

**A SURVEY ON CLOUD COMPUTING ADOPTION IN KENYA'S BANKING
INDUSTRY**

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DECLARATION

I, the undersigned, declare that this is my original work and has not been submitted for the award of a degree in any university.

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09/11/2011

DEDICATION

This study is dedicated to my parents, siblings and husband without whom I would not have come this far.

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I appreciate the support of the following who worked tirelessly to ensure that I conducted this research successfully. I am grateful to my Husband Nathan, my parents Paul and Edith for their encouragement and support with funds for carrying and conducting this research.

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LIST OF ABBREVIATIONS

ADSL	-	Asymmetric Digital Subscriber Line
AFCOM	-	Air Force Commendation Medal
ARPANET	-	Advanced Research Projects Agency Network
APEJ	-	Asia Pacific except Japan
CIO	-	Chief Information Officer
CBK	-	Central bank of Kenya
EC2	-	Elastic Compute Cloud
IDC	-	International Data Corporation
ISDN	-	Integrated Services Digital Network
HaaS	-	Hardware-as-a-Service
IT	-	Information Technology
SaaS	-	Software-as-a-Service
SMB	-	Small and Medium Size Businesses
SDSL	-	Symmetric Digital Subscriber Line
SPSS	-	Statistical Package for Social Sciences
XTP	-	Extreme Transaction Processing
VM	-	Virtual Machines

ABSTRACT

The purpose of this 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. The study was guided by three research questions. The questions are as follows: Is the commercial banking industry in Kenya aware of cloud computing? Is it ready to adopt it? What is its attitude on cloud computing?

The study targeted commercial banks in Kenya. Questionnaires were administered to Information Technology (IT) managers/Chief Information Officers (CIO) depending on the organization structure were administered with questionnaires.

The findings from the study revealed that majority of the IT managers/CIOs were aware of cloud computing technology as shown by a 95% respondents defining cloud computing terminology correctly. More so, a considerable number of the respondents were familiar with cloud computing classification. Sixty percent of the respondents were aware of software as a service and infrastructure as a service, 55% were aware of classification platform as a service and only 15% were unaware of any classification. The findings clearly show that cloud computing concept is known to most IT managers/CIOs.

The study also sorts to find out the attitude of IT managers on cloud technology. The results revealed that, majority of commercial banks were not willing to adopt the technology. None of the respondents' banks were using the technology nor did they assign any IT budget to cloud projects in their 2011 budget. The study also revealed that banks are not willing to put their IT services to cloud in the next 2 years. Security concerns, complexity of moving application for cloud and loss of control to third party management came out strongly as the major factors hindering the adoption of cloud technology.

When readiness of the commercial banks into adopting cloud computing was put into test. Majority of the banks (75%) of respondents had not trained their IT personnel on cloud technology. Moreover, only a few banks had a backup internet connection. Internet is the

backbone of the cloud technology and therefore banks need to be keen on this so as to ensure availability and stability of IT services incase one connection is down. It was however encouraging to note that all banks surveyed had an IT security team put in place and 80% had network monitoring tools in place.

CHAPTER ONE

INTRODUCTION

1.1. Background

Many organizations in Kenya have computerized their activities. Computerization of business processes and activities has resulted to faster operations, efficiency and improvement in business transactions, quick reference among other benefits. On the other hand, computerization comes with a cost. Storage is required for data store, larger data centers, servers, cooling capacity in the data centers, system engineers, software licensing among others. As a result of this, organizations end up incurring a huge budget in the acquisition and maintenance of Information Technology (IT) infrastructure (Linthicum, 2009).

According to Gartner (2009), many organizations want to venture into tasks that have high returns. Organizations want to pay only for what they need and not necessarily what they have. As an organization grows, flexibility and scalability of IT infrastructure becomes essential. On the other hand, if the level of activity of an organization reduces, a scale down of resources is also required without resulting to idle resources (Mitchell, 2009). Organizations want to concentrate their resources on core business and not in supporting IT services hence the need to reduce unnecessary costs.

Organizations are working towards reducing unnecessary IT costs and one way to deal with this is to adopt a technology that enables flexibility and scalability of IT infrastructure (Daryl, 2009). This can be made possible by accessing IT as a service. One technology that best supports this is cloud computing.

Gartner (2009) defines Cloud Computing as a means by which highly scalable and elastic technology-enabled services can be easily consumed over the Internet on an as-needed basis. According to Springboard Research (2009), Cloud Computing is a collection of IT-enabled resources and capabilities that can be delivered via the internet as a service. In the cloud computing environment, working is through virtualized applications on a

networked architecture. With Cloud Computing people work using appliances such as smartphones, iphones, and laptops without necessarily installing applications on these devices.

According to Garner (2009), there are three models of cloud computing. The first model being software-as-a-Service (SaaS) which offers applications online, examples of such include Gmail or Google docs. Second model is Application Infrastructure Service which offers higher-level development environments which abstract the underlying technology and provide for scalability and rapid application development such as Google App Engine. The third model is hardware-as-a-Service (HaaS) which offers resources such as processing and storage services to a customer (user). The customer does not have to physically buy these services. Other authors such as Springboard refer to this model as System Infrastructure Services.

With increasing business complexity, banks are seeking innovative business models and specialized technologies to cater for customer demands (Khera, 2006). Cloud computing technology can provide banks with competitive advantage through cost reductions, simplified maintenance and management of applications across the enterprise, greatly extended scalability, agility, high availability, automation, large data storages and reliable backup mechanisms (King, 2009). According to Appistry (2009), banks can focus on their core business as opposed to concentrating their efforts on infrastructure scalability through the use of cloud computing infrastructure.

Banks can accrue several benefits from cloud. Ellison (2010) classifies the primary benefits of migrating to cloud into two. The first relates to cost reduction, which cannot be achieved with a purely proprietary infrastructure. Banks can avoid purchasing costly infrastructure by outsourcing infrastructure to a third-party and manage all of their data and applications from a simple Web address on the Internet. The second benefit relates to scalable and Flexible. In this case banks will be able to pay for only what they need in terms of resources and capabilities.

Miller (2009) suggests that, banks can make use of cloud computing in several areas. Identity management process is a key area that can be moved to cloud thereby enhancing linking of identity information between accounts. This can significantly reduce costly provisioning, mitigate security loopholes and resolve traditional user issues caused by rigid application architecture. Enterprise content management is another candidate for Cloud Computing in banks, specifically on customer interaction archival and search. Banks can also enable transaction processing in the cloud through Extreme Transaction Processing (XTP) which pertains to a certain class of applications that need to handle large volumes of data that needs to be absorbed, correlated, and acted upon such as fraud detection, risk computation, and stock trade resolution. Other services that banks can move to cloud computing includes managing schedules by using web-based scheduling whereby everyone places his/her schedule in the cloud thus enabling the meeting organizer to easily see who is available. E-mail archiving, e-mail security and document creation, back-office activities such as credit card processing, Foreign exchange among others can also be moved to cloud.

Cloud Computing Technology has met a lot of resistance particularly by financial services firms due to security concerns (Cloud Security Alliance, 2009). The idea of hosting sensitive information on the Internet is considered insecure by the banking industry. Other concerns include issues surrounding the down time of resources and servers offered by providers, response times from the cloud may be too slow for certain time-critical transaction management, undue dependency on cloud infrastructure providers, lack of visibility into the technology and lack of control over the application (Guilbert, 2009)

1.2. Overview of banking Industry in Kenya

The banking industry in Kenya is governed by the Companies Act Chapter 486 of the laws of Kenya, the Banking Act, the Central Bank of Kenya Act Chapter 491 and the various prudential guidelines issued by the Central Bank of Kenya (CBK). The banking sector was liberalized in 1995 and exchange controls lifted. The CBK, which falls under the Minister for Finance docket, is responsible for formulating and implementing

monetary policies and fostering the liquidity, solvency and proper functioning of the financial system (Njoroge. 2010).

According to the Central bank of Kenya, there are 44 registered commercial banks in Kenya as at March, 2011 (see Appendix II) . These banks can be categorized into locally owned and foreign owned. Locally owned banks are further categorized into public financial institutions and private financial institutions

Commercial banks in Kenya offer several services to their customers such as personal loans, mortgage loans, credit cards, finance, savings accounts, current accounts, foreign exchange and share trading among others. Since banks offer similar services, high competition has been stirred in the banking industry. Due to this, Banking institutions are been forced to upgrade their service levels and the way they deliver services to customers. This has made banks embrace new technologies. One of the technologies that can help banks concentrate on their core business is Cloud Computing Technology. With cloud computing banks would be able to concentrate their efforts in their core functions hence resulting into a reduction of the expense required to support services such as servers, storage and application.

1.3. Research Problem

Banking industry like any other service industry is facing a dynamic market, new technologies, economic uncertainties, fierce competition and more demanding customers. The dynamic nature of the banking market has presented an unprecedented set of challenges (Atos 2010). Furthermore, the total spending in African's banking sector on information technology (IT) systems is expected to rise by 25 percent yearly according to Zilibotti (2008). Hence, there is need for a technology that can address the issue of high cost on IT services without compromising on the level and quality of service offered to customers. Cloud Computing is one of the technologies that can be used.

Carr (2009) surveyed banks in United States, on awareness of the possibility of providing data processing and software applications as utility services over a public grid. The result

revealed that cloud computing knowledge was limited to a fairly small set of IT specialists, and the term cloud computing was little known and rarely used. IT managers and suppliers, moreover, dismissed the entire idea of the Cloud as a pie-in-the-sky dream due to the security concerns. Therefore, there is need to know whether the know-how of cloud technology has hit the Kenyan's commercial banking industry and gauge IT managers' attitude on Cloud Computing.

For an organization to adopt any technology, it must be aware of it, ready to adopt it and have a positive attitude on it (Brett, 2008). Therefore, there is need to put into test the adoption of cloud computing technology. There are several factors that influence the rate of adoption of any technology and Cloud Computing is not an exception. They range from awareness, attitude to the readiness in terms of infrastructure and management commitment. Gubala(2011) study on cloud computing in United state showed that significant security concerns continue to deter many firms from putting their data and core processes in the cloud thus raising a concern whether banks are willing to venture into cloud technology.

This research was geared towards finding out whether commercial banking industry in Kenya is aware, willing and ready to adopt cloud computing. According to Schneider (2009), banking industries are known to be very aggressive on new technologies and therefore it is necessarily to evaluate their awareness, attitude and readiness to adopt cloud computing. With the onset of stiff competition, interest rates wars on loans and technological disruption within the industry, banks are expected to reduce their operational costs so as to offer competitive interest rates and low cost services. As a result, banks in Kenya are compelled to develop competitive strategies that will enhance their survival. One way of ensuring profitability in banks is by reducing IT related costs. Reduction of IT costs can be achieved by banks paying for only what they use and not necessarily what they have hence the need for a technology such as Cloud Computing (Plummer and Smith, 2008).

