A FRAMEWORK FOR CLOUD BANKING ADOPTION

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS
OF THE AWARD FOR THE DEGREE OF MASTERS OF SCIENCE IN
INFORMATION SYSTEMS OF SCHOOL OF COMPUTING & INFORMATICS
UNIVERSITY OF NAIROBI.

November 2012

I certify that this dissertation which I now submit for examination for the award of MSc in Information Systems is entirely my own work and has not been taken from the work of others save and to the extent that such work has been cited and acknowledged within the text of my work.

This dissertation was prepared according to the regulations for postgraduate study of the University of Nairobi and has not been submitted in whole or part in any other University.

The work reported on in this dissertation conforms to the principles and requirements of the School of Computing and Informatics guidelines for ethics in research.
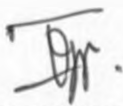
Signed: _____

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Approval

This dissertation entitled 'A Framework for Cloud Banking Adoption' has been done under my supervision and has been submitted to the University of Nairobi, School of Computing and Informatics for examination with my approval as the candidate's supervisor.

Sign..   Date ....07/01/2013..........

Dr. Elisha Opiyo

Dedication

This research report has been dedicated to Kenyan Banking and Technology Managers who aspire to take banking business to the next technology regime (Cloud Computing) and trust that they will find the outcome of this research an interesting read as well as a commendable reference.

Abstract

The Cloud has today become a buzz-word and is in the centre of almost all business and technology forums. Cloud opportunities have continued to expand with the penetration and reliability of Internet allowing more and more consumption of things beyond organizations firewalls. The banking sector like other industries has over the last decade continued to evaluate the impact and necessity to offer certain banking services on the cloud and since banking simply deals with wealth it carries a huge baggage of unique and sensitive features (including the taking and deposits and Lending of money) whereby any changes to such features are viewed through glasses of concern. This study has established that despite fast cloud evolution and computing capabilities in the banking sector there has not been evidence of significant adoption of cloud services due to demand for status quo, security, availability, confidentiality issues as well as lack of Vendor trust and acceptable cloud banking framework particularly in the Kenyan banking market. This study therefore strives to ensure that the cloud computing technology is understood and the benefits accruing from adopting this technology are clearly documented. The benefits raining from the cloud have been clearly presented to enable banks understand how cloud banking in particular would enable them achieve economies while using cloud application. The study was conducted through a cross sectional survey with data collected from representative banks out of the 44 Kenyan banks using questionnaire and interview techniques. Data analyzed led to the conclusion that there is a clear appetite for adopting cloud banking in Kenya although several factors remain on the way to achieving this objective and they include the absence of an adoption framework, security issues, data availability issues, confidentiality and lack of vendor trust. This dissertation therefore outlines all possible cloud options available for bank adoption, the benefits accruing from them and finally an elaborate Adoption Framework for Cloud Banking in the Kenyan banking market.

Key words: Adoption, Cloud Banking, Cloud Computing, Information Technology, Software-as-a-service.

Acknowledgements

With an authors' greatest fear being forgetting to thank some of the people who helped them very much and therefore making acknowledgement writing a very a difficult job. I will start by thanking all of you that provided any form of help to me along this way.

Thanks go to Mr. Elisha Opiyo of the School of Computing and Informatics University of Nairobi for agreeing to be my supervisor during the writing of this dissertation. Mr. Opiyo helped me greatly by providing critical directions in research, developing and writing of the report.

Great thanks to the entire team of panellists who include Mr. Antony Omwonsa (Panel Chairman), Mr. Eric Ayienga and Dr. Elijah Omwenga for their invaluable guidance and feedback during the panel sessions which I considered "challenging" in every way. To you my colleagues for the encouragement and experience we shared during the course work and research period.

Very special thanks to my entire family for their great support and particularly to my wife Valentina and our two daughters Grace and Fiona for assisting in editing and proof reading this dissertation.

Finally, big thank you to those friends who inspired me to stay on course to the end of the study.

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1. AO - Algorithmic Operations
2. API - Application Programming Interface
3. ATM - Automated Teller Machine
4. CB - Cloud Banking
5. CBA - Cloud Banking Adoption
6. CBAF - Cloud Banking Adoption Framework
7. CBK - Central Bank of Kenya
8. CC - Cloud Computing
9. CCAF - Cloud Banking Adoption Framework
10. CCK - Communication Commission of Kenya
11. CCK - Communication Commission of Kenya
12. CEO - Chief Executive Officer
13. CIO - Chief Information Officer
14. CRM - Client Relationship Management
15. DCM - Data Centre Management
16. EMEA - Europe Middle East Africa
17. ERP - Enterprise Resource Planning
18. FS - Financial Services
19. FSI - Financial Services Industry
20. IaaS - Infrastructure as a Service
21. IT - Information technology
22. MDC - Microsoft Data Centers
23. MWA - Microsoft Windows Azure
24. PaaS - Platform as a Service
25. PEOU - Perceived Ease of Use
26. PU - Perceived Usefulness
27. RAC - Rogers Adoption Curve
28. SaaS - Software as a Service
29. SACCOS- Savings and Credit Co-operative Societies
30. SAP - Systems Applications and Products (data processing)
31. TAC - Technology Adoption Curve
32. TAM - Technology Acceptance Model

Definition of Terms

1. Microsoft Windows Azure - Microsoft's cloud specific windows platform
2. Temenos - A global banking software development company
3. Microsoft - A global technology company
4. Oracle - A global technology company
5. Banking - Business of banking (Taking deposits, Lending to customers)
6. Cloud Computing - Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.
7. Cloud Banking - The use of cloud computing models whereby banks use infinite computing capabilities and resources (servers, storage, networks, applications and services) delivered as a service to customers using internet technologies
8. SACCOS – Savings and Credit Co-operative Societies operating as financial intermediaries.
9. CapEx - Capital Expenditure
10. OpEx - Operational Expenditure

1.0 Chapter 1:   Introduction

1.1   Background to the Study

Banks are the most important elements of financial systems that are crucial for the economic growth of any country and these financial systems need to be efficient enough to deliver their mandate with the support provided by information technology.

The banking industry like the other economically dependent industries world over has experienced various technology/computing regimes over the last 60 decades and continue to face the pressure of adapting to newer and better computing slants like the cloud computing. It will be accepted that Cloud computing represents the next evolutionary step for computing. Decades ago, the mainframe era kicked off computing a phase that lasted about 20 years and eventually giving way to the client/server era with the organizations then locating more employees in branch offices a phenomenon that gave rise to Internet computing[1]. Now the industry finds itself in the midst of another transformation which is the shift to cloud computing.

The Kenyan banking market space without exception has had its fair share of the impact created by each computing paradigms which created new ways of operating and managing information technology (IT). Today, just like in other markets, the Kenyan banking chief Information Officers (CIOs) are being faced within the horizon with Cloud Computing (CC) or Cloud Banking (CB) for the last half a decade presenting itself with reduced cost of computing, increasing network value, interdependency of network and for computing being tighter with each successive wave then cloud computing for banks has not only become a dare consideration but ultimate destination for all banking and financial institutions that must remain customer focused and profitable.

Kenya has over 50 banks, 30 microfinance institutions and over 12,000 Savings and Credit co-operative Societies (SACCOs). These banks operate in and across the neighboring countries with most of the banks maintaining their own secure infrastructure interlinking the branches via secure networks and intranets while a few of them provide their services via the internet. The level of operation and service delivery would certainly be subject to the

openness of the network specifically in this era of channel resource sharing like ATMs and others like M-pesa payment model. It is inevitable that time has come for the Kenyan banks to re-evaluate their compute strategies to ensure that they are consistent with the current/modern demands of their clients. The clients are certainly asking for complex banking services demanding them from anywhere and anytime which clearly must force the banks to deploy the best compute resources to cope with these demands.

The challenge of communication infrastructure in the country has always been the hindrance to the deployment of modern banking technologies although this has been significantly eliminated by the establishment of various means of communication. Kenya is ranked fourth among Africa's top internet user countries as at December 31 2011 figures. Nigeria is ranked the number one country with 45 million users but this is attributed to its huge population of over 155 million people. Kenya currently enjoys 10.4 million users as at the end of last year[2]. This figure however varies from the communication Commission of Kenya (CCK) statistics that put total number of internet users at 17.3 million combining all mobile and data internet subscribers, terrestrial wireless subscribers, satellite subscriptions, fixed internet connections, fiber optic subscriptions and fixed cable modem users. According to the World Internet statistics, Kenya's internet penetration is estimated at 25.5 percent of the population which stands at 41 million people. CCK's figures put the penetration at 36.6 percent. The Kenyans users account for Africa's 7.5 percent people with access to internet. Internet penetration and usage by the population has reached reasonably good levels to warrant delivery of reasonably admirable banking services.

This dissertation [**A Framework for Cloud Banking Adoption**] evaluates the level and appetite for the Kenyan banks to conduct banking in the cloud as well as the factors affecting the decision to adopt cloud banking. The benefits and fears of cloud banking have been outlined and the outcome of this research project has provided a framework for consideration by banks as they embrace and consider cloud banking as their next computing platform. It also attempts to outline those key areas of concern as the banks relocate their data, understand cloud operation, experience new opportunities and benefits of cloud banking.

The various Kenyan banking compute platforms / environments have exhibited certain weaknesses in far too many areas to deny the business the chances to adequately serve and deliver required services to their customers as well as realizing the expected return on investments. Technology is no longer an enabler, but a business driver (According to the Institute of Development of Research in banking technology (IDRBT) – Banking technology Awards 2010). The growth of the internet, mobiles and communication technology has added a different dimension to banking. The information technology available today is being leveraged in customer acquisitions, driving automation and process efficiency, delivering ease and efficiency to customers[3].

There are outright shortcomings among most Kenyan banking systems as well as known cases of system rigidity that do not allow the banks to effectively meet their customer's demands particularly when they want to access banking services from home via the internet or use of the credit and debit/ATM cards.

Majority of banking customers do unfortunately experience long and undeterminable transaction process and long turnaround times within the banking service areas. This could be partly due to inadequate computing resources, slow systems due to capacity caused by inadvertent customer demand at certain times of the business putting services delivery in disrepute.

A study carried out by the Central Bank of Kenya (CBK) in year 2005 indicated that the Kenyan customer experiences high cost of transactions due to high cost of delivery which is quite overburdening to majority of the customers particularly those in low income earning bracket. The cost of acquiring software and development of banking infrastructure as well as maintenance is quite heavy on the banks and such costs tend to be transferred to the customers via the charges and cost of service.

The resource turnover particular in the IT departments of the banks pose great threat to the provision of good service since there is high demand for the absent/rear specialised skills to man the bank systems. If asked for example, how long an IT Manager has held their current position? And the answer was less than two years that Manager would certainly not be alone.

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And Storm in (Storm, D December 2011) predicted that the turnover could be IT's biggest challenge in the New Year[4] and will continue to be so in 2012 and beyond.

Other challenges include deterrence to resource sharing among local banks due to lack of integration and platform uniformity while specific banks' software licenses commonly restrict the computers on which the software is deployed. Banks pay initial licenses for the software and also pay an annual maintenance fee in order to enjoy specified support services from the software providers. In a recent update to consumers, SAP (Internal Communication July 2011) announced that it would increase its annual maintenance fee to at least 22% of the purchase price of the software, which is close to Oracle's pricing at 21%. Hence, many cloud computing providers originally relied on open source software in part because the licensing model for commercial software is not a good match to utility computing[5]. The primary opportunity is either for open source to remain popular or simply for commercial software companies to change their licensing structure to better fit cloud computing.

There is ultimately a clear pursuit of relevant banking technologies in Kenya market begging the question why despite the great cloud evolution and cloud computing capabilities our Kenyan banks lack the appetite for the adoption of these platform[6]. There also exists no program that would facilitate joint handling of common industry project and subsequently lack of a framework that would enable banks to venture in cloud banking a gap that this study seeks to provide a solution out of the outcome and recommendation thereof.

1.3   Purpose of the Study

The purpose of the study is to establish the reasons why despite the fast cloud evolution and computing capabilities, banks and particularly those in Kenya have not shown interest in taking up cloud services. The banks in Kenya represented by a selected group of the key ones formed part of the study to provide the necessary evidence. The study therefore within itself sought to establish the key factors necessitating status quo, key barriers to cloud adoption, vendor and client relationship in terms of trust, key drivers to cloud adoption all which will facilitate the development of an acceptable Adoption Framework for consideration by Kenyan banks they want to evaluate cloud adoption options.

In cognizant of the fact that the Kenyan banks are under pressure caused by above massive challenges which include massive costs incurred by each individual banks in licensing banking software, its maintenance as well as upgrading their on-premise hardware systems. The need to expand their individual channel networks/infrastructure including ATM networks, patching up their legacy systems to meet most of the emerging business needs while raising the cost of transaction for services they provide to their clients in order to stay in business, there seems therefore to be no way out but to evaluate cloud banking and cloud capabilities for specific business objectives.

It has been acknowledged that most banks have continuously been enlarging their IT staff complements in order to create sufficient numbers to support the ever growing bank technology demand even as the business stretches out to the branch and agency outlets. Skills retention for IT resources is a challenge worldwide and Kenyan banks find themselves losing the experienced personnel to other sectors always affecting the delivery of the much needed service and support.

The study undertaken within this research attempted to present the opportunity to run business in a multi-tenant environment which appeared to be the only option to address majority of the issues outlined above. Cloud Banking would certainly enable different institutions to share same underlying resources and therefore collapsing the high demand for individual investment to deliver same services.

This study therefore having focused on the penetration of internet communication and usage within the Kenyan (counties) population studied various banking technology regimes and ascertained that the region like most other parts of the world have experienced reasonable cloud evolution but no reasonable cloud adoption has been realized. The outcome of the results of the data collected from the key Kenyan banks revealed the following; intention to maintain old system (status quo), fear for the security of their data, the availability of customer account data as well as confidentiality of their trade information. Lack of trust between the vendor and client as well as lack of an appropriate cloud banking framework were highlighted as key hindrances to adoption of could banking services. The ultimate

outcome of this study was to develop a Cloud Banking Adoption Framework (CBAF) for the Kenyan Bank and the specific objectives of the study were:-

(a). Determine the reasons behind the banks intentions to maintain status quo despite fast Cloud evolution and computing capabilities.

(b). Determine the key drivers to cloud banking adoption.

(c). Investigate the key barriers to cloud banking adoption i.e. Security, Availability and confidentiality issues.

(d). Determine level of vendor and client collaboration for successful adoption.

(e). Develop a Cloud Banking Adoption Framework to address the challenges that banks were currently facing.

1.5   Research Questions

The research questions here followed the key objectives set out in this proposal and seek to ensure that the researcher upon data collection finds answers to the key objectives that subsequently assist in advising on the key outcomes of the study. The basis of this research was to establish very clearly why despite all possible evidence that there is fast cloud evolution and computing capabilities in all business areas, the banks in Kenya have not shown significant appetite for cloud banking adoption. The key research questions there are as follows:-

(a). what is the reason that Kenyan banks wish to maintain status quo despite fast cloud evolution as well as huge computing capabilities?

(b). what are the key barriers to cloud banking Adoption

(c). what are the key drivers to cloud banking Adoption

(d). How would the relationship between vendors and client affect their collaboration in Cloud Adoption initiatives.

1.6   Project Justification/Significance of the study

This research project has been among the very few projects to be undertaken in the area of cloud computing particular for the sensitive banking sector in Kenya. However, the study was meant to expose the high cost of IT budgets for Software, Hardware and management skills not to mention customer frustration in terms of service and transaction costs and turnaround times. These factors therefore formed sufficient justification for the investigation of the situation in order to provide a solution in the form of recommendation and guidance into the use and access to uniform, cost effective, efficient and business friendly computing environment shareable by all Kenyan banks. The interaction therefore with bankers, vendors and customers provided a whole wealth of information that assisted in aligning the needs and expectation of each party appropriately.

The study further revealed that since computing resources in Kenyan banks was adopted in the early 90's, there has been consistent improvement in service delivery with the cost of computing drastically falling, allowing banks deploy more compute capabilities in more places and cost effectively thus the reason why cloud computing is becoming a reality[7]. Unlike before, the strategic value of the network continues to rise with computing becoming increasingly dependent on connectivity. In fact, cloud computing is the most network-centric computing model to date, and an organization's ultimate success or failure with the cloud can be determined by its network strategy. Over time, the relationship between computing and networking has grown increasingly stronger. With cloud computing, the network is the best way to manage, secure and orchestrate cloud-based resources.

In order to reduce operational cost and take advantage of the ever increasing power of the networks then cloud compute environment would be the next inevitable direction for the banking industry.
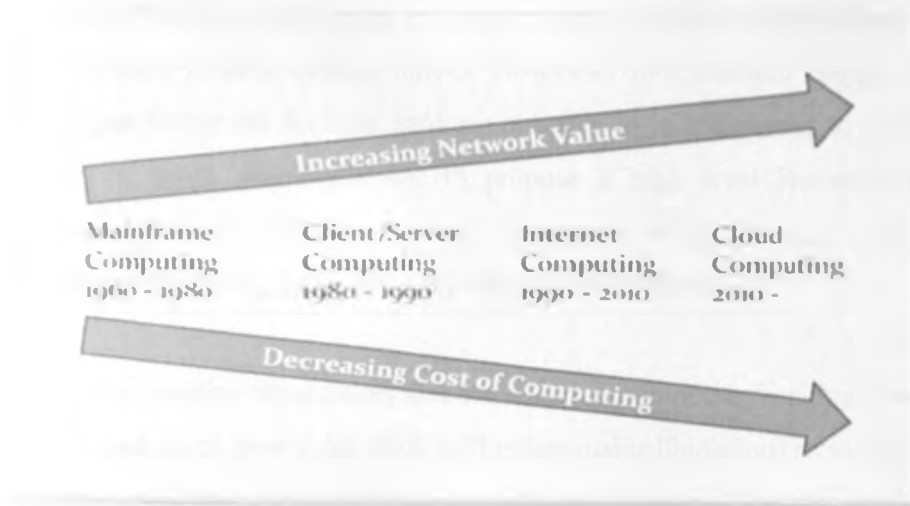
Figure 1: Computing Evolution

This study therefore suggested significant policy statement regarding the future of the cloud computing and its capabilities which its ultimate outcome is an elaborate Cloud Banking Adoption roadmap or framework that details in a step by step manner all the necessary procedures required in planning migration to the cloud, on boarding process, Cloud data centre operation policies including security and a proper enumeration of cost savings against on premise implementations. It is also seen that the Cloud Banking Adoption Framework (CBAF) is going to be of great use to Chief Information Officers, Technical Managers and the bank's Management in general as it combines both the strategic factors ranging from a number of disciplines namely Security, Legal and Organisational Management. Key areas of the study and questions to the respondents included the following:-

- What reasons cause the banks to want to maintain status quo despite huge cloud evolution and computing capabilities?
- What are the significant drivers to cloud adoption for banks?
- What are the key barriers to cloud banking adoption?
- Can a framework to address the challenges facing cloud banking Adoption to successfully adopt cloud banking be developed?

