remedies if a provider fails to meet service levels. Data should be protected from leakage, intentional or accidental loss to protect the reputation of the bank and increase customer's confidence (Sharma, 2012).

- ✓ **Regulation:** The rules governing the cloud differ from country to country. Many countries' data protection laws enforce constraints on where data is kept. Legal issues are essential for banks to consider as to who owns the data and who is allowed to access data (Sharma, 2012).

2.10 Cloud Computing in Ethiopia

Banking in Ethiopia began in 1905 with the bank of Abyssinia, a private company controlled by the bank of Egypt. Currently there are 18 private commercial banks and one government bank in the Ethiopian banking industry.

Banking in Ethiopia is among the least advanced sectors when it comes to implementing modern state of the art technologies (Bhaskar R and Tewdros S, 2011). Currently most of Ethiopian Banks have started providing Technology-based services/products like ATM (payment cards), Mobile banking, Internet Banking, SMS banking and Electronic fund transfer to their customers. Banks have a key place in the contribution of the economic growth of the country, so Ethiopian banks need to implement innovative technologies to satisfy customer and economic growth.

In today's fast changing world, banking environment has become highly competitive and banks are required to respond quickly to the dynamics or fast changing customer's expectations. To be able to survive and exceed in this changing market, banks are striving to improve their customer service delivery and productivity through adaptation of cloud computing.

2.11 Readiness for Cloud Computing

Readiness means different things to different people, in different contexts, and for various purposes. Readiness is the accessibility of required organizational resources to implement a technology (Fathian et al., 2008)

.

Cloud computing readiness of banking sector means the ability of the banking sector to successfully adopt, use, and benefit from Cloud computing through efficient use of available resources.

In order to ensure a successful implementation of Cloud computing and properly manage changes that arise as a result of Cloud computing, organizations need to prepare themselves and be ready before implementation. This is because more than half of all unsuccessful large-scale organizational change efforts are as a result of failure to establish sufficient readiness (Weiner, 2009).
An organization should determine their level of readiness for Cloud computing to determine their suitability for a successful adoption. Once the readiness level is known and the organization Cloud computing readiness is good enough, only then can the organization decide to adopt Cloud computing.

2.12 Technology Organization Environment (TOE) Framework

Many researchers have been used different frameworks in the study of adopting new technological innovation. Among frameworks that have been developed based on the past studies includes, the Technology Acceptance Model (TAM) (Davis, 1989), Diffusion of Innovation (DOI) and Technology-organization-Environment framework (TOE) (Tornatzky and Fleischer, 1990).

Technology Acceptance Model (TAM) (Davis, 1989) which posits the two sets of beliefs, i.e., perceived ease of use (PEOU) and perceived usefulness (PU) to determine individual's acceptance of a technology. PEOU refers to the degree to which an individual believes that using a particular system would be free of physical and mental effort, PU on the other hand is related to users' perception of the degree to which using a system will be beneficial.

Diffusion of Innovation (DOI) (Rogers, 2003) identifies five qualities that determine adoption of new products. These are: relative advantage,

compatibility with existing values and practices, simplicity and ease of use, trial-ability and observable result.

TOE framework was proposed by (Tornatzky and Fleischer, 1990); it is designed for studying the likelihood of adoption success of technology innovations. This framework is a comprehensive and well received framework in the context of innovation adoption by organizations and has been used in many studies. According to (Tornatzky and Fleischer, 1990), technology adoption within an organization is influenced by factors pertaining to the technological context, the organizational context, and the environment.

Misra and Mondal,(2011) think that the size of IT resources, the utilization pattern of the resources, data sensitivity, and the criticality of work done by organizations influence the adoption of Cloud Computing in organizations.

These characteristics must be thoroughly considered by organizations before implementing cloud computing as this will help them to determine what type of cloud services they require. These characteristics have been grouped based on the Technology, Organization, and Environment (TOE) framework (Tornatzkyet al., 1990) which is the selected framework for this research.

2.12.1 Technology Context

- ✓ **Technology Readiness** is the IT infrastructure available to an enterprise to get cloud services and human resources that can manage cloud services. Organizations should ensure that the essential infrastructure to support Cloud Computing is available to them before choosing to execute Cloud Computing. This incorporates the accessibility of important technologies and expertise to operate those technologies (Carroll et al., 2011).
- ✓ **Technology Awareness** The knowledge and familiarity of an organization about a technology is vital for the success of implementing

cloud computing. If an organization knows about a technology, they will have the capacity to make essential arrangements before adoption and this will increase the success of their implementation (Carroll et al., 2011).

2.12.2 Organization Context

- ✓ **Organization size** The organization size is defined by the number of employees, the amount of investments, the target market and annual revenue. The size of the organization is another influential factor in deciding an organizations Cloud Computing readiness since it will help the organization to figure out which type of cloud to implement (Misra and Mondal, 2011). Organizations with huge data centers and large IT infrastructure may choose to implement private cloud as this is more secure and the privacy and confidentiality of their data can be guaranteed on the grounds that the organization will be able to keep up aggregate control of their information. In order to determine the size of the IT resources of an organization, the number of servers the company keeps in its data centers, the size of the customer base of the company, yearly income from IT, and the number of countries across which the company has branches should be considered (Misra and Mondal, 2011)
- ✓ **The utilization pattern of the resources** Organizations should decide the use pattern of their resources by considering the normal utilization and top usage, and measure amount of data handling/transactions done for instance, organizations whose resources are underutilized may need to move into the cloud to cut expense of keeping up the unused resources and only pay for the utilized resources while on the cloud. This will be of high benefit since it will permit them to amplify the utilization of their resources and reduce waste thereby helping them save a lot on cost. Organizations that handle a lot of data will require a substantial transfer speed to

process and store information in the cloud, This will imply that the amount of money they will spend on bandwidth will be a great deal and it won't be advisable for them as the cost of Cloud Computing may then be more than the cost of their traditional systems in the long run (Misra and Mondal, 2011).

- ✓ **Sensitivity of the data they are handling** Organizations with confidential data need to carefully recognize which of their data should be moved into the cloud and which should stay on their traditional systems. They could, also choose to move the sensitive data into a private cloud and move the less sensitive data into a public cloud. This will help them guarantee the security of their data (Misra and Mondal, 2011)
- ✓ **Criticality of work done by the organization** Highly critical work requires very strict resources, platforms, applications, security work and also demands service level agreements (SLA's). Since SLA's have not yet been standardized for Cloud Computing, it is not advisable for organizations to carry out their critical work on the cloud (Misra and Mondal, 2011).
- ✓ **Top management support** Top management plays an important role and has a significant impact on the readiness for cloud computing at the organizational level. Support from top management is essential because they have the capacity to make the change and execute approval of the cloud. This change in the organization needs a supportive decision from top management. Support from management is an essential component to consider before executing Cloud Computing as the availability of resources for Cloud Computing implementation relies on upon the management's decision to make necessary resources for the implementation of Cloud Computing available (Sabah et al., 2011).

- ✓ **Satisfaction with existing system** Organizations that are happy with their current system should not move into the cloud since it is the most recent technology. They should move into the cloud as a result of their business needs. Organizations should ensure that they will achieve some improvement in their business process which their existing system is not offering them before deciding to move into the cloud (Carroll et al., 2011).
- ✓ **Skills** Cloud Computing requires some special skills to be implemented successfully. These include negotiation skills and management skills. Organizations should ensure training for their employees to ensure that the employees possess necessary skills to implement Cloud Computing successfully (McKendrick, 2012). In order to ensure that Cloud Computing implementation is successful, there are some necessary skills that organizations must strive to possess at it will help them to properly implement Cloud Computing to achieve the promises of Cloud Computing. Regardless of what type of cloud organizations want to adopt, these skills are still needed. For example, with public cloud where most of the computing is done by a service provider, organizations still need to have people with skills to negotiate SLAs, integrate cloud offerings with onsite offerings. They also need to be able to select what services are needed. If the organization decides to implement a private cloud, they will require skills similar to that of service providers as they will have to host and manage the private cloud in-house. Cloud computing therefore requires a number of new skills which may require the organization to either train some of their staff in-house or send them to cloud training providers for training in order to equip them with these skills.

2.12.2 Environment Context

- ✓ **Compliance with regulations** Compliance with regulation is an influential factor that can make a firm hesitant to move into cloud

computing. The lack of IT standards is a real problem that might obstruct adoption decisions. Legislation is an essential part of readiness as organizations need to be aware of existing laws and legislation about Cloud Computing. This will ensure that organizations know what to do in case of a violation of SLA, by the service provider. It will also inform organizations on their privacy and information protection. In cases where the data centre is in a different country from the organizations location, the organizations should also be aware of what rights and obligations they have in case of a violation and their information is exposed to a third party (Marston et al. 2010).