The research sort to find out whether commercial banking industry in Kenya was aware of Cloud Computing technology, its readiness and its attitude towards Cloud Computing technology

1.4. Research Objectives

The objectives of this research were to:

- i. Determine the level of awareness on cloud computing in commercial banks in Kenya
- ii. Evaluate the bank's attitude towards cloud computing adoption in commercial banks in Kenya
- iii. Assess the readiness of cloud computing adoption in commercial banks in Kenya

1.5. Importance of the Study

The study aimed at assessing the level of awareness, willingness and readiness of cloud computing technology adoption in Kenya's commercial banks. 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 cater for cloud computing adoptability. Researchers and scholars may use the report as a point of reference and a source of secondary data for future research related cloud computing. Cloud Computing Vendors and service providers could use this report to evaluate customers' concerns and factors hindering them from adopting Cloud technology. Vendors will therefore be able to come up with a plan to address the concerns and hence help customers accept cloud technology.

CHAPTER TWO

LITERATURE REVIEW

2.1.Introduction

This chapter presents a review of the literature on the topic of awareness, attitude and readiness to adopt cloud computing in different organizations.

2.2.History Of Cloud Computing

The history of cloud computing dates back to the late 1960s when the idea of an "intergalactic computer network" was introduced by Licklider (1969), who was responsible for enabling the development of ARPANET (Advanced Research Projects Agency Network). Licklider's vision was that everyone to be globally interconnected and be able to access information regardless of where they are located. McCarthy(1960) contributed to the concept of cloud computing when he proposed the idea of computation being delivered as a public utility, similar to the service bureaus.

Since the 60's, cloud computing has taken different dimensions. The Internet started to offer abundant bandwidth in the 90's therefore cloud computing for the masses has been something lately developed. The first milestone for cloud computing was the launch of Salesforce.com (1999). It pioneered with the concept of delivering enterprise applications via a simple website. Salesforce paved the way for both specialist and mainstream software firms to deliver applications over the internet.

According to Mohamed (2009), in 2002 Amazon provided a suite of cloud-based services including storage, computation and even human intelligence through the Amazon Mechanical Turk. In 2006 Amazon launched Elastic Compute cloud (EC2) as a commercial web service that allows small companies and individuals to rent computers on which to run their own computer applications.

Google (2009) started to offer browser-based enterprise applications through services such as Google Apps. This was made possible by the hit of Web 2.0. The most important contribution to cloud computing has been the emergence of "killer apps" from leading technology giants such as Microsoft and Google. When these services are delivered in a

way that is reliable and easy to consume, the knock-on effect to the industry as a whole is a wider general acceptance of online services (Taber, 2009).

Other key factors that have enabled cloud computing to evolve include the maturing of virtualization technology, the development of universal high-speed bandwidth, and universal software interoperability standards (Turner, 2009).

The most noticeable company currently embracing the cloud computing model is Google. Google offers a powerful collection of web-based applications, all served via its cloud architecture. Some of these applications include Google Docs for word processing; Google presentations for presentation software, gmail for emails, Google calendar for calendar/scheduling functionality. Other major companies that embraced cloud include Microsoft. Microsoft for example offers its Windows Live suite of web-based applications. Amazon has its Elastic Compute Cloud (EC2), a web service that provides cloud-based resizable computing capacity for application development. IBM has established a cloud computing centre to deliver cloud services and research to client (Miller, 2009)

2.3. Models of Cloud Computing

There are several kinds of Cloud computing service that commercial banks in Kenya can adopt and they are categorized depending on the type of service being offered. The models include Software as a Service, hardware as a Service and Platform as a Service.

2.3.1. Software As A Service (SaaS)

SaaS, just as the name suggest, offers software as a service and not a product. Software or an application is hosted in remote servers by a service provider and provided to customers as a service across the Internet. The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure (Mel', 2009). This mode eliminates the need to install and run the application on the customer's local computers. The applications are accessible from various client devices through thin client interfaces such as web browsers. SaaS therefore alleviates the customer's burden of software maintenance and support and reduces the up-front expense of software purchases,

through less costly, on-demand pricing (Tucker, 2010). According to Bois (2010), Salesforce was one of the first SaaS providers supplying enterprise resource software such as customer relationship management software (CRM) and also providing the cloud platform for building and running business apps. Other examples of SaaS include the Application Service Provider (ASP). The ASP provides subscriptions to software that is hosted or delivered over the Internet. Google's Chrome browser provides another approach to SaaS by adopting an open source model. As an open, modern software browser, it has the potential to improve their customers' cloud computing experiences. A new desktop could be offered, through which applications can be delivered (either locally or remotely) in addition to the traditional Web browsing experience

2.3.2. Hardware As A Service

According to Tucker (2010), this form of service involves offering IT hardware, an entire data centre, network and processing provision and other fundamental computing resources to users on a pay – as – you - go basis. Consumer can deploy and run arbitrary software, which can include operating systems and applications (Mell, 2009). The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems; storage, deployed applications, and possibly limited control of select networking components such as host firewalls. This form of computing has also been described as hardware as a service (HaaS). The offering is made possible by the rapid advances in hardware virtualization, IT automation and usage metering and pricing. Examples of HaaS providers are Amazon EC2 and IBM's Blue Cloud project, Nimbus and Eucalyptus.

2.3.3. Platform As A Service (Paas)

A report by Mckinsey and Company (2008) entitled "Emerging platform wars in enterprise software" described PaaS as cloud based IDEs that not only incorporate traditional programming languages but include tools for mashup-based development. PaaS enable users to subscribe to their favorite computing platforms with customized requirements of hardware configuration, software installation and data access demands.

Cloud platform services or Platform as a Service (PaaS) deliver a computing platform and/or solution stack as a service while using cloud infrastructure and sustaining cloud applications. It facilitates deployment of applications without the cost and complexity of buying and managing the underlying hardware and software layers (The Guardian, 2008). Examples of PaaS include: Salesforce's Force.com based on the Salesforce SaaS infrastructure and Apex language, Bungee Connect which is a visual development studio based on Java, Long Jump which is based on Java/Eclipse31 , Google App Engine (which is based on Python and Django) and <http://beta.cloudo.com> where users can upload files and access them on the cloud environment and do coding for programs

2.4.Awareness on cloud computing

Before any organization can use cloud computing, it must be aware of existence of such a technology, what it is used for and where it can be applied. This section explores the surveys carried out to find out the level of awareness in different organization.

A survey on cloud computing awareness by Market Connections (2008) on U.S. defense/military and federal government unearthed that cloud utilization is poised for rapid gains as awareness of cloud computing grow. From the analysis 34 % of federal government, respondents were not familiar with cloud computing, 3 respondents out of five respondents did not expressly trust cloud computing, and 23 % of respondents did not know what their organizations are doing with cloud computing. The research clearly shows that cloud computing Knowledge is not widespread among agencies involved in cloud computing.

Gens(2010) revealed increased awareness on cloud services market among Asia/Pacific CIOs as compared to an IDC survey in 2009. According to the survey CIOs have been inundated with a barrage of information about the cloud within duration of 12 months. Today, they are better informed about this fast moving market and have become more ready to start making commitments in the cloud space (APEJ Cloud Computing end user survey 2010)

According to a survey carried out by Gartner (2010) in US with the objective of finding out the level of awareness revealed that CIOs are now better informed about the cloud business and therefore taking up the role of initiating commitment to the cloud space. Morris (2010) survey on end user awareness of cloud computing revealed that CIO are living source of awareness to the organization in regard cloud computing awareness and implementation initiative.

Techaisle survey(July, 2010) on cloud computing adoption of small businesses (1-99 employees) within US, UK, Germany, Italy and Brazil showed that only 37 percent of Small Businesses have heard about cloud computing. Among those who have heard about cloud computing, 13 percent said that they did not know what it meant. 44 percent of the respondents thought that cloud computing means subscribing to services such as servers or storage hosted by a third party and 29 percent thought that it meant access to applications over the web. Even among the 29 percent of small business that use SaaS (software As a Service), not all of them have heard of cloud computing, public cloud, or whether implementing the application in a private cloud is the best solution.

Barnes (2010) noted that while Cloud adoption and awareness have increased rapidly across the region, a large number of organizations are still reluctant to embrace it. Ernst & Young survey (2009) on cloud computing adoption rate in India revealed that 81% of Indian CIOs were familiar and aware of cloud computing concepts.

A survey of 300 corporations worldwide by Information Technology Intelligence Corp (2009) found that 38 percent are undecided or unsure about whether they will adopt cloud services, and another 47 percent said they are not considering implementing cloud in the next year reason being that Security is the biggest roadblock. This survey was in contrast to the results from a Microsoft survey released in the same month (June, 2009) that found that many companies were willing to adopt cloud computing within two years. The Information Technology Intelligence Corp survey uncovered that an overwhelming 85 percent majority of corporate customers were not willing to implement a private or public cloud computing infrastructure in 2009 for fears that cloud providers may not be able to adequately secure sensitive corporate data Laura (2009).

Miller (2010), the data center industry group, carried an interview on managers of large-scale data centers worldwide on data center trends survey that showed that cloud computing has very limited adoption within large data centers, despite it being high on the watch list for the managers of such data centers ;only 15 percent have implemented cloud computing.

Springboard (2009) carried out a study in regard to the awareness of cloud computing in Asia. The outcome was that the overall awareness of cloud computing in Asia Pacific excluding Japan was relatively low, with only 46 percent of survey respondents in the region having familiarity with the concept

As awareness continues to increase, organizations still don't know the options of converting their environment to cloud computing. A report published by HP(July, 2009) discloses that while there are many roads to cloud computing from existing client-server infrastructure, there are three major paths open to business users. The first approach is virtual machines (VM) to cloud. This is for users already running applications hosted on VMs, Virtual servers can be brought together to form a VM cluster. As VM clusters proliferate, automatic source allocation is required to manage the virtual machines within a VM cluster in order to handle load balancing across the cluster, and for self service access to resources. This approach leads to implementation of a private cloud run by an organization's internal IT department. The second approach is Grid to cloud, for organizations already running grid(distributed systems managed by IT staff and shared by technical applications that are typically compute or data intensive), a cloud management software can be deployed. The third approach is desktop to cloud. This approach allows users to access applications hosted in cloud computing centers run by external service providers directly from the desktop or other client devices

The diagram below shows the migration options

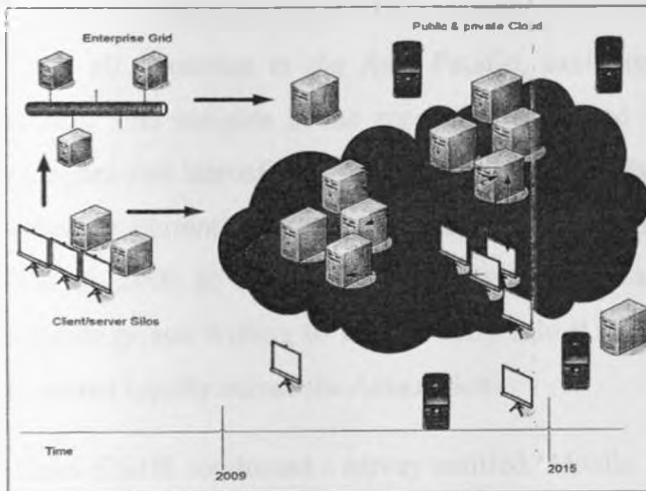


Figure 1: Migration options

Source: Cloud Computing and SOA Convergence in Your Enterprise Step-by-Step Guide, pg 270

2.5. Attitude on cloud computing adoption

According to Ellison (2010), the concept of cloud computing has aroused interest in the enterprise, but it is also clear that companies are testing their options to decide on whether they will adopt this technology. This behavior raises a question as to whether organizations are willing to venture into this. This section looks at the level of willingness in different organizations.

