

**ADOPTION OF CLOUD COMPUTING BY THE
NGO SECTOR IN KENYA**

BY

DENNIS MAIGE NYAKEYA

D61/61656/2010

A Research Project Submitted in Partial Fulfillment of the Requirements for the
Degree of Master of Business Administration (MBA) School of Business, University
of Nairobi.

OCTOBER 2012

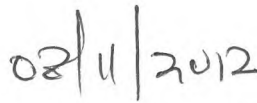
STUDENT'S DECLARATION

I the undersigned certify that this project which I now submit for examination for the award of MBA-Management Information Systems, is entirely my own work and has not been taken from the work of others except and to the extent that such work has been cited and acknowledged within my work. This project was prepared according to the regulations for postgraduate study of the School of Business, University of Nairobi and has not been submitted in whole or in part for an award in any other University or institution for Academic Credit.



.....
DENNIS MAIGE NYAKEYA

D61/61656/2010



.....
DATE

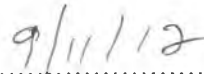
This research project has been submitted for examination with my approval as the University supervisor.



.....
DR. KATE LITONDO

School of Business

University of Nairobi



.....
DATE

DEDICATION

This study is dedicated to my parents, siblings and colleagues at work whose encouragement, love, prayers and support during my pursuit of post graduate education and career development has made me come this far.

ACKNOWLEDGEMENT

Writing an acknowledgement is not an easy. This is because there are so many people who have helped along the way. The authors' greatest fear is forgetting someone, so I start off by saying thank you to all. If your name is not mentioned, please forgive me!

First and foremost I am grateful to God the almighty for through Him this Study has been possible. I would here like to acknowledge the support of the respondents from sampled non-governmental organizations (They are World Vision, Compassion, Care International, Save the Children, Feed the Hungry, Plan International, World Concern, Pact and Action Aid staff who participated in this study). In addition, I feel greatly indebted to my supervisor, Dr. Kate Litondo not forgetting my moderator Mr. Joel Lelei for their guidance, inspiring feedback and observations. I will not complete this section before mentioning my two closest friends George Gathenya for your invaluable input and Cyrus Ongaki for encouragement the coordination of data collection for this research project. This research study would not have been accomplished without your support and facilitation.

May God the Almighty bless you all for the support and contributions.

COPYRIGHT

This report contains relatively classified information about non-governmental organizations in Kenya. Information and data in this report is therefore restricted for academic use by the student researcher.

ABSTRACT

Innovations are necessary to ride the inevitable tide of change. Most of organizations are striving to reduce their computing cost through the means of virtualization. This demand of reducing the computing cost has led to the innovation of Cloud Computing. Cloud Computing offers better computing through improved utilization and reduced administration and infrastructure costs. Cloud Computing is the sum of Software as a Service (SaaS), Infrastructure as a Service (IaaS) and Platform as a service (PaaS). In a nutshell, it's a computing model based on utility Computing.

Cloud Computing is still at its infant stage and a relatively new technology for the organizations especially the non-governmental organizations in Kenya. Therefore, most of the organizations are not very confident and ready to adopt it. This research paper tackles this issue for organizations in terms of adoptability of the technology especially the NGO sector in Kenya. In this paper the researcher discusses the perceived benefits, awareness levels, drivers of adoption as well as barriers to cloud computing adoption and assess the extent to which this technology has been adopted in the international NGOs in Kenya.

This study revealed the awareness levels to be overwhelming and further validated that economical, technical, strategic and functional being the key drivers of adoption. Lack of clear strategy, lack of ownership and loss of confidentiality were also endorsed as key barriers to adoption. Majority of the NGOs had more than 71% computerization levels with a paltry 26% of this having adopted the cloud. Cloud providers key concerns according to the study include security, the perceived loss of ownership and fear of confidentiality breach so as to encourage organizations to take up more of the cloud services on offer. Organizations should also be deliberate to capture cloud computing in their strategies to motivate adoption.

The intention of this research is to provide information about cloud computing that will assist those interested non-governmental organizations (NGOs) in this technology in making well-informed decisions. NGOs must become aware of the predictors that if adequately examined will indicate successful adoption of cloud computing for NGOs in Kenya.

TABLE OF CONTENTS

STUDENT'S DECLARATION	I
DEDICATION	II
ACKNOWLEDGEMENT	III
COPYRIGHT	IV
ABSTRACT.....	V
TABLE OF CONTENTS.....	VI
LIST OF FIGURES	IX
LIST OF TABLES	X
CHAPTER ONE: INTRODUCTION.....	1
1.1. Background of the study	1
1.1.1 Cloud Computing.....	2
1.1.2 Cloud Computing Adoption.....	3
1.1.3 Drivers to Cloud Computing Adoption	4
1.1.3 Barriers to Cloud Computing Adoption.....	4
1.1.4 NGO Sector in Kenya.....	5
1.1.5 Cloud Computing in the NGO Sector	6
1.2 Research Problem.....	7
1.3 Research Objective.....	9
1.4 Value of the study.....	9
CHAPTER TWO: LITERATURE REVIEW.....	10
2.1. Introduction.....	10
2.2. Cloud Computing.....	10
2.2.2 Cloud Computing Architecture.....	12
2.3. Cloud Computing Awareness.....	14
2.4. Drivers of Cloud Computing Adoption	15
2.5. Barriers to Cloud Computing Adoption.....	16
2.6 Summary of the Literature Review	17
2.7 Conceptual framework	18
CHAPTER THREE: RESEARCH METHODOLOGY.....	20
3.1 Introduction.....	20
3.2 Research Design	20
3.3 The Population	20
3.4 Sampling Design	20
3.5 Data Collection	21
3.6 Data Analysis.....	22

CHAPTER FOUR: DATA ANALYSIS	23
4.1 Introduction.....	23
4.1.1 Questionnaire Response Analysis.....	23
4.2 Demographics of Respondents.....	24
4.2.1 Age and Gender.....	24
4.2.2 Experience with NGO and Roles.....	25
4.3 Awareness of Cloud Computing.....	26
4.3.1 Awareness of Cloud Computing.....	26
4.3.2 Organization Strategy towards Cloud Computing.....	27
4.3.3 Trained staff on Cloud Computing.....	28
4.3.4 Internet Resource can Support Cloud Computing.....	28
4.4 Extent of Cloud Computing Adoption.....	29
4.4.1 Level of Computerization.....	29
4.4.2 Percentage of Services on the Cloud.....	29
4.4.3 Percentage of IT Budget Allocated to Cloud Computing.....	30
4.4.4 Services on the Cloud.....	32
4.4.5 Delivery Models Adoptability.....	35
4.4.6 Service Models Adoptability.....	37
4.5 Drivers to Cloud Computing Adoption.....	39
4.5.1 Economic Factors.....	39
4.5.2 Functional Factors.....	40
4.5.2 Technical Factors.....	41
4.5.3 Strategic Factors.....	44
4.6 Barriers to Cloud Computing Adoption.....	45
4.6.1 Loss of Confidentiality.....	45
4.6.2 Lack of Control and Ownership.....	46
4.6.3 Lack of Clear Strategy on Cloud Computing.....	46
4.6.4 Insufficient Internet Bandwidth.....	47
4.6.5 Impact on Work Practices.....	47
4.6.6 Lack of Trusted Vendors in the Market.....	48
4.6.7 Lock in to a Specific Infrastructure Vendor.....	48
4.6.8 Lack of Security and SLAs.....	49
4.6.9 Cost of Deployment.....	49
4.6.10 Maturity Levels of the Organization.....	50
4.6.11 Culture of the Organization.....	50
4.7 Chapter Summary.....	51

CHAPTER FIVE: DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS.....52

- 5.1 Introduction.....52
- 5.2 Summary52
- 5.3 Discussion.....53
 - 5.3.1 Awareness of Cloud Computing in the NGO Sector 53
 - 5.3.2 Extent of Cloud Computing in the NGO Sector 54
 - 5.3.3 Drivers of Cloud Computing Adoption 55
 - 5.3.4 Barriers to Cloud Computing Adoption in the NGO Sector 56
- 5.4 Conclusions57
- 5.5 Recommendations57
 - 5.5.1 Suggestion for Further Studies 59
 - 5.5.2 Limitations of the study..... 59

REFERENCES.....60

- Appendix I: Questionnaire67
- Appendix II: Introduction letter72
- Appendix III: List of NGOs73

LIST OF FIGURES

Figure 3.1 - Visual model of NIST Working Definition of Cloud Computing.....	12
Figure 3.2: Clarity in the Cloud and KPMG’s global Cloud Pulse survey. 2011	15
Figure 3.3: Conceptual Framework.....	19
Figure 4.1: Questionnaire Response Analysis	23
Figure 4.2: Gender.....	24
Figure 4.3: Respondents by Age.....	24
Figure 4.4: Experience with NGO.....	25
Figure 4.5: Respondents Roles.....	26
Figure 4.6: Respondents Awareness	26
Figure 4.7: Statement that describes organization strategy towards cloud computing.....	27
Figure 4.8: Internet connection findings.....	28
Figure 4.25: Level of computerization.....	29
Figure 4.26: Percentage of services on the cloud.....	30
Figure 4.27: Percentage of IT budget allocated to cloud computing	31
Figure 4.28: E mail hosting	33
Figure 4.29: Database hosting.....	33
Figure 4.30: Application Hosting	34
Figure 4.31: Online data storage.....	34
Figure 4.32: Public Cloud	35
Figure 4.33: Private Cloud – Owned Internally	36
Figure 4.34: Private Cloud - Owned by a trusted third party	36
Figure 4.35: Community Cloud	37
Figure 4.36: Hybrid Cloud.....	37
Figure 4.37: Software as a service (SaaS).....	38
Figure 4.38: Platform as a service.....	38
Figure 4.39: Infrastructure as a service.....	39
Figure 4.9: Cost saving.....	39
Figure 4.10: Speed to Solution	40
Figure 4.11: Functional capabilities.....	41
Figure 4.12: Everywhere Accessibility	41
Figure 4.13: Security of IT resources.....	42
Figure 4.14: Flexibility of IT services.	43
Figure 4.15: Higher performance of IT services.....	43
Figure 4.16: Speed linkage to stakeholders	44
Figure4.17: Transforming operations	45
Figure4.18: Lack of control and ownership	46
Figure4.19: Lack of clear strategy on cloud computing.....	47
Figure 4.20: Lack of trusted vendors in the market	48
Figure 4.21: Lock in to a specific infrastructure vendor.....	49
Figure 4.22: Cost of deployment.....	50
Figure 4.23: Maturity levels of the organization.....	50
Figure 4.24: Culture of the Organization	51