The responses to these questions have been addressed by the framework that provides the banks with an elaborate means of undertaking business migration to the cloud.

1.7 Limitations and Scope of the Study

As it stands now, cloud computing is still a maturing field and as such there is plenty of research avenues and challenges that can be explored without definite and anticipated

outcome. These research areas are such as Data Security, social-impact of cloud computing and business models among others. However, this research project has focused on the challenges facing the Kenyan banking industry in its endeavour to adopt cloud banking by identifying those challenges and to propose a high level Framework that will act as a guideline for technical and business managers within the banks who would use it in evaluating and getting involved with cloud banking initiatives.

The study therefore establishes that while cloud computing/banking continue to take certain breadth and depth over time, there still exists major limitations as to how much banks can let go to the cloud due to the critical and confidential nature of banking business and the fact that banks want to retain control over their client data as they owe confidentiality to their customers.

There is little published work on the legal and compliance considerations of adopting cloud computing, as well as the organisational impact that cloud computing will have on the Kenyan banking organisations.

This report singles out security as a topic that is receiving increasing focus as adoption of cloud computing is concerned. Industry publications point to the financial benefits of adopting cloud computing and the costs of migrating to the cloud.

Lack of a tool from the industry or academia that customers can use to measure vendors claims for how trustworthy their offerings are is another challenge[8]. Researchers have not provided the customers with a way of measuring the claims of the cloud service provider as to how trustworthy their clouds are and the challenges are in understanding what are the customers wants and what the current state-of-the-art of cloud computing can provide.

The ability to technically mount and manage the entire cloud data migration process efficiently without disrupting customer services is also another factor to consider and more often than not banks will show apprehension to this unless very clear roadmap to the exercise is provided. It is therefore inevitable that all parties involved in the cloud initiative appreciate the sensitivity of the banking operations in order to ensure that no business loss is experienced while the customers find no disruption.

Over the last 5 years, cloud computing has become a critical topic in virtually every business area including the banking industry. Much has been written by researchers in most disciplines and posted in various websites (both business and academic websites) and electronic journals. Business books in e-commerce have also carried out substantive documentation on cloud computing proposals that served to provide me with sufficient research materials. Technology companies involved in the development of business solutions in all areas of business take great interest in the cloud initiatives and have published their research finding in values bulletins that served as reference material.

Credible banking software companies with cloud solutions, Global/Multi-national banks and financial institutions already doing banking the cloud. Consultants involved in business on boarding for banks and available generated cloud related materials to the businesses also created research databases for my project.

Temenos Banking Software Company in partnership with Microsoft have already migrated 5 of its clients into the cloud Microsoft Data Centres (MDC) on the Microsoft Windows Azure (MWA) platform[9]. These 5 banking clients from Mexico are already live in the cloud for the last 10 months and are confirmed to function well. This has been a very useful point of reference for my project. Further, since my day to day role involved deploying banking solutions/technologies for banking clients, all discussion and experiences with prospective clients has boosted this research study immensely.

The literature review within this project will among other things seek to review and strengthen the case for cloud banking in Kenya and Africa in terms of viability, acceptance and recognition by the big banks operating in the market, the training and skills on the use of the bank in the cloud, availability of services from the cloud, security of data and transactions on the cloud, channel integration and service delivery from the cloud amongst other key operational aspects of the bank in the cloud.

Available documentation on all processes and components that are required in setting up a cloud bank were be identified and reviewed to ensure that there existed clear understanding of specific procedure / requirements for on boarding bank business onto the cloud. The

location of the cloud storage would be well identified and located. It would also follow that recommendation on the how development of cloud support skills for the Kenyan banking industry would be addressed.

Review of the materials relating to the risks that affect this nature of project would also be absolutely necessary to be able to identify what threats to such an understanding would be and therefore eliminate or control them. Key to the delivery of a sound cloud banking infrastructure is a very reliable network and therefore it was in order to study the limitations to the exercise which include:-

- Inefficient use of network bandwidth
- Inability to apply security policies
- Poor network visibility
- Lack of control and inconsistent user experience.

Various forums in Africa are currently discussing possibilities and strategies of transforming banking business from on premise to the cloud within the continent. Cloud computing was picking up in the entire globe in almost all spheres of business and it was therefore envisaged that the cloud will become a common place in Africa in the next few years. Various cloud providers in some business areas Kenya have started working on cloud initiatives including banking, education, airlines etc.

Summarily, the Literature review did among other areas address the following in very clear detail:-

- Cloud computing in general terms
- Banking in general terms
- The Linkage between banking and cloud banking
- Technology Adoption Models
- Technology frameworks in general
- Identified cloud banking technology adoption framework
- Detail the proposed conceptual framework

Cloud computing is a general term for anything that involves delivering hosted services over the Internet. These services are broadly divided into three categories:

- Infrastructure-as-a-Service (IaaS)
- Platform-as-a-Service (PaaS)
- Software-as-a-Service (SaaS)

A cloud service has three distinct characteristics that differentiate it from traditional hosting[10] It is sold on demand, typically by the minute or the hour; it is elastic that a user can have as much or as little of a service as they want at any given time; and the service is fully managed by the provider (the consumer needs nothing but a personal computer and Internet access). Significant innovations in virtualization and distributed computing, as well as improved access to high-speed Internet and for a weak economy have accelerated interest in cloud computing.

A cloud can be private or public. A public cloud sells services to anyone on the Internet. (Currently, Amazon Web Services is the largest public cloud provider.) A private cloud is a proprietary network or a data centre that supplies hosted services to a limited number of people. When a service provider uses public cloud resources to create their private cloud, the result is called a virtual private cloud. Private or public, the goal of cloud computing is to provide easy, scalable access to computing resources and IT services.

Infrastructure-as-a-Service like Amazon Web Services provides virtual server instance to start, stop, and access and configure their virtual servers and storage. In the enterprise, cloud computing allows a company to pay for only as much capacity as is needed, and bring more online as soon as required. Because this pay-for-what-you-use model resembles the way electricity, fuel and water are consumed; it's sometimes referred to as utility computing.

Platform-as-a-service in the cloud is defined as a set of software and product development tools hosted on the provider's infrastructure. Developers create applications on the provider's platform over the Internet. PaaS providers may use APIs, website portals or gateway software installed on the customer's computer. Developers need to know that currently, there are not

standards for interoperability or data portability in the cloud. Some providers will not allow software created by their customers to be moved off the provider's platform.

In the **software-as-a-service** cloud model, the vendor supplies the hardware infrastructure, the software product and interacts with the user through a front-end portal. SaaS is a very broad market. Services can be anything from Web-based email to inventory control and database processing[11]. Because the service provider hosts both the application and the data, the end user is free to use the service from anywhere.

Cloud computing isn't without risks. But companies can cover their assets by performing some due diligence before signing a service-level agreement (SLA). Service-level agreements are a royal pain to most IT pros, but at least they give you a leg to stand on with providers. Not so with cloud computing; sometimes "buyer beware" isn't enough.

2.2   Banking In General Terms

The general term "Banking" is applied to the business of dealing or trading in money, cheques, drafts, promissory notes, bonds, mortgages and other printed or written obligations for the payment of money or its equivalent. Another term for this is cash or currency, and the term funds, when used, means not only money, cash, or currency, but cheques, drafts, and other written or printed instruments which can quickly and easily be converted into money. This business, like all others, is done for the purpose of profit, mainly derived from the interest or percentage paid for the use of banking funds by those who borrow or hire them[12].

Banking in most parts of the world is done either by firms or individuals as in private banks, or by corporations, made up by aggregations of individuals, or other parties, to do business either as:-

- Central Banks
- Commercial Banks
- Savings Banks
- Merchant Banks
- Loan and Lending Institutions
- Development Finance Institutions

Kenya has the largest number of banks in the region and this survey will establish the various business engagements for all of them. To be able to obtain a representative opinion over the actual IT needs then a number sampling techniques was used and considering that it may not be possible to have all banks represented in the study, a kind of sorting them up was necessary so as to group them in a certain representative manner in order to access some on behalf of the rest in that category. It is therefore possible to apply the probability sampling within the each cluster pick some of the banks at random. This will ensure that we have not been biased in picking the representative banks and therefore the results will not be biased. It will be possible to use the Non-probability sampling technique which will necessitate convenience and/or purposive sampling so as to ensure that we get results from the respondents that are already known to the researcher in order to expedite the research exercise.

The questionnaire therefore was distributed to these respondents by courier; hand delivery and email to the identified respondents whose overwhelming and timely feedback enabled the researcher compile the analysis in good time for reporting.

This study involved personnel from 44 Kenyan banks all of which are regulated by the Central Bank of Kenya.

2.3   Linkage between Banking and Cloud Banking

Banking being a service key to the growth of the economy of any country, the people in the country must have access to banking services so as to develop and maintain or preserve wealth. Banks provide products and services through which all these are achieved and for effective performance of their mandate banks then must adopt tools and technologies to enable them deliver. The different types of banking institutions will certainly require different systems to adequately satisfy the needs of their specific client niche and therefore over the years, banks have experienced different computing regimes leading to the now most talked about cloud Banking depended on the use of the internet to deliver results.

A rapid shift in attitude towards cloud banking is happening within the financial services industry (FSI), according to Gartner Inc. A Gartner survey done in 2011 found that cloud is the top priority for global FSI CIOs and that 39 percent of those surveyed expect that more

than half of all their transactions will be supported via cloud infrastructure and software as a service (SaaS) by 2015.

In Europe, the Middle East and Africa (EMEA), 44 percent of FS CIOs expect that more than half of all their institutions' transactions will be supported via cloud infrastructure by 2015 and 33 percent of them expect that the majority of transactions will be processed via SaaS by 2015.

Early cloud adoption, especially in the FSI sectors may have been limited to non-core areas and proofs of concept but it is set to go mainstream moving the heart of the business, transaction origination and processing into the cloud, said Peter Redshaw[13] according to the Managing Vice President at Gartner. Cloud banking should be innovative dedicated to this industry and transformation.

Analysts at Gartner Symposium/ITxpo 2011, that was held in Barcelona on November 7-10 will discussed the future for cloud banking[14].

Cloud banking has the ability to drive creative destruction, added (Redshaw Peter) as well as helping to improve or optimize an existing service or process, cloud banking can provide the wealth and the freedom to try completely new services and processes, such as reverse auctions and third-party core banking systems, maybe even running them in parallel. Successful new cloud services can displace the existing and dominant process for design, distribution or transacting in a disruptive way, rather than just incrementally improving them.

Among the most attractive benefits of cloud banking is being able to deploy (in an economically feasible way) the "champion-challenger" model. This adds a competitive dynamic to the way processes are improved and chosen. As banks progressively replace people in the value chain with algorithmic operations (AOs) to run processes and make decisions, their intellectual property increasingly resides in these algorithms. The value of people is not in running operations but in improving the AOs.

Although the technology is still immature in many places, cloud is a top priority for banks that need to continue a long-term focus on efficiency and support the CEO's growth strategy by becoming more flexible and agile to support new business models, new markets, new channels, and new products.

This research attempts to recap the ideal steps followed in adopting new technologies to provide the required appreciation in adopting a cloud banking technology as shown below in Figure 2. The Technology adoption curve presents a typical adoption and retention curve for technology in general. The take-up and penetration of new services, products and technologies lies heavily in the hands of a consumer type called the Innovators. Innovators only represent 2.5% of any general population, but nevertheless, are a vital first link in the chain of adoption. The graph below shows the Rogers adoption curve[15] (RAC), a bell curve that shows the five different consumer types.

The Kenyan banks have been considered to adopt more technology than its counterparts within the region and therefore there is a sense of awareness of possible attitudes in adopting new technologies. This research also established that majority of Kenyan banks adhere to great and acceptable technology cycles.
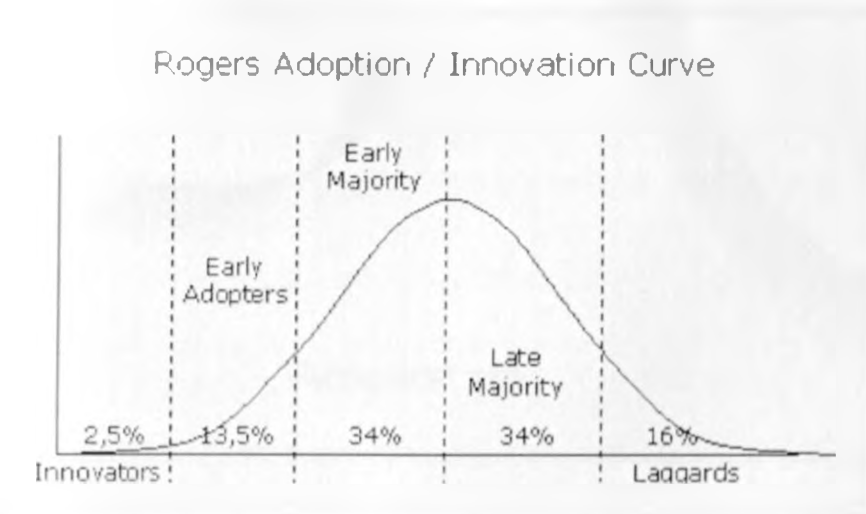
Figure 2: Rogers Adoption curve

According to Rogers, innovators are considered very brave people that are willing to try new products/services. Typically, the excitement and personal satisfaction of being one of the few to be actually using the product/service is the main reason for take-up. Very importantly, innovators accept that new products/services often contain bugs/problems/hick-ups, but they view these issues as an acceptable process.

When technology-based companies release early versions of software then the innovators are the target market and the catalyst for penetration. Importantly, innovators have a strong influence over the group referred to as early adopters. The innovators are those people living in the fast lane, the cosmopolitans who are always on the move and always found in non-geographic places since they are always running and commenting on blogs building in Second Life and commenting in forums and being referenced in all manner of specialist publications.

| Innovators 2.5% gp | Early adopters 13.5% | Early majority 34% | Late majority 34% | Laggards 16% |
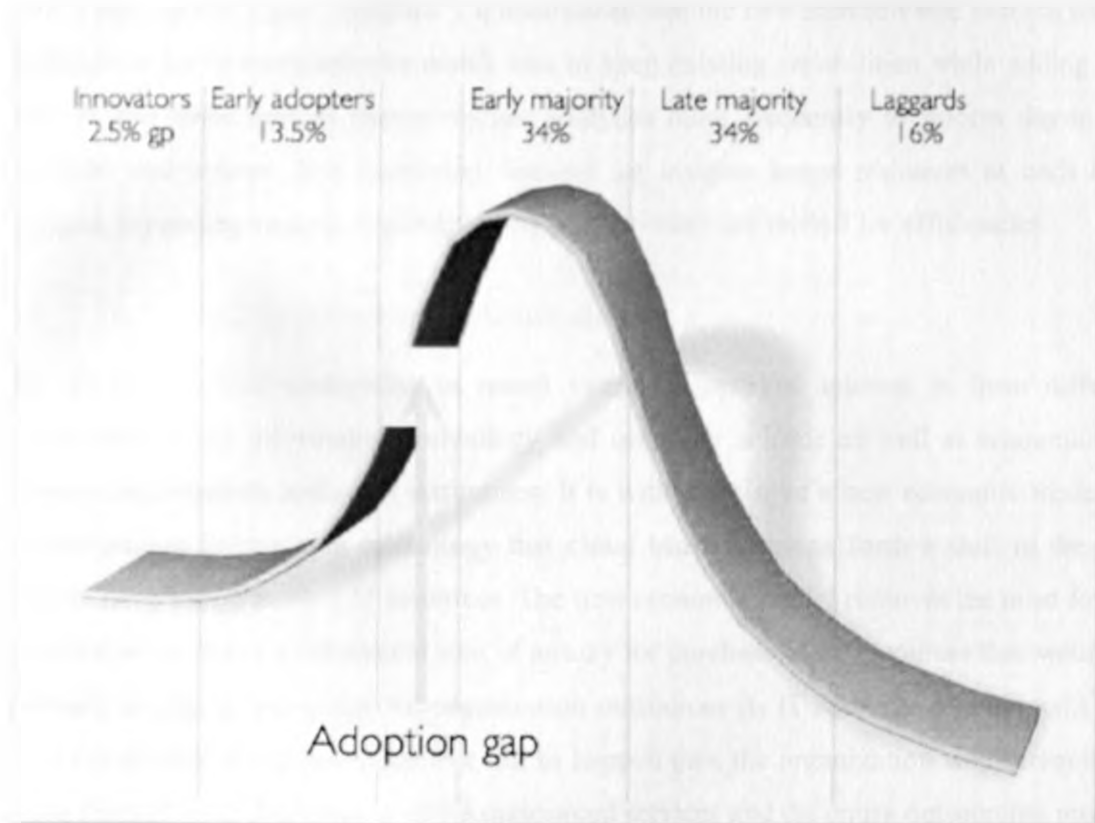
Adoption gap

Figure 3: Technology Adoption Curve

Moving forward and representing 13.5% of the GP, Early Adopters are closely tied to Innovators. These individuals are strong opinion formers/shapers within their social networks and have a more localised existence compared to innovators, who are more cosmopolitan. Early adopters as per the Technology Adoption Curve (TAC) typically give advice and recommendations to their friends and collegues and when they have found something they think is of value they often become brand advocates. Whereas innovators are prepared to put up with bugs and flaws in new technology as an acceptable part of the take-up process, they

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often do not discuss these issues with others. However, early adopters will explain these issues when recommending products/services to others and importantly, will reassure people about them. The earyl adopters are found all over the place speaking at specialist conventions, networking locally and are usually well-known in their geographical footprint[16] as well as all other possible innovative discussions.

Adoption gaps (AG) are nothing new, but they're huge issues for companies making everything from baby steps to big strides in embracing new technologies. According to MIT SMR's new special report analytics[17], it ascertained that the new path to value touches on this challenge in its recommendation which was to keep existing capabilities while adding new ones. It also notes that as executives use analytics more frequently to inform day-to day decisions and actions, this increasing demand for insights keeps resources at each level engaged, expanding analytic capabilities even as activities are shifted for efficiencies.

Technology Frameworks in General

The advent of cloud computing in recent years has sparked interest in from different stakeholders of the information technology and computer science as well as academicians, business organisations and other institutions. It is with promise of a new economic model for communication Information technology that cloud banking brings forth a shift in the way organizations invest in their IT resources. The new economic model removes the need for the organization to invest a substantial sum of money for purchase of IT resources that would be internally managed, but rather the organization outsources its IT resource requirements to a cloud computing service provider. For this to happen then the organization would require to be put through an understanding of the outsourced services and the entire outsourcing process in particular. The Technology Acceptance Model (TAM) as proposed by Davis et al. 1989 provided factors leading to acceptance of the outsourced services and technology.