Ostrowski (2009) survey which aimed at finding out the level of adoption of cloud computing, 64% reported involvement with cloud computing. 72 percent were planning to expand the number and types of cloud computing services in the year 2010. Carolyn (2010) noted that there is a growing momentum in cloud computing, evidenced by climbing adoption rates and greater awareness. According to Carolyn, cloud computing adoption is still growing and in the years ahead, it will be one of evaluation, trial and error and, most importantly, opportunity as the market sorts through the role IT channel

companies will play, best business models, sales and marketing strategies and most relevant technologies.

A research entitled "*Cloud Computing in Asia Pacific 2010 – End-User Adoption Trends*" by Springboard (2010) reported that Cloud adoption has accelerated sharply across all countries in the Asia Pacific, excluding Japan (APEJ) during the last 12 months. The insights in the report were derived from interviews with 474 CIOs, IT managers and line of business managers. The study revealed that, 45% of organizations are either currently using or planning Cloud initiatives. An increase in adoption from 22% in 2009 to 45% in 2010 clearly shows that organizations are embracing this technology and willing to venture fully into it. Therefore adoption and awareness have increased rapidly across the Asia region.

Daniel (2010) conducted a survey entitled 'Mobile Technology and Business' in US: the survey result showed that many respondents (95%) were generally aware of the concept of cloud computing and believe that its role and significance will increase in the next five years. When asked which layer(s) of the Cloud the respondents have adopted or are most likely to adopt, only about 51% of the respondents answered that they are currently implementing or are planning to adopt some form of cloud service, with another 9% stating that they do not plan to adopt cloud services.

A study by Ponemon Institute(2010) carried out on 642 IT executives in the U.S and 283 in Europe, revealed that security is a major drawback to the adoption of the technology. Roughly half of worldwide IT organizations said that they were pretty that no one in their organizations knew about every cloud computing service that end users in their company were storing data on. Larry (May, 2010), noted that at the moment the risk factors with cloud computing are high because not all cloud computing providers have the same level of security. This factor has contributed to the organizations shying off from cloud computing.

A report entitled *Computing in Australia and New Zealand 2010 – End-User Adoption Trends*(2010) based on interview of 109 CIOs, IT managers and line managers revealed that Australia and New Zealand organizations lead in the Asia Pacific region in terms of

Cloud understanding and adoption. The report also revealed that Australia and New Zealand has doubled the implementation of cloud computing technology over the past one year. Security issues were noted as a major hindrance to the adaptation of cloud computing. According to Mel Greer (2010), cloud computing chief strategist at Lockheed Martin Information Systems and Global Services, cloud computing remains a mystery to one-third of IT decision makers.

A survey conducted by Mimecast(2010) examined the attitudes to cloud computing services amongst IT decision-makers in UK and US businesses. The survey revealed that majority of organizations i.e. 51 percent are using some form of cloud computing service, and the levels of satisfaction amongst those companies is high across the board. Conversely, companies not yet using cloud services cite concerns around cost and security. The survey showed that of those businesses using cloud services, 74 percent say that the cloud has alleviated internal resource pressures, 72 percent reported an improved end-user experience, 73 percent managed to reduce their infrastructure costs and 57 percent said that the cloud has resulted in improved security. However, not everyone was convinced. 74 percent of IT departments still believed that there is always a trade-off between cost and IT security and 62 percent said that storing data on servers outside of the business is risky.

Herman (2010) study on customers' use of cloud computing services in different countries, revealed that Two thirds of respondents (66 percent) are currently using cloud computing services including data storage and shared applications. A fifth said they already store personal medical and financial information in the cloud. The survey also noted that there is a significant difference in the penetration of cloud services by country. In Spain, for example, 89 percent use technologies that run in the cloud and In South Africa 79 percent. However, just half (51%) of US consumers have adopted cloud services, and 27 percent in Germany. It was noted that the main barriers to more use of cloud computing services are lack of awareness and lack of perceived need. If the global problems associated with privacy and security can be overcome to consumers' satisfaction, then this new, convenient and highly efficient channel for delivering

information and services is very likely to play a major part in the further development of the global marketplace (Matuszak, 2010).

Harris (2010) carried a survey focused primarily on IT director in large enterprise organizations (2,500-20,000 plus employees). According to the result; 77 percent use some form of cloud computing. The survey also went further to analyze the form of cloud computing organizations are/were willing to adopt i.e. private, public or a mixed approach. 50% of the respondents who use cloud services were on private model, 34 % on mixed approach (private and public), with 43 percent planning to increase their use of the combined approach.

Cloud computing has yet to gain real support among banks, many of which are concerned about security and potential risks of a technology they view as immature. In a survey conducted on business and technical banking executives by TechMarket View in conjunction with banking systems provider Temenos at Temenos' annual client forum in Monaco (May, 2010), banks have been slow to adopt cloud computing. Although bankers clearly know cloud campaign's potential for cost savings, the survey's results revealed that 44% of bank executives see the lack of data security as a significant barrier to the adoption of cloud computing. 15% of the respondents said they were running cloud applications. 80% of the respondents could not name a leader of cloud computing in the banking sector. Respondents described cloud computing as 'commodity' computing resources accessible over the internet at lower cost, with both business and technology executives consistent in their views. Nearly half of the banking executives said they viewed cloud computing as means to cut infrastructure costs, while over a third thought it would give more cost flexibility. However, a further one third of executives admitted they simply 'didn't know enough' about the potential risks. From the findings it seems adoption of cloud computing may be slow in the banking fraternity until some of the critical issues are resolved i.e. security issue

LogLogic survey in 2010 on 82 world's largest banks, investment houses and insurance uncovered that financial service firms are avoiding popular IT infrastructure investments such as cloud computing, in large part due to data security and transparency concerns.

While the financial services market has traditionally been a leader in adopting cutting edge information technology, few financial services companies said that they have plans to invest in new technologies, like cloud computing. In particular, the survey found that: 34 percent of respondents believe that cloud computing is not strategic to their company, while 26 percent of respondents believe their company is risk-averse to cloud computing. From the survey, financial firms are hesitant to adopt cloud computing. This is due to the lingering questions about data security and transparency in the cloud (Churchward,2010).

Ernst & Young carried a survey on Cloud Computing in India (2009) entitled "*Cloud adoption in India-Infrastructure as a Service (IaaS)*" and was based on interviews with 50 chief information officers (CIOs) from leading SMB, enterprises and IaaS ecosystem players. It reported that: 72% of India's IT infrastructure companies will adopt cloud computing in a big way over the next 2-3 years. 81% of Indian CIOs are familiar with cloud computing concepts. 72% of Indian CIOs cited data privacy and security issues as a concern area for their business while adopting cloud computing services. 58% of Indian CIOs consider ability to focus on core activities and usage based payments as the top business benefits of cloud computing services. 92% of India CIOs are inclined to buy cloud services from data center service providers and IT systems integrators

From a study carried out in India (Tripathi, 2009) with the aim of finding out whether organizations are willing to adopt the technology, the result revealed that cloud computing has not gone past the awareness phase. From the research not many decision makers understand the terminology of IaaS, PaaS and SaaS and the differences between public, private and hybrid clouds.

A Survey conducted by Bank Systems & Technology in 2010 entitled "Cloud computing survey" with the aim of finding out how strongly bankers feel about cloud computing revealed that security was a major concern. According to the report, 58 percent said cloud technology does not provide adequate security safeguards, 38 percent said that cloud technology is untested. 31 percent were concerned about auditing capabilities in cloud

environments, and 31 percent said cloud computing has no perceived business value (Crosman, 2010).

2.6 Readiness of cloud computing adoption

Opinion-Matters(2009) pointed out that a formal strategy is required to be put in place for adopting the cloud. With more core applications moving to cloud, organizations need to ensure they cover all the bases i.e. whether the existing internet connection cope with the additional bandwidth demands, the reliability of the service provider, a backup line if the main one fails and how secure cloud services are.

Policies, procedures, and regulations followed by the cloud vendor may not be consistent with your requirements and expectations of the client (Gartner, 2009). Therefore assessment to compare the vendor's policies and procedures against industry best practices and regulatory compliance is inevitable. Therefore, as the organization move towards cloud computing, the following have to be defined (IBM, 2009): Legal contract and SLA review, E-discovery and information management, Information and data lifecycle management, Compliance and audit, Business continuity and disaster recovery management, Information integrity and confidentiality assurance, Operation, administration, and access management procedures and Incident response management and forensics.

Hayes (2008) points out that allowing a third-party service to take custody of personal documents raises questions about control and ownership. If an organization changes service providers, will it be able to migrate with the data and if the organization fails to pay, will it lose access to documents? This clearly show that policies have to be laid out and agreed between the parties supported with tight service-level agreements (SLAs). This put to test the readiness of organization to venture into cloud computing.

Easenet carried a study of UK Small and Medium Size Businesses' in 2009 on readiness for cloud computing and revealed that Half of the businesses surveyed had more than one internet connection, reflecting businesses increased reliance on the internet. The other half had no backup line at all. This clearly shows that organizations have to align

themselves in term of infrastructure to ensure availability of the service in the cloud (Stening, 2010).

Gartner (2009) survey on mid-sized companies in US revealed that more businesses are improving their internet connection as they adopt the cloud (19% in 2009 vs. 13% in 2008), but this is still very low. Alarmingly, the vast majority of businesses (85%) aren't putting more stringent security measures in place and 71% lack a formal strategy

From a study carried out in India (Tripathi, 2009) with the aim of finding out whether organizations are willing to adopt the technology, the result revealed that cloud computing has not gone past the awareness phase. From the research not many decision makers understand the terminology of IaaS, PaaS and SaaS and the differences between public, private and hybrid clouds.

According to a report by Internet Governance Forum entitled "Internet Governance creating opportunity for all" (2009), developing countries are bound to face challenges in the cloud computing field. Computing is bandwidth and network intensive and many developing countries do not have adequate resources. Moreover the maintenance of the datacenters requires highly skilled personnel which lacks in these countries.

In conclusion Cloud computing has low levels of awareness, trust and adoption among IT decision makers. Despite all the attention cloud computing has received as one of the leading IT trends, most IT professionals are not familiar with it and a good number don't trust it.

Generally, awareness and willingness are lacking among professionals. While cloud adoption is expected to grow, professionals' inexperience with cloud computing, security concerns (and in some cases, lack of concern) and uncertainty about governance could make it difficult for organizations to venture into this technology or realize full value from it.

From the reviewed surveys in this chapter, as much as awareness is low, an improvement of awareness is noted and therefore cloud computing will continue to expand, gain popularity, and dominate information field due to its advantages, allowing users to have easy, instant, and individualized access to tools and information they need wherever they are, locatable from any networked device.

However, most of the surveys and research done has been concentrated in other continents other than Africa. There is therefore no clear and true picture on the awareness, willingness and readiness of cloud computing in Africa.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

This chapter provides a discussion of the research methodology. It discusses the research design used in the survey. It also discusses the population of study, data collection methods as well as data analysis and presentation methods employed.