- ✓ **Competition** defined as the degree of pressure that an organization faces from competitors. In a highly competitive industry like bank, an organization encounters pressure from competitors to adopt new technologies. This pressure forces some organizations to adopt cloud computing technology and gain a great benefit, more business facilities and better operational efficiency. Organizations should not simply implement Cloud Computing because other organizations are implementing Cloud Computing. Every organization needs to research and find out how Cloud Computing could differentiate them from their competitors and improve their business process for increased return on investment. Most organizations that failed in their Cloud Computing implementation fail because they are not ready for Cloud Computing as they have little or no technical knowledge about Cloud Computing Organizations need to have the right motivation for Cloud Computing and not just do it because others are doing it as this will contribute to the success of their Cloud Computing implementation (Chauhan et al., 2012).
- ✓ **National infrastructure** National infrastructure such as bandwidth, internet facilities and other supporting infrastructures that enable Cloud Computing should be investigated by organizations so that proper

arrangements could be made to ensure that there will be continuous access to the services, infrastructure, and applications subscribed for without any interruptions as a result of poor infrastructure. Once organizations are sure of the availability of the necessary infrastructure, they can then decide on moving some or all of their data into the cloud (Sabah et al., 2011).

2.13 Change Management

The implementation of Cloud Computing brings about a change in the way organizations carry out their daily activities. The process of change management is therefore a serious management issue because it will determine the success of the organizations Cloud Computing implementation Proper change management practices should be put in place in order to overcome issues as a result of change (Carroll et al., 2011). Implementation of new technologies in organizations sometimes brings a shift in the structure of the organization. The business processes may also need to be reengineered. These changes in the organization need to be properly managed as they could have a negative effect on the implementation process. If the change process is not properly managed, it could also lead to failure of the entire implementation. As a result, an effective change management process needs to be put in place as this will help reduce resistance and other issues that may arise. The adoption of Cloud Computing would bring about so many changes in the organization. This will affect different organizational processes as well as the organizational structure. The impact will be mostly felt by the IT department. These changes will lead to issues such as employee resistance, job insecurity which will affect the readiness for cloud computing (Todnem, 2005)

2.14 Related Works

Many studies in the field of Information Systems (IS) have investigated significant factors influencing the adoption of new technologies or service

solutions. However, research on Cloud computing readiness is of the less explored and examined topics in the IS domains, particularly for the banking sector. Most of the literature on Cloud computing has widely focused on Cloud computing architecture, potential applications, and Cloud computing costs and benefits.

Related research work done in area of cloud computing in foreign countries is discussed below:

David (2014) investigates the factors influencing cloud computing adoption in organizations adopting Cooperative Insurance Company of Kenya as a case study.

Elizabeth (2011) on her thesis titled "A Survey on Cloud Computing Adoption in Kenya's Banking Industry" geared towards finding out whether commercial banking industry in Kenya is aware of cloud computing, ready to adopt it and its attitude towards cloud computing.

Manrice (2012) propose a framework that small business could use to guide them with the adoption of cloud computing.

Olumide (2014) developed a framework that will serve as a tool by which financial institutions can determine and improve their Cloud Computing readiness.

Research in Cloud computing is still in its early stages in Ethiopia and most of the current research in the field of Cloud computing is focused on the adoption, diffusion, implementation and impact of Cloud on IT development practices.

Alemayehu (2015) investigates the readiness of 7 selected Organizations from four different sectors located in Ethiopia and produces a Strategic guideline that could be used by Ethiopian organizations for the successful adoption of cloud computing.

Some of the related work that has been done in the area of cloud computing in Ethiopia Meskerem (2013) conducted a research in title "Cloud Computing Security Framework for Banking Industry" aimed to develop cloud security framework for banking industry.

In a similar research, Fasil (2015) provide a cloud readiness assessment framework and an expert system but it is not focus on the banking sector.

Alemayehu (2013) develops an integrated cloud computing framework for Ethiopian banking industries. These researches do not asses the readiness level of the banking sector.

Selamawit (2014) explore the internal and external factors that have influenced IT executives and expert's decision on the adoption of cloud computing focusing on the Ethiopian banking sector. The paper focuses only on the factors that affect cloud computing and it doesn't asses the banks readiness level.

Sewale (2012) states the advantages of cloud computing for educational institutions, shows the limitations of current IT utilization in Ethiopian Higher Education institutions. Also proposes alternative solutions Hybrid Cloud Computing model to solve the current IT utilizations limitations in Ethiopian Higher Education Institutions.

So as we see above research on cloud computing readiness is minimal. This needs urgent attention because readiness is a phase before adoption and it is an essential factor in determining the success of adoption because lack of readiness has been found to account for majority of the failures in technology adoption.

Many organizations adopt technologies without considering their level of readiness for that technology and this leads to weak implementation and sometimes failure. In the case of cloud computing, this is mostly as a result of lack of awareness and lack of a regulatory framework for computing

implementation (David, 2014). In order to avoid the problem of weak implementation and failure, the banking sector should assess their readiness level before they finally adopt cloud computing to ensure successful cloud computing implementation.

Author	**Objective**	**Method**	**Finding**
David (2014)	To investigate the factors influencing cloud computing adoption.	Quantitative research	The study found that technological factors were the most significant factors influencing adoption of cloud computing in CIC INSURANCE Kenya Limited
Elizabeth (2011)	Study was geared towards finding out whether commercial banking industry in Kenya is aware of cloud computing, ready to adopt it and its attitude towards cloud computing.	Quantitative research	The findings clearly show that cloud computing concept is known to most IT managers/CIOs. The results revealed that, majority of commercial banks were not willing to adopt the technology.
Manrice (2012)	Propose a framework that small business could use to guide them with the adoption of cloud computing	Qualitative research	The study found that company lack a framework to guide them in adopting cloud computing.

Olumide (2014)	Developed a framework that will serve as a tool by which financial institutions can determine and improve their Cloud Computing readiness.	Qualitative research	This research identified and discus the barriers and enablers of Cloud Computing in order to be able to come up with solutions to the barriers.
Meskerem (2013)	Develop cloud security framework for banking industry	Qualitative research	Propose cloud computing security framework for banking industry.
Fasil (2015)	provide a cloud readiness assessment framework and an expert system	Quantitative research	Developed expert system combines cloud readiness prediction and recommendation, and Provides an automated solution to the end user.
Alemayehu (2013)	Develops an integrated cloud computing framework for Ethiopian banking industries	Qualitative research	The study proposed Hybrid Cloud Computing model
Selamawit (2014)	Explore the internal and external factors that have influenced IT executives and expert's decision on the adoption of cloud computing	Qualitative and Quantitative research	The result indicates that the internal factors: complexity, compatibility, employee skills, risk of failure and external factors: customer demand, external pressure, cost, and consistency of cloud computing were found to have a positive influence on decision to adopt cloud computing.

Sewale (2012)	To examine existing ICT utilization strategy in Ethiopia Higher Education Institutions (EHEIs) and analyze cloud computing concepts for adopting cloud computing technology in EHEIs and to design a prototype cloud computing framework	Qualitative research	Cloud Computing is the better ICT utilization mechanism for Education institutions teaching-learning and design a prototype cloud computing framework
Alemayehu (2015)	Investigates the readiness of 7 selected Organizations from four different sectors located in Ethiopia and produces a Strategic guideline	Qualitative research	Produces a Strategic guideline that could be used by Ethiopian organizations for the successful adoption of cloud computing

Table 1 Summery of Related Works

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Overview

This chapter presents the research methodology, including research design, the research approach, data collection methods as well as data analysis methods employed in the study.

3.2 Research Design

The purpose of this thesis is to conduct descriptive research in order to gather as much information as possible concerning the cloud computing readiness in Ethiopian banking sector.

This research is focused on describing the current situation of the problem and answers the research questions which are in the form of "what", and to highlight the most important factors that can negatively or positively affect the cloud computing readiness in Ethiopia banking sector. Moreover, this research aims to explain the phenomenon and assess the current situation of cloud computing readiness in Ethiopian banking sector. Therefore, descriptive research is being used to fulfill this approach.

3.3 Research Approach

According to (Kothari, 2004), there are three approaches to conduct a research: qualitative, quantitative and mixed approaches. Quantitative approach involves the generation of data in quantitative form which can be subjected to accurate quantitative analysis in a formal and inflexible fashion. Qualitative approach to

research is concerned with subjective assessment of attitudes, opinions and behavior. Research in such a situation is a function of researcher's insights and impressions. Mixed approach utilizes the strengths of both qualitative and quantitative research.