LIST OF TABLES

Table 3.1: Sampling Frame.....	21
Table 4.1: Gender and Age Cross Tabulation.....	25
Table 4.2: Heard of the term cloud computing before and definition of cloud computing Cross tabulation.....	27
Table 4.3: Trained Staff on Cloud Computing.....	28
Table 4.4: Internet resource can support cloud computing.....	29
Table 4.15: What is the percentage of computerized services that are at the cloud? Versus what is the level of computerization on the activities in your organization? Cross tabulation.....	30
Table 4.16: What is the percentage of computerized services that are at the cloud? Versus What percentage of your IT budget is set aside for cloud computing usage? Cross tabulation.....	32
Table 4.17: Webhosting.....	32
Table 4.5: Shift from Capital Expenditure to Operations Expenditure.....	40
Table 4.6: Simplicity of IT resources.....	42
Table 4.7: Scalability of IT resources.....	42
Table 4.8: Enhanced uptime/high availability of IT resources.....	43
Table 4.9: Focus on core competencies by the organization.....	44
Table 4.10: Diversification of IT systems and resources.....	45
Table 4.11: Loss of confidentiality.....	46
Table 4.12: Insufficient Internet Bandwidth.....	47
Table 4.13: Impact on work practices.....	48
Table 4.14: Lack of security and SLAs.....	49

CHAPTER ONE: INTRODUCTION

1.1. Background of the study

Information Technology has become a strategic asset for companies, increasing competitiveness and shaping business operations from finance and logistics to customer relations and human resources. However, the direct and indirect costs of IT deployments have been substantial. This is because IT systems have traditionally been run on an “ownership” model, requiring investment in all the underlying infrastructure, ongoing maintenance of systems, and, every few years, expensive and time-consuming upgrades.

Innovations are necessary to ride the inevitable tide of change that has characterized the 21st century. Most of organizations are striving to reduce their computing cost through the means of virtualization. This demand of reducing the computing cost has led to the innovation of Cloud Computing. Cloud Computing offers better computing through improved utilization and reduced administration and infrastructure costs.

Corporate organizations are skewed towards profit and shareholders wealth maximization and the obvious headache is how to minimize administration and running costs to achieve their goals. Non-Governmental Organizations (NGOs) and non-profit cause-oriented corporations perform crucial functions when it comes to championing social, environmental, and governmental watchdog causes (NGO Coordination Board, 1990). However, running servers and data centers are generally not within such organizations’ scope of core competencies. By off-loading basic IT infrastructure needs to specialized ‘cloud’ providers, non-governmental organizations’ can be devoted to tasks aligned with their specific missions (Nethope’s International, 2010). There are many benefits of Cloud Computing stated by different researchers which make it more preferable to be adopted by organizations and non-governmental organizations are not an exception. Cloud Computing infrastructure allows enterprises to achieve more efficient use of their IT hardware and software investments (Boss, 2007).

1.1.1 Cloud Computing

Cloud Computing has become one of the most talked about technologies in recent times and has received lots of attention from analysts because of the opportunities it is offering. Cloud computing does not yet have a standard and agreed upon definition. Some define it generally as the next stage in the evolution of the internet (Hurwitz, 2010). Others label it as new computing and information architecture that integrate massive and low-cost information storage with services that provide virtual computer systems which flex to meet the needs of the user (Cowhey and Aronson, 2009). Finally, it can be seen as service on demand: infrastructure as a service, platform as a service, software as a service and data storage as a service. Thus creating a layer of architecture where various resources are provided for different levels of need (Pokharel and Park, 2009).

According to Gartner(2010) cloud computing is means by which highly scalable and elastic technology-enabled services can be easily consumed over the internet on as-needed basis. Springboard Research(2010) has also difined cloud computing as a collection of IT enabled resources and capabilities that can be delivered via the internet as service. In the cloud computing environment, working is through virtualized applications on a networked architecture. This involves working with appliances such as smartphones, laptop and desktop computers without necessarily installing the application being run onto to the devices.

As pointed out by Rayport (2009), the idea leading to cloud computing paradigm is that the computing resources and software are available to the end-user, whether an organization or an individual, in a virtualized environment - commonly known as "cloud" - and the user can access it on demand and using a pay as you go approach.

According to Hayes (2009), these services in industry are respectively referred to as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). West(2010) has further pointed out that cloud computing can take the form of software-as-a-service (running specific applications through a cloud), platform-as-a-service (using a suite of applications, programming languages, and user tools), or infrastructure-as-a-service (relying on remote data storage networks). Deployment depends on whether the cloud is a private, community, public, or hybrid one. Private clouds are operated for a specific organization for example, whereas

community clouds are shared by a number of organizations. Public clouds are available to the general public or large groups of agencies, while hybrid clouds combine public and private elements in the same data center (Rayport ,2009).

1.1.2 Cloud Computing Adoption

According to Furrier (2008) cloud computing adoption is determined by the level of knowledge on services, and solutions will take advantage of expertise and how best to implement this cloud technology. While cloud adoption terminology has generally been applied to profit making organizations, this term will be used to gauge the ability of NGOs embrace cloud computing based on the level of IT adoptability so far gained within it. It's important to note that non-governmental organizations manage bulky, sensitive and classified data on their beneficiaries, donors, staff etc. Careful consideration should be given to the sensitivity and criticality of the data that is maintained and utilized by the organization. Therefore before venturing into cloud computing, it must fully understand its business, their data, their beneficiaries and stakeholders.

According to Hayes (2009) allowing a third party service to take custody of personal documents raises concerns about control and ownership. If an organization changes service providers, will it be able to migrate with the data and if the organization fails to pay, will it loose access to documents? This clearly show that policies have to be laid out and agreed between the parties supported with tight service level agreements. This ordinarily puts non-governmental organizations to test the readiness of organization to venture into cloud computing technology.

A formal strategy is required to be put in place for adopting new technologies like cloud computing (Furrier, 2009). With more core applications moving to the cloud, organizations need to ensure they cover all the bases i.e. whether the existing internet connection will cope with the additional bandwidth requirements, the reliability of the service provider, a backup line if the main one fails and how secure cloud are. Policies, procedures and regulations followed by the cloud vendors may not be consistent with your requirements and expectations of the client (Gartner 2009).

1.1.3 Drivers to Cloud Computing Adoption

According to the research on the subject of emerging trends in cloud computing usage for Klynveld Peat Marwick Goerdeler (KPMG's) global cloud Pulse survey looked at what is driving the adoption of cloud computing by end-user organizations (KPMG, 2011). A primary driver typically cited in the market was reducing IT costs and this was supported by these research findings. The research ranked the listed findings as being economic, functional, technical and strategic factors. All four factors were ranked relatively equally.

Khajeh-Hosseini (2010) has summarized the drivers to adoption as security, elasticity, virtualization, cost, mobility, collaboration, risk reduction, feedback and usability. This is further classified to economic factors, functional factors, technical factors and strategic factors.

1.1.3 Barriers to Cloud Computing Adoption

Furrier (2009) argues that a formal strategy is required to be put in place for adopting new technologies like cloud computing, therefore lack of a clear formal strategy is a major barrier to adoption. Sullivan (2009) argues that cloud computing is not going to happen overnight, rather it could take 10 to 15 years before typical enterprise make this shift. The decision to adopt Cloud Computing is challenging because of the range of practical and socio political reasons coupled also by socio-technical factors like cost, confidentiality and control (Sullivan, 2009).

Khajeh-Hosseini (2010) summarizes the challenges as to provide accurate information on costs of cloud adoption, to support risk management and to ensure that decision makers can make informed trade-offs between the benefits and risks. Hayes (2009) points out that allowing a third party service to take custody of personal documents raises concerns about control and ownership more so when an organization changes service providers. Whether the existing internet connection will cope with the additional bandwidth requirements to run the cloud is also another major barrier to adoption (Gartner, 2009).

1.1.4 NGO Sector in Kenya

The NGO Coordination Act (1990) defines non-governmental organizations as a private voluntary grouping of individuals or associations, not operated for profit or for other commercial purposes but which have organized themselves nationally or internationally for the benefit of the public at large and for the promotion of social welfare, development, charity or research in the areas inclusive of, but not restricted to, health, relief, agriculture, education, industry and the supply of amenities and services".

The NGO Coordination Board (2012) lists some of the leading non-governmental organizations to be World Vision, Plan international, Red Cross, Catholic Relief Services, Care International, Save the Children Alliance, OXFAM etc.(See appendix II). The priority interventions of non-governmental organizations include Households Food Security and Resilience, Health and Nutrition, Equitable Access and Quality Education ,Spiritual Nurture and Protection of Children and Peace, Justice and Governance. This is achieved through sound programming approaches to ensure maximized social impact of the projects.

Due to non-governmental organizations expansive coverage all over the country and spanning across the country with staffing levels of some of them averaging over 700 (NGO Coordination Board, 2012). It is no doubt that they are spending a substantial amounts of budget to support their capital expenditures as well as operational expenditures with regards to IT infrastructure thus the need to hedge the costs involved.

With the various generic functional units i.e. Sponsorship relations, Finance, Accounts, Programs, Quality Assurance, Human resource, Support Services and Operations, non-governmental organizations undoubtedly handles huge volumes of data that matches the resources that accompany the IT infrastructure that go with it. The organization makes use of function specific application software's some of which licenses are pegged on fixed batches i.e. license for 250,500, 1500 etc (World Vision Kenya Annual report, 2011). Which at some instances lead to idle licenses that are paid for but not in use. The ideal situation is paying for what is in use not necessarily for what they have. Thus technologies like cloud computing can come handy to

address the idle capacities in such contexts to efficiently and cost effectively provide the needed service.

1.1.5 Cloud Computing in the NGO Sector

With increasing business complexity, organizations like Non-Governmental Organizations (NGOs) are seeking innovative business models and specialized technologies to cater for customer demands (Khera, 2006). Cloud computing technologies can provide non-governmental organizations with viable advantage through cost reductions, simplified maintenance and management of applications across the organization, greatly extend scalability, agility, high availability, automation, large data storages and reliable backup mechanisms (King, 2008). This shall ensure that NGOs focus on their core mandates as opposed to concentrating their efforts on infrastructure scalability through the use of cloud computing infrastructure.

NGOs can accrue several benefits from cloud computing. Ellison (2010) classifies the primary benefits of migrating to the cloud into two. The first benefit relates to cost reduction, which cannot be achieved with purely proprietary infrastructure. Non-governmental organizations can avoid procuring costly infrastructures by outsourcing infrastructure to third parties to manage all of their data and access applications from simple web addresses over the internet. The second benefit relates to scalability and flexibility. In this case non-governmental organizations shall be able to pay for only what they need in terms of resources and capabilities.