3.2. Research Design

The research used descriptive research design. The design was preferred because the study was concerned with answering questions such as who, how, what, which, when and how much (Cooper and Schindler, 2000).

3.3. Population

The targeted population in the survey was the commercial banks in Kenya. The total number of commercial Banks in Kenya was 44 as at the time of study (See appendix II). A census was conducted on all the commercial banks.

3.4. Data Collection Methods

The study utilized primary data was collected with the help of a questionnaire. The questionnaires were structured and included close-ended type of questions. The questionnaires were administered to Information Technology (IT) manager/Chief Information Officer (CIO) depending on the organization structure in each of the commercial banks.

3.5. Data Analysis Methods

Descriptive statistics such as mean, frequencies and proportions were used to analyze the collected data. Information was presented in form of tables and charts. Data was analyzed with help of a Statistical Package for Social Sciences (SPSS) program.

CHAPTER FOUR

DATA ANALYSIS AND INTERPRETATION OF RESULTS

4.1. Introduction

This chapter presents analysis and findings of the study. The results are presented on awareness, attitude and readiness of cloud computing adoption in Kenyan commercial bank.

4.2. General Information

This section details the background information of the respondents and their banks. It gives information on the bank ownership, number of branches, gender of the respondents, age of respondents and how long they had worked in IT field.

4.2.1. Response Rate

A total of 44 questionnaires were administered to IT managers in the 44 commercial banks in Kenya. Thirty six questionnaires were returned resulting to 82% response rate. This was a good representation of the population.

4.2.2. Distribution of Respondents by Gender

Table 1 show that 85% of respondents were male while the rest (15%) were female.

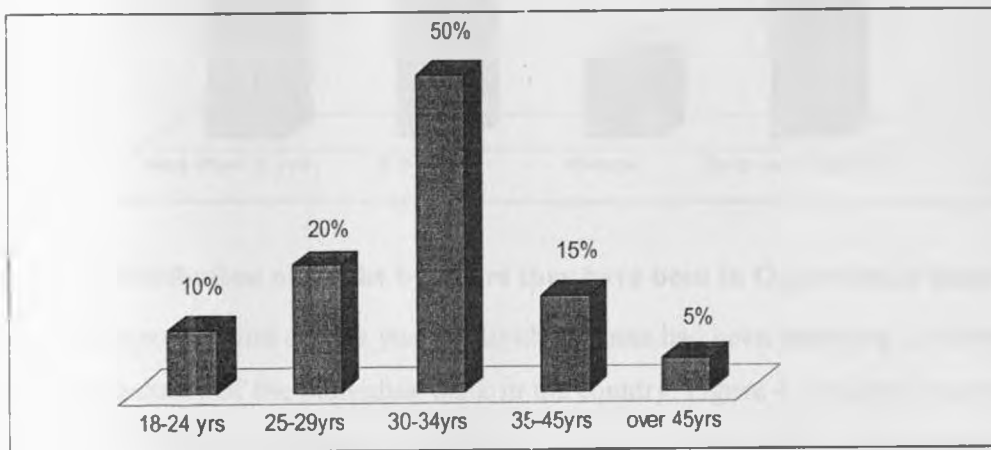
Table 1: Distribution of Respondents by Gender

Gender	Frequency	Percentage(%)
Female	5	15
Male	31	85
Total	36	100

4.2.3. Distribution of Respondents by Age

Figure 2, indicates that the majority of respondents (50%) were aged between 30-34 years, 20% were aged between 25-29 years, 15% were aged between 35-45 years, 10% were aged between 18-24 years while a small proportion (5%) were 45 years and above.

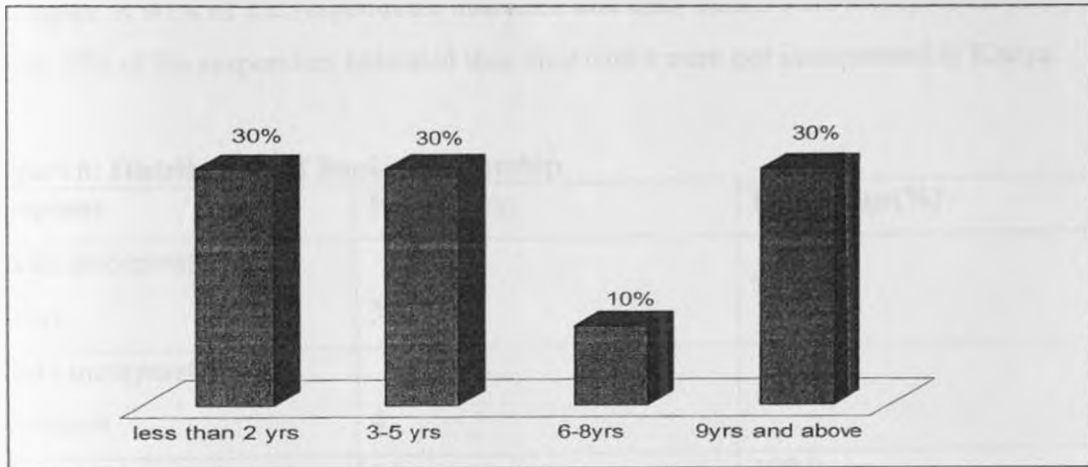
Figure 2: Distribution of Respondents by Age



4.2.4. Distribution of Respondents by Year of Service in IT field

The period one has worked in a certain field has an influence on their level of knowledge in that field. Figure 3 shows that, 30% of the respondents had worked in IT field for between 3 to 5 years, 30% for over 9 years and another 30% had worked in IT field for less than two years. A small proportion (10.0%) of the respondents had worked for between 6 and 8 years.

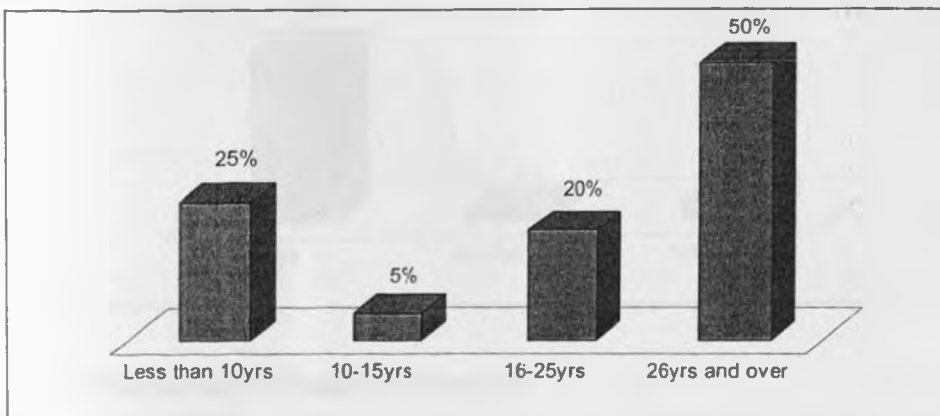
Figure 3: Distribution of Respondents by Year of Service in IT field



4.2.5. Distribution of Banks by Years they have been in Operation in Kenya

The study sort to find out the years individual banks had been operating in Kenya so as to test the maturity of the individual bank in the country. Figure 4, indicates that majority of the banks (50.0%) had been in operation for over 26 years, 25% for less than ten years, 20.0% between 16 and 25 years, while a small proportion of 5.0% between 10 and 15 years.

Figure 4: Distribution of Years banks have been in Operation in Kenya



4.2.6. Distribution of Banks' Ownership

On figure 5, 90% of the respondents indicated that their banks were incorporated in Kenya while 10% of the respondent indicated that their banks were not incorporated in Kenya.

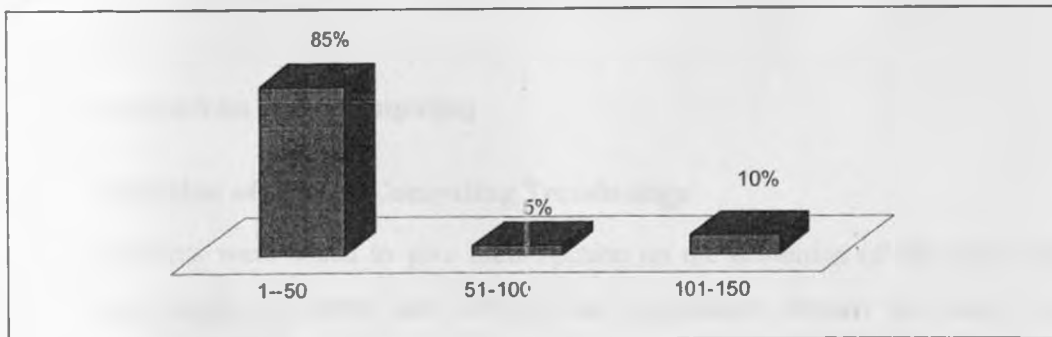
Figure 5: Distribution of Banks' Ownership

Response	Frequency	Percentage(%)
Banks incorporated in Kenya	32	90.0
Banks incorporated elsewhere	4	10.0
Total	36	100.0

4.2.7. Distribution of Banks by Number of Branches

On the number of branches , figure 6 indicates that 85.0% of the respondents' banks had 1 to 50 branches, 10.0% of the respondents indicated that their banks had 101-150 branches, 5.0% of the respondents indicated that their banks had 51-100 branches.

Figure 6: Distribution of Banks by Number of Branches



4.2.8. Distribution of Banks by Category

As shown in the Table 7, 70% of the respondents said that their banks were locally owned, while 30% were foreign owned.

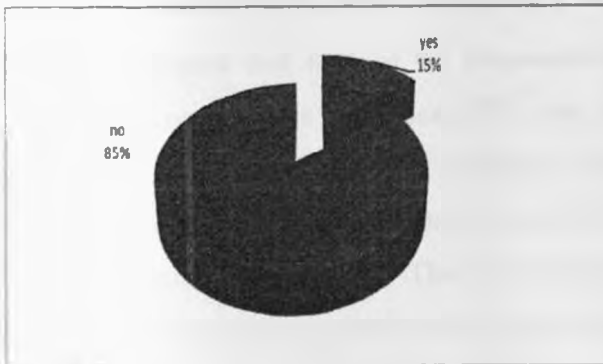
Table 2: Category of Bank

Category	Frequency	Percentage (%)
local	25	70.0
foreign	11	30.0
Total	36	100.0

4.2.9. Government Ownership

Figure 7 shows that 85% of the respondents indicated that government is not a major shareholder in their banks while 15% indicated that the government is a major shareholder in their bank.