In order to achieve the objective of this study and answer the research questions, this research adopts mixed research approach to asses cloud computing readiness in the Ethiopian banking industry to converge across qualitative and quantitative methods. Employing this approach is used to neutralize or cancel the biases of applying any of a single approach and a means to offset the weaknesses inherent in a single method with the strengths of the other method (Creswell, 2003). Mixed research approach opens door to multiple methods of data collection and helps to generate the findings to a population and develop a detailed view of the meaning of a phenomenon or concept for individuals (Creswell, 2003).

3.4 Target Population and Sampling Method

According to the National Bank Of Ethiopia (NBE, 2015), currently there are 19 Banks (18 private and 1 publicly owned). However, to undertake this research, four samples are selected randomly from banks: Commercial Bank of Ethiopia, NIB International bank, Oromia International bank and Wegagen Bank. Simple random sampling was preferred, because the population is small and relatively homogenous and also it is often impossible or too expensive to collect data from all the potential units. Hence, samples are chosen to represent the relevant attributes of the whole population.

Regarding target respondents, purposive sampling specifically expert sampling was used to select a total of 160 IT Staff to participate in the study. Purposive sampling was used because participants were selected based on their insight or special perspective and experience on the issue under investigation.

3.5 Method of Data Collection

Primary and secondary data were used in this study. The primary data was collected through interviews and questionnaire. Primary data is recognized as data gathered for a specific research in response to a particular problem through interviews and questionnaires. Additional data were obtained by examining various documents including banks annual reports, research reports, books and journal articles related with issues of cloud computing.

This research primarily used closed ended questionnaire to collect data Questionnaire was used because it is an efficient and economical way of gathering data as well as relatively easy for analysis the data (Kothari, 2004).
The questionnaire contains 31 close-ended questionnaire items, it was adopted from literatures related to Cloud Computing and some of them are adopted from (Fasil, 2015).

Customization was made to the questions in order to reflect the objective of the study.

In order to gather relevant data, online questionnaire has been developed. The questionnaire is prepared using Google forms and used to gather data from banks about their cloud readiness.

Questionnaires URL is sent to all IT department professional staff of the selected banks. Those respondents were selected, because they are knowledgeable about cloud computing system.
Semi-structured interview was conducted with the management (IT managers) of the four banks. The interviews were conducted between July and August 2016. The interview lasted approximately forty to forty-five minutes for each

participant. Semi-structured interview was preferred because it enables the researcher to give firsthand data from knowledgeable key informants (Zohrabi, 2013)

3.6 Validity

Validity is concerned with ensuring that the findings reflect exactly what the research objective aims for. Validity indicates the degree to which an instrument measures what it is supposed to measure (Kothari, 2004).
The questionnaire was reviewed and edited to validate the content addressed in the survey instrument and copies of the questionnaire were distributed to five people to pilot test questionnaire.

The objective of the pilot study was to test whether the questionnaire elements are clear, consistent and accurate information. Based on the feedback given by respondents in the pilot survey, some questionnaire items were modified to reduce bias and maximize the response rate.

3.7 Method of Data Analysis

The data collected via questionnaires was analyzed with descriptive statistics using statistical package for social scientists (SPSS) version 23. Furthermore, (Creswell, 2003) suggested that qualitative research is fundamentally interpretative i.e. the researcher makes an interpretation of the data. Thus, the data that was collected from the interview and reviews of documents were interpreted qualitatively. To sum, the analysis of quantitative data and interpretation of qualitative data combines to seek convergence among the results (Creswell, 2003).

The analysis of the resulting data is done based on the frequency and the percentage of the related concept.

Qualitative data is presented in a narrative form. Basically the interview has about eleven questions as shown in Appendix C.

3.8 Summary of the methodology

The purpose of the study was to assess cloud computing readiness of the banking sector in Ethiopia.

The research approach employed in this study was both quantitative as well as qualitative (mixed) approach. In the case of research method used in this study, data was collected by using questionnaire and interview. Finally data collected from questionnaires was analyzed with descriptive statistics using statistical package for social scientists (SPSS) and data collected from interview analyzed using qualitative method.

CHAPTER FOUR
FINDINGS AND DISCUSSION

4.1 Overview

In the previous chapter, the overall methodology, which was focused on research design, research approach and the specific method of data collection and data analysis used in the study, has been presented. On the other hand, this chapter presents the results and analysis of data collected via questionnaire, interviews and document analysis.

As it is discussed in the methodology part of this study, data is collected by using different techniques. In this chapter the data collected via questionnaires was analyzed with descriptive statistics using statistical package for social scientists (SPSS) and the data that was collected from the interview and reviews of documents were interpreted qualitatively.

Questionnaires were distributed to four randomly sampled banks IT staffs, one state owned bank (commercial bank of Ethiopia) and three private banks (NIB International bank, Oromia International bank and Wegagen bank). In four randomly sampled banks one person in each bank has been delegated to send the URL of the questionnaire to IT staff in the bank.
Out of the total 160 questionnaires URL sent by email, 126 responses were obtained (79% response rate). In addition to questionnaire, the researcher conducted an interview with only two IT managers in each bank managers and reviews different documents related to cloud computing. Descriptive measures of each questions response and an interview conducted with IT managers of selected banks results are presented in the following sections.

4.2. General Information

The demographic profile of respondents, participated in this study was shown in Table 2 as follows.

Variable	Classification of variables	Percentage
Educational Level	MSC	27.3%
	BSC	72.2%
Work Experience	1-2 years	15.2%
	3-4 years	9.1%
	More than 4 years	75.8%
Distribution of Banks by category	Government	24.2%
	Private	75.8%

Table 2 Respondent Demographic Profile

The distribution of respondents with respect to educational level is 27.3 % had MSC and 72.7 % had BSC. This shows that the highest percentage of them has BSC. When it comes to working experience 15.2% had 1- 2 years, 9.1 % were 3-4 years, and 75.8% were more than 4 years.

The distribution of respondent with respect to bank category 24.2% of the respondents said that they work in government bank 75.8% work in private bank. The largest percentage of participants was selected from the private banks.

4.3 Awareness on Cloud Computing

In terms of their understanding of Cloud Computing, all the participants have knowledge of Cloud Computing and were able to give their own definitions of Cloud Computing based on their experience. Some of the definitions of Cloud Computing by the participants are:

One interviewee said that:

"Cloud computing allows organizations to have access to infrastructures, software and platforms on a pay per use basis without having to purchase"

Another interviewee from other bank also said:

"Cloud computing generally refers to providing resources over the internet to people in different locations."

Concerning awareness on Cloud Computing the interview result was summarized as follows:

Based on the various definitions, cost is of high importance to Bank because they mostly refer to the ability of Cloud Computing to reduce cost. Most participants also noted the ability of Cloud Computing to allow users to pay per use. This is also an important factor for Banks because they believe it will help them reduce cost.

The questionnaire result somewhat agrees with the interview.

All participants in this study were asked Do you think cloud computing is useful technology to adopt? 100% say yes. The entire bank participated in this study were asked Do you think cloud computing is more advantageous than traditional IT deployment? 100% say yes.

The advantages of Cloud Computing mentioned by the participants also show that cost is the most attractive to the Banking sector. The flexibility of Cloud Computing is another important factor for the banking sector. It is clear that

the participants understands Cloud Computing and knows how their organizations can benefit from Cloud Computing.

Do you think accessing cloud computing first is important before adopting it?
96.9% yes and 3.1% no
What factors do you consider to be the most important when using cloud computing?

Most of the participants in interview mentioned security as the most important factor to consider when adopting Could Computing especially for the banking sector that deal with sensitive data and confidential information of clients. The other factor to consider is cost and Cloud computing dependence on the internet will be among the top disadvantages that would be mentioned by all the participants because of the bandwidth issues in Ethiopia. This shows that cost, security and bandwidth are the most important factors for the banking sector. As several literatures mentioned cost and security are the top issues with Cloud Computing.

To identify if the bank have Cloud computing regulatory question were asked and most of the participating organizations do not have Cloud Computing governance in place. The participants all agreed that having Cloud Computing governance in place is one of the most important steps towards a high level of Cloud Computing readiness.

To know if the bank have cloud computing strategy question were asked and all the participating banks indicate that they do not currently have a Cloud Computing strategy in place but are looking to have one in place in future.

4.4 Technology Readiness

The technological factors include cost, ICT infrastructure, and technology bottlenecks. They should first be considered in order to check the

organization's capabilities in terms of the technological requirements of Cloud Computing.