Technology Acceptance Model (TAM)[18] is an information systems theory that models how users come to accept and use a technology. The model suggests that when users are presented with a new technology, a number of factors influence their decision about how and when they will use it, notably:

- **Perceived usefulness** (PU) - This was defined by Fred Davis as the degree to which a person believes that using a particular system would enhance his or her job performance.
- **Perceived ease-of-use** (PEOU) - Davis defined this as the degree to which a person believes that using a particular system would be free from effort (Davis 1989).
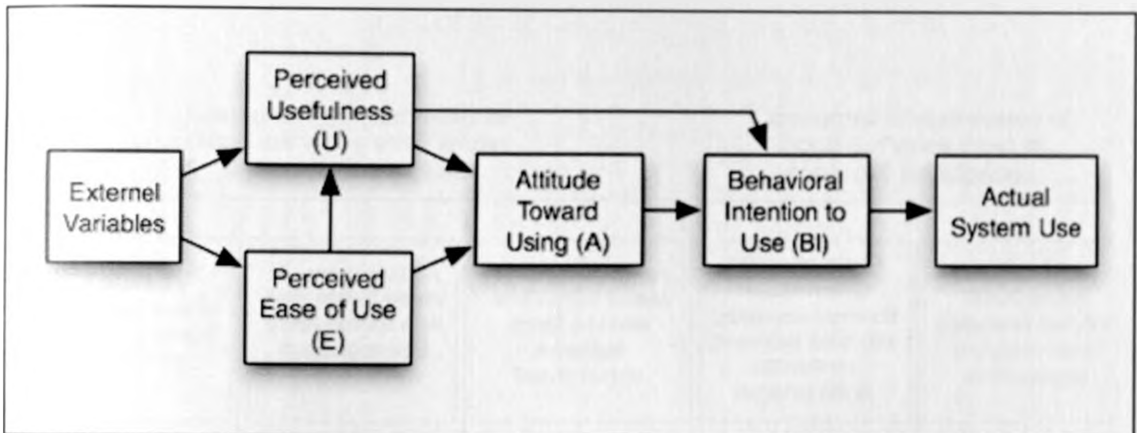
Figure 4: Technology Acceptance Model (Davis 1989).

The TAM has been continuously studied and expanded-the two major upgrades being the TAM 2 (Venkatesh & Davis 2000 & Venkatesh 2000) and the Unified Theory of Acceptance and Use of Technology (or UTAUT, Venkatesh et al. 2003). A TAM 3 has also been proposed (Venkatesh & Bala 2008).

The first dimension to consider when developing a cloud framework or strategy is the delivery model to be employed, which is the horizontal dimension of the framework[19]. There are two primary cloud delivery models: public and private.

A private cloud is one in which both the consumer of cloud services and the provider of those services exist within the same enterprise. The ownership of the cloud assets resides within the same enterprise providing and consuming cloud services.

A public cloud is one in which the consumer of cloud services and the provider of cloud services exist in separate enterprises. The ownership of the assets used to deliver cloud services remains with the provider. *A hybrid cloud* combines multiple elements of public and private cloud, including any combination of providers and consumers, and may also contain

multiple service layers. As shown in Figure 5, the cloud computing adoption frame-work also defines various subtypes within the private cloud and public cloud delivery models. These segmentations within public and private delivery models allow for a more targeted discussion of roles and responsibilities for both the provider and the consumer of cloud services, based on the specifics of a given scenario. The subtypes also carry an implication of the level of skill and sophistication necessary to successfully deliver and consume cloud services.
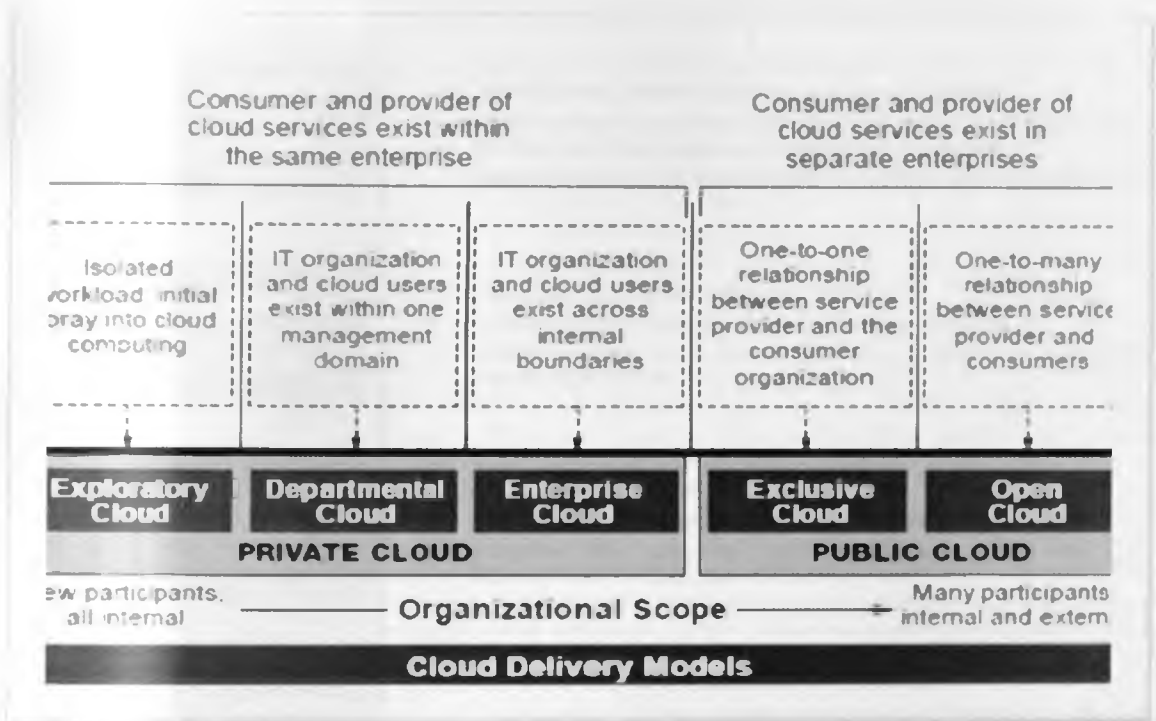
Figure 5: A cloud Computing Adoption Framework (Hybrid Cloud)

An organization implementing an exclusive cloud can hope to reduce both capital and operating expenses for the consumer and to develop cloud partnering skills, such as securing consensus for changes to the business or operational support sys-tem changes, defining security issues and establishing cloud service level agreements. This cloud type requires differing levels of trust, regulations concerning the physical location of data, as well as equitable cost allocations.

The second dimension defined by the cloud computing adoption framework is service type. This is the vertical dimension of the framework. As shown in Figure 6, the four service types defined in the framework are layered to represent the increasing level of structure and

standards. Each service type is built on, and requires the structure and standards of, the one below it. As discussed later in this paper, this progression has significant implications for both the provider and consumer of cloud services. In many cases, organizations will choose one or more service types, adding to the level of complexity in selecting cloud delivery methods for each and underscoring the need for a visual map from which to examine all aspects of cloud delivery.
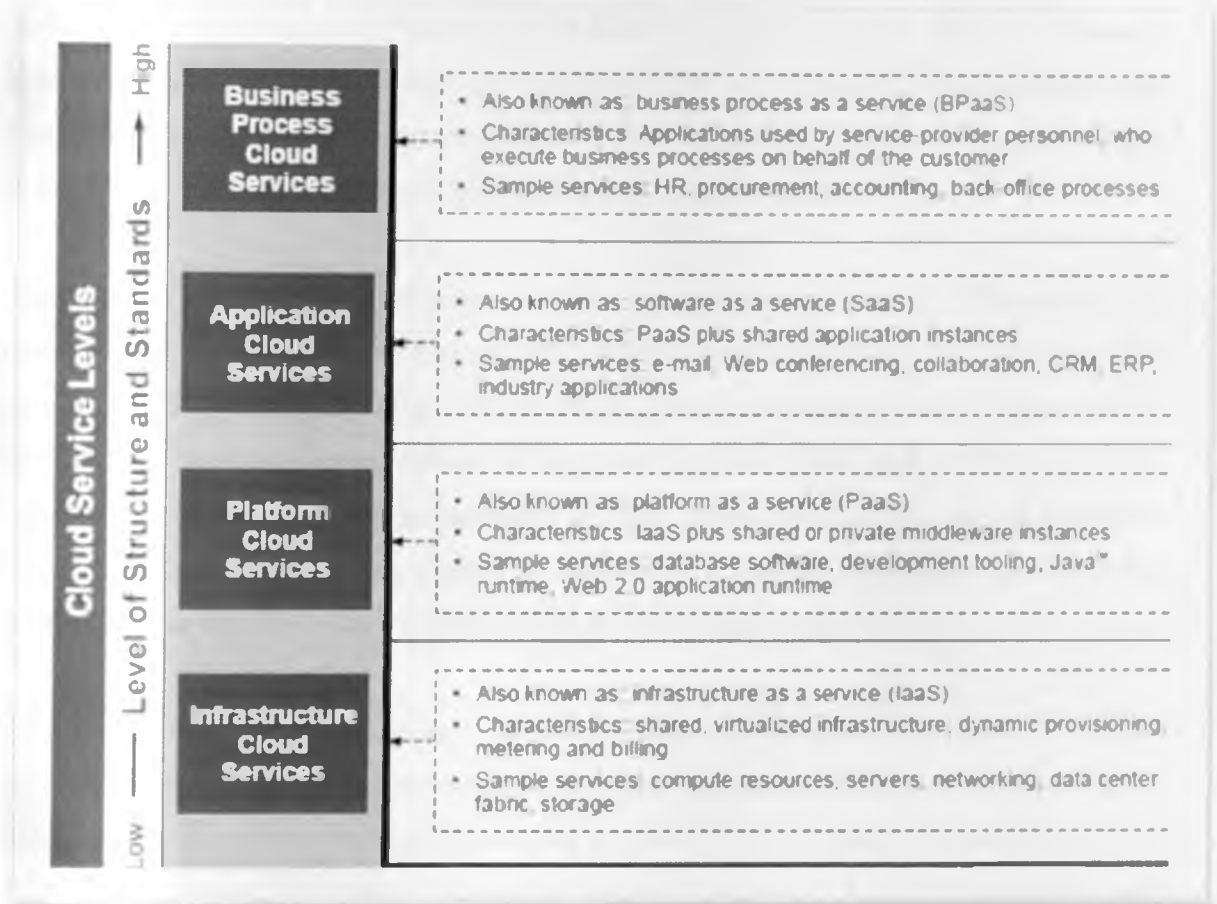
Figure 6: Cloud Services by Types.

The cloud service types defined in the framework are:

Infrastructure cloud services (also known as Infrastructure as a Service, or IaaS) - These provide on-demand, pay-as-you-use access to infrastructure resources, including servers, storage or network devices, that the consumer configures and controls, running the applications of their choosing. The service can be delivered in a consumption-based business model - for example, by the instance-hour used or gigabyte transferred—or as a fixed fee for

a virtual device with a predefined capacity and configuration, either way the resources are accessed via the network, typically over the Internet. Infrastructure cloud services may also include an operating system with or without basic system management tools.

Platform cloud services (also known as Platform as a Service or PaaS) - These services deliver compute capability (infrastructure) plus a predefined middleware stack that is typically structured for developers or advanced IT users. Providers can chose to offer a variety of service products (stacks), configurable to varying degrees by the consumer. Examples include database, Web or application server soft-ware. Configuration and management of these middleware resources are the responsibility of the consumer, but the provider may offer to maintain standard images once they are defined.

Application cloud services (also known as Software as a Service, or SaaS) - The service is a predefined application, such as CRM and ERP, which is typically delivered via a public cloud provider. Consumers from multiple organizations share a single application instance, with virtualization technologies employed to segregate customer data and maintain privacy. Application configuration and management are the responsibility of the service provider. However, an organization may choose to implement a similar, application-based service within a private cloud to reduce costs licensing fees and other costs.

Business process cloud services (also known as business process as a service, or BPaaS) - This service combines application cloud services and the shared services model in which a single organization delivers business services, such as employee benefits management, help desk or procurement, to multiple internal or external consumers. Although consumers are purchasing business services, not applications, they can benefit from the reduced cost and increased flexibility that the provider realizes by employing a cloud-based service delivery infrastructure.

The perception towards cloud adoption would certainly be seen from different points of view by various adopters' right from what the business have in place whereby they manage the entirety of their business technologies themselves up till when every business component is fully outsourced. Figure 7, below presents a comprehensive and systematic cloud adoption from on premise with full control to a full cloud adoption facilitating what would be described as SaaS. Temenos, a Banking Software Company whose banking solution has been

placed in the cloud with partnership with Microsoft has outlined various cloud strategies as below.
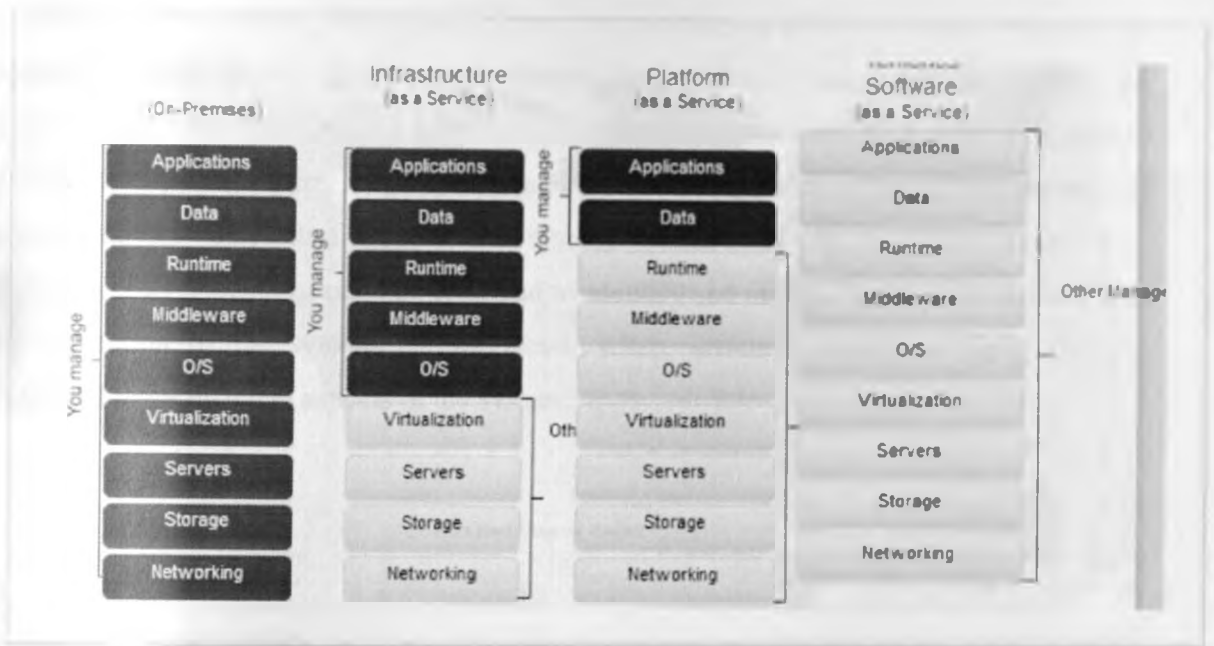
Figure 7: Cloud Adoption Approach (Temenos 2011)

While Temenos Software as a Service adoption approach provides a clear migration from what would have been an on-premise deployment of a banking solution to a SaaS deployment the actual step by step migration of activities have not been outlined and hence the usual fears of the unknown still exist. An acceptable migration methodology should detail in an elaborate manner what action takes place at what stage.

Another Cloud Adoption Toolkit comprises a conceptual framework[20] for organizing decision makers'concerns and matching these to tools that address them. Decision makers can use any tools/techniques that they wish to however, we provide five tools/techniques that we believe to be extremely useful: Technology Suitability Analysis; Cost Modeling; Energy Consumption Analysis; Stakeholder Impact Analysis; and Responsibility Modeling.

The purpose of the conceptual framework is to organise decision makers thinking about the concerns that they and other stakeholders have, and the tools that can be used to explore these concerns. It is important that decision makers view the proposed cloud adoption project from multiple stakeholder's perspectives in order to learn from a diverse range of stakeholder

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concerns and receive a broad range of feedback from the organisational environment. Figure 8 provides an overview of the Cloud Adoption Toolkit and how it can be used. Decision makers would start with a Technology Suitability Analysis, and if the cloud is found to be suitable for their system, they would proceed by investigating either the costs of running the system on public clouds, or the energy consumption (and hence energy costs) of running the system on private clouds. At the same time, Stakeholder Impact Analysis can be performed to assess the impacts of using cloud computing on the work of stakeholders in the enterprise. If these analyses show that running the system on the cloud is a viable option, then Responsibility Modelling can be performed to identify and analyse the risks associated with the operation of the system on the cloud, where different cloud providers could be responsible for different aspects of the system.
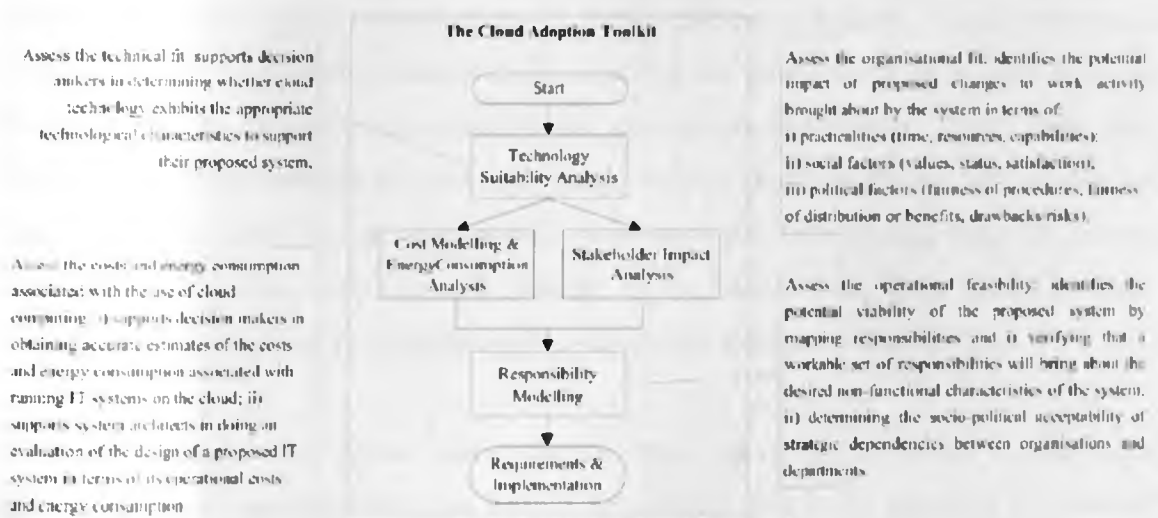
Figure 8. Cloud Adoption Toolkit

The purpose of Technology Suitability Analysis is to support decision makers in determining whether cloud computing exhibits the appropriate technological characteristics to support their proposed system. Understanding the characteristics of cloud computing is extremely important as it has the potential to exhibit radically different properties to those of traditional enterprise Data Centres. This is mainly due to the cloud's highly scalable nature, physical resource sharing between virtual machines, potential issues to do with communication over the internet and insufficient guarantees regarding the up-time and reliability of processing and data storage services. For example, typical IaaS offerings make no reassuring guarantees

about server uptime or network performance which has important implications for the viability of certain classes of software architectures and business critical systems.