Figure 7: Government Ownership

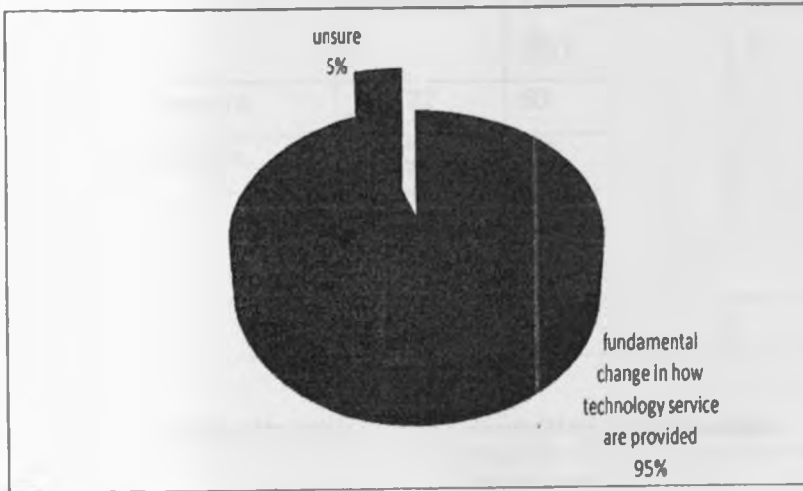


4.3. Awareness on cloud computing

4.3.1. Definition of Cloud –Computing Terminology

The respondents were asked to give their opinion on the definition of the term Cloud-Computing. Figure 8, shows that 95% of the respondents defined the word cloud-computing as fundamental change in how technology services are provided while 15% were not sure on the definition of the word cloud-computing. This clearly shows that majority of the IT managers are familiar with the term 'cloud computing'. The findings are in line with Ernst & Young survey (2009) on cloud computing adoption rate in India revealed that 81% of Indian CIOs were familiar and aware of cloud computing concepts.

Figure 8: Definition of “Cloud Computing”



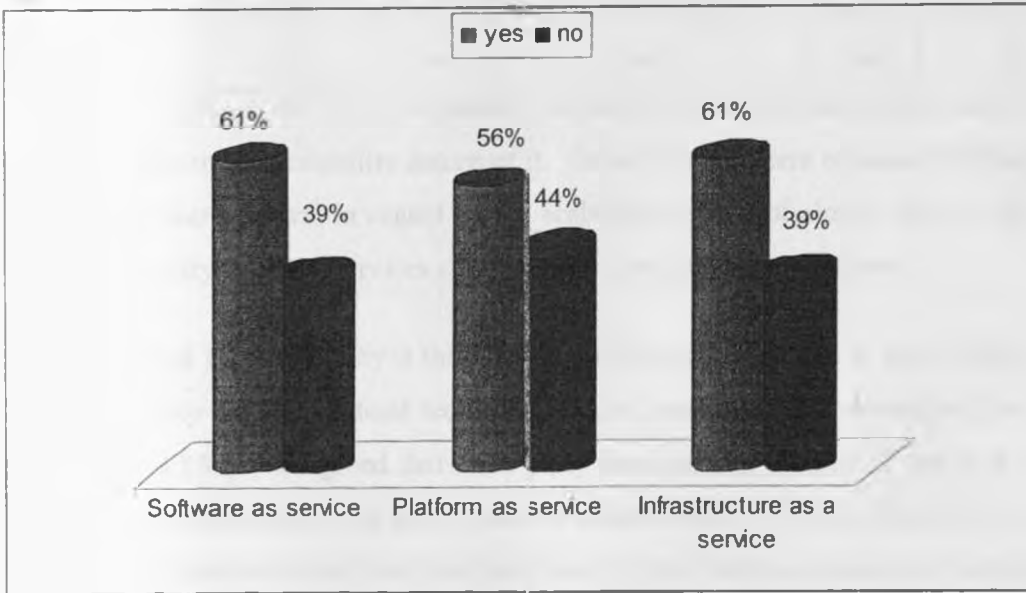
4.3.2. Familiarity with Cloud Computing Classification

Table 3, indicates that 60% of the respondents were familiar with cloud computing classification on software as service, 55% were familiar with platform as a service, 22% were aware of infrastructure as a service while 15% were unfamiliar with any classification. The result showed that a significant number of IT managers were aware of cloud computing classification. The findings contradicted with a study carried out in India (Tripathi, 2009) on organizations willingness to adopt the technology which stated that decision makers did not understand the terminology of IaaS, PaaS and SaaS. This indicates that awareness has increased over the years.

Table 3: Familiarity with Cloud Computing Classification

Cloud computing	Yes		No	
	Frequenc y	Percentage (%)	Frequenc y	Percentage (%)
Software as service	22	60	14	40
Platform as service	20	55	16	45
Infrastructure as a service	22	60	14	40
None	5	15		

Figure 9: Familiarity with Cloud Computing Classification



4.3.3. Factors that would drive banks into adopting cloud computing

Respondents were requested to rate factors that would drive them into adopting Cloud Computing technology in their banks.

Table 4: Factors that would drive banks into using Cloud Computing

	Strongly agree		Agree		Neutral		disagree		Strongly disagree		Index (%)	Rank
	count	%	count	%	count	%	count	%	count	%		
Capacity	15	41.7%	9	25%	5	13.9%	2	5.6%	5	13.9%	66.70%	3
Cost	20	55.6%	5	13.9%	5	13.9%	5	13.9%	1	2.78%	41.68%	6
Uptime	5	13.9%	10	27.78%	2	5.6%	12	33.3%	7	19.4%	55.60%	5
Management	5	13.9%	15	41.7%	7	19.4%	6	16.7%	3	8.3%	83.40%	1
Security	5	13.9%	3	8.3%	3	13.9%	5	13.9%	18	50%	69.50%	4
Performance	10	27.8%	17	47.2%	1	2.8%	1	2.8%	7	19.4%	66.70%	3

As shown in Table 4, 41.7% of respondents strongly agreed that they would adopt cloud technology due to the scalability nature of it. Twenty five percent of respondents agreed, while 13.9% were neutral in regard to the scalability nature of cloud. The rest felt that resizable capacity of cloud services cannot drive them into adopting cloud.

Management of IT services by a third party was not considered as a factor that would drive banks into adopting Cloud technology. Fifty percent of the respondents strongly disagreed and 13.9% disagreed that third party management of their IT services would make them move to cloud. This could indicate either majority of banks fear losing control of their IT services or do not trust third part handling their core applications or services.

Table 4 shows that, 55.6% strongly agreed and 13.9% of the respondents agree that they would adopt cloud technology so as reduce their IT cost. Majority of the respondents either strongly agreed or agreed that if use of cloud would result to reduction of IT cost, then they would adopt it.

On testing whether banks would adopt cloud so as to enhance and ensure uptime of IT services, 13.9% strongly agreed and 27.8% respondents agreed that they would use the technology so as to enhance uptime. However, 33.3% and 19.4% of the respondents felt

otherwise. This could indicate that majority of the respondents do not trust that cloud technology can enhance uptime and availability of IT services

As shown in Table 4, 13.9% of the respondents strongly agreed and 41.7% agreed that they would adopt cloud so as to reduce the deployment time and enhance deployment process of IT services. Therefore, the findings indicate that majority of the respondents would use cloud on new projects so as to save on time required to setup and deploy new services.

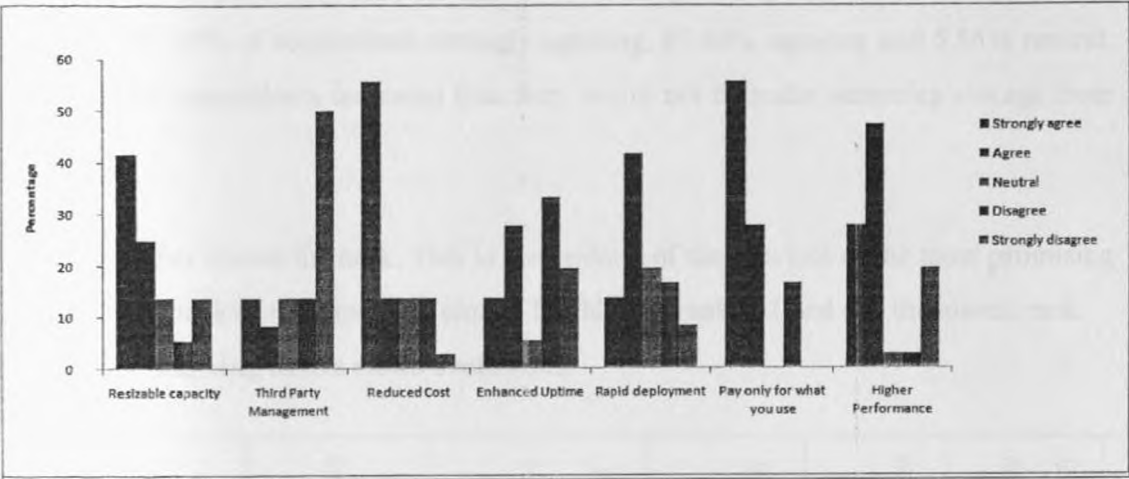
Respondents agreed that they would adopt cloud technology so as to pay for only those services they are using and not necessarily what they have. Nearly 55.6 % of respondents strongly agreed and 27.8% agreed that the concept of paying for only what the bank uses would drive their banks into adopting the technology. This could be attributed to the necessities of reducing operating cost of IT services.

Respondents felt that they would adopt Cloud technology so as to enhance the performance of IT services. Nearly 27.9% of respondents strongly agreed and 42.2% agreed that the need for better performance of IT services would drive them into cloud computing technology.

Pay for what is used factor was rated as the most factors that would drive users into adopting cloud with 75% either strongly agreeing or agreeing to it. Better performance was rated second; reduction in cost due to cloud adoption was rated fourth. Third party management was not considered as a factor that would drive banks into using cloud.

The results from the survey is in agreement with Mimecast(2010) survey on the attitudes on cloud computing services amongst IT decision-makers in UK and the survey showed that businesses were using cloud services to improve end-user experience, reduce infrastructure cost and improve on performance of IT services.

Figure 10: Summary of factors that would drive banks into adopting cloud computing



4.3.4. Most Promising cloud Area

The respondents were asked to indicate their level of agreement in regard to areas where they would have most promising active cloud. On rating access of server capacity on cloud, 33.33% of the respondents strongly felt that they would access server services on cloud, 47.22% felt that they would access the server capacity on cloud, 11.11% were neutral while 8.33% disagreed that they would access server capacity on cloud. On average 80.55% of the respondents either strongly agreed or agreed that access of server capacity on cloud has a chance of been adopted in their banks. The high rating of server capacity on cloud could be attributed to the high budget required to acquire high end servers, maintenance commitment and efforts required to setup hence banks would prefer to obtain the service at a cheaper cost.

Application/software access from cloud was rated highly. 38.89% of the respondents strongly agreed that they could move their application to cloud. 58.33% of the respondents agreed while 2.78% were neutral.

Backup and archival of data is also a possible candidate of cloud as shown by 22.22% of respondents strongly agreeing and 63.89% agreeing that they would backup and archive their data on cloud. Only 14.89% of the respondents did not consider backup and archival

as a candidate for cloud in their banks.