The organization needs to know about Cloud Computing and related technologies so as to determine how it will fit into their business processes. The organization also needs to look at the existing system in terms of cost, ease of use, efficiency and effectiveness and compare this with Cloud Computing to determine if Cloud Computing offers more benefit than the existing system.

The cost of Cloud Computing is the first factor that needs to be considered as it will be a waste of time to continue analysis if the organization cannot afford Cloud Computing. The organization needs to make provisions for all the necessary infrastructure and architecture that will ensure there is continuous service availability in the cloud data, and infrastructure are available to authorized users immediately upon request (Armbrust, et al, 2009).The organization also needs to make plans that will improve security, integrity and data confidentiality. This will ensure that confidential and sensitive organizational data are not lost or exposed to unauthorized third parties once in the cloud.

Since Cloud Computing relies on the internet for its services, the quality of internet service is a vital requirement for Cloud Computing as poor quality of internet service will result in poor quality of Cloud Computing services. The organization needs to investigate the kind of internet services available to them and determine whether the quality of the available internet service meets the requirements of their Cloud Computing service. All other known issues related to technology should be considered at this stage and proper plans should be put in place to provide solutions to them.

The issues raised in this study in relation with technological factor described as the IT infrastructure available to an enterprise to obtain cloud services and human resources that can manage cloud services. Organizations should ensure that the necessary infrastructure to support Cloud Computing is available to them before choosing to execute Cloud Computing. This incorporates the accessibility of important technologies and expertise to operate those technologies (Carroll et al., 2011).

Do you think cloud Computing is compatible with your company's existing IT infrastructure?

On Figure 1, 57.6% of the participating banks existing IT infrastructure is compatible to integrate with Cloud Computing while 42.4% said it is not compatible with Cloud computing the interview result also show the same.

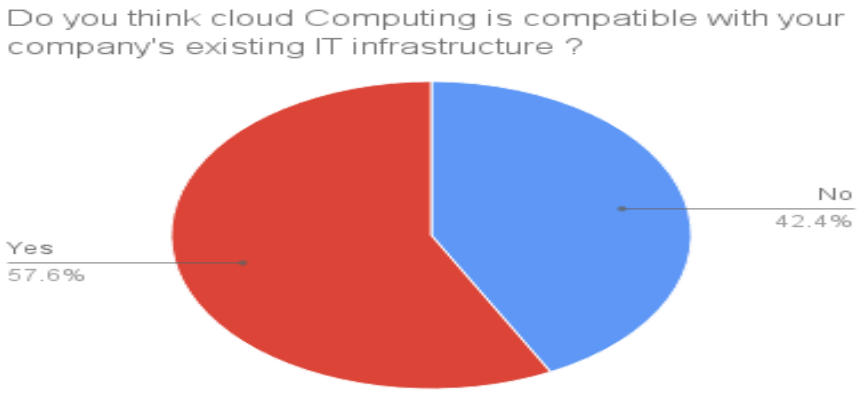

Figure 1 Cloud Computing Compatibility with exiting IT Infrastructure

4.4.1 Connectivity Readiness

The quality of internet service is very important for Cloud Computing to function effectively because cloud services are offered over the internet. Cloud Computing service will only be good if the internet service is good because of its reliance on internet (Chauhan, Bansal and Alappanavar, 2012)

In order to know the internet connection of banks question were asked and as shown in Figure 2, 50% of respondent have Slow Internet < 20Mbit/s.

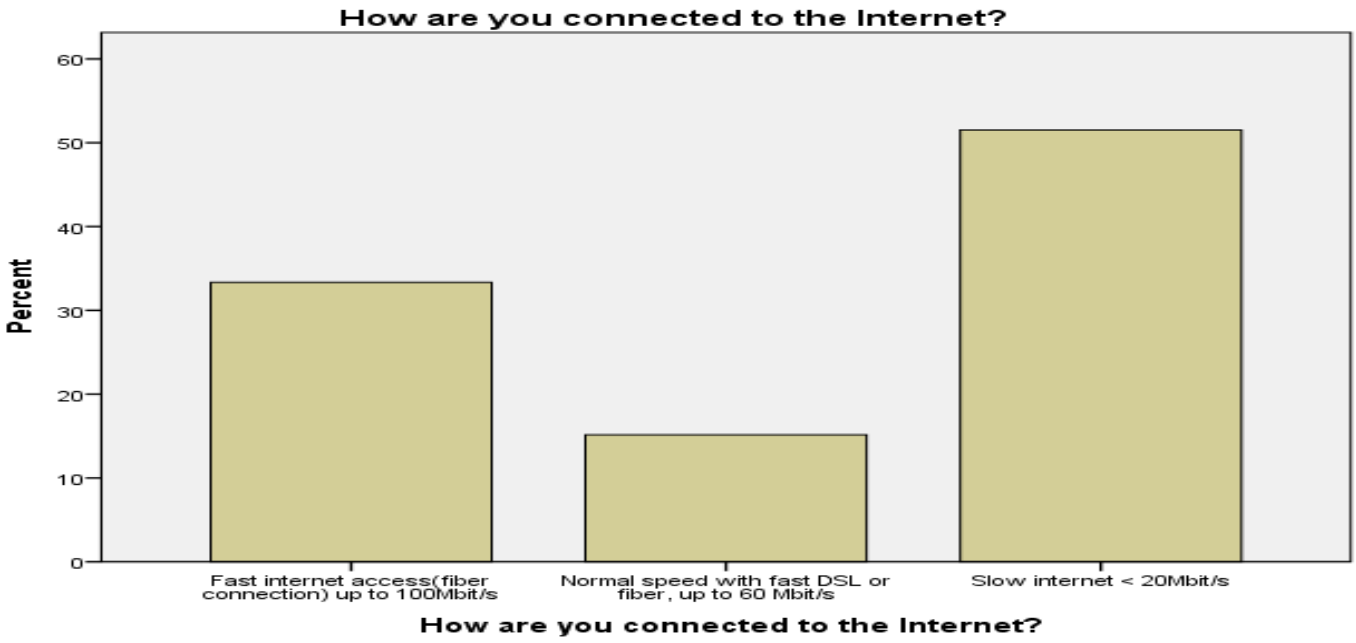

Figure 2 Connection Speed

When accessing servers and data at a remote location, a permanent, reliable broadband connection is obviously needed. This is extremely important for cloud readiness.

To know availability of redundant broadband network question were asked and as shown in Figure 3, 60.6% respondents have one internet connection.

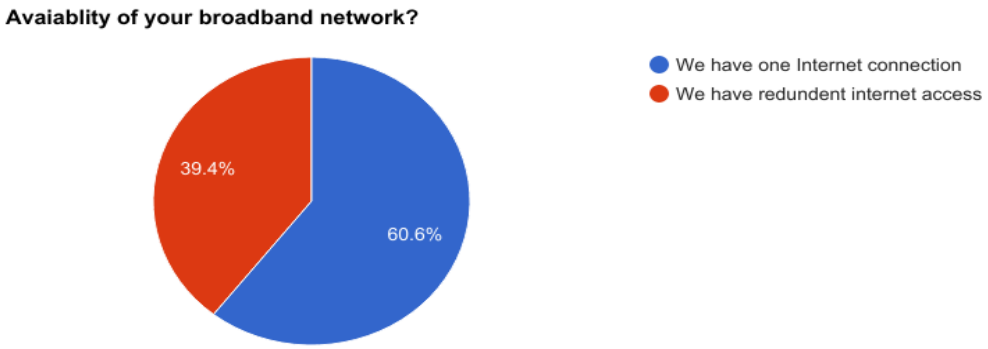

Figure 3 Availability of Redundant Connection

Generally banks connectivity readiness is not good because most of the bank don't have redundant connection and their internet connection is very slow, to use the cloud efficiently it required to have a fast internet access; the faster the speed, the better the overall performance will be. A redundant connection will improve the availability of cloud services.

The interview result also support the quantitative result because of the bandwidth issues in Ethiopia, Cloud Computing dependence on the internet will be among the top disadvantages that would be mentioned by all the participants.

4.5 Organizational Readiness

Organizational factors such as size of the IT resources, the utilization pattern of the resources, sensitivity of the data they are handling, criticality of work done by the company, top Management support satisfaction with existing system and skills should be considered at this stage.

The support of the top management is important organizational factor as most organizations fail in their technology adoptions because there is no support from the top management. The size of the IT resources is also important at this stage because it will assist in selecting the right type of cloud. The utilization

pattern of resources is also important because organizations that utilize a large amount of resources should be able to use that to negotiate for lower price with the service provider. This will assist them in cutting cost in the long run. The sensitivity of data is also an important consideration at this stage. This will assist the organization to identify the more sensitive data and separate them from the less sensitive data. They will then be able to determine which ones to move into the cloud and which ones should remain in-house. The criticality of work done by the company should be considered at this stage because stringent SLAs, resources, platforms, applications and security are needed for highly critical works while requirements of less critical works may be flexible.