While this adoption framework attempts to address the salient aspects of suitability of technology, stakeholders impact on the cloud adoption. Responsibility as well as requirements and implementation it is a bit generalized and would not fit the banking situation in Kenya.

2.6   Cloud Banking Technology Adoption Framework

Cloud Computing is a promising paradigm for delivering computing utilities as services. Just as personal computers and servers shook up the world of mainframes and mini computers or as smartphones and tablets revolutionized the mobile commerce industry, cloud computing is bringing similar far-reaching changes to the licensing and provisioning of infrastructure and to methodologies for application development, deployment and delivery. Some firms have already realized the benefits of cloud computing, which include scalability, cost savings and time to market. Firms that are still looking to leverage the cloud should begin by moving nonrevenue generating and non-core systems to the cloud. And, they should consider developing a comprehensive cloud strategy to move core applications to the cloud

Cloud computing has caused more debate than many other recent technological advancements. Regardless, there has been a tremendous rise in its adoption by financial services firms over the last couple of years with major banks across the globe taking lead in this initiative[21]. Figure 4 below proposes a Cloud Adoption Framework which technology adopters in the banking industry might want to follow as a guideline to taking various and mission critical business operations to the cloud. It is imperative that Cloud banking projects should be handled with the care deserving of all banking migration projects.

The Cloud Computing Adoption Model provided below can be modified to suite any specific business process to be on-boarded to the cloud.
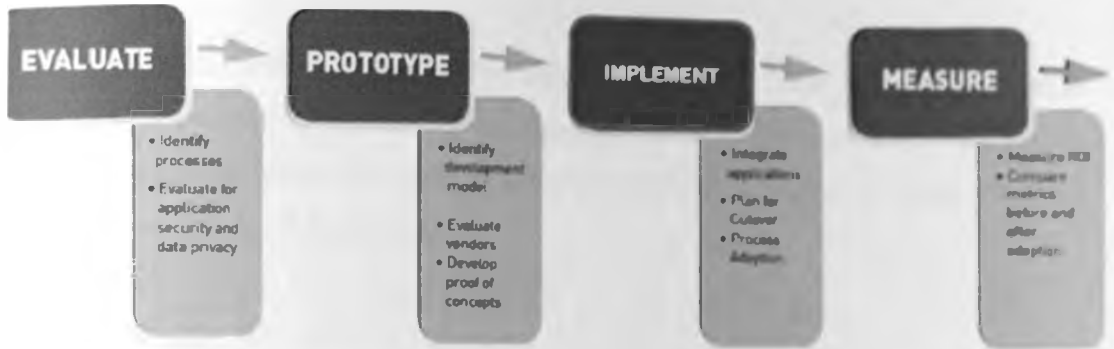
Figure 9: Cloud Computing Adoption Framework

Phase I—Evaluate

Developing a successful cloud strategy starts with a thorough evaluation of current business processes and applications as well as identifying those that can be moved to a cloud. The processes and applications should be evaluated using a balanced scorecard. The identified processes typically show characteristics similar to the applications documented in the section above. The balanced scorecard uses parameters, such as privacy requirements when the information is stored on a cloud, peak load hours, architecture constraints and such legal requirements as the physical location of hardware, which will decide applicable legal jurisdiction and laws of country.

Phase II—Prototype

In the Prototype phase, particular processes are selected and the type of deployment model, including public, private or a hybrid cloud, is decided. Plus, strategies for storing data with different security requirements and complexities are developed. Some of the key decisions focus on where the most sensitive data should be located and how less sensitive data will be processed. This phase also includes the evaluation of cloud vendors based on data and architectural parameters. Proper assessment of cloud vendors with respect to their focus on security, data confidentiality and availability are completed. Choosing the right vendor involves understanding what each one can offer and how their offerings align with the firm's requirements.

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Phase III— Implement

Once the deployment model is decided and cloud vendors are chosen, the implementation phase begins. In this phase, applications are deployed on cloud. Several factors are kept in mind during this phase, including migration and cutover planning, as well as the adoption and operational management of the new process.

Phase IV— Measure

Finally, an organization should spend considerable time measuring the ROI achieved and fine-tuning the adoption process. In this phase, ROI is measured considering the objectives and feedback is collected from end users. The output of this phase is fed back into the evaluation process to fine-tune the next roll-out.

2.7   Recommendable Conceptual Framework

There are countless opportunities for financial services firms to leverage the benefits of cloud computing by migrating a variety of applications to the cloud. Non-core applications and such business processes as recruiting, billing and organization-wide travel management can and should easily move to the cloud. A number of infrastructure operations, such as Data Centre Management (DCM), data storage and disaster recovery, should also move to a cloud after a thorough evaluation of different vendors offerings and based on the flexibility of cloud vendors in documenting contracts. Although very few firms are currently using cloud computing for their core applications[22], different hosting architectures provided by (IaaS) cloud providers and new avenues in the community and hybrid cloud space, will drive more firms to move their core applications to the cloud. In fact, core solutions, such as batch processes running throughout the day, analytics and reporting applications, are perfect candidates.

In order to achieve the above, an extensive literature review on cloud computing, trust and security issues related to cloud computing, legal and compliance issues and organisational challenges for cloud adoption has been undertaken. The objective was to understand how organisations particular banks and other financial institutions perceive cloud banking/computing despite its promised benefits.

An extensive exploration of trust models, security standards, regulations on privacy and data protection and the impact of technology on industry standards, processes and structure was undertaken also. Considering the amount of trust and security issues originating from the traditional bank computing environment and those related to legal and compliance all are of complex nature the following Model or Adoption Framework and strategy has been developed by the researcher to act as guideline to banks considering taking up cloud services.

The Model recognises all the major concerns observed during the study whereby the banks raised fears over matters data security, data availability, client data confidentiality, vendor trustworthiness, usability, affordability and actual functionality. The model below therefore promises the banks a simple process walk through to be followed when evaluating and for adoption any cloud based services. Figure 9 is therefore shows one the Possible/ recommendable framework which cannot however be suitable for the Kenyan banking scenario but whose content has been borrowed when developing final framework for the Kenyan banks in Figure 21.
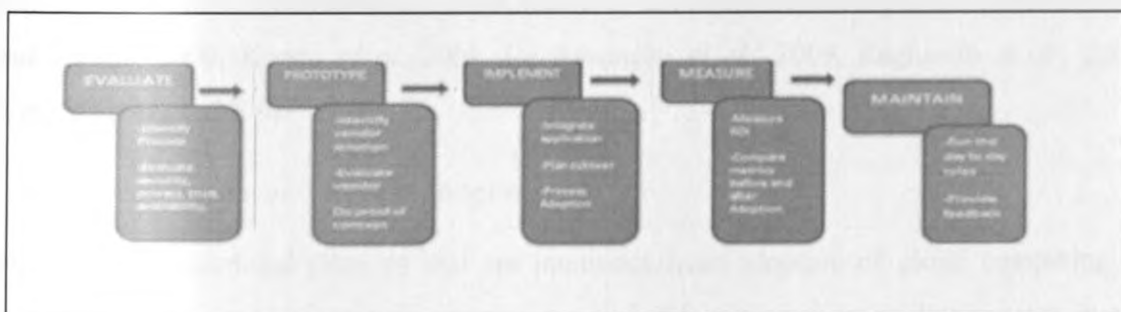
Figure 10: Possible Cloud Banking Adoption Framework

Analysis and Recommendation

Despite being a close fit for the cloud adoption with elaborate stages of progression there is lack of detailed activity for adoption in a local banking context. The need to internalise the evaluation process by both the IT and Business Managers requires a process that is broken down into details easily understood and managed by the bank teams themselves.

2.8   Organizational Factors in Cloud Banking

2.8.1   The Economics of Cloud Computing

One of the appealing benefits of cloud computing is its payment model where the customer pays for what they use. Another closely related characteristic is the removal of investment costs for using cloud services whereby the customer is not required to invest in purchasing the IT infrastructure. However, how organisations can benefit from this utility model is not very clear. The challenges being the management of costs and the calculation return on investment (ROI) (Golden, 2009). Another challenge is that of comparing capital expenditure (CapEx) against operational expenditure (OpEx)[23] (Buyya *et al.*, 2009, Armbrust *et al.*, 2009, Khajeh-Hosseini *et al.*, 2010a, COMSCI, 2010).

How the Kenyan banks and other financial institutions are going to benefit from the economies of scale promised by cloud computing is among the research challenges. Different researches have been carried out that have addressed the issues related to costs of using cloud computing from both the customer and vendor perspectives (Khajeh-Hosseini *et al.*, 2010a, Buyya *et al.*, 2009, Armbrust *et al.*, 2009, Klems *et al.*, 2009, Greenberg *et al.*, 2008, Barroso and Hölzle, 2009, Kondo *et al.* 2009, De Assunção *et al.*, 2009, Raghavan *et al.*, 2007, Weinhardt *et al.*, 2009).

2.8.2   Governance and Risk Management

With the organisational changes that are imminent from adoption of cloud computing as discussed in the previous section, governance and risk management of It resources in the cloud environment is another challenge facing organisations. Effective management of IT resources in cloud environment and risk management should be a result of an organisation having a well-developed IT resources and information security governance processes, as part of the organisations' corporate governance obligations (CSA, 2009). The results of a well-developed governance processes are information security management processes that are flexible, repeatable, measurable, sustainable, defensible, cost-effective on an on-going basis (CSA, 2009). For cloud computing the main concerns to organisations in relation to governance and enterprise risk management is how the organisation can identify and implement appropriate organisational structures, processes and controls to ensure that there is effective information security governance, risk management and compliance (CSA, 2009,

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Buyya *et al.*, 2009, Armbrust *et al.*, 2009, Golden, 2009). The governance and risk management requires organisations to ensure that there are proper mechanisms and processes across the information supply chain that covers cloud providers, customers and other stakeholders, and supporting third parties to vendors (Golden, 2009, CSA, 2009).

2.8.3 Organizational Change

The IT department in organisations are the ones that are going to be greatly affected by the adoption of cloud computing (Mather *et al.*, 2009). These departments are used to having control over different aspects of organisation IT infrastructure operations and management. These departments controlled such things as IT procurement, IT asset management, security control and billing (Khajeh-Hosseini *et al.*, 2010a). With cloud computing this is about to change. In 2008 Nicholas carr argued that the mode of IT service delivery resembles in some aspect that of electricity delivery in the early days of electric invention (Carr, 2008). During that time every manufacturer had to generate their own electricity regardless of the type or nature of their business. In the same respect today's business organisations build their own IT infrastructure regardless of their business (Carr, 2008, Khajeh-Hosseini *et al.*2010b, Khajeh-Hosseini *et al.*, 2010a). This trend results in inefficient IT infrastructures (Economist, 2008). Cloud computing is about to change that. This will be possible through cloud computing provision of facilities such as computational power, storage capacities and offer these as utility services.

2.8.4 Service Level Agreements (SLA) Management

The need for specific SLAs is another challenge. This is a challenge due to the fact that vendors may not always meet the requirements for SLA of an organisation. The potential for 57 down-time and lack or inadequate SLA agreement from some cloud vendors pose a great challenge (Google, 2010, Golden, 2009, Amazon, 2010).

2.8.5 Systems and Application Migration

For start-ups migration of applications is not a challenge as the organisation starts by using cloud computing from the start. On the other hand, business which are already established, have a large number of systems and applications that are a result of a long period of time in business. In most cases these systems have been developed and depend on a number of

different technologies, are owned by different departments or sections of the organisation, and have complex dependencies between the systems and the data they use. The business processes of the organisation also evolve to make use of the systems and are dependent on the systems. This results in a situation whereby no department or section of the organisation that has full knowledge of all the systems working in the organisation and the dependencies within them (Khajeh-Hosseini *et al.*, 2010a, Cloud computing, 2010).

Moreover, the development and deployment and use of IT Systems and resources are affected by organisations politics. For example, the organisation top management may set IT policies but the implementations of these policies are left to individual departments. As a result of the freedom on deciding how to implement policies, departmental managers tend to decide and adopt strategies that best suits their departments (Forbes, 2010, Khajeh-Hosseini *et al.*, 2010a, Cloud computing, 2010). For cloud computing, migrating systems and applications poses a challenge to organisations. The challenges include IT policy formulation, organisational politics and culture. It also includes identifying the system dependencies and how the migration to cloud will affect these dependencies and the work processes in place. Other challenges involved with migrating systems and applications to the cloud are security, compliance, and SLAs management.

2.8.6 Security and Cloud Computing (Standards and Best Practices)

With all the fears surrounding information security and cloud computing in particular, in this sub-section a review of a number of security standards and best practices that have been developed and used in conventional computing is done. The review aims to identify and see how these standards and best practices can be used in ensuring cloud computing security and build trust.

ISO 27001 (BS ISO/IEC 27001:2005, BS 7799-2:2005)
This standard which was formerly was known as BS 7799-2, is intended to provide a model for establishing, implementing, operating, monitoring, reviewing, maintaining and improving an information security management system (ISMS). The standard defines how a business or an organisation can organise it information security, based on it needs, objectives and security requirements. The standard also can be used by both internal and external parties in assessing the security posture of an organisation; this has led to certifications showing that an

organisation meets the standards requirement for information security. The certification is an indication that the organisation has implemented information security in the best possible way. However, certification for cloud computing may not be very useful. This is because the client and vendor security requirements and practices may differ which will still require vendor to adjust their practices to meet clients' needs. Nevertheless, vendor certification is still important as an indication that they are committed to ensuring security and use of security best practices. The standard prescribes how information security can be managed through ISMS. The management system has four phases which are: the Plan phase which is dealing with the planning of organisations' information security; sets objectives for information security and selects the appropriate security controls.

2.8.7 Cloud Computing Source of perceived security threats

With the different security challenges, vulnerabilities and threats facing cloud computing, fear raises in the potential clients of cloud computing. This creates distrust as to cloud computing from clients and hinders/slows down adoption of cloud computing. In this section a brief dissection of some of the sources of the perceived threats resulting into trepidation is done. The most common threats[24] (Andert et al., 2002) are described below:

Confidentiality: This raises questions such as how will sensitive data stored in the cloud be? Will the cloud not leak or compromise confidentiality of clients' confidential data? These questions and other of similar nature are linked to the fear of loss of control over data 39 stored in the cloud. Thus, this calls for security mechanisms in the cloud environment which will appeal to clients feelings related to confidentiality.

Integrity: This related to the clients need to be sure that, the provider is performing the right kind of operation on data. It also relates to the need for assurance that data stored or processed in the cloud has not been tampered. This calls for the need of integrity mechanisms which are transparent without compromising security.

Availability: What happens if cloud service provider is attacked? Will the customer loose business? What happens if the provider files for bankruptcy? Or is acquired by a new management? These questions relate to the issues of disaster recovery and business continuity. This calls for cloud computing service providers to have a mechanism which assures clients of business continuity.

Privacy: What happens when provider performs data mining on clients' data? An example being Google mail (Gmail). Will the results of the data mining on the clients' data not be revealed to a third party?

Increased attack surface: How does cloud respond to phishing attacks? As communication is via the Internet, will the attacks now be targeting the communication link?

Auditability and forensics: how will data be audited? Who will perform the audit? With data in the cloud, how can forensic and e-discovery be performed? Who will be responsible for forensic and e-discovery? The client or the provider?

Legal quagmire and transitive trust: is the customer or the service provider responsible for compliance? What happens if the service provider subcontracts? Should the customer trust the subcontractor? Even though the fears are based on the conventional computing environment, in order to be able to build clients' trust, these fears highlight the need for service providers to adapt well known security mechanisms or techniques. They also call for research and innovation in security techniques and technologies in order to ensure that cloud computing is secure and hence trustworthy.

3.0 Chapter 3: Research Methodology

3.1   Introduction

A great deal of work for this project was undertaken within the precincts of major commercial banks who are considered opinion shapers by virtue of their size and market share and they include Kenya Commercial Bank Limited, Barclays Bank of Kenya, Standard Chartered Bank, Co-operative Bank of Kenya and perhaps a few more smaller banks. Key international Software vendors (companies) like Temenos, Infosys, Oracle and other local software development companies focusing on the cloud initiatives and also topical writers who address themselves to the development of cloud platforms for various business objectives. Discussions with management and staff of these organizations formed a great part of my activity within the project.

Extensive secondary research was conducted. Acknowledged texts, standards documents, industry periodicals and white papers, analysts' reports and conference journals were referenced. A critical analysis of the secondary research is applied in the formulation of the roadmap and framework proposed.

The data for this research was collected from statements about privacy policy, acceptable use policy, terms of use and service level agreements (SLAs) available from the websites of the cloud vendors. Where such data could be scanty then similar information will be sought via internet research of whitepapers, press releases and news articles of cloud computing in different IT magazines.

It will be possible to rely on certain benchmarks like published information on Top 20 lists from Forrester research, Market Intelligence, CIO's Cloud computing vendors to watch, Top 5 Software Vendors in Kenya awards and scores assigned to vendors.

The research will focus on cloud computing within the banking sector since the intention is to develop Could Banking framework

To be able to provide well support case for the development and reliability of the internet and local Kenyan communication technology to support cloud banking, a status report of the

types of internet delivery channels must be analysed with leading ISPs which include UUNet, Commcarrier, Access Kenya among others.

Infrastructure development companies deploying satellite communication and communication devices were important in providing the researcher with the cost for both acquiring and deploying necessary infrastructure to support the cloud based operation and correct and relevant costing will provide indicative numbers for investment purposes.

It was quite important within this call to clearly establish who cloud banking providers were and what level of cloud solution deployment they were able to do so that we can also ascertain the status development and readiness for cloud deployment in the local scene.

To achieve all the above the researcher developed a questionnaire that facilitated the collection of most of the data from the various parties for analysis.

3.2   Research Design

This study was conducted through a survey research design whereby in the survey selected banks in Kenya considered opinion shapers had their key staff complete the research questionnaire providing information classified into 3 sections. The first section of the survey questionnaire sought to bring out understanding of the respondent responsibility and the nature of their organisation or bank, their role in IT decision making, size of their organisation or bank and the geographical location. This is important because personnel at different levels of management, with different level of involvement in IT decisions may have different understanding of technology and its impact to the organisation. Also the geographical location of the bank or branch of the bank could be affected differently by regulatory and/or compliance issues.

The second section of the survey questionnaire aimed at understanding the drivers for adoption, perceived appropriate cloud banking service deployment and delivery model and the type of IT or business processes that organisation/bank are willing to outsource to cloud banking/computing. This section sought to understand from the bank's point of view any crucial information and the sensitivity of taking their banking data away from their data centres to the cloud.