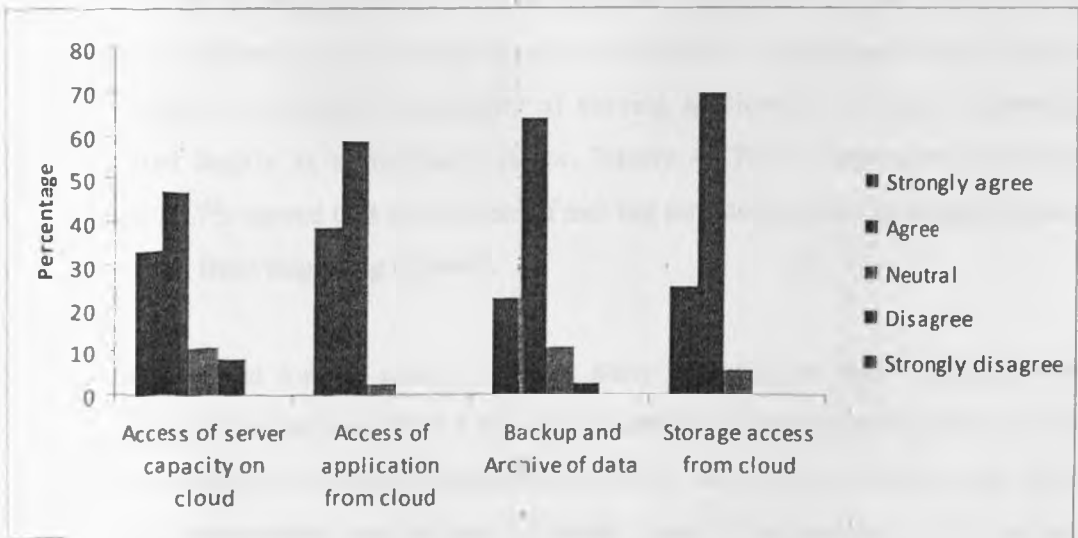
Majority of respondents would consider accessing storage services from cloud as indicated by 25% of respondents strongly agreeing, 69.44% agreeing and 5.56% neutral. None of the respondents indicated that they would not consider accessing storage from cloud.

Table 5 further shows the rank. This is the ranking of the services of the most promising services that banks would move to cloud. The highest rank is 1 and 4 is the lowest rank.

Table 5: Promising active cloud evaluation

	Strongly agree		Agree		Neutral		disagree		Strongly disagree		Index	(%)
Access of server Capacity on cloud	12	33.33%	17	47.22%	4	11.11%	3	8.33%	0	0.00%		
Application/software access from cloud	14	38.89%	21	58.33%	1	2.78%	0	0.00%	0	0.00%		
Backup and archival of data	8	22.22%	23	63.89%	4	11.11%	1	2.78%	0	0.00%		
Storage access from cloud	9	25%	25	69.44%	2	5.56%	0	0.00%	0	0.00%		

Figure 11: summary of services that banks would move to cloud



4.4. Willingness on Cloud Computing Adoption

4.4.1. Implementation of Cloud Computing

The study further sought to establish whether the respondents had implemented cloud based services. Table 6, indicates that none of the respondents' banks had implemented cloud based services. This indicates that banks have shied away from cloud. The findings are in line with Daniel (2010) survey entitled 'Mobile Technology and Business' on cloud computing adoption where majority of respondents said that they do not plan to adopt cloud services.

Table 6: Level of Cloud Computing Adoption

Response	Frequency	Percent
Banks that have implemented Cloud	0	0%
Banks that have not implemented cloud	36	100%
Total	36	100%

4.4.2. Reasons for not Adopting Cloud Computing

None of the respondents' banks had implemented cloud technology. Table 7, gives a summary of the hindering factors. Security concern was rated as the most hindering factor with 91.7% strongly agreeing. The findings are in line with Monaco (May, 2010) where bank executives saw the lack of data security as a significant barrier to the adoption of cloud computing. Complexity of moving applications to cloud computing was also rated highly as a hindrance factor. Nearly 41.7% of respondents strongly agreeing and 16.7% agreed that the process of moving services to cloud is complex hence preventing them from migrating to cloud.

Respondents felt that loss of control to third party management was a hindrance to moving to cloud. An average of 69.4 % of respondents strongly agreeing and 22.2 % agreed that the idea of a third party managing banks' IT service is not ideal, while 2.8% of respondents were neutral on the issue. A small group of respondents, 5.6%, did not

consider third party management concept as a hindrance to moving to cloud.

It was interesting to note that 36.1% of respondents agreed and 27.8% strongly agreed that cloud computing was not cheap enough. This is in agreement with Mimecast(2010) where cloud computing was considered not cheap enough.

As shown in the table 7, 25% of respondents strongly agreed and 19.4% agreed that moving to cloud will decrease the level of flexibility and customization of their service. Hence they did not consider cloud as a technology they would adopt. However, 55.6% of respondents did not consider decreased of flexibility as a hindrance factor to migrating to cloud.

Table 7 further shows how the factors hindering the adoption of cloud are ranked. The ranks are 1 to 5 with one been the highest ranked.

Table 7: Reasons for not implementing Cloud Computing

	Strongly agree		Agree		Neutral		Disagree		Strongly disagree		Index(%)	Rank
	Count	%	Count	%	Count	%	Count	%	count	%		
Security Concerns	33	81.7	2	5.6	1	2.8	0	0	0	0	97.30	1
Complexity of Moving Apps for Cloud	15	41.7	10	27.8	6	16.7	5	13.9	0	0	69.50	3
Loss of Control to Third party	25	69.4	8	22.2	1	2.8	2	5.6	0	0	91.60	2
Not Cheap enough	10	27.8	13	36.1	4	11.1	1	2.8	8	22.2	63.90	4
Decreased flexibility	9	25	7	19.4	0	0	11	30.6	9	25%	44	5

Figure 12: Summary for not implementing Cloud Computing



4.4.3. Bank's Strategy towards Cloud Computing

The study sought to establish from the respondents the statement that best described their bank's strategy towards cloud computing. A small group of respondents (27.8%) indicated that their banks had discussed cloud computing formally and it was part of their IT strategy. Table 8, shows that 22% of the respondents indicated that cloud computing had been discussed formally but no adoption plan was in the pipeline. Majority of respondents (41.7%) said Cloud computing had not been discussed as a topic within their banks, while 8.3% of respondents indicated that cloud computing had only been discussed informally. The study shows that majority of the commercial banks were not keen on cloud. The findings are in agreement with Gartner (2009) survey on mid-sized companies on Cloud Technology in US which revealed that majority of companies lacked a formal strategy

Table 8: Bank's Strategy towards Cloud Computing

	Frequency	Percentage
Cloud computing has been discussed formally and it is part of our (IT) strategy	10	27.8
Cloud computing has been discussed formally but no implementation plan in the pipeline	8	22.2
Cloud computing has only been discussed informally	3	8.3
Cloud computing has not been discussed as a topic within our organization	15	41.7

4.4.4. Banks' 2011 IT Budget Set Aside for Cloud Computing Usage

The percentage of the banks' 2011 IT budget set aside for cloud computing usage was put into test. Table 9, shows that none of the banks had allocated any budget and therefore this could indicate that banks are not keen on cloud computing.

Table 9: Banks' 2011 IT Budget Set Aside for Cloud Computing Usage

Proportion	Response	Percent
None	36	100%
Less than 2%	0	0%
2-5%	0	0%
5-10%	0	0%
more than 10%	0	0%
Totals	36	100%

4.4.5. Level of Services to be in Cloud in 2 Years

The percentage of the banks' IT services that would be delivered from a cloud platform over the next 2 year was tested. From Table 10, none of the banks, foresee their services been delivered on cloud over the next 24 months. The findings raised concerns on whether Kenya's commercial banks will ever embrace Cloud Computing. The findings

are in line with Monaco (2010) findings where the results revealed that banks have been slow to adopt cloud computing as much as they are aware of potential benefits of cost savings.

Table 10: Level of cloud usage

Proportion	Response	Percent
10-25%	0	0%
51-75%	0	0%
1-9%	0	0%
26-50%	0	0%
More than 75%	0	0%
None	36	100%
Totals	36	100%

4.4.6. Cloud adoption Attitude statement

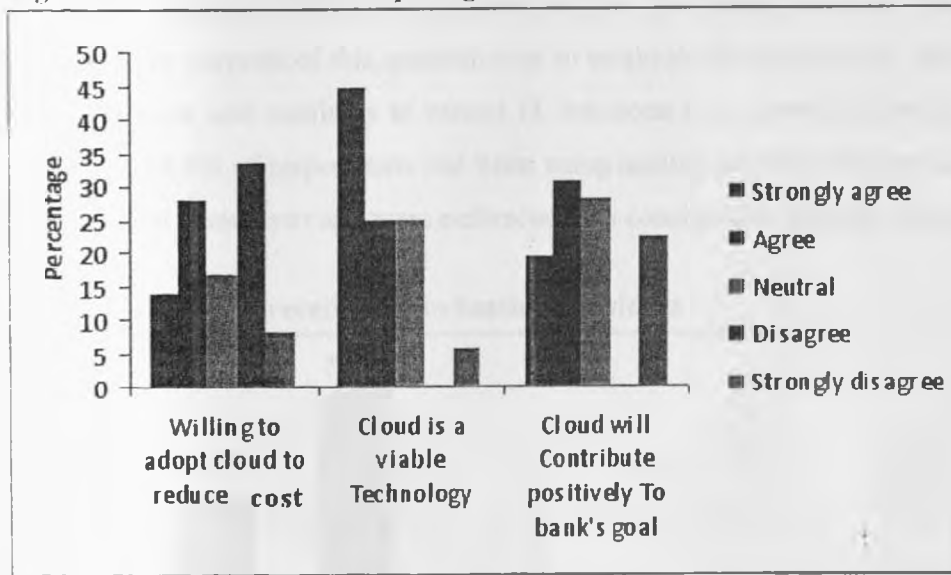
Table 11 indicates that a considerable number of respondent agreed that cloud computing is a viable technology for their banks. Forty four percent of respondents strongly felt that cloud Computing is a technology that can be used in their organization. Twenty five percent of the respondents felt that cloud is a usable technology in their bank while 25% were neutral. As much as there were no respondents who felt that cloud cannot be adopted in their banks, it raises a concern why majority of the respondents have not adopted it and not planning to adopt it in the nearby future as indicated by the Table 10.

Thirty three percent of the respondents felt that cloud technology was not cheap enough however, 13.9% and 27.8% respondents felt that a considerable amount of money can be saved by using cloud service. The findings further revealed that cloud computing could contribute positively towards the banks' goal as majority of the respondents agreed as shown in table 11 with a percentage of 30.6 agreeing and 19.4% strongly agreeing.

Table 11: View of cloud Technology

	Strongly agree		Agree		Neutral		Disagree		Strongly disagree		index
	Count	%	Count	%	Count	%	Count	%	count	%	
Willing to adopt cloud to reduce coast	5	13.9%	10	27.7%	6	16.7%	12	33.3%	3.00	8.3%	41.3%
Cloud is a viable Technology	16	44.4%	9	25%	9	25%	0	0%	2	5.6%	69.4%
Cloud will Contribute positively To bank's goal	7	19.4%	11	30.6%	10	27.8%	0	0%	8.00	22.2%	50%

Figure 13: View of cloud computing



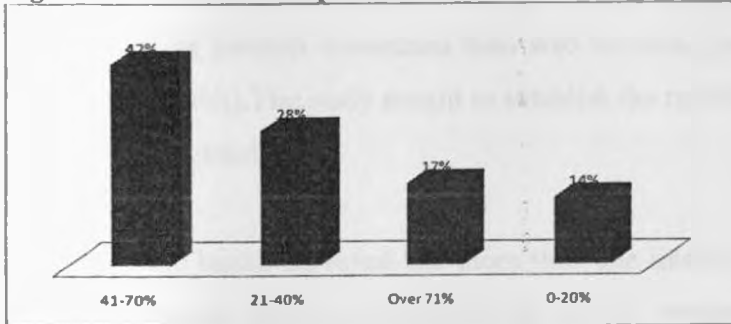
4.5. Readiness of cloud computing adoption

4.5.1. Level of computerization

Majority of the respondents(42%), as shown in figure 14, had computerized their activities between 41-70% of their operations followed by 28% who had computerized between 21-40% of their operations. 17% of the respondents had computerized over 71% of their activities while 14% of the respondents had their level of computerization between 0-20%. Majority of the respondents have computerized their activities, this means that they can easily move their services to cloud since computerization is a

backbone to cloud computing.