Another important consideration at this stage is skills. There are some skills important for successful adoption of Cloud Computing. The organizations should arrange training for their IT staffs in order to equip them with the necessary skills. This will ensure that the staffs are able to tackle any issues that arise in a professional manner and avoid any problems that could have occurred as a result of lack of necessary skills.

4.5.2 Sensitivity of the Data they are handling

Figure 4 indicates that 43.8 % of the respondent's data is highly confidential; their data can only be accessed by company employees and authorized partners. This indicates that most of the participant data is sensitive.

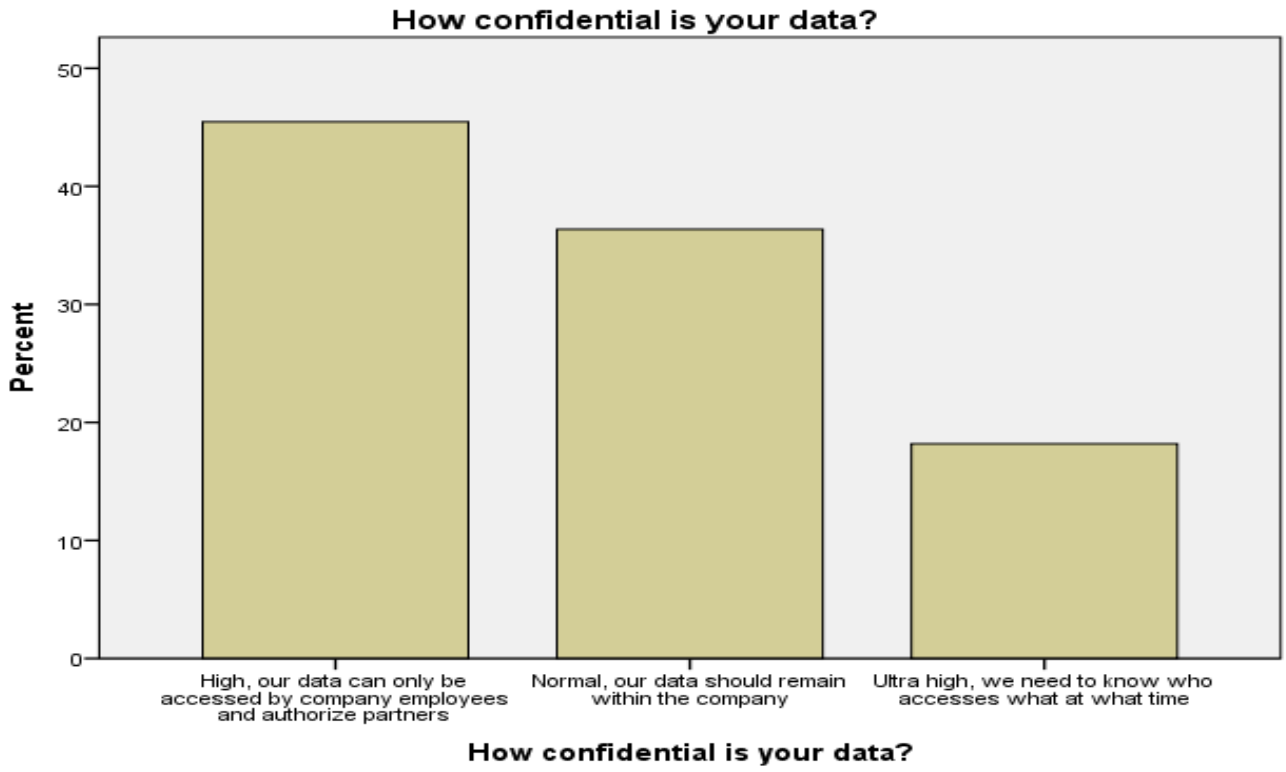

Figure 4 Sensitivity of Data

4.5.3 Criticality of work done by the Organization

As shown in the Figure 5, 57.6% of the respondent say existence of system is Important, we need to access our data daily and 33.3 % say existence is dependent on technology; we cannot function without our systems.

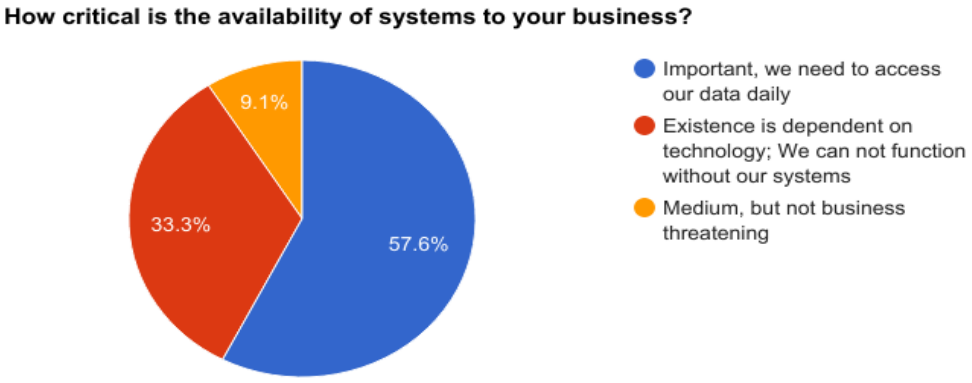

Figure 5 Criticality of a system

4.5.4 Top Management Support

Is there executive or higher management support and knowledge for any cloud related initiative? 32.3% of the respondent says yes, 67.7% say no.

When participant asked in interview how supportive is the management team to take initiatives toward cloud computing, most of the participants noted that there is no top management support this is mean that interview result align with questionnaire result.

Figure 6 Top Management Support

4.5.5 Skill

It can be an advantage to have internal resources that manage company IT, and who also have the skills necessary to migrate to cloud. Having resources present that can both assist and work internally to prepare for the migration is a valuable asset. Otherwise, these resources would have to be contracted which would in turn drive up costs.

To identify what skills require to use cloud computing participants are asked what skills do you think require in order to use cloud computing? All the

participants mentioned that proper understanding of Cloud Computing is important as the organizations needs to know how Cloud Computing will fit into their business and what impact it will have on their business. It is also important to understand security requirements, project management, financial management, SLA, vendor management and communication skills to be able to negotiate SLAs with service providers and also to communicate information to your employees.

In terms of Cloud Computing experience, all the participating companies do not have employees with Cloud Computing experience.
In order to achieve all the expected benefits of cloud computing, training is essential so as to make sure that they know what to do whenever they need to make use of any cloud service.

To identify if participant bank have training program for employees on cloud computing question were asked and all the participating banks do not currently have any training program on Cloud Computing for their employees.
The respondent asked who manages their IT infrastructure and server 56.3 % of the respondent answer they manage themselves where 40.6 % of respond their IT infrastructure is mange by third company.

It can be an advantage to have internal human resources that manage company IT, and who also have the skills necessary to migrate to Cloud. Having human resources present that can both assist and work internally to prepare for the migration is a valuable asset. Otherwise, these human resources would have to be contracted which would in turn drive up costs.

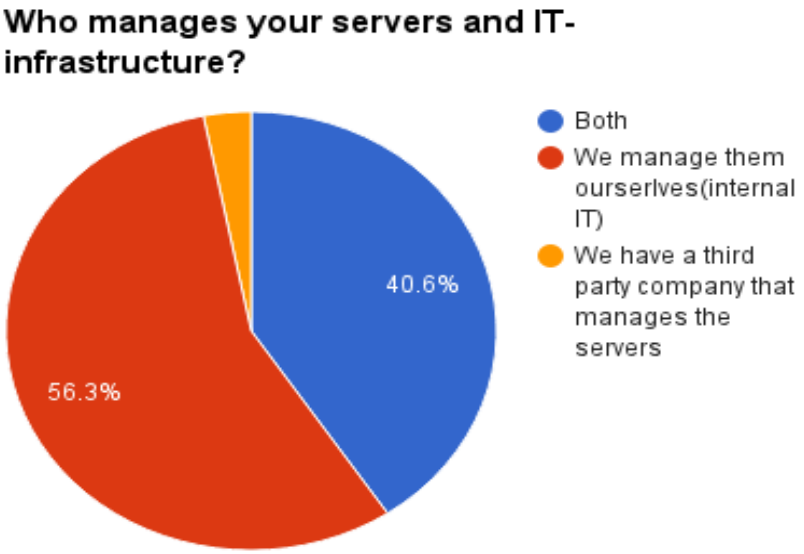

Figure 7 IT Infrastructure Management

The respondent asked to describe knowledge about cloud computing and IT Infrastructure management within their company 65.6 % of respondent answer they have basic knowledge and understand of cloud computing and IT infrastructure, 25% of respondent have weak understanding..