The third section of the questionnaire constituted a few questions aiming at understanding the characteristics that would be considered key to vendor selection, as well as key concerns for vendor trustworthiness and barriers to adopting cloud banking/computing where explicit evidence for any against would be required.

The survey outcome therefore enabled the researchers present an all rounded opinion on the key research questions for this study. It will provide the necessary data to be used advanced sufficient conclusion regarding reason for and against cloud banking adoption in Kenya while the proposed framework for cloud banking adoption will stand firm grounds.

3.3   Population Sampling

The study was conducted within a selected number of banks out the 52 banks in Kenya. It was expected that to be able to produce an acceptably admissible results that representative banks grouped into categories of the large, the medium size and the small banks be set aside so that were it in not possible to receive responses from bank A for example, and respondents from same group/category will have responded to provide representation for banks in their own category.   It was also necessary to send out questionnaires to specific respondents selected by the researcher due to their known involvement in Banking technology and could almost provide a guaranteed response. The researchers send out 75 questionnaires in total to all the selected banks and individual banks and IT professionals and by the time the researcher was compiling this update report 30 out of the 75 questionnaires were completed and received by the researcher.

The study utilised both probability and Non-probability sampling techniques (probability because it included simple random sampling of member banks within a cluster or category of banks and Non-probability sampling techniques because it the researcher was able to identify some specific individuals out of convenience and purposely send the questionnaires to them.

3.4   Data Collection

The data collection for this survey was based on two approaches:-

1. Questionnaires which was basically of two types. The first type of questionnaire focused on identifying the challenges facing cloud adoption as perceived by industry practitioners/bankers and was conducted using emails to distribute and receive feedback from the respondents. The second type of questionnaire focused on understanding the acceptability of the proposed framework and was done for only selected respondents.
2. One-on-one interview with specific people in relevant positions with the banks and in areas of authority and decision making. A similar questionnaire as in 1 above was used.

It was expected that the electronic mode of distributing and coordinating the exercise on email would be both effective and convenient. It was indeed very effective because it broadened the accessibility and reach of respondents, and convenient in that it did not require an immediate response from the respondent. It allowed for respondent to fill in the questionnaire at their own pace and return them to me. A mailing list for respondents was created to ensure definite mailing of the survey questionnaire to them with a request to access and respond.

3.4.1 Questionnaire

The main questionnaire had four sections described as follows:-

The first section of the survey questionnaire aimed at understanding the respondent responsibility and the nature of their organisation or bank, their role in IT decision making, size of their organisation or bank and the geographical location. This is important because personnel at different levels of management, with different level of involvement in IT decisions may have different understanding of technology and its impact to the organisation. Also the geographical location of the bank or branch of the bank could be affected differently by regulatory and/or compliance issues. The organisation/bank size is also important as it affects how different systems and SLAs were managed.

The second section of the survey questionnaire aimed at understanding the drivers for adoption, perceived appropriate cloud banking service deployment and delivery model and the type of IT or business processes that organisation/bank were willing to outsource to cloud

banking/computing. This section will seek to understand the from the bank's point of view any crucial information on the sensitive of taking their banking data away from their data centres to the cloud. This will certainly allow me the opportunity to analyses any changes in bank/bankers understanding of cloud banking/computing and its benefits. In the proposed outcome of the study i.e. the Framework, the importance of this will be to shown within the planning phase how the bank/ organisation will select and choose the appropriate cloud infrastructure and platform.

The third section of the questionnaire constituted a few questions aiming at understanding the characteristics that would be considered key to vendor selection, as well as key concerns for vendor trustworthiness and barriers to adopting cloud banking/computing where explicit evidence for any against would be required.

The fourth section of the questionnaire constituted two free format questions whereby the respond gives personal opinion over the subject matter. The respondents had been advised to put forth very precise and simple responses to the questions. It would however not be expected that the responses in this section would be deviate from the responses provided in other sections.

3.5   Quality Control

To control the quality, the researcher had endeavored to attain high levels of validity and reliability of the information provided on the instrument of study (questionnaire) by ensuring that key questions are repeated with different wording to see how the respondents answer them. This ensured that if the respondents are not focusing on the answers they provide then chances are that we could different answers for the same question hence leaving doubts on the responses provided by a particular respondent. Also, the selection of the respondents was partly random after the banks had been classified into certain groups that have similar feature i.e. customer size, staff size, same range of branches and available in the same locality. This was to ensure that randomization restricts seeking opinion from those banks known to think in a certain way and not others being influenced by known factors i.e. the bank where one had an account etc.

3.6   Data Analysis

All the data collected via the questionnaires was uploaded into excel or other tools and analysed/verified to provide the necessary outcome for the study. The various questionnaire information specific sections were analysed and together with the findings/feedback collated into various bucket sorted as is necessary and subsequently represented together.

3.7   Assumptions and Limitations

The level of respondents from the banks would influence the correctness of the outcome considering banks do not authorise junior members to provide private information. This was poised to lead to withholding of necessary information required for establishing the actual requirement for a good and functional framework. The time also available to respond to the questionnaires and the actual respondents to be involved did pose a limitation to how much information we could get for the effectiveness of this framework.

4.0 Chapter 4: Data Presentation, Analysis and Interpretation

4.1 Introduction

All the data collected via the questionnaires has been uploaded into excel sheets and other tools and analysed/verified to provide the necessary outcome for the study. The various questionnaire information specific sections was analysed and together with the findings/feedback collated into various bucket sorted as is necessary and subsequently represented together. Section 4.2 was intended to establish the positions and profile of the respondents within the bank so as to determine the reliability of the outcome of the study. Section 4.3 was as well meant to determine the decision making capability in the IT structures within the bank which is quite key in determining the level of authority the recommendation coming from the bank's IT department was carry to be believed and relied upon. Sections 4.4, 4.5, 4.6, 4.7 and 4.8 all address the size of the banks in terms of employees and their amount of experience in working in the banking market in Kenya, type of banks, size of bank in terms of client base and also the location of these respondents within the geographical map of Kenya.

4.2 Respondents by Job Title

The analysis of the respondents by their titles is as follows: IT Management (Technical Consultant/system integrator) 30%, Business Management Consultant 10%, IT Management (CIO, CTO, CSO) 13%, IT Management (Director, Senior Manager) 10%, Business Management (CFO, CEO) 30%, Other IT Personnel 7%.
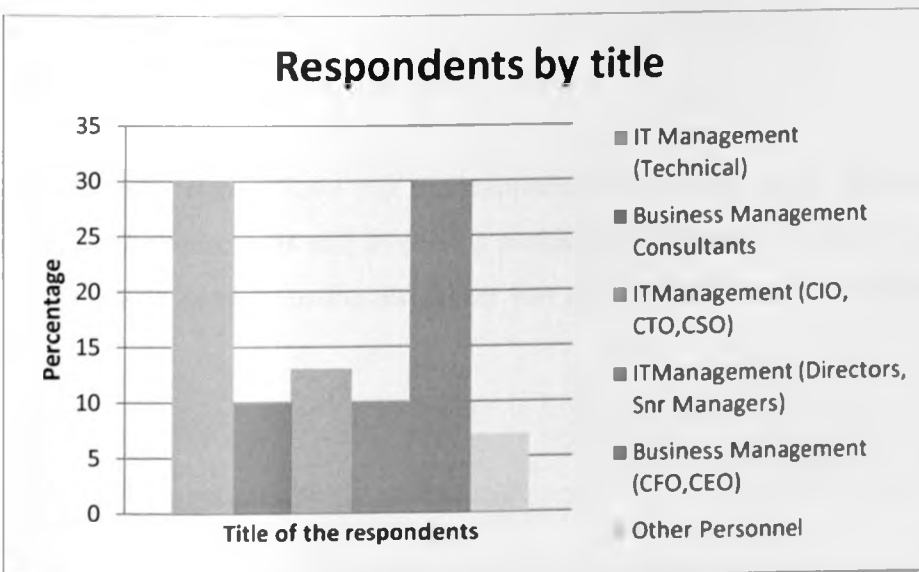

Figure 10: Respondents by Title

The cross section of the respondents which is very good particularly from the very senior management teams shows the level of reliability of the results and therefore provides for good inputs to the design of the Framework.

4.3   Respondents by Role in IT Decisions

Based on the already received results by the respondents in the IT decision making roles the results are such that Evaluators of vendor solutions 23%, Solution recommendations 20%, Determining IT needs 27%, Authorization of IT purchase 13%, Creation of IT Strategy 13%, and Provision of IT Innovation guidance 3%.
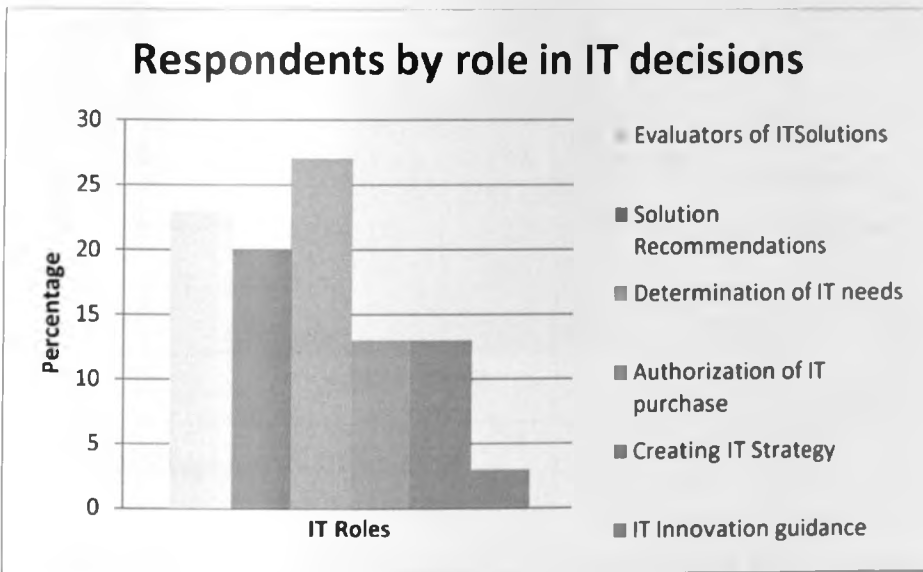
Figure 11: Respondents by role in IT decisions

These results also indicate that the respondents understand their organizations requirements in terms if IT resources and do occupy positions of influence in decision making in the banks which would confirm to the researcher that the feedback comes from the right personnel in the bank.

4.4   Respondents by nature of the bank

The nature of the bank was to determine whether the bank substantive enough to provide opinion good enough to guide other banks. The results obtained are as follows; Retail bank

only 10%, corporate bank only 0%, Retail and corporate bank 90%, Central bank 0%, Housing Finance bank 0% and Microfinance bank 0%. These results reflect the ideal Kenyan banks situation and indicate that majority of the banks in Kenya have uniform operation and the decision to take up cloud services would be fitting for all of them.

4.5   Respondents of employees by banking career

Based on the respondents baking career the results were as follows: Employees between 1-5 years (0%), 6-15 years (43%) and above 16 years (57%).
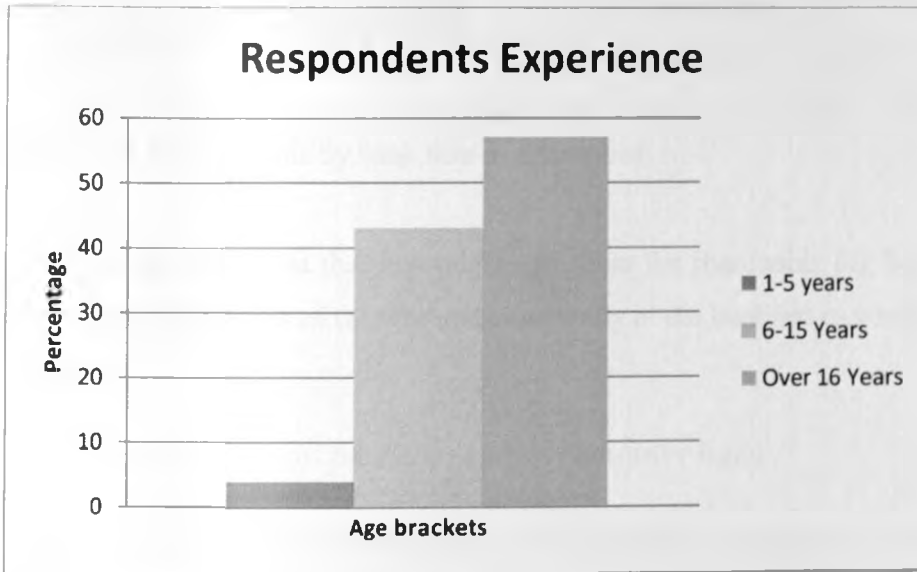
Figure 12: Respondents Experience

The results show that the respondents are employees with huge experience in banking have been in the industry for a long time and have experienced other technology regimes. This goes to support the outcome of the survey that the data is factual and provided by people with sufficient experience in the banking and IT industry.

4.6   Respondents of bank size by employees

Based on the respondents by bank size the results were as follows: Bank with employees between 1-99 (0%), between 100-499 (30%), between 500-999 (30%), between 1000-4,999 (40%) and above 5,000 (0%).
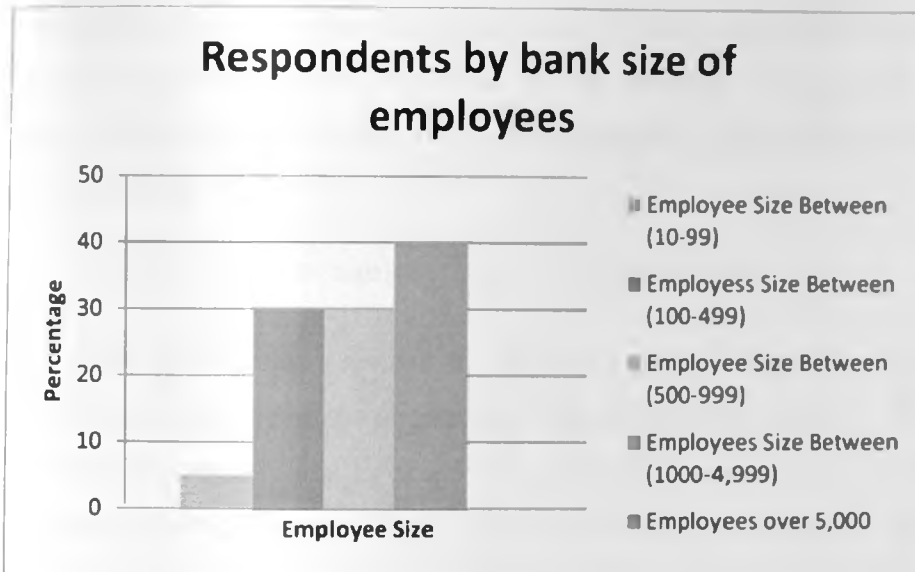
Figure 13: Respondents by bank size of employees

These results show that the respondents are from the reasonably big banks which are quite representative in terms of the size and complexity of the business to warrant a country market opinion.

4.7   Respondents of banks by size of customer base

Based on the respondents by bank size of customer base the results are as follows: Customer base between 1-9,999 (3%), between 10,000-29,000 (2%). between 30,000-99,999 (17%), between 100,000-499,999 (27%), between 500,000-999,999 (23%) and above 1,000,000 (28%).
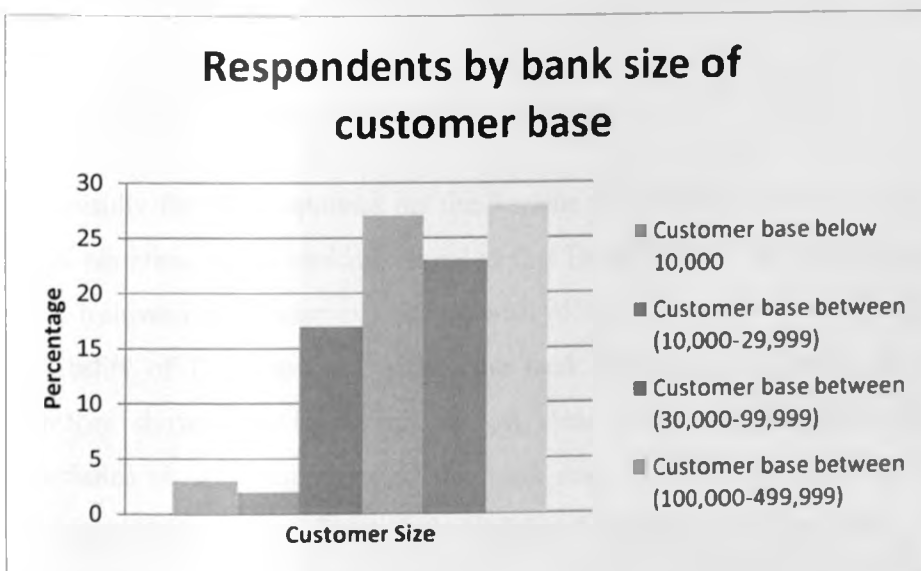
Figure 14: Respondents by bank size of customer base

The results indicate that the responding personnel represent the large banks by customer base and therefore their opinion if positive it will represent the desire of the entire banking industry which therefore would follow that acceptance of the results by the industry would be overwhelming.

4.8   Respondents of bank by geographical location

Due to the short period provided to respond to questionnaires the already received results indicate that majority of the respondents were from Nairobi based on the following results: Nairobi 87%, Nairobi and Environs 13%, other locations and towns in Kenya have not yet returned their responses and hope to include them in the next update of this report.