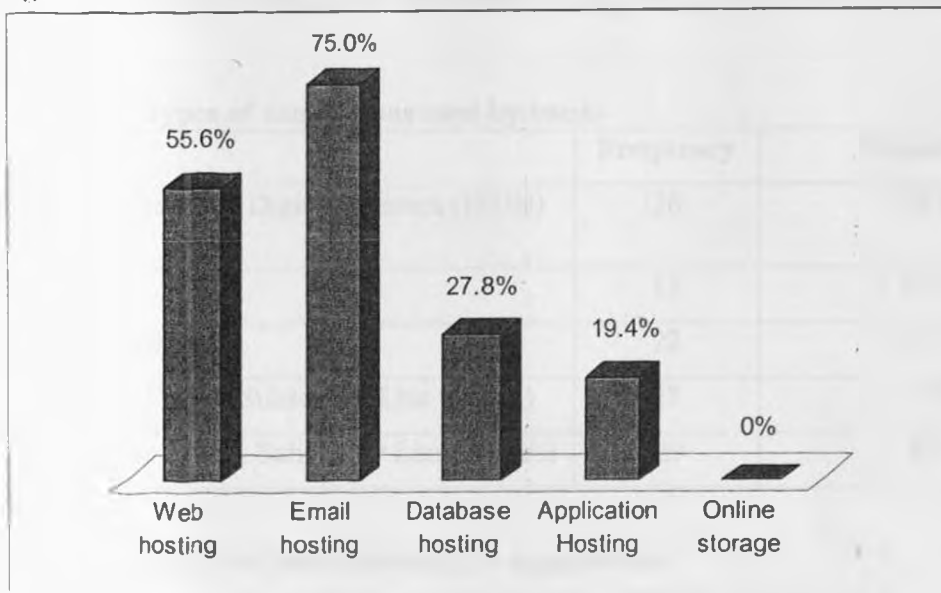
Figure 14: Level of computerization



4.5.2. Services Received From Hosted Providers

The study sought to establish the services that the banks received from a hosting provider. The purpose of this question was to establish the respondents' familiarity with hosted services and readiness to extend IT functions to an external provider. Figure 15 show that, 35.5% of respondents had been using hosting provider in some capacity. This indicates that hosted services were embraced by a considerable number of banks.

Figure 15: Services received from hosting providers



4.5.3. Type of Internet connection

Internet connectivity, in particular the type of connection and speeds available, is certainly important in cloud. This is due to the fact that cloud computing places different demands on an internet connection than web browsing (in particular a greater focus on upload bandwidth). The study sought to establish the type of connection the banks used as they look into cloud.

Several of the banks surveyed had more than one internet connection, reflecting banks' increased reliance on the internet. This means that several of banks have a backup line in case the primary one fails. These findings are in line with Easenet(2009) readiness of cloud computing study of UK Small and Medium Size Businesses which revealed that half of the businesses surveyed had more than one internet connection, reflecting businesses increased reliance on the internet. Table 12 shows that, 72.2% of respondents connected on Integrated Services Digital Network (ISDN), 41.7% on Cable, 61.1% on Fibre/Leased line, 75% on Symmetric Digital Subscriber Line (SDSL) and 80.5% on Asymmetric Digital Subscriber Line (ADSL). The results showed there is a definite appetite for higher bandwidth connections among banks and this is in line with cloud computing.

Table 12: Types of connections used by banks

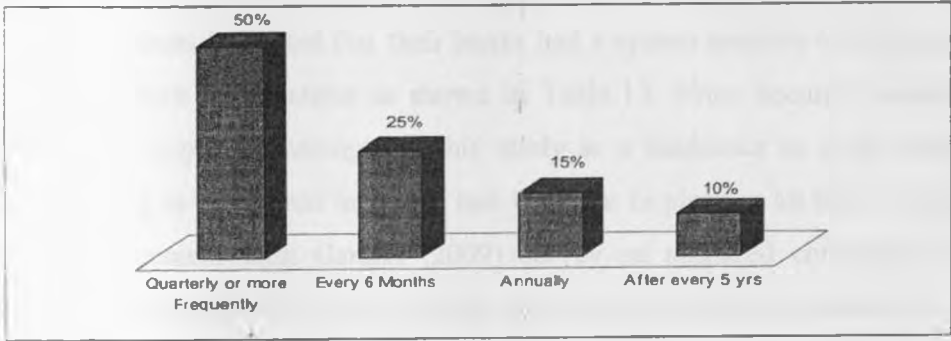
	Frequency	Percentage
Integrated Services Digital Network (ISDN)	26	72.2%
Cable	15	41.7%
Fibre/Leased line	22	61.1%
Symmetric Digital Subscriber Line (SDSL)	27	75%
Asymmetric Digital Subscriber Line (ADSL)	29	80.5%

4.5.4. Frequency of bank updating its applications

Figure 16 indicates the frequency at which banks update their users' applications. Fifty percent of respondents indicated that their bank update their applications on quarterly or more frequently basis, 25.0% of the respondents indicated that bank update its applications every 6 months, 15% of the respondents indicated that bank update its

applications annually, while 10% of the respondents indicated that bank update its applications after every 5 yrs. With cloud computing the burden of updating the application will be moved to the cloud provider hence enabling the banks to concentrate on their core business.

Figure 16: Frequency of bank updating its applications



4.5.5. Readiness Test

The banks' readiness for cloud was tested.

Table 13: Readiness Test

	Yes(%)	No(%)
Whether the bank has trained employees on cloud computing	25	75
Does the bank have network management tools that monitor the network performance and availability	80	20
Does the bank have a system security team that audit the net work and systems	100	0
Has the bank been experiencing undue network latency	45	50

Table 13 indicates that 75% of the respondents indicated had not trained employees on cloud computing, while 25% had trained employees. This indicates that banks have not embraced cloud technology and the management has a long way to go incase they are to adopt the technology since knowledge of cloud is vital to the IT personnel.

Most of the respondents' banks indicated that they had network management tools to monitor the network performance and availability as indicated by 80.0% of respondents. This indicates that most banks can easily move to cloud since they have mechanism for performance and availability monitoring and hence can easily detect any network related issue or latency.

All respondents indicated that their banks had a system security team that does auditing of the network and systems as shown in Table 13. Since Security concerns on Cloud technology came out strongly in this study as a hindrance to cloud adoption, it was encouraging to note audit measures had been put in place in all banks. The findings are not in agreement with Gartner (2009) survey on mid-sized companies in US which revealed that companies are not putting more stringent security measures in place.

Table 13, indicates that 55% of the respondents' bank had not experienced undue network latency, while 45% of them indicated that their bank had been experiencing undue network latency. The success of accessing services from cloud is highly dependant on a good network, therefore there should be no network latency and if any, banks need to address the issue before moving cloud.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter gives a summary of the whole survey. In addition, the recommendation given on the study will be of great help to commercial banks.

5.2 Summary

The study sought to survey on awareness, attitude and readiness of cloud computing adoption in commercial banking industry. The study was guided by three research objectives which included determining the level of awareness on cloud computing in commercial banking industry in Kenya, evaluating the bank's attitude towards cloud computing adoption in banking industry in Kenya and assessing the readiness of cloud computing adoption in commercial banking industry in Kenya.

The findings indicated that majority of the IT managers were aware of cloud computing technology. More so, a considerable number of the respondents were familiar with cloud computing classification software as a service, infrastructure as a service and platform as a service. The findings clearly show that cloud computing concept is known to many IT managers in the banking industry.

The study also sorts to find out the attitude of IT managers on cloud technology. The results revealed that none of the respondents' banks were using the technology nor was there any IT budget assigned to cloud projects. The study also revealed that none of the banks was willing to put its IT services to cloud within the next 2 years. 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 commercial banks into adopting 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 (75% respondents) had not trained their IT personnel on cloud technology. A technology cannot be used if the supporting teams have no know-how of the 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 all banks have a security and audit team in place and majority of them have network monitoring tools.

5.3 Conclusions

Putting into considering the research questions of this study, various observations were made that lead to the following conclusions

5.3.1 Awareness on Cloud Computing in Commercial Banking Industry In Kenya

The study revealed that most of the commercial banks' IT managers/CIOs in Kenya were aware of cloud computing concept as supported by 95.0% of the respondents who defined the word cloud-computing correctly. This is in line with Ernst & Young survey (2009) on cloud computing adoption rate in India revealed that 81% of Indian CIOs were familiar and aware of cloud computing concepts. The survey also indicated that majority of CIOs/IT managers knew the different types of classification of cloud technology. Sixty percent of the respondents were familiar with cloud computing classification software as service, 55% were familiar with platform as a service, 60% were aware of infrastructure as a service and only a small percentage (15%) was unfamiliar with any classification.

Twenty five of the respondents had indicated that they were using cloud. On following up, it was discovered that respondents did not differentiate between highly virtualized environment and cloud computing concept. This indicates that cloud computing concept is not widely understood as shown by a number of respondents who did not know the particular attributes of cloud. Confusing virtualization concept with cloud computing indicate that some respondents have a vague understanding of cloud technology.

On testing the services that banks would consider moving to cloud, access of server

capacity on cloud was rated highly. An average 80.6% of respondents either strongly agreed or agreed that they would access server capacity from cloud. The findings indicate that commercial banks are more willing to access online servers as compared to having their own server in the datacenter. The Finding also indicated that 94.1% of the respondents would consider accessing storage from cloud. On average 94.4 % of the respondents would consider using backup and archive services from cloud. From the study, majority IT managers/CIOs seem to know the concept of cloud technology and services that can be migrated to cloud.

5.3.2 Commercial Bank's Attitude towards Cloud Computing

From the study findings, it was concluded that banks in Kenya have shied away from cloud computing. Hayes (2008) points out that allowing a third-party service to take custody of personal documents raises questions about control and ownership. Commercial banks were also more concerned about the security, control and ownership of their data. This was supported by the findings which ranked security concerns as one of the major factor hindering adoption of cloud with 97.2 % of the respondents either strongly agreeing or agreeing that security is a major issue in the cloud. On average 91.6% of the respondents considered loss of Control due to third party management as another factor hindering them from using cloud services. This indicates that banks are not ready to have a third part manage its critical application. Complexity of moving applications to cloud computing was also considered as a factor hindering adoption of cloud service with 69.5 % of the respondents supporting agreeing to this factor. This means banks consider moving services to cloud complex and could be attributed to factors such as: highly customized applications, incompatibility of character sets, data quality issues among others. Sixty four percent of respondents felt that cloud technology is not cheap enough. All these factors affected the attitude of Kenya's commercial banks in the implementation of cloud computing.