NGOs can adopt cloud computing in their daily support operations more so on backup and recovery, beneficiaries management and stakeholder's relationship management applications, human resources (HR) application, data centres, financial application and last but not least e-mail. Organizations are shifting from the client-server model to the cloud computing model. There are still some concerns about the security of cloud based servers relating to security, response time and downtime (Nethope International 2010).

Nethope International is a consortium of 35 leading international humanitarian organizations whose mission is to act as a catalyst for collaboration, bringing together the knowledge and power so that the best information communication

technology and practices can be used to serve people in the developing world. It advises non-governmental organizations to band together for their IT needs so they can maximize their organization's impact in their core specific mandates. It provides non-governmental organizations with an opportunity to off load their IT operations to specialized remote providers. Nethope's aim is to support non-governmental organizations implement cloud technologies so they can free up resources and time to better pursue their organization's core missions. It provides cloud-based technologies fit many of the technical challenges faced by non-governmental organizations regardless of their specific focus (Nethope's International 2010),

1.2 Research Problem

Due to the pressure of organizations such as non-governmental organizations working with slim budgets to support operations, it follows that unnecessary IT infrastructure costs should be hedged and one way of dealing with this is by adopting technologies that enable flexibility and scalability of IT infrastructure (Darlyl, 2009). This can be made possible by accessing IT as a service technology and one best fit option is arguably cloud computing. According to Gartner (2009), many organizations want to venture into tasks that have high returns or impact. Organizations want to pay only for what they need and not necessarily what they have.

Thus as organizations grow, flexibility and scalability of IT infrastructure becomes essential. On the other hand, if the level of activity of an organization reduces, a scale down of resources that does not result into idle resources is also required (Mitchel and Smith, 2008). It is also a prism that organizations want to concentrate their resources on core business and not in supporting IT services hence the need to reduce unnecessary costs related to operations. According to (Cloudtweaks, 2010) many analysts firmly believe that the benefits of using the cloud for certain applications will far outweigh its risks. The need to store most of the relevant data and access it efficiently is the main driving force behind many companies moving to the cloud.

According to Nethope International (2010), some organizations like non-governmental organizations are 'technologically shy', and therefore it is necessary to evaluate their awareness, attitude and readiness to adopt cloud computing. With the

ever demanding goals and objectives of the non-governmental organizations sector, cloud computing can ensure that the pressure to minimize operational costs is realized and thus dedicating the bulk of the resources to the primary core business. As a result non-governmental organizations like any other organizations will only pay what they use and not necessarily what they have. Furthermore Cloud computing provides technologies that are scalable and flexible (Plummer & Smith, 2008).

Scalability refers to the ability to grow a system over a wide capacity range to meet the processing needs of the organization (Ricky, 2008). Thus choice of technology or platform for an application should consider the ability to grow the application with more users and more data as need arises. While flexibility focuses to the ability of system to change easily in response to different user and system requirements. Non-governmental organizations grow and shrink from time to time subject to availability of funding and the desired state in regards to IT infrastructure is that they pay for what they use without having extra idle capacity thus the need to have a highly scalable and flexible solution.

Cloud computing adoptability studies have been conducted where by one sought to assess the awareness level of cloud computing (Karanja, 2011) and the other focused on adoptability of cloud computing by the banking sector (Wangui, 2011). Both of the stated research works were not focused on non-governmental organizations but this study shall have a shift to focus on non-governmental organizations adoptability of the technology. It is a fact that Non-profits are seen as generally technology shy and non-aggressive towards adopting trendy technologies and thus the drive (Nethope's International, 2010). Wangui found out that banks were aware of the cloud computing technology as well as its benefits but are hesitant to adopt it due to what the study quoted as "security concerns". Karanja also found out that the awareness was relatively low by the time of the study adoption was relatively low versus the awareness index then.

The research sought to find out the extent to which non-governmental organizations in Kenya have adopted the Cloud technology, the primary drivers for adoption of the cloud as well as the factors affecting its adoption. This study also sought to evaluate and assess the general awareness of cloud computing technologies.

1.3 Research Objective

The objectives of this research were to;

- a) Assess the level of awareness of cloud computing in the non-governmental organizations in Kenya.
- b) Assess the extent to which the non-governmental organizations has adopted cloud computing.
- c) Establish the drivers of cloud computing adoption by the non-governmental organizations.
- d) Determine the barriers of cloud computing adoption by the non-governmental organizations in Kenya.

1.4 Value of the study

The study is aimed at assessing the awareness and readiness levels, barriers and drivers of adoption of the cloud and the extent of adoption of the cloud by the non-governmental organizations sector in Kenya. The non-governmental organizations sector Information and Communication Technology (ICT) Managers could use the information from the study to cultivate a culture that would help in changing the attitude and alignment of their strategies so as to cater for technologies such as cloud computing adoption.

Researchers and scholars alike can use the report as a point of reference and a source of secondary data for future research related to cloud computing. Cloud computing vendors and services providers could use this report to evaluate customer concerns and preferences to inform their products and technologies offering. This shall arguably enable them device ways to address the concerns and issues to enhance adoptability by the non-governmental organizations clientele.

CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction

This chapter presents a review of literature on awareness of cloud computing, extent of adoption of cloud computing, drivers to cloud computing adoption as well as the barriers affecting adoption at the same time introduce the theoretical framework of this research.

2.2. Cloud Computing

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

Since the 60’s, cloud computing has taken different dimensions. The internet started to offer abundant bandwidth in the 90’s therefore cloud computing for the masses has been something lately developed. The first milestone for cloud computing was the launch of “Salesforce.com” in 1999. It pioneered with the concept of delivering enterprise applications via a simple website. Salesforce paved way for both specialist and mainstream software firms to deliver applications over the internet (McCarthy, 1960). According to Mohamed (2009), in the 2002, Amazon provided a suite of cloud-based services including storage, computation and even human intelligent through the Amazon Mechanical Turk. In the year 2006, Amazon launched Elastic Compute cloud (EC2) as a commercial web service that allows small companies and individuals to rent computers on which to run their own computer applications.

The most important contribution to cloud computing has been the emergence of “Killer apps” from leading technology giants such as Microsoft and Google (Taber, 2009). Google in the year 2009 started to offer browser-based enterprise applications

through services such as Google Apps. This was made possible by the hit of Web 2.0. When these services are delivered in a way that is reliable and easy to consume, the knock-on effect to the industry as a whole is a wider general acceptance of online services (Taber, 2009). Other key factors worth mentioning that have enabled cloud computing to evolve include the maturing of virtualization technology, the development of universal high-speed bandwidth, and universal software interoperability standards (Turner, 2009).

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

According to Armbrust (2009) Cloud Computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the datacenters that provide those services. The services themselves have long been referred to as Software as a Service (SaaS). The datacenter hardware and software is what we will call a Cloud. When a Cloud is made available in a pay-as-you-go manner to the general public, we call it a Public Cloud; the service being sold is Utility Computing. We use the term Private Cloud to refer to internal datacenters of a business or other organization, not made available to the general public. Thus, Cloud Computing is the sum of SaaS and Utility Computing, but does not include Private Clouds. People can be users or providers of SaaS, or users or providers of Utility Computing.

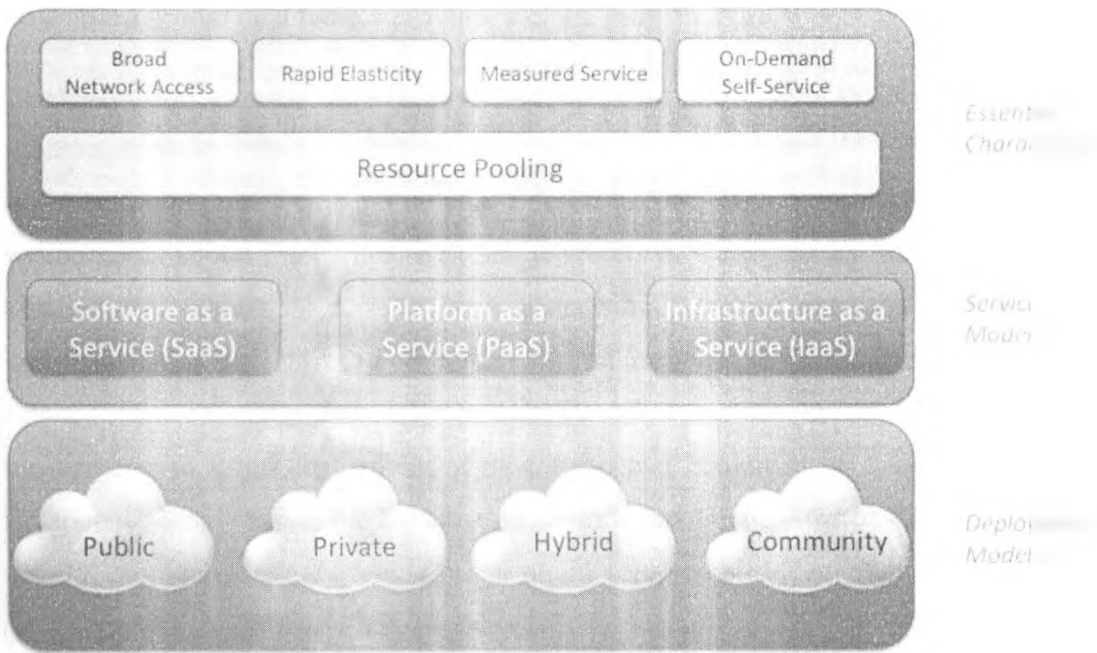
Gartner(2010) defines cloud computing as means by which highly scalable and elastic technology-enabled services can be easily consumed over the internet on as-needed basis. SpringboardResearch (2010) on the other hand define cloud computing as a collection of IT enabled resources and capabilities that can be delivered via the internet as service. In the cloud computing environment, working is through

virtualized applications on a networked architecture. This involves working with appliances such as smartphones, laptop and desktop computers without necessarily installing the application being run onto to the devices.

2.2.2 Cloud Computing Architecture

Cloud Security Alliance, (2009) has described the National Institute of Standards and Technology (NIST) as a well-accepted institution all over the world for their work in the field of Information Technology. NIST defines the Cloud computing architecture by describing five essential characteristics, three cloud services models and four cloud deployment models. The NIST model of cloud computing is presented in figure 3.1.

Figure 3.1 - Visual model of NIST Working Definition of Cloud Computing



Source: Cloud Security Alliance, 2009.