Respondents by geo-location

13%

■ Banks in Nairobi
◩ Banks in Nairobi Environs

87%
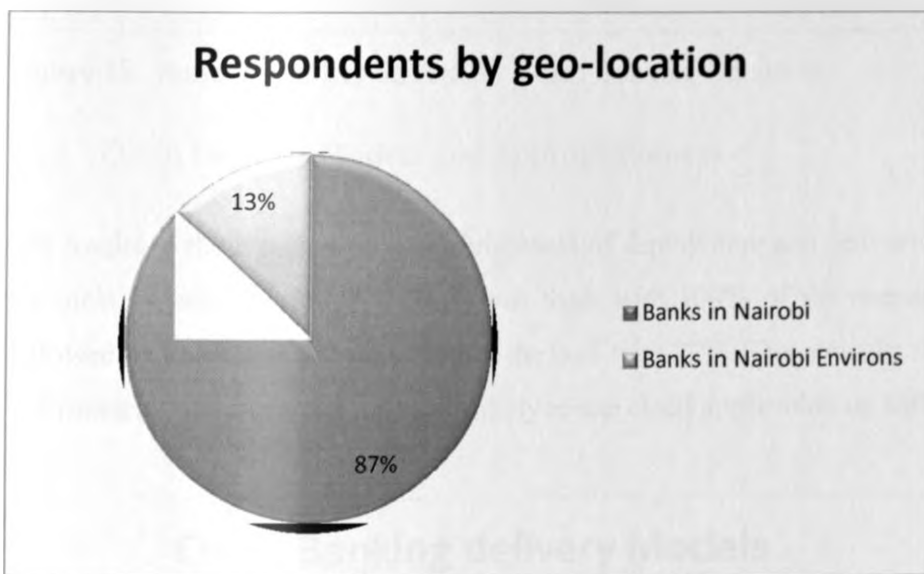
Figure 14: Respondents by Geo- Location

4.9   Key drivers for cloud banking adoption

The results for the responses on the various drivers for banks in Kenya for consideration while adopting cloud banking revealed that Data Security was most important concern with 97%, followed by vendor experience with 94%, Stable and Reliable Communication at 90%, Flexibility of IT Resources within the bank 80% and Economies of Scale at 68%. This therefore shows that there was almost clear consensus that Data Security and Vendor experience is very important so the bank must establish the security of their data before adopting cloud services. Figure below shows the summary of the results.
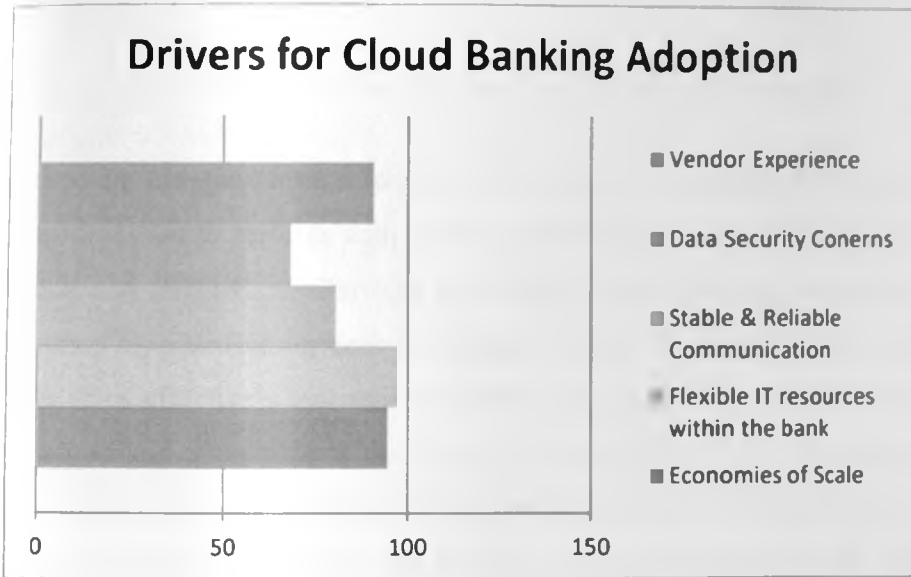
Figure 15: Summary of key drivers for Cloud Banking Adoption

4.10   Cloud Delivery Models and Appropriateness

The results to the question on appropriateness of deployment and delivery model showed that the most favourable cloud platform was SaaS with 100% of the respondents voting for it followed by PaaS with 87% and finally the IaaS with 73%. These results suggested that banks and financial organizations are more likely to use cloud application on software as a service.
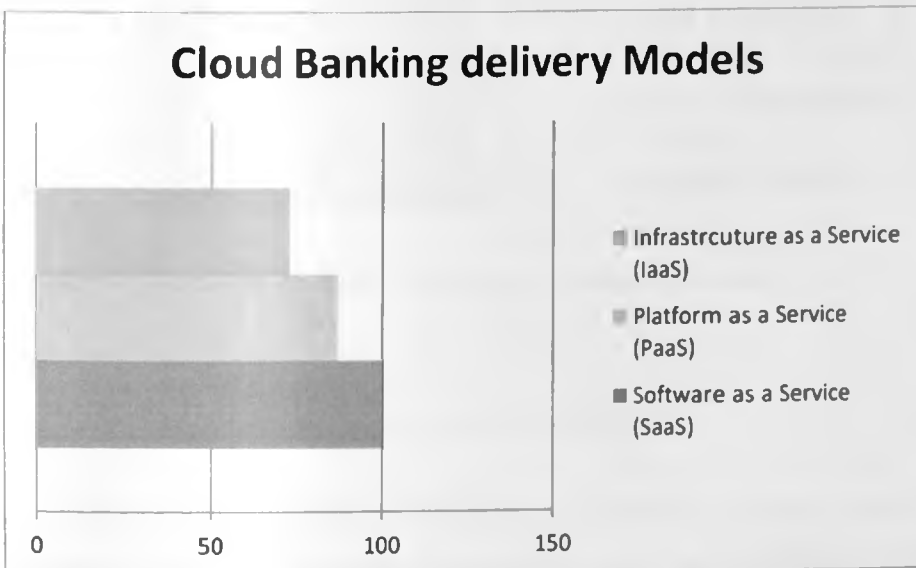
Figure 16: Summary of Cloud Banking Delivery Models

The results obtained from responses on this question it emerged that the banks were happy to outsource payroll services with a rating of 95%, followed by ATM Services Only with 92%, Credit and Debit Cards Services with 90%, Cheque Clearing services with 86% and Core Banking Operational Services (including Account Opening, Deposit and withdrawals) with 56%. This effectively indicates that there is fear within the Kenyan banks to let go of their core business operations to the cloud but more willing to let non-core services like payroll and Cheque clearing services. The respondents despite the desire to welcome cloud baking they displayed apprehension due to lack of information on how the cloud service delivery model would address the issues to do with data security, availability and confidentiality.
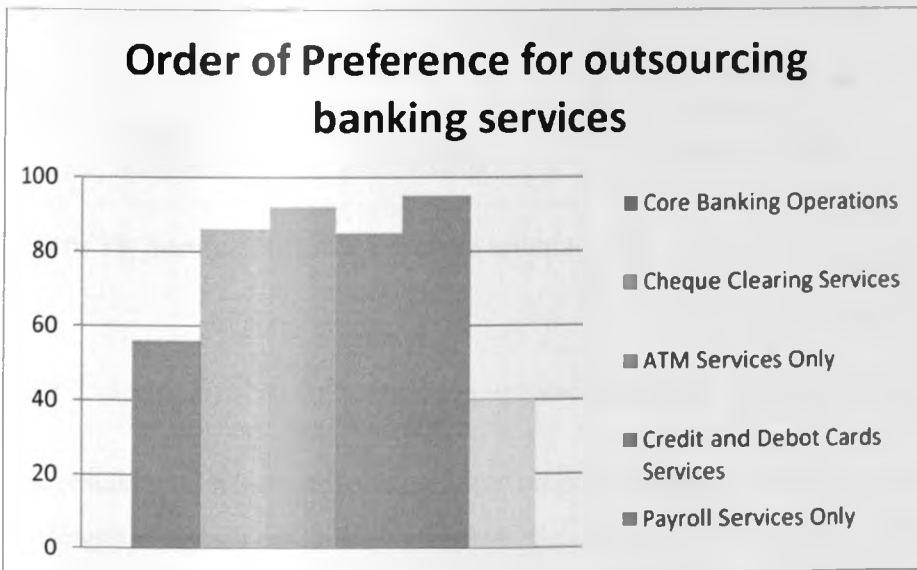
Figure 17: Summary of order of outsourcing banking services

4.12   Key Characteristics for vendor selection

The results for this question provided an overwhelming lead for vendor reputation perhaps because the banks are saying that they needed to trust the company they will entrust their data and subsequently their business to so the vendor reputation received 70%. These results also confirm that security concerns for the data as well as its availability and confidentiality are critical and the reputation of the vendor provides the comfort the banks require. The Terms of service and use of the cloud solution received 13%, the Size of the Company received 10%

while Specific cloud experience with the vendor received 7% perhaps to say that it wasn't a very important prerequisite since the bank would always have to go through a specific adoption process that establish the competence of the vendor during the implementation and on boarding process. It was not a worry of the respondents regarding where the vendors are located since they after all were going to run the business via the internet.
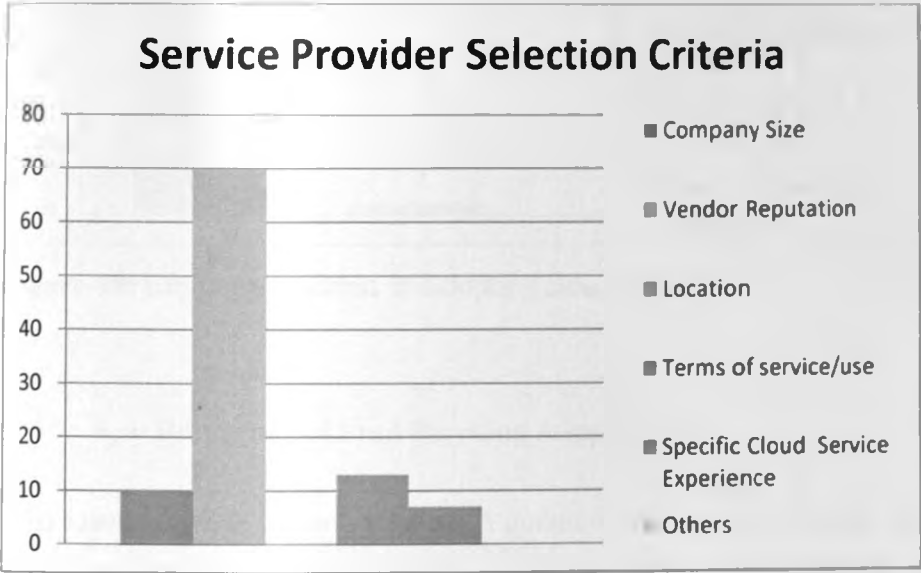
Figure 18: Service Provider Selection criteria

4.13   Key Concerns for vendor trustworthiness in cloud service delivery

The results overwhelmingly singled out vendor reputation with 87% a very important aspect of determining vendor trustworthiness. Security practices received 7%, while Terms of Service and Relevant experience and compliance received 3% each. The respondents didn't think that Information Assurance practices were critical since the banks would ordinarily audit their data and therefore would always ensure that their data/information is under constant check.
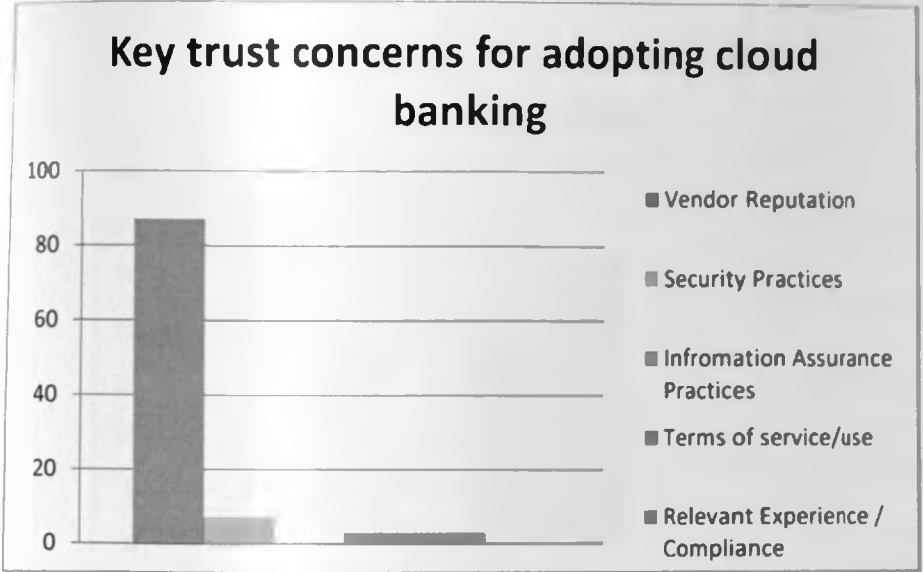
Figure 19: Key trust concerns in Adopting cloud banking

4.14 Key Barriers to Cloud Banking Adoption

The results for this important research question revealed that Security concerns tops the list with 33% followed by lack of clear adoption framework receiving 27% while Service availability and Network Issues both received 20%. Integration issues and regulatory and compliance requirements were not seen to worry the respondents perhaps because integration is part of the implementation and has its place in the on boarding exercise when the banks take sufficient look at the integration requirements. The regulatory requirements for the Kenyan market have not been developed and therefore the respondents felt that it would not be a concern at this stage. It is therefore clear from the research that there are certain barriers that must be overcome in order to experience a reasonable update of cloud services and a framework for adoption sorting out the issues raised in this research would be appropriate.
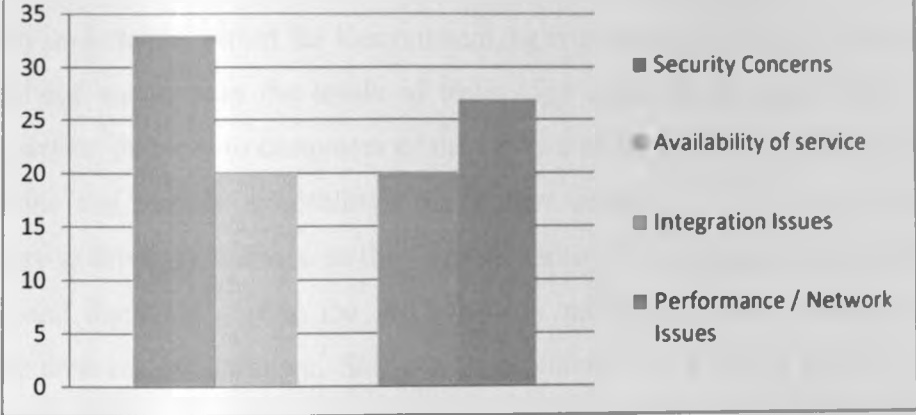
Figure 20: Key barriers to cloud banking adoption

5.0 Chapter 5: Discussion of Results

5.1 Introduction

The study undertaken within the Kenyan banking community has revealed that indeed there exists a huge variance in the levels of technology deployed by banks within the market making service delivery to customers of the banks a nightmare both in terms of high cost of transactions and service availability. While there seemed to be a good acceptability of technology to drive the business in the Kenyan market, the technology deployment levels are pathetic and disparate costing the local industry millions of shillings in acquisition and recurring cost of maintenance. Skills and technology go together and the banks have experienced severe IT skills loss over the years with overwhelming staff turnovers. This study has also provided insight on the strategic desires majority of the banks plan to take in the coming years to keep their business afloat and competitive. Despite fears of the evolution and conducting business in the cloud there is a definitive mood to acknowledge cloud computing as the next computing technology regime of choice that without a doubt the industry will want to adopt as long as elaborate frameworks and guidelines get established.

5.2 Reasons for status quo despite huge cloud evolution/computing capabilities.

In this section the researcher provides a summary of the major findings of the study as the survey has revealed a number of interesting facts. For example, depending on the nature of respondents title whether technology or business within large or small banks we obtained different results whereby respondents from large organizations whether from the business of the IT departments perceived cloud banking as the next immediate technology regime or tool they banks were due to adopt. It was also within the huge banks that we have the longer services staff contributing effectively with understanding of the impact of an updated delivery technology but obviously expressing outrightly what they considered immediate fears of general adoption of new technologies in banking business as well as cloud banking adoption in particular.

- **Respondents job role**

The respondents for this survey were from both the technical and business roles of the bank within a selection of over 44 local banks in Kenya. A summary of this is given in table 1

which shows the different types of respondents and their job roles within the banks they work for which clearly indicates that the outcome of this survey is reliable to a large extend since majority of respondents taking part are quite senior and their opinion counts in terms of the position taken or to be taken by their banks.

Respondents Job role	Area of Business	Respondent Count	Percentage
IT Management	Technical	9	30%
Business Management	Business	3	10%
IT Management (CIO,CTO)	Technical	4	13%
IT Management (Director, Snr Manager)	Business	3	10%
Business Management(CFO,CEO)	Business	9	30%
Others (IT Personnel)	Technical	6	7%
		30	100%

Table 1: Bank Respondents by Job Profile

The results of table 1 above indicates that the respondents participation was largely by the senior management both in the IT Management and the Business Management while less participation was in the lower cadre perhaps because of the gravity of the research title whose authority and decision making mandate within the banks rests with the senior management. This therefore in itself is an indication that the outcome will be authoritative having come from the top bankers in the Kenyan market hence giving the outcome the credibility required of any such a survey. The recommendations similarly have been verified by a section of the same respondents to ensure that it is in tandem with opinions earlier provided. It is without a doubt therefore to conclude that the findings provided here have enabled the researcher establish the reasons why despite the huge cloud evolution and computing capabilities our Kenyan banks have not warmed up to cloud banking. Table 2 below provides the reason presented by the bankers with their specific justification for the same while the recommendations from the researcher have been provided.

Bank fears for cloud adoption	Justification for the fears	Proposed Recommendations
Cloud Provider Trust	- Are they financially sound? - Do they have security policies - Do they have procedures?	Carry out thorough due diligence on the cloud service providers
Data Security concerns	- Do they have data management policies? - Do they have data privacy policies? - How about Hacker attacks?	Establish what level of data encryption they employ and if they are ISO certified.
Data Availability issues	- How rampant are system failures? - Correctness of data? - Integrity of data?	Data should be available as and when required in its good order.
Data Confidentiality	- Any changes of malicious modification of data? - Any chances of unauthorised access of data?	Protect data by all means from unauthorised access by any parties not required to access it.
Regulatory & Compliance Issues	- Where is the data to be stored? - Is your regulator in approval for data to be stored away? - Does your supplier compliant with specific standards? - Are you satisfied with SLA arrangements?	You must define scope of services required, any restrictions, regulatory and compliance issues.
Network Performance Issues	- How reliable will the Internet be? - What would be the adoptable communication speeds? - What would be cost of the communication lines?	Must ensure you have a reasonably reliable links whose cost is affordable.
Absence of Adoption Strategy	- How to choose provider? - How to conduct due diligence - How to negotiate SLA and contract? - How to test the strategy	Ensure due diligence is carried out thoroughly on the service providers.

Table 2: Respondents view of banks' delay in adopting cloud banking services.

The findings from the research have revealed that the banks management would have liked cloud banking adopted using cloud services at the upper stack of the platform as compared to the lower stack which means the preferred adoption would be in the order of SaaS. IaaS and PaaS in the order (section 4.10). However, due to the fact that the interviewed respondents indicated concerns that there were not as many well-known cloud providers in the market place and only a handful of them could be trusted.

It was also evident from the research that the adoption of cloud services in the banking industry would have been more welcome starting with certain business operations than with others (Section 4.11). The table 3 below provides the order of adoption that the respondents revealed which shows the manner in which business lines would be let go to the cloud while keeping hold of some of the very core operations of the banks.