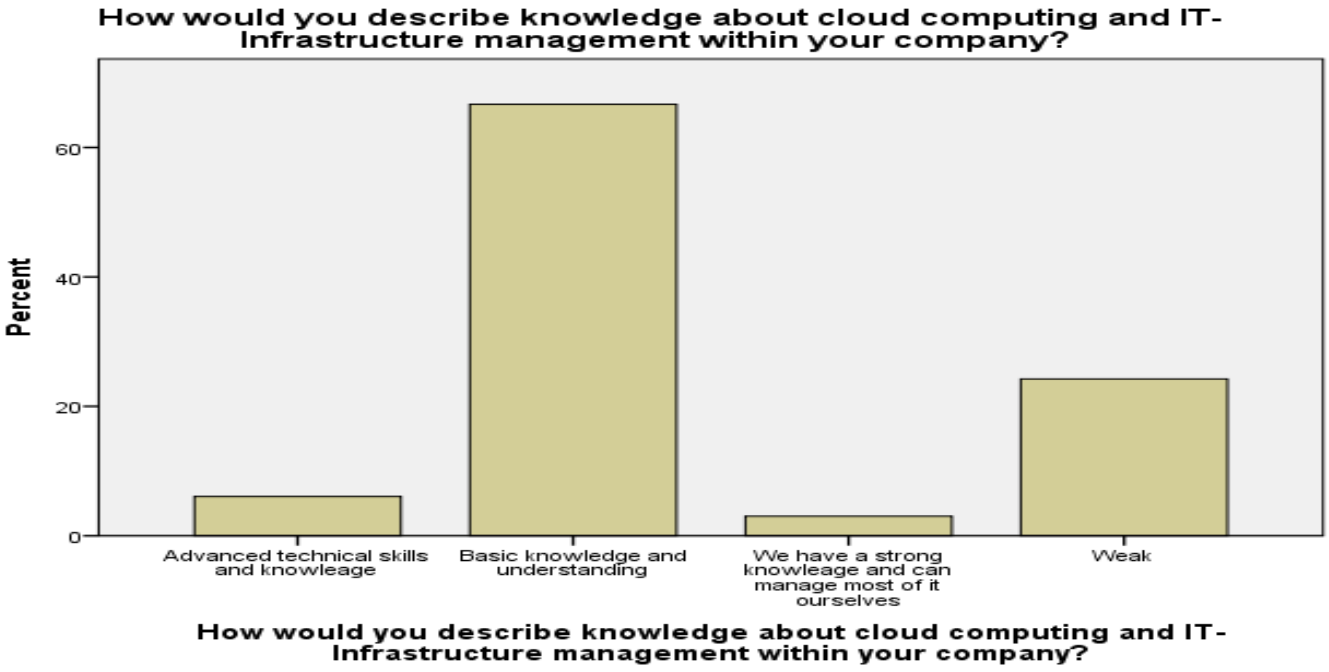

Figure 8 Knowledge of Cloud Computing and IT-infrastructure

4.5.6 Growth and Scalability

Cloud computing enables new ways of deploying systems; it introduces a new level of elasticity and agility to scaling systems and acquiring resources on demand. Being flexible allows a company to react faster to changes.

As shown in Figure 9, 51.5% of the respondent indicates that they have predicted a rapid growth rate over next 3 years and, therefore, need to be flexible and migrating to the cloud would add many benefits to infrastructure and flexibility for dynamic growth.

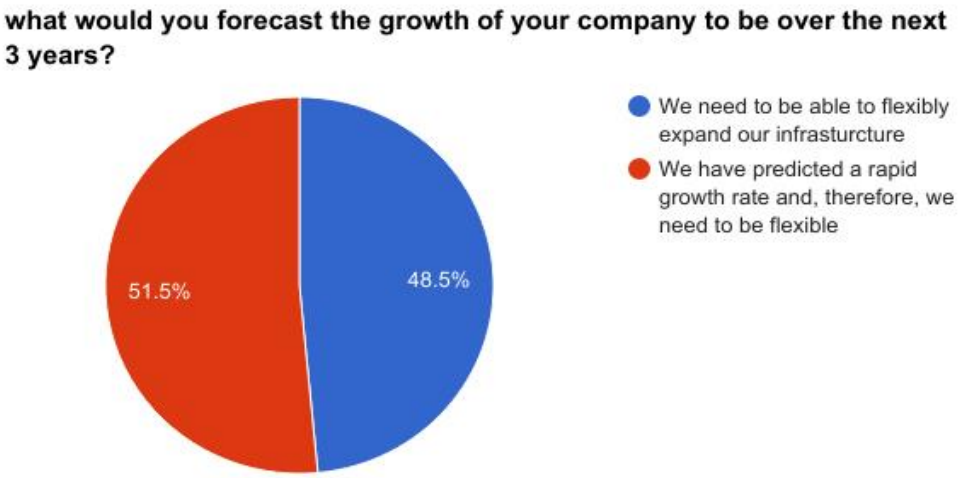

Figure 9 Growth and Scalability

4.6 Environmental Readiness

The environmental issues include government support in terms of national infrastructure, regulations, legislation, competition from rivals should be considered at this stage.

The organization needs to find out about the available government support such as the available national infrastructure, available bandwidth and strategies that could influence Cloud Computing.

Regulations and legislations issues should be considered at this stage because they will have an impact on the success of Cloud Computing adoption. If there are regulations and legislations issues that can help regulate Cloud Computing, organizations should be aware of them and develop strategies in order to make sure that they meet the requirements of those legislations and regulations.

It is also important to investigate whether competitors are already using Cloud Computing and whether it is giving them some form of competitive advantage over the organization. This will give the organization a clear picture of where their Cloud Computing implementation will place the in relation to competitors.

4.6.1 Disaster Recovery

From the organization's perspective, business continuity and disaster recovery are very important.

As shown in Figure 10, 90.9% of the respondent data synced to an alternate location. That mean all most all of the participating banks have business continuity and disaster recovery plan. During the interview question were asked to know if business continuity and disaster recovery plans are in place and the entire participant answered they have business continuity and disaster recovery plan.

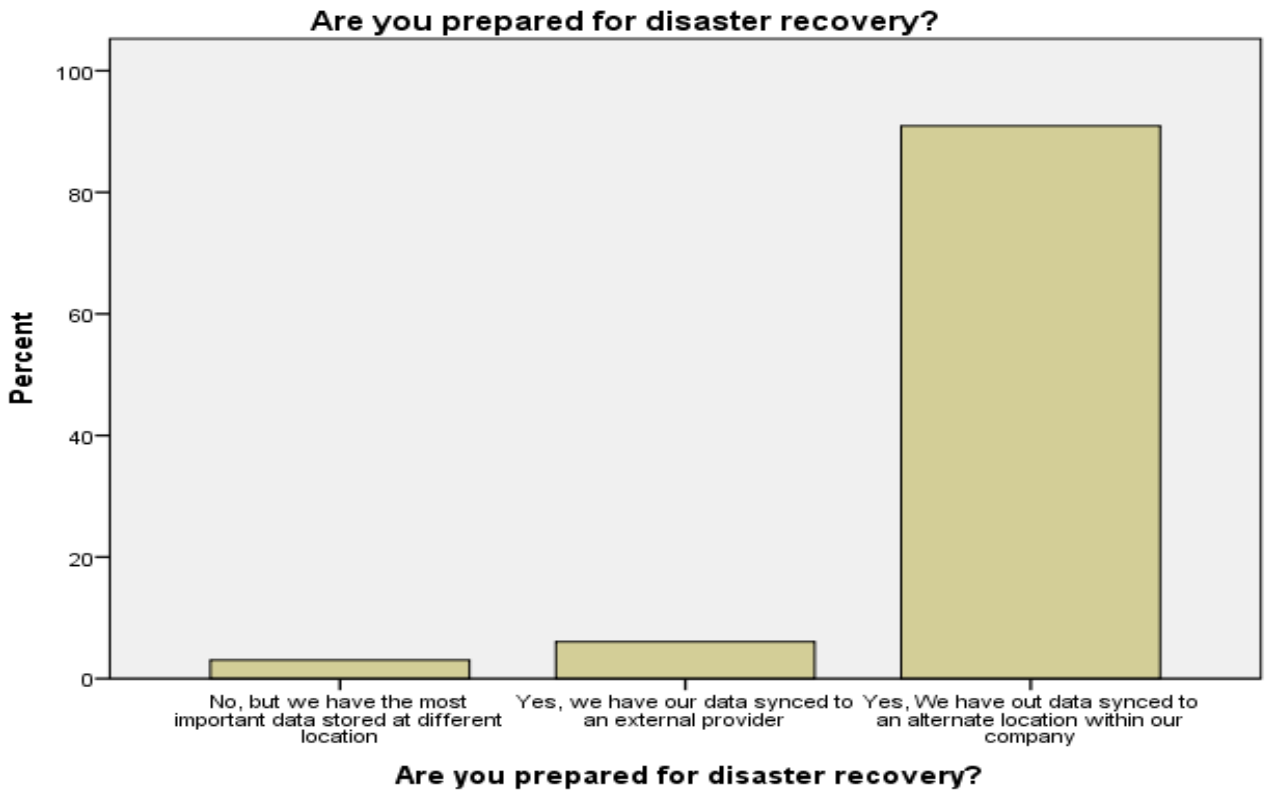

Figure 10 Disaster Recovery

Good monitoring tools can help to measure data, uptime metrics, throughput, resource consumption and so forth. Having a good monitoring system in place can give information regarding the potential requirements of joining the cloud and also an estimation of costs.