Cloud Security Alliance (2009) has identified five essential characteristics of Cloud Computing which explains their relation and difference from the traditional computing. On-demand-self-service where by a consumer can provision or un-provision the services when needed, without the human interaction with the service provider. Broad Network Access which has capabilities over the network and accessed through standard mechanism. Resource Pooling where by the computing resources of the provider are pooled to serve multiple consumers which are using a multi-tenant model, with various physical and virtual resources dynamically assigned,

depending on consumer demand. Rapid Elasticity which refers to services which can be rapidly and elastically provisioned. Measured service refers to cloud computing systems that automatically controls and optimizes resource usage by providing a metering capability to the type of services like storage, processing, bandwidth, or active user accounts.

There are three Cloud Services Models and as illustrated in figure1 (Cloud Security Alliance, 2009). These three fundamental classifications are often referred to as software, platform or infrastructure as a service (SPI) model. Cloud Software as Service refers to a capability in which the consumer can use the provider's applications running on the cloud. Often geared towards the end user who needs access through a web browser or other thin clients, SaaS provides access to applications hosted on a service provider's cloud infrastructure.

Cloud Security Alliance (2009) further argues that rather than simply delivering prepackaged applications via the on a service model, a PaaS provider offers up the entire computing platform and solutions stack needed for an application runtime environment. Cloud Infrastructure as Service refers to the capability provided to the consumer by which it can provision processing, storage, networks and other fundamental computing resources where the consumers can deploy and run the software like operating systems, applications. This service model enables user organizations to forgo deployment of new datacenter equipment to handle growing operational needs. Rather, the business obtains needed IT infrastructure like servers, security, storage, networks, etc. from a cloud services provider, often via a self-service catalog.

There are primarily four cloud deployment models according to National Institute of Standards and Technology (NIST). Public Cloud refers to where the cloud infrastructure is available to the general public. The public cloud deployment model represents true cloud hosting. In this deployment model, services and infrastructure are provided to various clients. Private Cloud refers to the type of the cloud that is available solely for a single organization. This model doesn't bring much in terms of cost efficiency: It is comparable to buying, building and managing your own infrastructure. Still, it brings in tremendous value from a security point of view.

During their initial adaptation to the cloud, many organizations face challenges and have concerns related to data security. Community Cloud also refers to the type of cloud deployment model where the infrastructure of the cloud is shared by several organizations and supports a specific community with shared concerns. In the community deployment model, the cloud infrastructure is shared by several organizations with the same policy and compliance considerations.

2.3. Cloud Computing Awareness

Cloudtweaks (2012) found out that awareness motivates adoption of cloud computing appear to be more perceptual than prohibitive, according to the survey on cloud they conducted. Professionals who are most aware of and involved with cloud computing and cyber security generally trust the cloud model, and do not consider it a leading security vulnerability¹. The findings suggest cloud utilization is poised for rapid gains as awareness of cloud computing and the related cyber security implications grow.

Isom and Holey (2012) have pointed out that one way to ready your company for cloud is to incorporate cloud into your enterprise architecture (EA) your integrated business and IT strategy. Enterprises must consider the benefits, drawbacks and other effects of Cloud Computing on their enterprises and usage practices before adopting and using Cloud Computing (Khajeh-Hosseini, 2010). Similarly Fellowes (2008) argue that in enterprises, the adoption of Cloud Computing is much dependent on the maturity of organizational and cultural processes as the technology per se. Some predict that adoption of Cloud Computing is not going to happen overnight, rather it could take 10 to 15 years before typical enterprise make this shift (Sullivan, 2009).

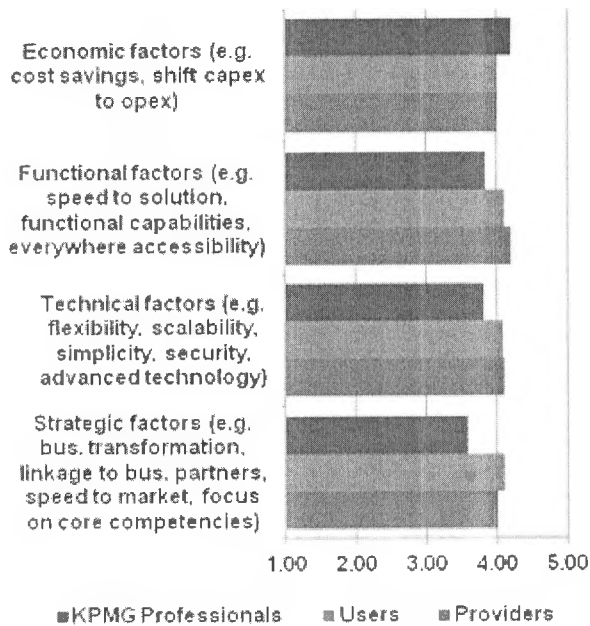
Cloud Security Alliance (2009) further points out that it is not possible that all enterprises outsource their whole back end computing requirements to cloud providers rather; they will establish a heterogeneous computing environment which is based on dedicated servers, organizational clouds and possibly more than one public cloud provider. How the adoption to Cloud Computing is managed does not only depend on technical issues but also on socio-technical factors (i.e. cost, confidentiality and control), the impact on work practices and constraints derived from existing business models.

2.4. Drivers of Cloud Computing Adoption

According to the research on the subject of emerging trends in cloud computing usage for Klynveld Peat Marwick Goerdeler (KPMG's) global cloud Pulse survey looked at what is driving the adoption of cloud computing by end-user organizations (KPMG, 2011). A primary driver typically cited in the market was reducing IT costs and this was supported by these research findings. The research ranked the listed findings as being economic, functional, technical and strategic factors as below. All four factors were ranked relatively equally.

While it is good that, in the view of KPMG consultants, buyers have a well-rounded set of drivers for their cloud efforts, it is also important to determine and understand if any of the elements of the drivers are conflicting or contradictory. Typically, for example, it is harder to improve process performance while simultaneously reducing process costs than it is to simply cut cost; or specifically to the cloud, a functional factor such as everywhere accessibility may challenge a technical driver such as security (KPMG, 2011). The figure 3.2 depicts a graphical presentation of the findings.

Figure 3.2: Clarity in the Cloud and KPMG's global Cloud Pulse survey. 2011



Source: KPMG International, 2011, Clarity in the Cloud and KPMG Global Cloud Pulse Survey

Carnegie-Mellon University (2012) has summarized the drivers to adoption as security, elasticity, virtualization, cost, mobility, collaboration, risk reduction, feedback and usability. This is further classified to economic factors, functional factors, technical factors and strategic factors. Scalability refers to users having access to a large amount of resources that scale based on user demand. Elasticity refers to environment that transparently manages a user's resource utilization based on dynamically changing needs. Virtualization ensures each user has a single view of the available resources, independently of how they are arranged in terms of physical devices.

Cost enables the pay-per-usage model that allows an organization to only pay for the resources they need with basically no investment in the physical resources available in the cloud. There are no infrastructure maintenance or upgrade costs. Organizations seeking to expand their IT capabilities are also driven into the Cloud by low cost of adoption. Mobility refers to users having the ability for the user to access data and applications from around the globe. Collaboration enables users to see the cloud as a way to work simultaneously on common data and information. Risk reduction ensures that users can use the cloud to test ideas and concepts before making major investments in technology. Feedback is important because it gives the user the ability to obtain the statistics on utilization levels. Last but not least usability allows for ease with which the user is able to configure and operate virtual resources from the cloud (Carnegie-Mellon University, 2012).

2.5. Barriers to Cloud Computing Adoption

According to Sullivan (2009) the decision to adopt Cloud Computing is challenging because of the range of practical and socio political reasons. How the adoption to cloud computing is managed does not only depend on technical issues but also on socio-technical factors (i.e. cost, confidentiality and control), the impact on work practices and constraints derived from existing business operations models. Khajeh-Hosseini (2010) summaries the challenges as to provide accurate information on costs of cloud adoption, to support risk management and to ensure that decision makers can make informed trade-offs between the benefits and risks.

Hayes (2009) points out that allowing a third party service to take custody of personal documents raises concerns about control and ownership. The question is if an

organization changes service providers, will it be able to migrate with the data and if the organization fails to pay, will it lose access to documents.

Furrier (2009) argues that a formal strategy is required to be put in place for adopting new technologies like cloud computing, therefore lack of a clear formal strategy is a major barrier to adoption. Gartner (2009) points out that with more core applications moving to the cloud, organizations need to ensure they cover all the bases i.e. whether the existing internet connection will cope with the additional bandwidth requirements.

Organizations must consider the benefits, drawbacks and other effects of Cloud Computing on their enterprises and usage practices before adopting and using Cloud Computing (Khajeh-Hosseini, 2010). Similarly Fellowes (2008) argue that in enterprises, the adoption of Cloud Computing is much dependent on the maturity of organizational and cultural processes as the technology per se. Some predict that adoption of Cloud Computing is not going to happen overnight, rather it could take 10 to 15 years before typical enterprise make this shift (Sullivan, 2009).

According to Khajeh-Hosseini (2010), the challenges that enterprises must address before Cloud Computing adoption are accurate information on costs, support risk management and the decision makers to be informed of trade-offs between the benefits and risks. The economic appeal of Cloud Computing is often mentioned as converting capital expenses to operating expenses (Armbrust, 2009). Enterprises using Cloud Computing pay differently depending on the agreement between them and the Cloud Computing providers. Usually Cloud Computing providers have detailed costing models which are used to bill users on pay per use basis (Khajeh-Hosseini, 2010).

In a survey conducted by cloudtweaks (2012) on the barriers to adoption of cloud computing, it found out that the top issue overall was a perceived lack of security and service level agreements (SLAs), with 45% of respondents referring to it. Lock-in to a specific infrastructure vendor was revealed to be the second biggest barrier cited by 40% of respondents.

2.6 Summary of the Literature Review

This chapter has presented the insight of other researchers and scholars on cloud computing awareness, drivers to adoption and barriers to adoption as well as highlight

behavioral factors determining adopting of the cloud computing technologies by organizations. The literature review sought to answer the questions on awareness, drivers as well as barriers of cloud computing adoption in organizations. On awareness, the literature baselines unearthed three key findings. Cloud computing adoption is determined by the level of knowledge/awareness on services, awareness motivates adoption of cloud computing and awareness informs strategy.