None of the respondents' banks in Kenya were using cloud computing, this shows there is obvious an issue. None of the respondents' banks had set aside an IT budget for cloud projects. This indicates that banks are not ready to make any investment in cloud

computing as for now

It was interesting to note the responses from the survey in regards to the percentage of the banks' IT services that would be delivered from a cloud platform over the next 2 years. All respondents (100%) said that none of their services would be delivered through cloud. This response raises a concern on whether there is a corporate agreement on the benefits that reside in the cloud.

Majority of the respond indicated that cloud had not been discussed in their organization (41.7%), 22.2% of respondents said that cloud computing had been discussed formally but no adoption plan was in the pipeline and 8.3% respondents said that cloud computing had only been discussed informally. Only 27.8% indicated that Cloud Computing had been discussed formally and it is part of our (IT) strategy. The findings indicate that majority of the commercial banks are not keen on cloud because they have not enforced it in their strategy and this means cloud technology has a long way to go before commercial banks can venture into it.

5.3.3 Readiness of cloud computing adoption

For commercial banks to adopt cloud technology they need to be ready in terms of know-how, infrastructure, digitization of data, and security mechanism among others. The study revealed that a considerable number of banks had computerized their activities and data. Forty two percent of respondents had computerized between 41-70% of their banks activities and data. Seventeen percent of respondents had computerized over 70% of their activities. However there are banks that had a low level of computerization, 28% of the respondents had only computerized between 21-40% of their activities and 14% had computerized between 0-20 percent of their activities. Computerization is one of the major factors that need to be considered before moving to cloud. Any data that need to be moved to cloud has to be in digital form. Therefore, some banks have a lot to do before they can think of moving to cloud.

The backbone of cloud is internet connection and the speeds are of essence. Backup connectivity is also a necessity if the bank is to move to cloud. From the study more than half of the respondents did not have a backup connection. However, with the rolling out of Fibre Optic in Kenya many banks might express optimism in adopting cloud computing as this would improve reliability, accessibility of the data and reduces network latency for those banks experiencing network latency.

In most commercial banks, the study revealed that there was a knowledge gaps on cloud technology. Seventy five of the respondents had not trained their IT personnel on cloud. Training of the employee is necessary before any bank can think of embracing any technology. As much as all respondents reported that they had a security team in place, it raises a concern on whether they are aware on what to be on lookout in the cloud setting since they have not been trained on cloud technology.

5.4 Policy Recommendations

The study recommends that IT personnel be trained on cloud computing technology. As noted from the study, a considerable number of IT managers could not differentiate between virtualized environment and cloud computing technology.

The study also recommends that banks be enlightened on the benefits of cloud computing including its advantages and disadvantages so as to increase its usage and the range of services that banks can migrate to cloud computing. More enlightening will enable commercial bank appreciate cloud technology and hence invest in it.

Cloud computing vendors also need to address the issue of security as raised by respondents. This can be done through seminars or publications thus enlightening the target groups.

5.5 Limitations of the Study

There were several limitation encountered during the study. Banks are known to have strict data security policies. Therefore, respondents would refer the researcher to the authorizing unit to have the approval before they could fill the questionnaires. Most

requests were rejected and the researcher had to use other channels to get the information. This therefore raises a concern about the integrity of data collected.

Most respondents cited that the information that was been requested was highly confidential. There is a possibility that the information provided did not give a true scenario of the banks.

5.5 Recommendation for Further Studies

Factors hindering adoption of cloud were identified in the study. However, the survey did not seek to find solutions hindering adoption of cloud. The researcher therefore recommends further studies on the challenges facing cloud technology in banking industry and a recommendation on how they can be addressed.

The study also suggests that further research be conducted on major industries operating in Kenya to establish the level of cloud computing and its effects on information management systems.

Security concerns strongly came out of this study as one of the major hindrance of adoption of this technology. The study therefore recommends that a research be conducted on how cloud computing vendors are addressing the security concerns.

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APPENDICES

APPENDIX I: INTRODUCTION LETTER

University Of Nairobi,
School of Business
MBA program
P.o. box 30197
Nairobi

To whom it may concern

Dear Madam/ Sir

RE: INTRODUCTION LETTER

The bearer of this letter Elizabeth Wangui Kiiru registration D61/71110/2009 is a Master of Business Administration (MBA) student of the University of Nairobi. She is required to submit as part of her coursework assessment a research project on a management problem. We would like the students to do their projects on real problems affecting firms in Kenya. We would, therefore, appreciate if you assist her by allowing her to collect data in your organization for the research.

The results of the report will be used solely for academic purposes and a copy of the same will be available to the interviewed organizations on request.

APPENDIX II: QUESTIONNAIRE

I am a postgraduate student undertaking a Master of Business Administration degree at the University of Nairobi. I am currently carrying out a survey on cloud computing adoption in banking industry. I kindly request you to support my course by providing the required information. The information required is purely for academic purposes and will be treated in the strict test of confidentiality. A copy of the research project will be made available to you upon request. I will appreciate your cooperation in this academic exercise.

Thanking you in advance

PART I: GENERAL INFORMATION

1. Gender (select your gender)

- Female Male

2. Please select your age

- 18-24 25-29 30-34 35 – 45 Over 45

3. For how long have you worked in IT industry?

- Less than 2 years
 3-5 years
 6-8 years
 9 years and over

4. How long has your bank been in operation in Kenya?

- Less than 10 years
 10-15 years
 16-25 years
 26 years and over

5. Is your bank incorporated in Kenya? (Select one)

Yes No

6. How many branches does your bank have?

1 to 50

51 to 100

101 to 150

151 to 200

201 and above

7. Which category does your bank fall into?(select one)

Local Foreign

8. Is the government a major shareholder in your bank?

Yes No

PART II: AWARENESS ON CLOUD COMPUTING

1. When you hear the term “cloud-computing,” what definition first comes to mind?(select one)

Fundamental change in how technology services are provided

A tool that might work for another company

Another buzzword

Unsure

2. Which cloud computing classifications are you familiar with? (select all applicable)

Software as a Service

Platform as a Service

Infrastructure as a Service

None

3. To the best of your knowledge, please rate the factors that will drive your bank into adopting cloud computing (Single response only per statement)

	Strongly agree	Agree	Neutral	disagree	Strongly disagree
a) Resizable Capacity of infrastructure	①	②	③	④	⑤
b) Third party managing your IT services for you	①	②	③	④	⑤
c) Reduced capital Cost	①	②	③	④	⑤
d) Enhanced Uptime/High availability of IT services and infrastructure	①	②	③	④	⑤
e) Rapid deployment of application and IT infrastructure	①	②	③	④	⑤
f) pay only for what you use	①	②	③	④	⑤
g) Higher Performance of IT services	①	②	③	④	⑤

4. Please rate your level of agreement on where you would have most promising active cloud evaluation? (Single response only per statement)

	Strongly agree	Agree	Neutral	disagree	Strongly disagree
a) Access of server Capacity on cloud	①	②	③	④	⑤
b) Application/software access from the cloud	①	②	③	④	⑤
c) Backup and archival of data	①	②	③	④	⑤
d) Storage access from cloud	①	②	③	④	⑤

PART III: ATTITUDE ON CLOUD COMPUTING ADOPTION

1. Has your bank implemented cloud based services? (single response)

Yes No

a) If no to No. 13 above, is it considering or planning on implementing cloud based services? (single response)

Yes No

b) If no to No. 13 above, please rate the factors preventing your company from using the cloud? (Single response per statement)

	Strongly agree	Agree	Neutral	disagree	Strongly disagree
a) Security Concerns	①	②	③	④	⑤
b) Complexity of moving application to cloud	①	②	③	④	⑤
c) Loss of Control due to third party	①	②	③	④	⑤

management					
d) Not cheap enough	①	②	③	④	⑤
e) Decreased flexibility: Special customization not possible	①	②	③	④	⑤

2. Which statement best describe your bank's strategy towards cloud computing?

- Cloud computing has been discussed formally and it is part of our (IT) strategy
- Cloud computing has been discussed formally but no adoption plan in the pipeline
- Cloud computing has only been discussed informally
- Cloud computing has not been discussed as a topic within our organization

3. What percentage of your 2011 IT budget was set aside for cloud computing usage

- None
- <2%
- 2%-5%
- 5%-10 %
- >10%

4. Over the next 24 months, what percentage of your IT services do you estimate will be delivered from a cloud platform? (Single response)

- None

- 1%-9%
- 10% -25%
- 26%-50%
- 51-75%
- More than 75 %

5. Please rate your level of agreement on the following statements in regard to your bank (Single response per statement:)

	Strongly agree	Agree	Neutral	disagree	Strongly disagree
a) Willing to adopt new technology to save on future costs	①	②	③	④	⑤
b) Cloud computing is a viable technology option	①	②	③	④	⑤
c) Cloud computing will contribute positively towards achieving the bank's goal	①	②	③	④	⑤

PART IV: READINESS OF CLOUD COMPUTING ADOPTION

1. What is the level of computerization on the activities in your bank?

- 0-20%
- 21%-40%
- 41%-70%

Over 71%

2. Which services does your company currently receive from a hosting provider?
(Select all applicable)

Web hosting

Email hosting

Database hosting

Application Hosting

Online storage

3. What type of connection do you use(Select all applicable)

Integrated Services Digital Network (ISDN)

Cable

Fibre/Leased line

Symmetric Digital Subscriber Line (SDSL)

Asymmetric Digital Subscriber Line (ADSL)

4. About how frequently does your bank update its applications (Single Response)

Quarterly or more frequently

Every 6 months

Annually

Every 2 years

Between 2 and 5 years

Above 5 years

Don't know

5. To the best of your knowledge, give the position of your bank in regard to the following statements (Single response per statement)

	yes	no
a) Has your bank trained employees on cloud computing?		
b) Does your bank have network management tools that monitor the network performance and availability?		
c) Does your bank have a system security team that audits the network and systems?		
d) Has your bank been experiencing undue network latency?		

THANK YOU FOR TAKING YOUR TIME TO COMPLETE THE QUESTIONNAIRE

APPENDIX III: LIST OF BANKS

African Banking Corporation

Bank of Africa Kenya

Bank of Baroda

Bank of India

Barclays Bank of Kenya

CFC Stanbic Bank, Nairobi

Charterhouse Bank Ltd

Chase Bank Ltd

City Finance Bank

Citybank

Co-operative Bank of Kenya

Consolidated Bank of Kenya Ltd

Credit Bank Ltd

Development Bank of Kenya

Diamond Trust Bank

Dubai Bank Kenya Ltd

Ecobank Kenya, Nairobi

Equatorial Commercial Bank Ltd

Equity Bank

Family Bank

Fidelity (Commercial) Bank Ltd
Fina Bank Ltd
First Community Bank Ltd
Giro Commercial Bank Ltd
Guardian Bank
Gulf African Bank Ltd
Habib Bank A.G. Zurich
Habib Bank Ltd, Nairobi
Housing Finance Co. Ltd
I&M Bank Ltd
Imperial Bank
K-Rep Bank Ltd
Kenya Commercial Bank Ltd
Middle East Bank
National Bank of Kenya
National Industrial Credit Bank Ltd (NIC Bank)
Oriental Commercial Bank Ltd
Paramount Universal Bank Ltd
Prime Bank Ltd
Standard Chartered Bank
Trans-National Bank Ltd

UBA Kenya Bank Ltd.

Victoria Commercial Bank Ltd