Business Area	No. of respondents	Percentage
Core Banking Operations	17	56%
Cheques Clearing Services	26	86%
ATM services Only	28	92%
Credit/Debit Card Services	27	90%
Payroll Services	29	95%

Table 3: Order of precedence for outsourcing banking services

Findings from the above table show that the core banking activities which are indeed mission critical received very few votes from the respondents which means that banks in Kenya would wish to let core banking activities to the cloud after every other activity has been on-boarded to the cloud. The biggest driver of cloud banking adoption according to this research therefore has been voted as Flexible IT resources within the bank followed by Economies of Scale while others are vendor experience, Stable and Reliable communication and Data security concerns in that manner and order of importance (see Section 4.9). It was apparent that the respondents wanted to know that sufficient IT skills exist within the bank to able to

manage the new technology for themselves particularly when their customer records be mounted into cloud data centres, to see that access is only by authorised users, its maintained in terms of update and modification in a controlled environment and how secure that cloud data centres were by themselves and that the banks have full control of their business. The table 4 below shows the how respondents felt about the factors driving the need for cloud adoption in the Kenyan banking market.

Drivers for Adoption	No. of Respondents	Percentage
Economies of Scale	28	94%
Stable & Reliable Communication	24	80%
Data Security Concerns	20	68%
Vendor Experience	27	90%
Flexible IT resources within the Bank	29	97%

Table 4: Drivers for Cloud Banking Adoption

The results out of this survey have shown too much apprehension on matters technology and IT skills within the banks to manage the new platform and therefore any persuasions into adopting cloud banking services must seek to address first and foremost matter of IT skills and resources as well as present an elaborate growth plan showing how the new technology would be adopted in a small manner and then ensuring full adoption in all areas of the business. The banks did not seems to have any issues to do with costs since cloud banking proposition always presented a cheaper option than the on premise system deployment.

5.4 Barriers to Cloud Banking Adoption

The research findings have shown that all respondents both with business knowledge and those with technology understanding all considered security concerns to be the most significant factor or barrier in cloud banking adoption as pointed out in section 4.14. This could be certainly due to weight placed on data confidentiality regarding customer financial information by the business management teams while the technical managers considered it so due to the need to have a secure technical infrastructure to deliver their business. The second

most important barrier identified after the security was the absence of clear cloud adoption strategy considering like every new technology, none of the banks would have wanted to be used as guinne pigs particularly when they already had somewhat working systems though they acknowledged that it was going to be inevitable that cloud banking adoption was going to be a must for future successful businesses. Table 5 below how the respondents voted for the barriers affecting the decision to adopt cloud banking for the Kenyan banking market.

Barriers to Adoption	No. of Respondents	Percentage
Security concerns	10	33%
Integration Issues	0	0%
Availability of service	6	20%
Performance/Network Issues	6	20%
Lack of Adoption strategy	8	27%

Table 5: Key barriers to cloud banking adoption

In the psychology of security, Schneir argues that "security is both a feeling and reality and they are not the same" (Schneir, 2008). In this, Schneir means that the reality of security is based on the probability of different risks and how effective the various mitigation strategies are in place in dealing with the perceived risks. Security is also a feeling based on the psychological reaction to both the risks and the counter measures. Therefore, this means that cloud banking needs to appeal to the feelings of clients who are the banks to address the potential security risks in a manner that they will feel secure.

By addressing security in this way the banks will feel safe and secure hence trust the cloud service providers. Figure 20 shows that next to security concerns is the lack of an adoption strategy or framework that banks would follow when adopting the new technology to ensure that trust is entrenched and security fears removed through an elaborate frame or work (framework) for mounting, managing and maintaining banking business in the cloud.

5.5 Vendor selection and trust issues in cloud banking adoption

The selection criteria and issues surrounding the vendor were a key objective of this study and research question just to establish what would constitute key selection criteria for that vendor or service provider who would carry the trust of the banks to host and manage their data. The findings on these two issues as they relate to cloud banking adoption found that security practices and disaster recovery and business continuity were quite important from both the perspective of technical and business managers as provided in table 5.

The key findings on the key selection approach heavily centered on the reputation of the vendor with special emphasis on what the vendor stands for in the local market. While vendor reputation in other parts of the would be equally important, it was the opinion of the Kenyan banking market that a vendor with local experience in undertaking project within the country and region would fit the requirement and carry the rust of the local banks much more. The bank also faced the fact of life that most competent vendors had international perspective of things and it would be most unlikely the local vendors would equally carry the exposure and experience required to undertake some of the huge cloud banking projects for key banks in Kenya. Table 6 below shows the key characteristics for vendor selection.

Characteristics for selection	No. of Respondents	Percentage
Company Size	3	10%
Reputation	21	70%
Location	0	0%
Terms of service/Use	4	13%
Specific experience in cloud services	2	7%
Others	0	0%

Table 6: Key characteristics for vendor selection

The findings strongly point at the reputation of the vendor as a key reason for selection and this is because banks would want to know that they entrust their business data and expose themselves to organization that have reputation in themselves and can be trusted. Also besides the reputation of the vendor the banks wanted to know that the vendor they select had established operational guidelines for cloud banking with clear terms of service /use and indeed was not a small company and hence their size as a corporate entity was a key consideration. It also followed that specific experience in cloud service provision was a factor.

In terms of the status of vendor trustworthiness and service delivery the respondents hinged once again on the vendor reputation and the ability of the vendor identify with security practices that would be above board since handling banking date requires to be handled in very secure manner. Having discussed in earlier sections of this report key barriers to cloud banking to be security concerns then it follows that the for any service providers to be able to collaborate in a successful cloud banking adoption with the banks there must exist sufficient trust and the service provider must be reputable. Section 4.13 provides statistics that shows how certain factors will determine the relationship between vendor and client (banks) in creating a collaborative environment in adopting cloud services. While also this section concerns itself with identifying how banks can address the challenges facing cloud banking and the possibility of customer and service provider collaboration all these have been addressed in the proposed roadmap and strategic framework for cloud banking adoption. It was also hypothesized that by the use of the proposed roadmap the technical managers as well as the business managers of the bank will have a better understanding of the key issues involved in cloud banking and a tool to guide the process of adopting cloud banking. Section 5.6 evaluated various frameworks for cloud adoption and recommends a suitable framework for cloud adoption within the Kenyan perspective.

5.6   Cloud Banking Adoption Framework (CBAF).

As demonstrated in the previous sections, a successful cloud banking adoption must focus on the areas of security, reputation or trust, IT resources within the banks as well as reliable communication of the internet. This section therefore integrates all the critical issues from the previous sections into a framework for a successful cloud banking adoption project so that both the business and technical managers can use the framework to address strategic issues at

each stage of the project lifecycle. This framework is known as Cloud Banking Adoption Framework.

The Figure 21 below shows the proposed cloud banking adoption framework which is composed of (5) phases for the adoption of cloud banking projects. This has been designed with feedback received from the Kenyan banking respondents and the analysis of the various adoption frameworks discussed in the Literature review. The (5) phases include Analysis, Planning, Adoption, Migration and Management.

This is how the framework will work; within the analysis phase, the analysts work with users to conduct analysis on the existing systems, applications and business processes which should be done using tools such as SWOT analysis in order to ascertain the direction, security, legal and compliance issues, usability and accessibility issues, analysis of impact to organizational structure and culture. It is this phase whereby the strengths and weaknesses of the existing system are identified as well as the applications and business processes, the impact of moving to the cloud and the possible candidates for migration to the cloud.

The planning phase deals with the benchmarking and standards, choosing the appropriate platforms for deployment, the cloud infrastructure, finance plan, security, Legal and compliance plan and roll-out plan for the adoption project. This phase sets the objectives and direction for the adoption of cloud banking. The third phase, the Adoption phase is where the analysts and the project teams work on application integration with cloud platforms and infrastructure, outsourcing strategies, works on the Service Level Agreements (SLAs), customer service management, Security policies, legal and compliance management and a contract with the vendor developed and signed. This phase sets the stage for migration (on boarding) of the selected applications and systems to the cloud.

The fourth phase is the migration phase which ensures that the application and data are carried out a specified in the roll-out plan which was developed in the planning phase. It is also at this phase that we ensure the availability of user support in the whole process of migrating data to the cloud and monitoring and control of the migration exercise. In the fifth phase, that is the management phase the project team works to ensure that contracts are properly managed and that the project is signed off. The best-practices and lessons learned

are properly documented; technical support is ensured for continual support of the systems and users with the review of the whole project being undertaken consistently.

Analysis Phase
1. Run a SWOT analysis
2. Analyse security issues
3. Analysis of Legal & compliance issues
4. Analysis of usability and Accessibility
5. analysis of banks readiness
6. Analysis of other operational impacts

Planning Phase
1. Establish standard
2. Decide and choose cloud infrastructure
3. Budget/Finance plan
4. Security, Legal & compliance planning
5. Adoption and migration planning

Adoption Phase
1. Application and data integration
2. Information on-boarding
3. Policy generation i.e SLA etc
4. Contracting with the service providers

Migration Phase
1. Implement the migration plan
2. Application and data migration
3. Support services
4. Monitoring and control

Management Phase
1. Manage contacts with service provider
2. Document best practices and lessons learned
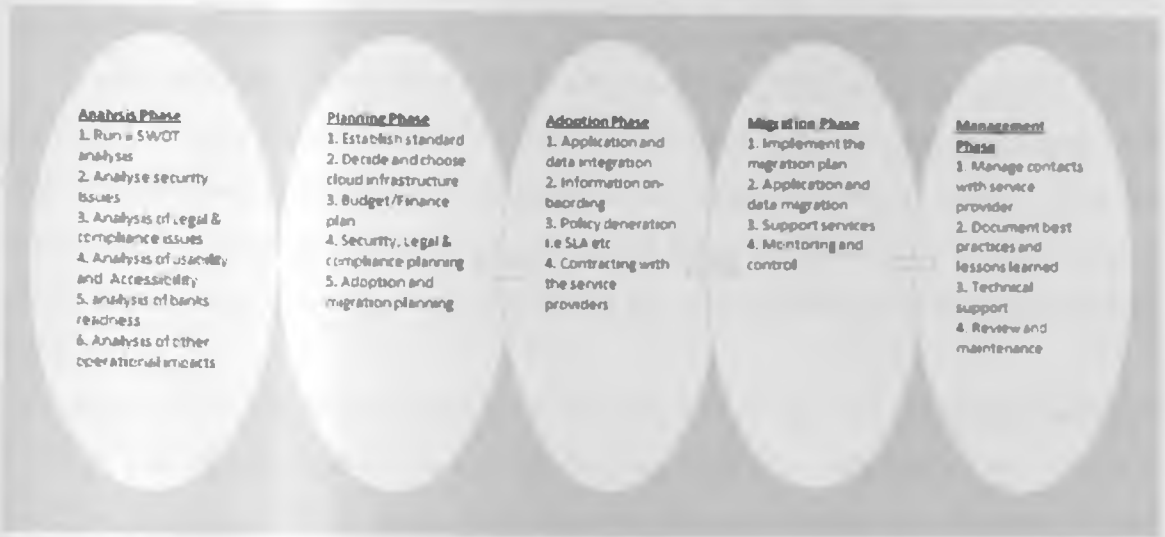3. Technical support
4. Review and maintenance

Figure 21: Recommended Cloud Banking Adoption Framework (CBAF).

In the case of a bank that wants to adopt cloud banking but they are not sure of how much it would cost them and what would be the banks IT budget or do not even have elaborate procurement procedure and therefore unable to carry out a reasonable due diligence then in the analysis phase using tools such as SWOT the bank can identify current state of the IT financial status. It is also at this stage that cost benefit analysis is undertaken to determine whether the move besides bringing new way of doing business will have a positive financial implications to the bank. During the planning stage any changes emerging are communicated to the management of the bank for action including any perceived impact on the analysis undertaken at the analysis stage. The outcome of the planning phase drifts to the Adoption stage where contracts, SLAs and other policies are actualised. In the migration stage proper controls, checks and balances are developed to ensure that the financial and procurement policies and plans are followed and finally in the management phase the documentation of all the lessons learnt as well as best practices is completed. The technical support is provided for continual support of the system and users and review of the whole project is done from time to time with feedback to the top management of the bank. Although a bit generic this adoption framework is purely based on research carried in chapters 1, 2, 3 and 4 and therefore can be applied to the domain of cloud banking.

Phase 1: Analysis

Like in all software projects, the initial stage is understanding users' requirements in order to determine whether the project is feasible and doable within the resources available in the organization. It is therefore at this stage that the initial requirements, feasibility, project scope, costs and initial plan is developed. During this phase of the project the business case is developed. Careful thought should be given to how the existing systems strengths and opportunities can be maximised, the weaknesses and threats minimised (Session 2.8.2), the impact to the organization culture, processes, and structure minimised and the effects of SLAs as well as how the return on investments and cost of adopting cloud banking can be managed.

The impact of organizational security policies, standards and legal and compliance issues are key here and must be analysed so that the strengths, weakness, opportunities and threats of the existing system a SWOT matric (Swinton, 2004) is useful, in accessing the organizational impact of moving to the cloud the PESTLE matrix developed by the Associates is invaluable (Associates 2003), Also the organization may use tools that are familiar within the organization. The Table 7 summarises the issues that are addressed within the analysis phase.

Issues	Section
Security	4.9
Legal and compliance	1.6, 5.6
Usability and Accessibility	2.7
SLA Management	3.1, 5.2
Vendor refutation	4.9

Table 7: Summary of Issues addressed in analysis phase (Source: author)

Phase 2: Planning

In this phase the standards/benchmarks for security, legal and compliance issues identified in the analysis phase are established. The benchmarks will reflect the internal organizational best practices, policies and standards to industry standards and best practices and how they can achieved when moving the bank operations to the cloud. The benchmarks also will reflect the legal and compliance best practices that need to be maintained and achieved in the cloud environment. The selection of cloud platform and infrastructure suitable for the banks' systems and applications to be moved to the cloud is done. The financing and cost management plan is developed and how cost will be managed and it is also at this stage that

the method or model of payment is decided upon and how this is to be managed within the bank (Section 2.8.1). The plan on how to ensure security compliance, legal and compliance to standards and regulations is laid down.

In preparing the adoption or roll-out plan it is important at this stage to decide whether prototyping of cloud services will be used and whether there will be pilot projects before full roll-out and identifying risks and how they are to be mitigated (Section 2.8.2) the Table 8 below summarises the issues addressed in the planning phase.

Issues	Section
Technology	2.5, 2.6
Deployment Models	2.6
Drivers and benefits of adoption	4.9
Governance and Risk Management	2.8.2
Economics of cloud computing	2.8.1

Table 8: Summary of issues addressed in the planning phase (Source: author)

Phase 3: Adoption

This phase is the preparation phase for the actual migration of the system and the applications selected to be moved to the cloud platform and infrastructure of choice, in this phase systems/application integration is done to ensure that the candidate application will be able to function with the internal application that are not migrated to the cloud and also with the cloud infrastructure of choice (Section 2.8.5). outsourcing strategies are decided upon and the benchmarks developed in the planning phase are used to measure vendor ability to provide service that will not affect the organizations service of delivery and business, As indicated in section 2.8.4 and 2.8.6 collaboration with vendors is crucial in establishing SLA agreements and different security policies as well as best practices to ensure compliance and trust. The last thing in this phase is contract development and signing that meets the user requirements for using the cloud services. Table 9 summarises the different issues that are addressed at the adoption phase.

Issues	Section
Standards and best practices	2.8.4
System and application migration	2.8.5
SLA Management	2.8.4
Contract development and signing	5.6

Table 9: Summary of Issues addressed in Adoption phase (Source: author)

Phase 4: Migration

At this point the preparation for migration to the cloud is concluded giving way to the actual migration to proceed. At this stage the project can either be discarded or enhanced to meet the user requirements. With the outcome from the previous three (3) phases the roll-out plan can be put in place. Application and data migration can proceed. The support of users during the migration process is provided and the monitoring and control of the project is maintained to ensure successful migration. Table 10 summarises the different issues facing cloud migration that the migration phase addresses.

Issues	Section
Sources of perceived threats	2.8.4
Standards and best practices	2.8.4
Governance and risk management	2.8.2
SLA Management	2.8.4

Table 10: Summary of Issues addressed in the Migration Phase (Source: author)

Phase 5: Management

The project now should be fully operational in the cloud however contract and vendor management, testing and maintenance, users support and review should be on-going for several months subsequent to the launch. The system metrics or benchmark developed and established in phase 2 can be used as indicators of project success and should be monitored , Security standards compliance, SLAs, legal and compliance issues, IT governance best practices and cost management are desirable metrics.

Also documentation of lessons learnt and best practices during the project should be documented and communicated to all stakeholders. Table 11 provided a summary of the different issues addressed by management phase.

Issues	Section
Contract and Vendor Management	5.6
Cloud Adoption	Whole Project
Security standards Compliance	2.8.4

Table 11: Summary of Issues addressed in the Management Phase (Source: author)

As provided in section 5.6, the researcher provided the framework for cloud banking adoption that would assist the Kenyan banks manage their migration of their businesses to the cloud. Though a new concept would require strong appreciation of the guidelines provided here as well as good information technology project implementation tenets the researcher developed a test kit to run through the key IT and Business Managers at the banks whereby they provided their feedback allowing the establishment if the framework would actually work in a real cloud banking adoption.

Since the primary objective of the framework was to provide a tool for assisting migration of banking business to the cloud, the five stages outlined in the framework must be tested individually to ensure that every key attribute at each stage is tested and the Managers understand the implication of having them right. To test the framework therefore, each section contains a series of questions which would be answered on a scale on 1 to 5. On the responses 1 indicates an unfavourable response to the question and 5 a strongly favourable response. Each response is then multiplied by a specific weighting factor. The weights applied was decided in by the researcher and it really means that different attributes and questions would carry different weights depending on how the researchers thinks they impact the entire migration projects to the cloud.

In order to ensure recognition of key factors affecting cloud banking adoption as earlier highlighted from the feedback from the banks in Kenya, the aspects of vendor reputation, security and data availability were allocated high weightings than those touching on documentation and service level management for example.

This is the questionnaire send to a selected bank representatives deemed by the researcher as opinion shapers and capable of giving a representative opinion regarding the necessary feedback on testing the cloud banking framework developed after interviews and questionnaire with over 35 banks in Kenya. The researcher using this questionnaire returned only to two banks in Kenya namely the Kenya Commercial Bank represented by the Head of IT Mr. Immanuel Mwazhige and the Co-operative Bank of Kenya represented by Mr. Bundotich Ruto (actual names concealed for security reasons). The feedback from the two representatives revealed that the Cloud banking adoption framework work for the Kenyan banking market with over 80% approval pass.

Phase 1: Analysis			
Question	Weight	Response	Score
1. How critical is initial project requirement definition and identification.	1	X at 5 (1 2 3 4 5)	5
2. Would the analysis of internal systems be necessary?	1	X at 4 (1 2 3 4 5)	4
3. Would the analysis of security, compliance issue	1	X at 5 (1 2 3 4 5)	5
4. How critical is analysis of risks and benefits of moving to the cloud?	1	X at 5 (1 2 3 4 5)	5
5. How important is assessment of the impact of moving to the cloud by all stakeholders?	1	X at 4 (1 2 3 4 5)	4
6. How critical is the financial implication of cloud adoption?	1	X at 4 (1 2 3 4 5)	4
7. How critical is the identification of order of application	1	X at 5 (1 2 3 4 5)	5
Weighted Total			32

Table 12: Summary of two respondents on Analysis phase

It is worth noting from the observations made here that necessitating attributes of the framework causing the bank managers to use certain tools in establishing key aspects of the cloud adoption exercise is critical and helps the business manager is developing trust in the process.