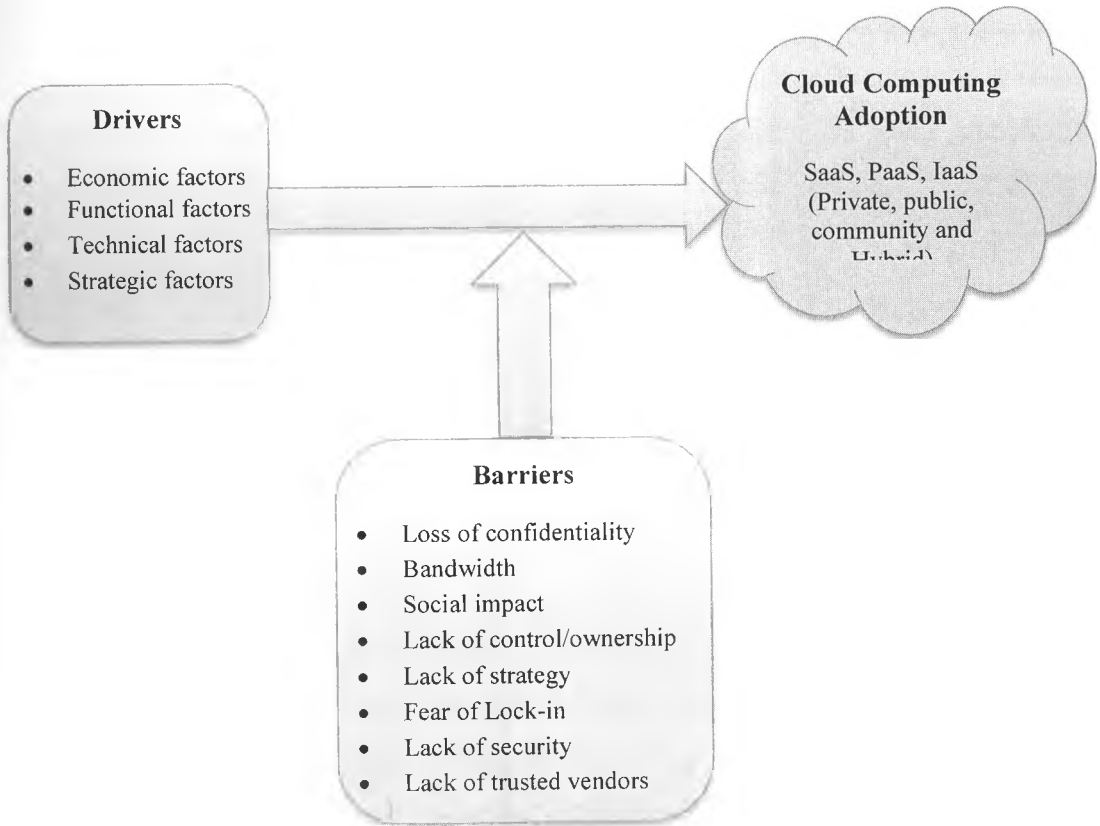
The literature baselines also found out that the decision to adopt Cloud Computing is challenging because of the range of socio political reasons and socio-technical factors such as economic, functional, technical, strategic factors. Some of the barriers that literatures brought forth include Lack of clear strategy, accurate costing and deployment costs, lack of confidentiality, lack control and ownership, lock-in to a specific vendor, security concerns, impact on work practices, maturity level of the organization, bandwidth and lack trusted vendors in the market. The insights obtained from the literature review in this chapter have been very useful in design of research *questions and methodology in general as outlined in Chapter three.*

2.7 Conceptual framework

The framework for cloud computing adoption takes into account factors that affect organizational propensity to adopt cloud computing in regard to technological and environmental circumstances of organizations. In this sense, there is need to conceptualize a model constructs that can be used to examine the causal relationship *between drivers and barriers of cloud computing in relation to the organization's* behavioral intention to adopt cloud computing. This framework shall inform this study by taking assumptions, expectations, beliefs and theories on cloud computing adoption.

The drivers economic, functional, technical and strategic factors enhance the susceptibility of organizations towards adopting of the cloud technology but the barriers which are loss of confidentiality, bandwidth, social impact, lack of control/ownership, lack of strategy, fear of lock-in. lack of security, lack of trusted vendors in the market come in between the adoption appetite thus have to be addressed to enhance the likelihood of adoption as per the proposed framework in Figure 3.3.

Figure 3.3: Conceptual Framework



Source: Own compilation.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the research methodology that was utilized by the researcher. The chapter begins with a discussion on the research design adopted. The research design, the population and sampling design; data collection methods and research procedures follow. The chapter ends with a discussion on Data analysis and presentation methods utilized.

3.2 Research Design

A cross sectional type of research design was utilized for this study. A cross sectional study takes a snapshot of a population at a certain time, allowing conclusions about phenomena across a wide population to be drawn (Kothari, 2000). This allowed the researcher to focus on the population groups thus understanding the wider picture. The population for this study was the International NGOs as provided by NGO coordination board (see appendix II).

3.3 The Population

According to Cooper and Schindler (2000), a population is defined as the total selection of elements about which the researcher want to make some inferences. Cooper and Schindler further state that the basic idea of sampling is that by selecting some of the elements in a population, conclusions may be drawn about the entire population. A large set of observation can be termed as the population while the subset is called the sample. The NGO Coordination Act (1990) lists thirty International NGOs (see appendix II). Overall, this will be the study population though a convenient sample will be taken based on the sampling design to represent the rest of the organizations in the sector. The study proposed to survey the ICT Team leaders of the sampled organizations and two other Non-IT staff to get the general behavioral factors that influence adoption of cloud computing technology in the NGO sector.

3.4 Sampling Design

Sampling design involves the determination of the number of participants. A sample is therefore a group of respondents, cases or records comprising of part of the entire

study population that is empirically selected to represent the study population and a good sample must be accurate, precise and representative of the total population (Cooper and Schindler, 2001). A sampling frame is defined as a list of elements from which the sample which has characteristics similar to those of the population is drawn (Cooper and Schindler, 2001). For the purpose of this study, the sampling frame is thirty NGOs as provided by the NGO coordination board (see appendix I).

The random sampling without replacement technique was used to select the sample. This was considered to ensure that the desired representation from the study population will be achieved through sampling. Thus the proposed sample was nine NGOs as advised by Kothari. According to Kothari (2000), 30% is a representative sample. This study utilized the sample size recommended by Kothari and the sample will be taken as illustrated by Table 1. In the nine sampled NGOs, the researcher shall administer three questionnaires in each focusing on the IT Manager, Management and one user.

Table 3.1: Sampling Frame

Description	Totals
Number of international NGOs in Kenya	30
Sample taken 30% (of 30)	9
Questionnaires administered (9x3)	27
IT – 9, Non IT – 18 (Management and user)	
Total	27

3.5 Data Collection

The researcher collect data using questionnaires (see appendix I). A questionnaire was developed to help in capturing quantitative data. The questionnaire was developed while considering the available literature on the topic of research, research work conducted by other scholars and the research questions which this study sought to determine. The questionnaire also had sections A to E with section A: focused on demographics of respondents, section B: focused on Awareness of cloud computing, section C: focused on the Extent of adoption of cloud computing, section D: focused on Drivers to cloud computing and lastly section E: focused on Barriers to adoption of cloud computing. Questionnaires were administered using drop and later pick method.

3.6 Data Analysis

The data analysis was based on quantitative approach using descriptive statistics.

The data analysis was done in line with the sections on awareness, drivers and barriers of cloud computing. The data analysis utilized the statistical package for social sciences (SPSS). Data collected from the sections was analyzed to uncover relationships among several variables. The results are presented in tables, charts and graphs. Cross tabulation was also be used to make comparisons between desired variables.

CHAPTER FOUR: DATA ANALYSIS

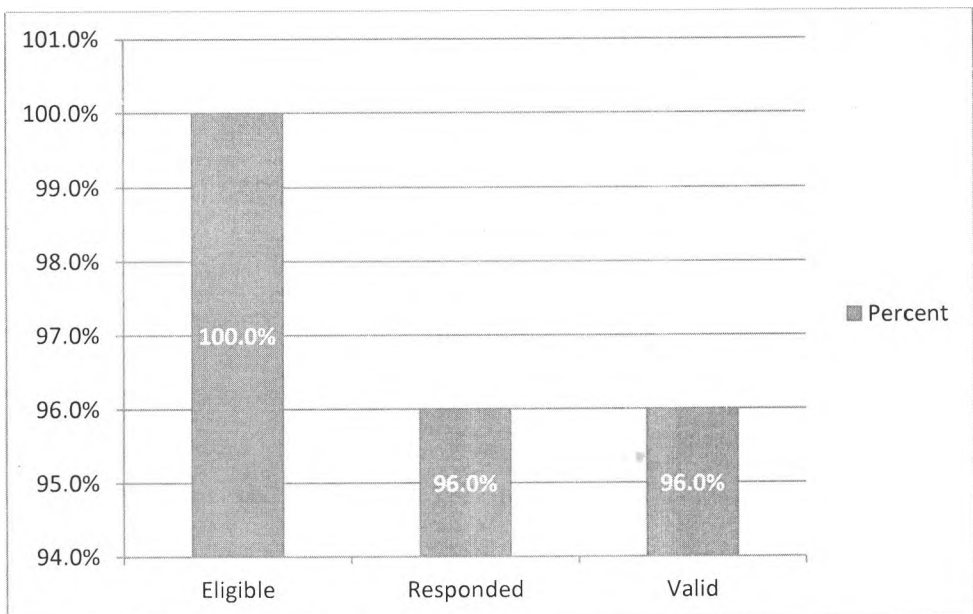
4.1 Introduction

This chapter presents the results of data analysis and findings. The findings are presented through the following subtopics: demographics of respondents, level of awareness of cloud computing in the NGO sector, the extent to which the NGO sector has adopted cloud computing, drivers and barriers to cloud computing adoption by the NGO sector. The chapter ends with a summary of key points and an introduction to the next chapter.

4.1.1 Questionnaire Response Analysis

With the reference to the sampling technique that employed as quoted by Kothari (2000) that recommends 30% of the population as representative sample a total of 27 research questionnaires were issued to nine randomly selected NGOs (three to each). As per data illustrated through Figure 4.1, the response rate to the questionnaires was at 96% with 100% validity. The findings and conclusions can therefore be reliably generalized to the entire population.