As indicated in Figure 11, 45.5% of the respondent indicated that they had network management tools to monitor the network performance and availability. This indicates that most banks can easily move to cloud since they have mechanism for performance and availability monitoring which help to easily detect any network related issue or latency.

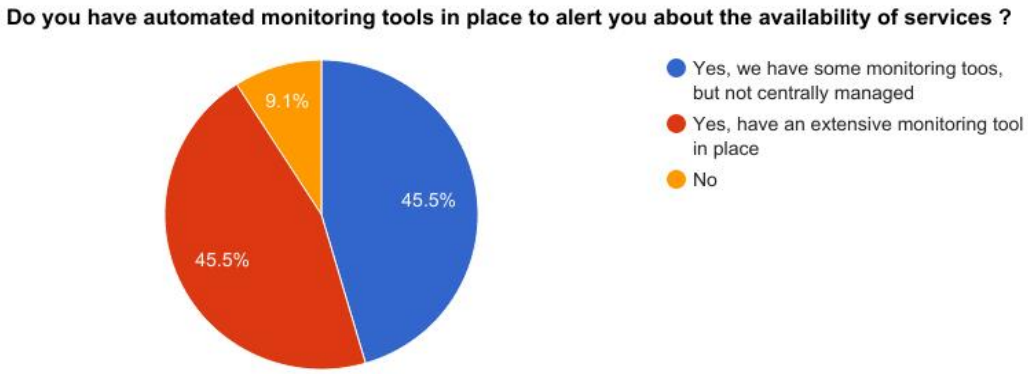

Figure 11 Network Monitoring Tools

4.7 Change Management

Changing the systems and transferring them from an internal data center to Cloud can go unnoticed by regular employees. However, the new functionalities of the system that add value to the business require employees to adapt. Often software upgrades are incorporated into a migration and users are forced to deflect.

As shown in Figure 12, 51.5.4 % of the respondent indicated that employees in their company are flexible and would adapt to change over time.

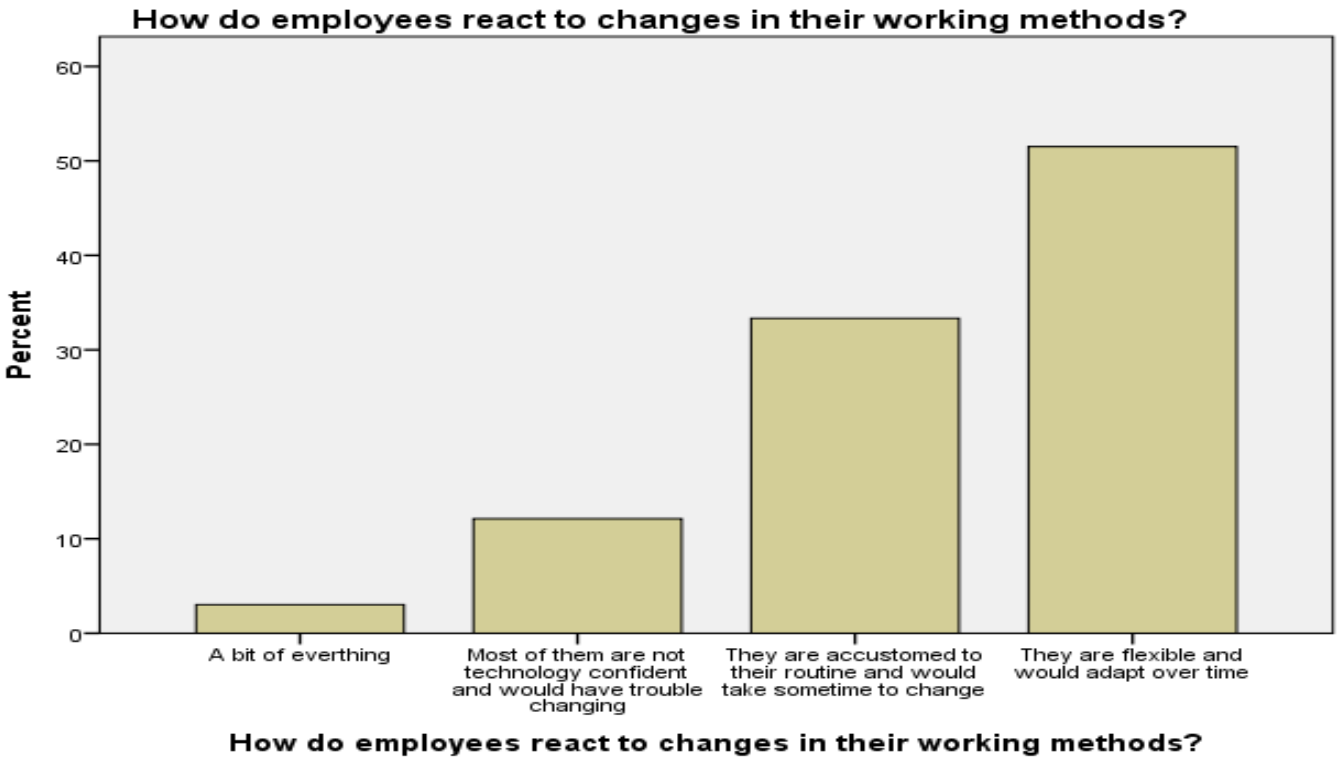

Figure 12 Change Management

4.8 Summary

In this chapter, data obtained from survey, interview and documents has been analyzed.

The findings indicated that majority of the respondent were aware of cloud computing technology.

The study also finds out Security concerns, complexity of moving application to cloud and loss of control to third party management came out strongly as the major factors hindering the adoption of cloud technology.

Readiness of the banking sector for cloud computing was put into test from the findings, there is a lot to be done for the banks to become ready for cloud. Majority of the banks had not trained their IT personnel on cloud technology.

Moreover, more than half of the banks had no backup internet connection. Internet is the backbone of the Cloud Computing; therefore banks need to be keen on this so as to ensure availability and stability of IT services. It is however encouraging to note that majority of banks have network monitoring tools.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this chapter is to summarize the major findings of this study and to draw conclusions based on the results. It also provides recommendations based on the findings are presented in this chapter by drawing together the results from the previous chapters.

5.1 Conclusions

The findings from this study confirmed that Cloud Computing readiness level of Ethiopia banking sector is low. This research also found out that adoption of Cloud Computing in Ethiopia is generally low.

It was also confirmed that security and privacy are among the biggest concerns about Cloud Computing among Ethiopian banking sector.

The data analysis revealed that organizations are paying little attention to training in terms of Cloud Computing because most of the participating organizations do not have Cloud Computing training program in place. The data analysis also revealed that cost and security are the most important factors to organizations when considering Cloud Computing adoption. There is no specific legislation or law in Ethiopia to regulate Cloud Computing.

This research also found that government support is not available in Ethiopia in terms of making necessary infrastructure such as bandwidth available for organizations wishing to adopt Cloud Computing.

This research also confirmed that the quality of internet service in Ethiopia is not so good because of the poor bandwidth availability. Successful implementation of Cloud Computing is dependent on fast, reliable bandwidth.

The lack of adequate bandwidth can affect the quality internet service which will also affect the quality of Cloud Computing service.

Banking sector in Ethiopia prefer private clouds because it offers more security and control than public clouds. The ability of users to have more control of their data and information in private clouds makes it a preferred choice for Ethiopia Banking sector. Another reason why Ethiopian banking sector prefer private clouds is that the skills needed for private clouds are similar to the traditional IT skills i.e. they need to set up a data centre and manage it in-house.