Phase 2: Planning			
Question	Weight	Response	Score
1. Importance of planning with known system and applications	1	X at 4 (1 2 3 4 5)	4
2. Consideration for clearly identifying candidate system	1	X at 3 (1 2 3 4 5)	3
3. Criticality of selecting cloud infrastructure to project success	1	X at 4 (1 2 3 4 5)	4
4. Development of finance and management plan critical to the project success	1	X at 3 (1 2 3 4 5)	3
5. How feasible is the plan for security and compliance	1	X at 5 (1 2 3 4 5)	5

	Weight	Response	Score
6. How critical is the involvement of the vendors in the process?	1	X at 4 (1 2 3 4 5)	4
7. What is the importance of the roll-out plan details for candidate system?	1	X at 2 (1 2 3 4 5)	2
Weighted Total			25

Table 13: Summary of the feedback on Planning Phase

Planning is so critical to the success of any project and therefore what emerged out of the feedback from the selected bankers is that every aspect of planning was required to succeed in cloud adoption. Key in this phase is to ensure that banks use organizations familiar benchmarking tools so that they can use those systems already stable and properly operational on premise can be migrated to the cloud. Also it was emphasised the at planning phase the bank would be able to selected an appropriate cloud infrastructure and service provider of choice to host the bank's business.

Phase 3: Adoption			
Question	Weight	Response	Score
1. Would clear adoption rehearsals provide better adoption results?	1	X at 4 (1 2 3 4 5)	4
2. Would the bank put in place acceptable procurement procedures?	1	X at 3 (1 2 3 4 5)	3
3. How critical is SLAs, security policies and IT governance procedures by the vendor?	1	X at 5 (1 2 3 4 5)	5
4. How critical are well drawn contracts addressing the interests of both bank and vendor?	1	X at 3 (1 2 3 4 5)	3
Weighted Total			15

Table 14: Summary of the feedback on Adoption Phase

This stage tested feeling of the respondents on the actual adoption process and what came out is that the banks interviewed indicated that this stage depended highly on the outcome of the earlier stages.

Phase 4: Migration			

Question	Weight	Response	Score
1. How comprehensive would you expect the roll-out plan to be?	1	X at 5 (1 2 3 4 5)	5
2. What kind of awareness would you expect the users affected to have?	.1	X at 4 (1 2 3 4 5)	4
3. What level of approval would you expect for data migration at this stage?	1	X at 3 (1 2 3 4 5)	3
4. What level of user support and control mechanism would you expect to see at this stage?	1	X at 4 (1 2 3 4 5)	4
Weighted Total			16

Table 15: Summary of feedback on Migration Phase

The interviewed representatives of the banks felt that the involvement of the users in this phase was critical so as to address issues related to resistance to change as well as addressing social technical issues that come as a result of adopting cloud computing since the involvement of all people would allow them identify the critical areas affecting the entire process.

Phase 5: Management			
Question	Weight	Response	Score
1. What would be the banks view on the issue of vendor and contract management?	1	X at 4 (1 2 3 4 5)	4
2. What is the view on contract executions for cloud projects?	1	X at 5 (1 2 3 4 5)	5
3. What would you like to see in terms of documentation of lessons learnt and best practices?	1	X at 4 (1 2 3 4 5)	4
4. How about a strong technical support established for the outsourced environment?	1	X at 4 (1 2 3 4 5)	4
5. How strongly would you consider having clear testing and maintenance plans before launching cloud project?	1	X at 4 (1 2 3 4 5)	4
6. How strongly would feel for applications and data choice adoption and operational success?	1	5 at 5 (1 2 3 4 5)	5
Weighted Total			26

Table 16: Summary of the Management Phase outcome

Looking critically at the issues around the Management phase we are convinced that the banks admit that there were lessons to be learnt and best practices coming for the experience of the vendor to tap into so that the actual business migration and adoption to the cloud can be less painful and less dreading than always anticipated.

Table 17: provides the phase totals as well as the total score as provided by the bank representatives that were interviewed.

Overall Phase Totals		
	Phase	Score
Phase 1	Analysis	32
Phase 2	Planning	25
Phase 3	Adoption	15
Phase 4	Migration	16
Phase 5	Management	26
		81%

Table 17: Summary of the Overall Phase totals

The bank representatives reviewed the recommended cloud adoption framework and strongly agreed that they were for in support of the five phases and also indicated that they found the framework to be a useful and effective tool for analysing cloud project for adoption by the Kenyan banks. They also indicated that the process of using a cloud adoption framework would create a uniform platform for which banks in the Kenyan banking environment would be able to adopt an acceptably uniform tool to do the same thing.

The research has therefore provided a template with which banks can place their requirement for cloud adoption and get the necessary facilitation. The test questionnaire and interview also provided confidence that the framework is not only a theoretical and academic work but also proved that it can be adopted in the real life banking projects.

6.0 Conclusion / Summary

6.1 Introduction

This final chapter reviews how the dissertation and research carried out and its outcome. In the research study had five questions were answered and assessed. The questions included (a).What had caused the Kenyan bank not want to adopt cloud banking despite the fast cloud evolution and computing capabilities (b). Determine the key drivers to cloud banking adoption. (c). Investigate the key barriers to cloud banking adoption i.e. Security, Availability and Confidentiality issues. (d). Investigate the status of the trust between Vendor and client (establish possible vendor client collaboration) and finally (e). Develop a Cloud Banking Adoption Framework that would guide banks as the consider adopting cloud banking. Majority of these questions have been answered in chapters 2, 3, and 4 while chapters 5 provided banks feedback that the researcher used to piece together facts leading to the development of the proposed cloud banking roadmap.

The research also very critically evaluated and recommendations drawn from the analysis in chapter 5 placing all the research recommendations from the preceding chapters in the context of a roadmap and an associated framework, the chapter also set apart some high level areas of focus. These recommendations are important to successful cloud banking/ computing adoption projects. The recommendations include:-

- Collaboration between customers and cloud service providers.
- The use of security and IT governance best practices migrating to clouds
- Analysis and planning should form the basis of any cloud banking adoption project
- Impacts of migrating to the cloud on culture politics and work processes are critical
- Deploy projects based on best practices and agreed security and compliance issues

This last chapter also discusses future research areas. As the discipline of cloud banking/ computing is still young leaving a large scope for future research work. Some of the suggestions outlined in this chapter include the impact of cloud computing to the social-technical aspect of the organisation.

6.2   Research Definition and Overview

The successful adoption of cloud banking is key for realisation of benefits that today promised by cloud banking customer is looking for from their bankers. The high cost of transaction, the denial of services experienced in most of the service points and the burden of high software costs incurred by banks in Africa and the world. As organisations are faced with the need for high processing capabilities, large storage capabilities, IT resource scalability and high availability, at the lowest possible cost, cloud computing becomes an attractive alternative. However, the nature of cloud computing pose challenges to organisation as they consider adopting it. Issues such as security, legal and regulatory compliance become more prevalent. The aim of this research study was to investigate the challenges facing cloud banking adoption and synthesise a roadmap or framework which will provide banking organisations with guidelines for successful cloud banking adoption by addressing the challenges identified.

6.3   Contribution to the body of Knowledge

In this research study, several challenges facing cloud banking adoption were identified as the main research area of the study with the reason for this is being the slow adoption of cloud computing by many large organisations such as financial institutions/banks as well as state or government agencies. The outcome of this study therefore is a roadmap for successful adoption of cloud banking and its achievement framework. The motivation for development of the roadmap being the need to address the identified challenges and provide Kenyan banking organisations with a tool for guidance in adoption of cloud banking. In order to achieve this, an extensive literature review on cloud computing, trust and security issues related to cloud computing, legal and compliance issues and organisational challenges for cloud adoption was conducted. The objective was to understand how organisation perceives cloud computing despite its promised benefits. An extensive exploration of trust models, security standards, regulations on privacy and data protection and the impact of technology on organisation culture, processes and structure were done.

The literature revealed that most of the trust and security issues raised originate from the traditional computing environments, while those related to legal and compliance issues related to the complex nature of technology and the rate at which technology changes as

opposed to legislation. As to the organisational impact of cloud computing, it was revealed that little research has been conducted as to the impact of cloud computing to social technical aspects of cloud banking/computing.

Based on the findings from literature review, a survey was prepared which aimed at investigating the main concerns of organisation in adopting cloud banking and also the information assurance practices of vendors. The targeted survey respondents were CEO, CIO, executives, and IT strategists among others. And for the survey on information assurance practices vendors were selected based on the publicly available information to the top banking institutions in Kenya and it revealed that the greatest concerns were security, privacy, SLA and vendor lock-in. Other concerns were regulatory compliance, application portability and lack of standards. Moreover, the survey showed that these concerns are the same worldwide. The aim of the research was to develop a roadmap that would assist banks in leveraging cloud banking through successful adoption. Using the results from literature review and survey, the roadmap for enabling successful adoption of cloud banking was developed. The roadmap is an open framework that can be used in any organisation and for any cloud computing platform and infrastructure as guidance towards successful cloud computing adoption. The roadmap was evaluated by business expert and proved to be applicable in a banking organisational context.

6.4   Future Work and Research

Considering that the general technologies supporting cloud computing have existed for many decades, cloud computing as a computing paradigm has existed for just a few short years. In that regard therefore the scope for further research is enormous. In this section the researcher provides some starters for future work and research.

There exists a great requirement for more research and case studies to evaluate the technology adoption frameworks and in particular those related to cloud computing adoption.

These case studies from both successful and unsuccessful projects will help to improve the roadmap and the framework. Another area for further research is that of assessing the social-technical impacts of cloud computing in organisation. This is the impact of migrating to cloud computing and its effects on the organisational culture, people and their relationships, work performance and system affordances. Research in this area should seek to answer

questions such as: how does migrating to cloud affect the current work practices? Will system affordances change and how will they change and address questions of trust and vendor customer relationship.

6.5   Conclusion

Finally, this chapter has presented the overall conclusion of the research carried out and the recommendation for future researchers. At the same time the research overview was given where the aim for the research project was outlined.

The aim of the research was to develop a framework that will enable successful adoption of cloud banking adoption by banks and financial institutions in Kenya and to achieve this perceived challenges facing organisation in cloud banking adoption and the information assurance practices of cloud vendors that hinders adoption of cloud banking were identified.

The research contribution to knowledge was identified as the developed framework. The chapter also, discussed future research areas. Some suggested research areas outlined.

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8.00 Appendices

8.1 Project Schedule

Task No.	Activity	Weeks	Planned Start Date	Actual Start Date	Planned End Date	Actual End Date	Deliverable
1.	Preparing project for discussion	2	12/04/2012	12/04/2012	21/04/2012	21/04/2012	Draft project proposal
2.	Review and prepare final Project Proposal & schedule	½	22/04/2012	22/04/2012	24/04/2012	24/04/2012	Agreed Project Proposal
3.	Research Cloud banking and cloud computing technology	½	03/05/2012	003/05/2012	08/05/2012	08/05/2012	Survey Notes
4.	Proposal Presentation	0	09/05/2012	09/05/2012	09/05/2012	09/05/2012	Project File
5.	Project Proposal Review	2	14/05/2012		28/05/2012	27/05/2012	Revised Project Plan
6.	Cloud Banking Survey study	1	30/05/2012		11/06/2012	15/06/2012	Study Documentation
7.	Preparation of questionnaires	3	15/06/2012		02/07/2012	30/06/2012	Questionnaires Document
8	Progress Presentation	0	03/07/2012		03/07/2012	03/08/2012	Updated Project File
9.	Cloud banking / technology review	3	04/07/2012		18/07/2012	18/07/2012	Survey questionnaire
10.	Gathering Project details	2	19/07/2012		31/07/2012	31/07/2012	Project Information
11.	Cloud Banking Model analysis	2	24/07/2012		04/08/2012	10/08/2012	Cloud Banking Mosel
12.	Model analysis	0	15/08/2012		15/08/2012	15/08/2012	Updated Project File
13.	Analysis of Research information	2	16/08/2012		28/08/2012	23/08/2012	Analysis report
14.	Documentation of Project	2	03/09/2012		10/09/2012		Project Documentation draft
15.	Final Project Review	2	11/09/2012		22/09/2012		Final Project Document
16.	Preparation for Final Presentation	1	23/11/2012		23/11/2012		Final Presentation materials
Total Weeks		24					

8.2 Project Gantt chart

CTIVITY	WK 1	WK 2	WK 3	WK 04	WK 06	WK 08	WK 10	WK 12	WK 14	WK 16	WK 18	WK 20	WK 22	WK 24
...tes	09/4	16/4	09/5	28/5	11/6	30/6	18/7	3107	15/8	30/8	15/9	15/10	15/11	23/11
...rms of Reference	▓													
...ject. Plan		▓												
...earch		▓												
...ject. Presentation			▓											
...ject. Review				▓										
...ud Banking study				▓										
...estionnaire. Preps					▓									
...Progress								▓						
...ud Banking Rev"w									▓					
...nering details										▓				
...ud Banking Model										▓				
...Progress											▓			
...ta Analysis												▓		
...ect documentation													▓	
...al Project Review														▓
...al Project. Present														▓

8.3 Project Budget

INCOME	INCOME SOURCE	AMOUNT
	Own Contribution/savings	Kes5,000
	Well-wisher Donations	Kes5,000
TOTAL PROJECT INCOME		Kes10,000
EXPENSE	TYPE OF EXPENSE	COST
	Data Collection Clerks - Payment	Kes4,000
	Equipment(Laptops, Printers etc)	Kes1,000
	Stationery costs	Kes1,300
	Meeting Materials	Kes1,000
	Travel expenses/Taxi	Kes1,300
	Meeting Refreshments	Kes1,400
TOTAL PROJECT EXPENSE		Kes10,000

UNIVERSITY OF NAIROBI
School of Computing & Informatics

Survey Questionnaire

Topic

A Framework for Cloud Banking Adoption

This questionnaire serves to collect information to be used for survey work to be submitted in partial fulfillment of the requirements for the award of a MSc degree in Information Systems and elicits information on the viability of adopting cloud banking technology in Kenya from Kenyan banking industry managers, technology and software vendors as well as industry regulators.

Jason M Maingi
P56/P/7949/04
Supervised by: Mr. Elisha Opiyo

Respondents Details [OPTIONAL)

Name ....   Date............................

Address ....

Designation ....

Office Telephone ....

Mobile Telephone ....

Gender (circle)   ○   Female   ○   Male

Section 1

Kindly respond to all the questions in Section 1.

1) What is your job description? *(Circle one item)*

○   IT Management (Technical Consultant)

○   Business Management (Consultant)

○   IT Management (CIO,CTO)

○   IT Management (Director, Senior Manager

○   Business Management (CFO, CEO)

○   Other IT staff

○   I don't know

○   Other

2) What is your key IT decision role at the bank? *(Circle one item)*

○   Responsible for evaluation of vendors

○ Responsible for solution recommendations

○ Involved in determining IT needs

○ Authorization of IT Purchases

○ Creation of IT strategy

○ Provide IT Innovation guidance

○ Other

2) What is the span of your banking career? *(Circle one item)*

○ 0 – 5 years

○ 6 – 15 years

○ 16 years and over

4) What is the type of your banking Institution? *(Circle one item)*

○ Retail Bank Only

◉ Corporate Bank Only

○ Retail and Corporate Bank

◉ Central Bank

○ Housing Finance Bank

○ Microfinance Bank

○ Merchant Bank

○ Savings Bank

○ Development Financing bank

○ Other

5) What is your bank/institution size by number of employees? *(Circle one item)*

○ Between 1 - 99

○ Between 100 - 499

○ Between 500 - 999

○ Between 1000 - 4,999

○ Above 5,000

6) What is the size of your bank/institution by number of customers? *(Circle one item)*

- Between 1 - 9,999
- Between 10,000 - 29,000
- Between 30,000 - 99,999
- Between 100,000 - 499,999
- Between 500,000 - 999,999
- above 1,000,000

7) Please provide the location for which you are Geo-located? *(Circle one item)*

- Nairobi
- Nairobi environs
- Mombasa
- Kisumu
- Eldoret
- Kenyan Provincial headquarters

Section 2

Please respond to all questions in section 2 as comprehensively as possible and to the best of your knowledge

8) How would you rate the following drivers for cloud banking adoption? (Circle one for each item)

	very Low	Below Average	Average	Above Average	Very High
Flexible IT resources with the bank	○	○	○	○	○
Vendor experience	○	○	○	○	○
Vendor trustworthiness	○	○	○	○	○
Stable and reliable communication	○	○	○	○	○
Economies of scale	○	○	○	○	○

9) How would you consider or rank the following cloud delivery models? (Circle one for each item)

	Not at all	Slightly	Moderately	Very	Extremely
Infrastructure as a Service (IaaS)	○	○	○	○	○
Platform as a Service (PaaS)	○	○	○	○	○
Software as a Service (SaaS)	○	○	○	○	○

10) How would you in order of importance prefer the following banking services outsourced to the cloud? (Circle one for each item)

	Not at all important	slightly important	Fairly important	Quite important	Very important
Entire Banking Operations	○	○	○	○	○
Only Account Operational Services	○	○	○	○	○
Only ATM services	○	○	○	○	○
Credit and Debit Cards	○	○	○	○	○
Only payroll services	○	○	○	○	○
Only Accounting Services	○	○	○	○	○

Section 3

This section of the survey questionnaire aims at understanding the characteristics considered in vendor selection, key concerns on vendor trustworthiness, and barriers to adopting cloud banking.

11) What would you consider when selecting a vendor for cloud services adoption? (Circle one item).

○ Company size

○ Reputation

○ Location

○ Terms of service / Use

○ Specific experience in Cloud Services

○ Others

12) What would you consider when establishing vendor trustworthiness for delivery on cloud services? (Circle one item)

○ Reputation

○ Security practices

○ Information Assurance practices

○ Terms of Service / Use

○ Relevant experience / Compliance

○ Other

13) What would you consider common barriers to cloud adoption by Kenyan banks? (Circle one item)

○ Security concerns

○ Integration Issues

○ Availability of service

○ Performance / Network Issues

○ Regulatory Compliance

○ Lack of clear adoption framework

○ Others

Section 4

Please provide comprehensive answers for each of the questions below.

14). what would you think should be done to facilitate positive bank management desire to adopt cloud banking? *Please provide your thoughts in the space below.*

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15). If an elaborate Framework for cloud banking adoption was provided to the banking industry today, would you expect more banks to tend towards cloud banking? Give us your thoughts!