Figure 4.1: Questionnaire Response Analysis

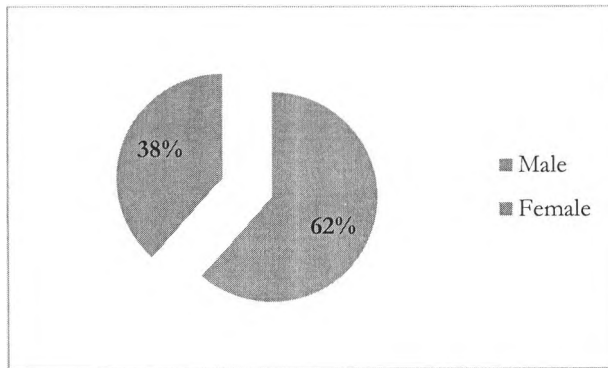


4.2 Demographics of Respondents

4.2.1 Age and Gender

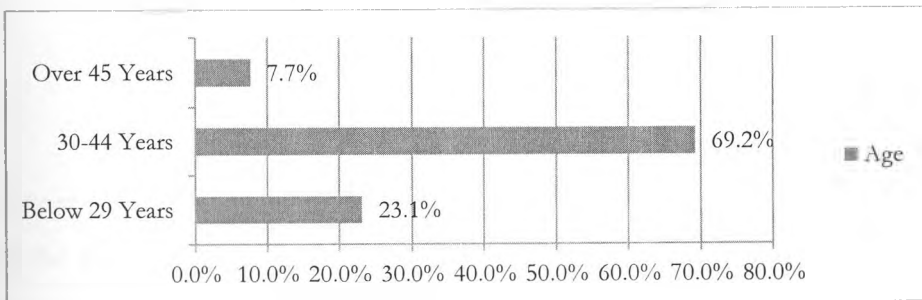
A total of 26 out of the 27 respondents who were targeted participated in this study. As per the data described in Figure 4.2, 62% of the respondents were male while 38% were female.

Figure 4.2: Gender



On the other hand, as per the data described in Figure 4.3, 23% of the respondents were in the age bracket of 29 years and below and 69% were in the age bracket of 30 – 44 years. Only 8% of respondents were in the age bracket of above 45 years.

Figure 4.3: Respondents by Age



As per the data shown in Table 4.1, 15.3% of male respondents were in the age bracket of 29 years and below, 46.1% in 30 - 44 years and none of the male respondents was 45 years or older. Female respondents were 7.6% in the age bracket of 29 years and below, 23.1% in 30 - 44 years age bracket and 7.6% 45 years and older.

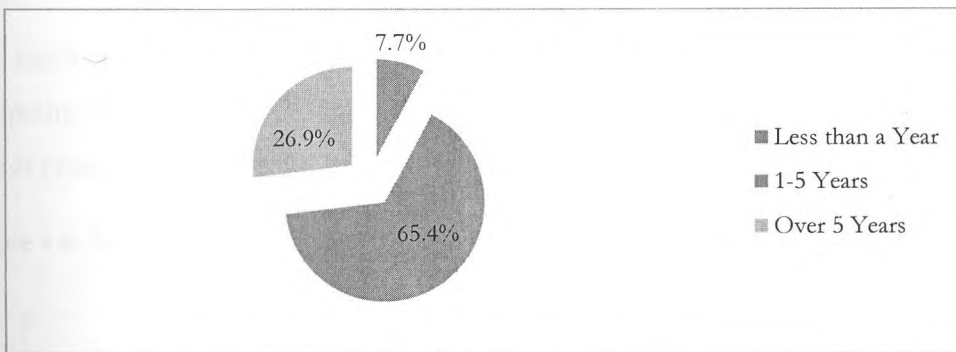
Table 4.1: Gender and Age Cross Tabulation

			Age			Total
			29 and below	30 - 44	45 and above	
Gender	Male	%	15.3%	46.1%	0.0%	61.5%
	Female	%	7.6%	23.1%	7.6%	35.5%
Total		%	23.1%	69.2%	7.6%	100.0%

4.2.2 Experience with NGO and Roles

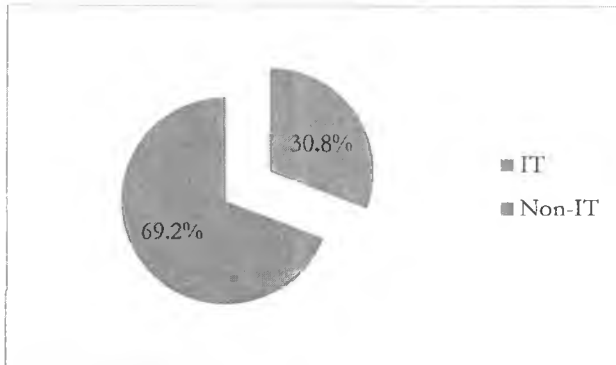
A majority of NGO staff had worked for between 1-5 years. As per the data obtainable by figure 4.4, More than 92% of respondents had worked with Non-Governmental organizations for more than a year. 65.4% had worked for a period of 1 - 5 years while 66.9 % had worked for more than five years. Only 7.7% of the respondents had worked for less than a year.

Figure 4.4: Experience with NGO



As per the data described by figure 4.5, 31% of the respondents worked with the IT department while 69% of the respondents were from other roles other than IT.

Figure 4.5: Respondents Roles



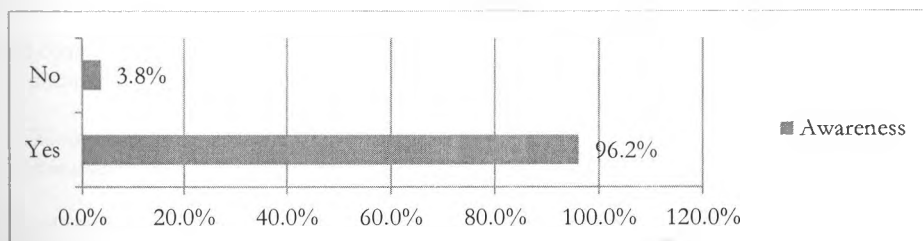
4.3 Awareness of Cloud Computing

This study sought to gather information from employees of NGOs on the awareness levels of cloud computing by the NGO sector. This subtopic therefore presents the findings on the awareness levels and readiness. The findings are organized in categories seeking to understand if the respondents have heard of the term before, they can be able to define it and point out their strategy towards adoption as well as assess if the sampled NGOs have internet resource that is paramount to adoption.

4.3.1 Awareness of Cloud Computing

The study found out that 96% of the respondents had heard about the term cloud computing before. However, 4% of the respondents had never heard of it before. This data is presented in figure 4.6 below.

Figure 4.6: Respondents Awareness



The study also sought to establish the ability of respondents to define cloud computing as 'the fundamental change on how technology services are provisioned'. As per Table 4.2, 88% of the respondents who had heard about cloud computing before were able to define it while 12% were unsure of the definition. However, 100% of the respondents who had never heard of cloud computing were also unable to define it.

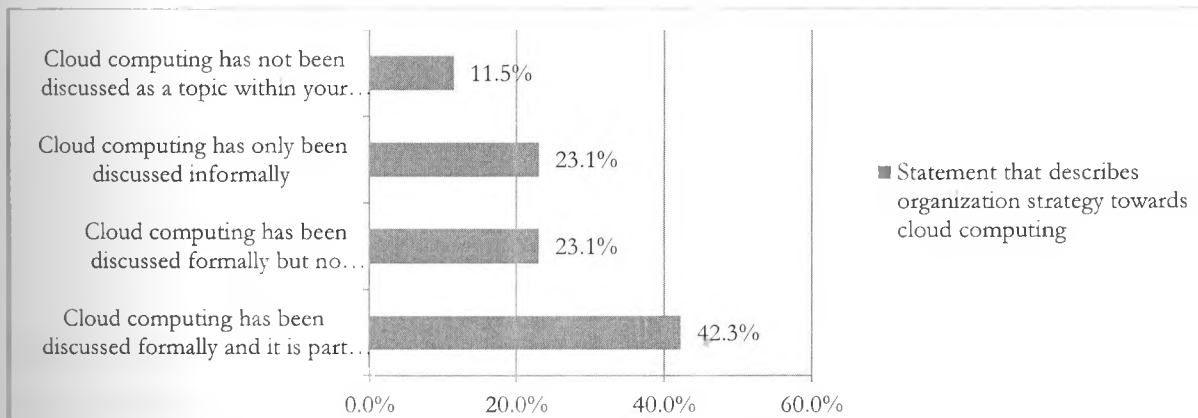
Table 4.2: Heard of the term cloud computing before and definition of cloud computing
Cross tabulation

Category		Definition of Cloud computing		Total
		Fundamental Change in how technology services are offered	Unsure/No idea	
Heard of the term Cloud computing before?	YES (f)	22	3	25
	(%)	88%	12%	100.0%
	NO (f)	0	1	1
	(%)	0%	100%	100%
Total	f	22	4	26
	%	84.6%	15.4%	100.0%

4.3.2 Organization Strategy towards Cloud Computing

The study also captured respondents views on their organizations strategy towards cloud computing it revealed that a majority of NGOs had formally discussed cloud computing and it was part of their IT strategy. According to data presented in Figure 4.7, 42% of the respondents revealed that cloud computing has been discussed formally and was part of their IT strategy, 23% of the respondents answered that cloud computing had been discussed formally but no adoption plan was in place, another 23% responded that Cloud computing had only been discussed informally in their organizations and 12% of the respondents revealed that cloud computing had not been discussed as a topic within their organizations.

Figure 4.7: Statement that describes organization strategy towards cloud computing



4.3.3 Trained staff on Cloud Computing

As per data presented on Table 4.3, 46% of the respondents agreed that they have been trained on cloud computing and a further 7.7% strongly agreed while 23% disagreed and a further 7.7% strongly disagreed. 15.4% of the respondents were not sure.

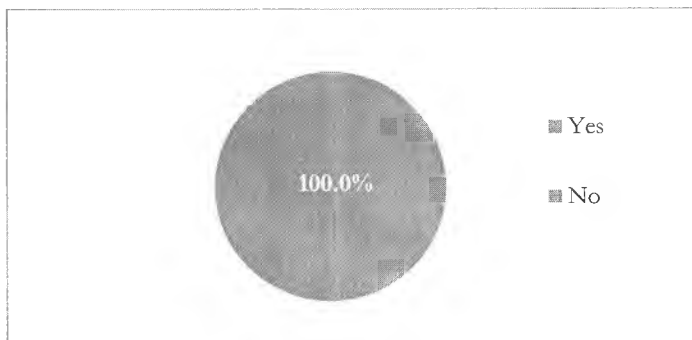
Table 4.3: Trained Staff on Cloud Computing

Category	Frequency	Percent
Strongly agree	2	7.7
Agree	12	46.2
Not Sure	4	15.4
Disagree	6	23.1
Strongly-disagree	2	7.7
Total	26	100

4.3.4 Internet Resource can Support Cloud Computing

The study revealed that 100% of the sampled organizations had an internet connection as shown by Figure 4.8.

Figure 4.8: Internet connection findings



Most respondents confirmed that their organization's internet connection can support the cloud computing model. According to data in Table 4.4, 53.8% of the respondents agreed with a further 23.1% strongly in agreement. However 23.1% of the respondents were indifferent whether it can support the cloud computing model.