To answer the research questions, the Cloud Computing readiness of Ethiopia banking sector is still in its early stages as most of the banking sector are not yet ready for Cloud Computing adoption. Some of the barriers of Cloud Computing adoption include security and privacy, governance issues, confidentiality, etc.

The enablers of Cloud Computing adoption include scalability and flexibility, broad network access, pay per use, economies of scale and cost effectiveness, reliability, increases speed of time to market, user centric interfaces, improved communication, improved focus on core business, scalability, cost reduction etc.

5.2 Recommendations

It is recommended that organizations should try and achieve a high level of Cloud Computing readiness before adopting Cloud Computing to improve their chances of success.

For the successful implementation of cloud computing ICT infrastructure, is a major prerequisite so government should support the banking sector by investing on ICT infrastructure development. The researcher also recommends that top management awareness of cloud computing systems will enhance readiness of the system in the organization.

Since this research focused specifically of banking sector, future research could focus on another industry or organization as the result of this research cannot be generalized. Top management were not included in the study hence further research considering only the CIOs might help clearing up this uncertainty.

The results from different research across several industries could be combined in future in order to come up with solution that could be applied across several industries. The study also suggests that further research be conducted on developing readiness assessment framework for banking sector to determine and improve their level of Cloud Computing readiness level of banking sector.

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APPENDICES

Appendix A

Dear respondents:

My name is Lensa Begna, a post-graduate student at the school of Information Science at Addis Ababa University. Currently I am doing a Masters thesis entitled as “Cloud Computing Readiness Assessment Framework for banking sector in Ethiopia”.

The objective of this questionnaire is to collect data from Ethiopia banks in order to investigate cloud computing readiness of banks in Ethiopia, propose framework to be follow by banks to be ready for cloud.

Therefore, I kindly request you to fill this questionnaire carefully. All the information you will provide will be kept strictly confidential. Moreover, the information that you will provide is quite useful to achieve the objective of the study.

I would like to thank you in advance for spending some time in answering the questions related to the issues.

Thank you for your participation

Best regards,

Lensa Begna Bekele
MSc student at Addis Ababa University
School of Information science
Email lensa_7@yahoo.com

Appendix B

Answer the following questions by putting the (√) symbol on the following boxes or write in the space provided.

General Questions

1. **Education level**

☐ **BSc** ☐ **MSc** ☐ **PhD**

2. **Work Experience:**

☐ 1-2 years

☐ 3-4 years

☐ More than 4 years

3. **What type of bank are you working?**

☐ Private

☐ Government

4. **Are you familiar with Cloud computing?**

☐ Yes

☐ No

5. **Do you think cloud computing is useful technology to adopt?**

☐ Yes

☐ No

6. **Do you think cloud computing is more advantageous than traditional IT deployment?**

☐ Yes

☐ No

7. **Do you think trying or evaluating cloud computing first is important before adopting it?**

☐ Yes

☐ No

8. **Do you think cloud computing is compatible with your company's existing IT infrastructure?**

☐ Yes

☐ No

9. **Is there Executive or Higher management support and knowledge for any cloud related initiative?**

☐ Yes

☐ No

Hardware Readiness

10. **How many Servers / Systems do you have in place?**

☐ 1 to 3

☐ 4 to 10

☐ 10 to 20

☐ More than 20

☐ Over 100

11. **Are your servers virtualized?**

☐ No

☐ Some of the servers are virtualized

☐ Most of the servers are virtualized

☐ All servers are virtualized

12. **Where are your servers located?**

☐ In a room in our company's facility

☐ In a room dedicated for servers in our company's facility

☐ Hosted with an external partner

☐ Distributed over different locations

13. **What is the average age of your server and storage hardware / technology platform?**

☐ Less than 1 year old

☐ 1-2 years

☐ 1-3 years

☐ 1-4 years

☐ 2-4 years

☐ All over 3 years

14. Do you plan to upgrade your server's operating systems to support new technologies?

☐ Yes, we are on Windows Server 2008 or 2008 R2 but want Windows Server 2012

☐ Yes, we are still on Windows Server 2003

☐ We have a mixed environment (and might upgrade when migrating to the cloud)

☐ We are using the most current operating systems and don't need to upgrade

☐ We are running an old operating system, but would like to keep the existing setup

Connectivity Readiness

15. How are you connected to the internet?

☐ Slow Internet < 20Mbit/s

☐ Normal speed with fast DSL or fiber, up to 60 Mbit/s

☐ Fast Internet access (fiber connection) up to 100Mbit/s

☐ Backbone connection faster than 100Mbit/s

☐ No Internet connection available

16. Availability of your broadband network?

☐ We have redundant internet access

☐ We have one internet connection

Software Readiness

17. What operating systems do you use?

☐ Microsoft Windows Servers

☐ UNIX Servers

☐ Both

18. . What client operating system(s) do you use?

☐ Microsoft Windows XP or Vista

☐ Microsoft Windows 7

☐ Microsoft Windows 8

☐ Mixed Windows Environment

☐ Mac (Apple) / UNIX

☐ Mixed

Disaster Recovery Plan

19. How do you backup your data?

☐ We use an external hard drive and save it manually

☐ We have the backup jobs automated

☐ We don't backup, each user is responsible for their own backup

20. How confidential is your data?

☐ Low, we have nothing to hide

☐ Normal, our data should remain within the company

☐ High, our data can only be accessed by company employees and authorized partners

☐ Ultra high, we need to know who accesses what at what time

21. Where is your company's data stored?

☐ Distributed on various computers and laptops

☐ Centrally stored on a server

☐ External hard disks

☐ Centrally stored on a SAN, NAS, or other storage solutions

☐ A bit of everything

22. How much data does your company store?

☐ Less than 100 GB

☐ Less than 500 GB

☐ Less than 2 TB

- [ ] More than 2 TB
- [ ] More than 50 TB

23. What would you forecast the growth of your company to be over the next 3 years?

- [ ] Constant, we don't plan to expand
- [ ] We need to be able to flexibly expand our infrastructure
- [ ] We have predicted a rapid growth rate and, therefore, we need to be flexible
- [ ] Decreasing

24. Do you encounter occasional increased workloads on your servers? (during some periods of the year or on some specific days)

- [ ] Yes
- [ ] No

25. Are you prepared for disaster recovery?

- [ ] Not at all
- [ ] No, but we have the most important data stored at a different location
- [ ] Yes, we have our data synced to an alternate location within our company
- [ ] Yes, we have our data synced to an external provider

26. How critical is the availability of systems to your business?

- [ ] Not very important, we also function without technology
- [ ] Medium, but not business threatening
- [ ] Important, we need to access our data daily
- [ ] Existence is dependent on technology; we cannot function without our systems

27. Do you have automated monitoring tools in place to alert you about the availability of services?

- [ ] No
- [ ] Yes, we have some monitoring tools, but not centrally managed
- [ ] Yes, have an extensive monitoring tool in place

Sourcing & Expertise (Staff requirements and readiness of people)

28. Who manages your servers and IT-Infrastructure?

- ☐ We manage them ourselves (internal IT)
- ☐ We have a third party company that manages the servers
- ☐ Both

29. How would you describe knowledge about cloud computing and IT-Infrastructure management within your company?

- ☐ Weak
- ☐ Basic knowledge and understanding
- ☐ Advanced technical skills and knowledge
- ☐ We have a strong knowledge and can manage most of it ourselves

30. Does your organization need to free IT personnel for other projects?

- ☐ No
- ☐ IT-Personnel would appreciate freedom from certain regular tasks
- ☐ Yes, we would like to use them for new projects

31. How do employees react to changes in their working methods?

- ☐ They are flexible and would adapt over time
- ☐ They are accustomed to their routine and would take some time to change
- ☐ Most of them are not technological confidence and would have trouble changing
- ☐ A bit of everything

https://docs.google.com/forms/d/e/1FAIpQLSdUEqf_vClIDg8n4iGK1gRuhODsSwVr755se5eCtK01cY77YA/viewform#responses

Appendix C

Interview Questions

1. What is your understanding of cloud computing?
2. What skills do you think require in order to use cloud computing?
3. What factors do you consider to be the most important when using cloud computing?
4. Is there cloud computing regulatory in your bank?
5. In your opinion, what are the advantages of cloud computing?
6. In you view, what are the disadvantages of cloud computing?
7. Does your organization have a cloud computing strategy in place?
8. Does your organization have training program for employees on cloud computing?
9. How supportive is the management team to take initiatives toward cloud computing?
10. How would you describe the degree of automation in your current IT-Infrastructure?
11. Do you have business continuity and disaster recovery (BCDR) plans in place?