Table 4.4: Internet resource can support cloud computing

Category	Frequency	Percent
Strongly agree	6	23.1
Agree	14	53.8
Not Sure	6	23.1
Total	26	100

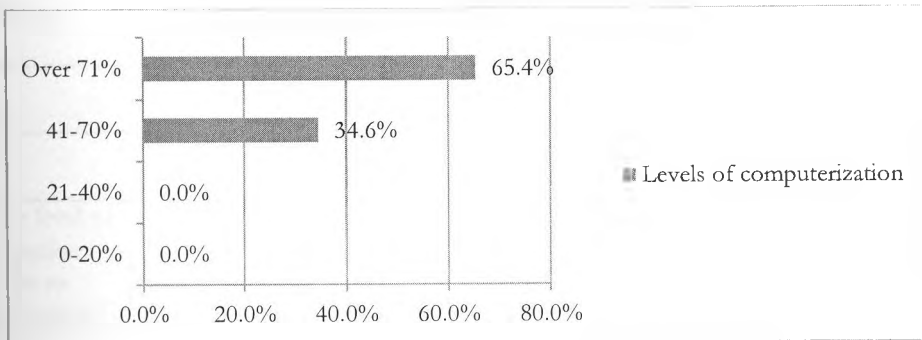
4.4 Extent of Cloud Computing Adoption

The second focus of the study was gathering information on the extent of cloud computing adoption by the NGO sector. This subtopic therefore presents the findings on computerization levels, percentage on services on the cloud, budget allocation levels, services currently on the cloud, delivery and service models adopted at the time of the study.

4.4.1 Level of Computerization

The study found out that the levels of computerization in a majority of the sampled organization stood at an impressive ‘over 71%’ with 65.4% of the respondents stating so and 34.6% of the respondents citing that computerization levels at their organization stood at “40-70%” as per figure 4.25.

Figure 4.9: Level of computerization

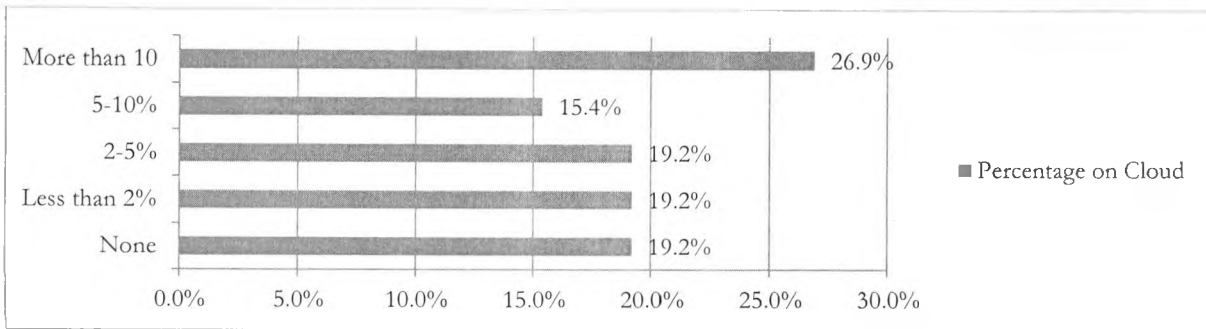


4.4.2 Percentage of Services on the Cloud

The study revealed that, 26.9% of respondents from sampled organizations established that “More than 10%” of services in their organizations were on the cloud As illustrated by the data in Figure 4.26, 15.4% of the respondents stated “5-10%” services were on the cloud, 19.2% of the sampled stated “2-5” of the services were on

the cloud, with another 19.2% stating that “less than 2%” of the services on the cloud. However, a solid 19.2% stated that “None” of their services were on the cloud

Figure 4.10: Percentage of services on the cloud



As illustrated in Table 4.15 an impressive 35.5% of the respondents who placed their organization computerization levels at Over 71 percent also went ahead to state that their organizations had more than 10% of their computerized services on the cloud, 11.8% stated that they had between (5-10) percent of their computerized services were on the cloud, another 17.6% stated that they had between (2-5) percent of their computerized services were on the cloud with another 17.6% stating they had less than 2% and finally 17.6% stated they had None of their computerized services were on the cloud.

Table 4.5: What is the percentage of computerized services that are at the cloud? Versus what is the level of computerization on the activities in your organization? Cross tabulation.

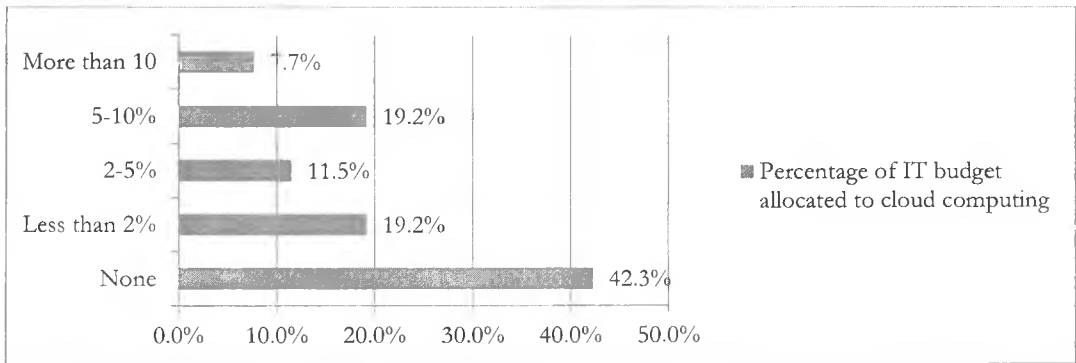
Category		What is the percentage of computerized services that are at the cloud?					Total
		None	Less than 2%	2-5%	5-10%	More than 10%	
What is the level of computerization on the activities in your organization?	41-70%	22.2%	22.2%	22.2%	22.2%	11.1%	100%
	Over 71%	17.6%	17.6%	17.6%	11.8%	35.5%	100%
Total		19.2%	19.2%	19.2%	15.4%	26.9%	100%

4.4.3 Percentage of IT Budget Allocated to Cloud Computing

The study found out that majority of organizations had none of their IT budgets allocated to cloud computing initiatives. As illustrated in the data presented in Figure 4.27, 42.3% of the respondents had none of their IT budgets allocated to cloud

computing. Only 7.7% respondents stated that their organization allocated more than 10% of the IT budget to cloud computing, 19.2% of the respondents stated “5-10%”, 11.5% or the respondent stated “2-5%” allocation and 19.2% of the respondents had an allocation of “Less than 2%”.

Figure 4.11: Percentage of IT budget allocated to cloud computing



As illustrated by the data presented in Table 4.16 the study further revealed that 100% of the respondents who placed their organization’s computerized services on the cloud to be more than 10% also cited that their IT budget allocation to cloud computing was more than 10% of their total IT budget followed by an impressive 80% stating that a budget allocation of between 5-10% of the total IT budget was allocated to cloud computing., a further 33% stated that an allocation of 2-5% of their total IT budget. 18.2% of the respondents who placed their organization computerized services on the cloud at between (5-10) percent stated that “none” of the IT budget had been allocated to cloud computing with a further 40% of the respondents citing that an allocation of Less than 2 % was allocated.

Table 4.6: What is the percentage of computerized services that are at the cloud? Versus What percentage of your IT budget is set aside for cloud computing usage? Cross tabulation

Category		What is the percentage of computerized services that are at the cloud?					Total
		None	Less than 2%	2-5%	5-10%	More than 10%	
What percentage of your IT budget is set aside for cloud computing usage?	None	45.5%	18.2%	18.2%	18.2%		100%
	Less than 2%		60.0%		40.0%		100%
	2-5%			66.7%		33.3%	100%
	5-10%					80%	100%
	More than 10%					100%	100%
Total		19.2%	19.2%	19.2%	15.4%	26.9%	100%

4.4.4 Services on the Cloud

This sub section sought to collect information on the services that organizations in the NGO sector had adopted. This subtopic therefore presents the findings on Webhosting, Email hosting, database hosting, application hosting and online data storage.

The study revealed that non-governmental organizations had adopted the webhosting cloud service. As per Table 4.17, 34.6% of the respondents were strongly in and a further 23.1% were in agreement. 19.2% of the respondents however were in disagreement that their organizations have adopted webhosting cloud service. A significant 23.1% of the respondents were indifferent.

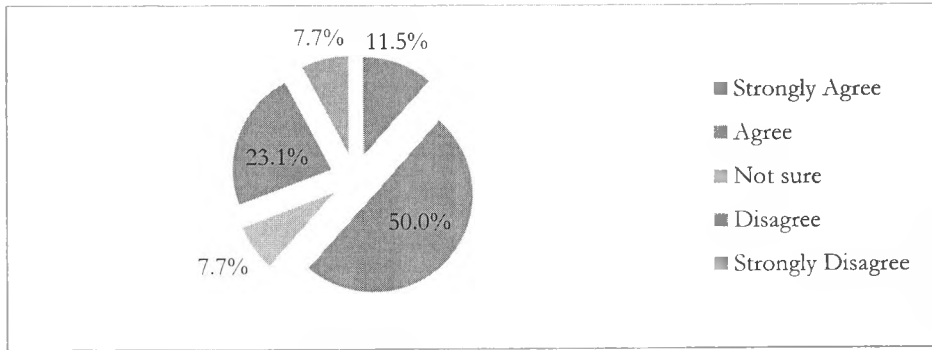
Table 4.7: Webhosting

Category	Frequency	Percent
Strongly agree	9	34.6
Agree	6	23.1
Not Sure	6	23.1
Disagree	5	19.2
Total	26	100

The study found out that an impressive 50% of the sampled organizations respondents were in agreement that they had adopted the email hosting cloud service with a further 11.5% of the respondents who were strongly in agreement. 23.1% of the respondents

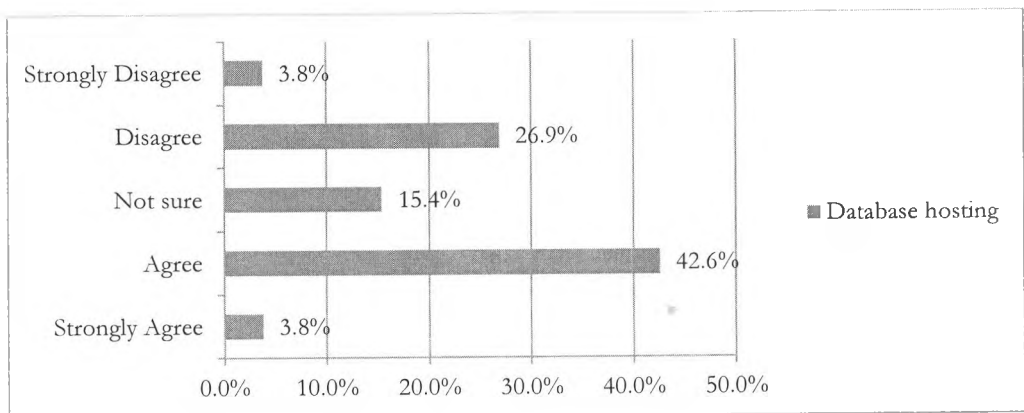
however were not in agreement that their organizations have email hosting cloud service with a further 7.7% who strongly disagreed. Another 7.7% of the respondents were indifferent on the issue as illustrated by Figure 4.28.

Figure 4.12: E mail hosting



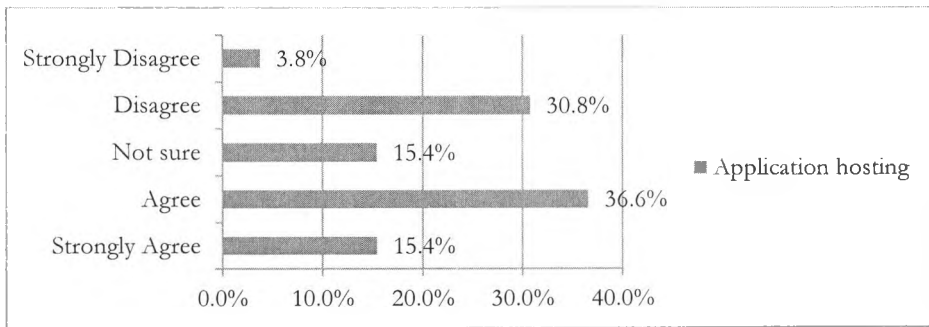
The study found out that non-governmental organizations had adopted database hosting cloud service. As per data in Figure 4.29, an impressive 42.6% of the respondents were in agreement that their organizations have adopted database hosting cloud service with a further 3.8% who were strongly in agreement. A significant 26.9% of the respondents were in disagreement that their organization has adopted the database hosting cloud service with a further 3.8% who strongly disagreed. However, a solid 15.4% of the respondents were indifferent.

Figure 4.13: Database hosting



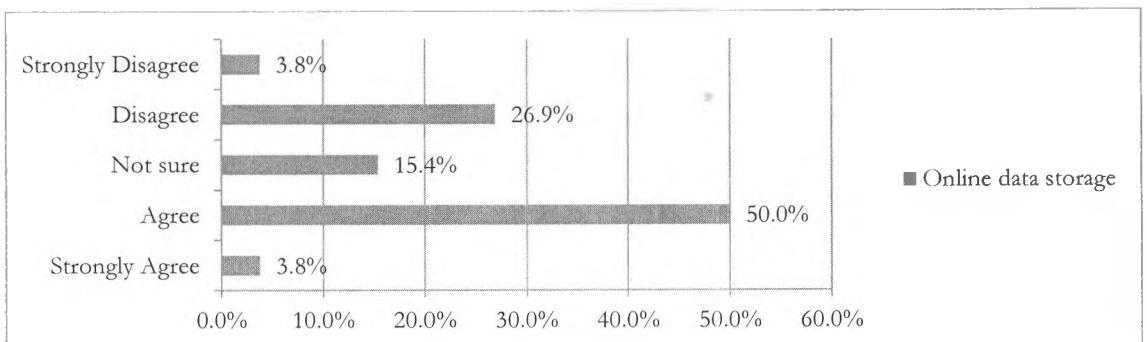
The study revealed that NGOs had adopted application hosting cloud service. As per data presented in figure 4.30, 36.6 percent of the respondents were in agreement that their organizations had adopted application hosting cloud service with a further 15.4% were strongly in agreement. 30.8% of the respondents however disagree that their organizations have application hosting cloud service with a further 3.8% who were strongly in disagreement. The rest accounting for 15.4% of the respondents were not sure thus indifferent if their organization had adopted the application hosting cloud service.

Figure 4.14: Application Hosting



Online data storage was found out to be a cloud service that had been adopted by NGOs. As per data presented in Figure 4.31, 50% of the respondents were in agreement that their organizations had adopted online data storage cloud service with a further 3.8% who were strongly in agreement. 26.9% of the respondents however were in disagreement with a further 3.8% of the respondents who were strongly in disagreement. 15.4% of the respondents were indifferent whether their organizations have adopted the online storage cloud service.

Figure 4.15: Online data storage

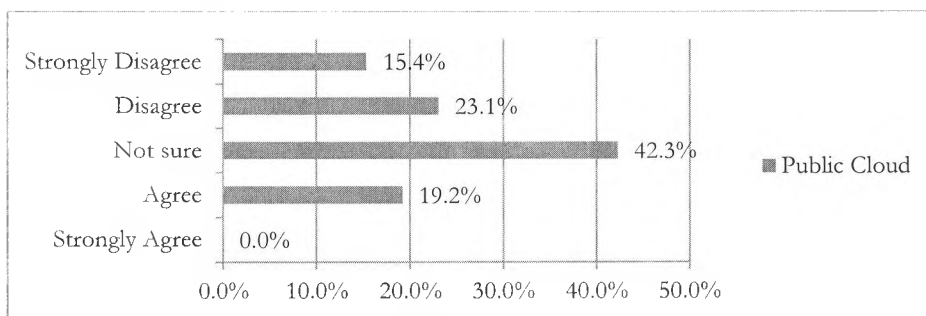


4.4.5 Delivery Models Adoptability

This sub section sought to collect information on the cloud computing delivery models that organizations in the NGO sector had adopted. This subtopic therefore presents the findings on Public, private, community and hybrid cloud models.

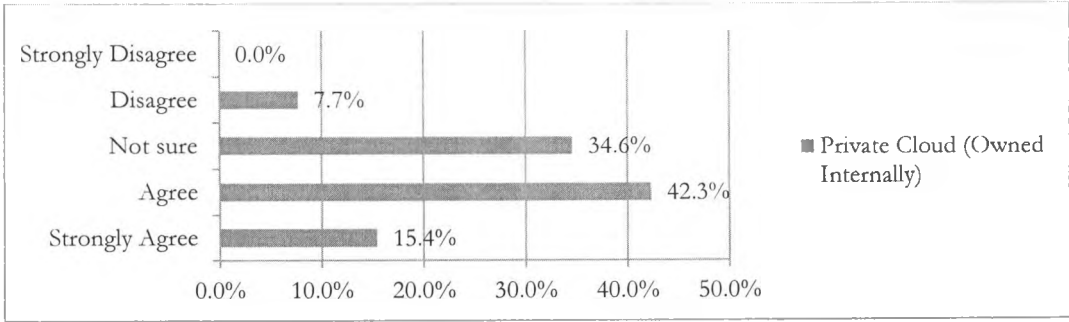
Public cloud delivery model was found to be unpopular with non-governmental organizations. As per data presented in figure 4.32, 42.3% of the respondents were indifferent whether their organizations had adopted the public cloud model. 19.2% of the respondents were in agreement that their organizations had adopted the public cloud. However an emphatic 23.1% of the respondents were in disagreement with a further 15.4% of the respondents were strongly in disagreement.

Figure 4.16: Public Cloud



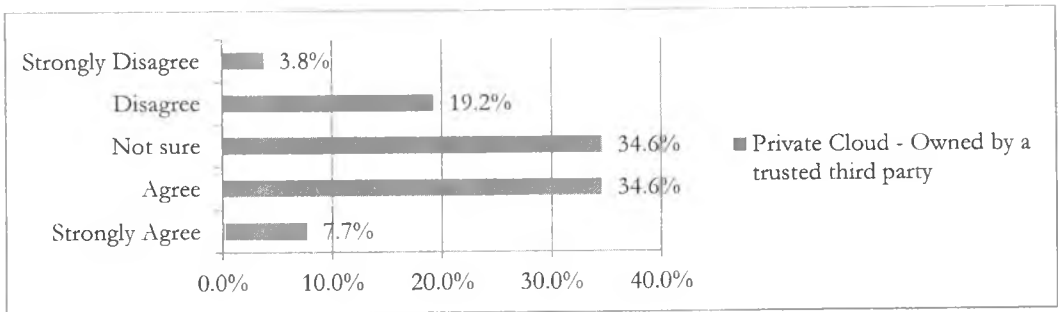
Private cloud (owned internally) was found to be popular with NGOs in Kenya according to the findings of the study. As illustrated by data presented in figure 4.33, an emphatic 42.3% of the respondents were in agreement that their organization had adopted the private cloud-owned internally with a further 15.4% of the respondents were strongly in agreement. A paltry 7.7% of the respondents were in disagreement. However, 34.6% of the respondents were indifferent whether their organizations had adopted the cloud delivery model.

Figure 4.17: Private Cloud – Owned Internally



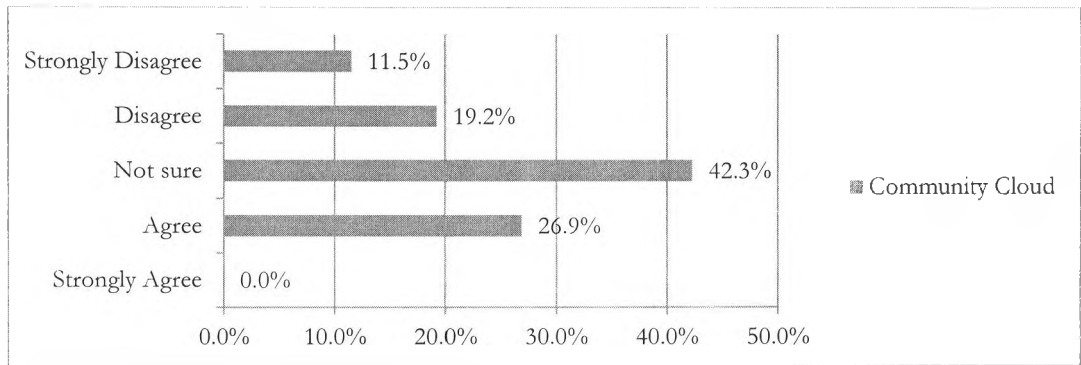
As illustrated by data in figure 4.34, the study revealed that 34.6% of the respondents were in agreement that their organizations had adopted the private cloud-owned by a trusted third party with a further 7.7% who were strongly in agreement. 19.2% of the respondents however were in disagreement with a further 3.8% of the respondents strongly in disagreement. 34.6% of the respondents were indifferent if their organization had adopted the cloud model in question.

Figure 4.18: Private Cloud - Owned by a trusted third party



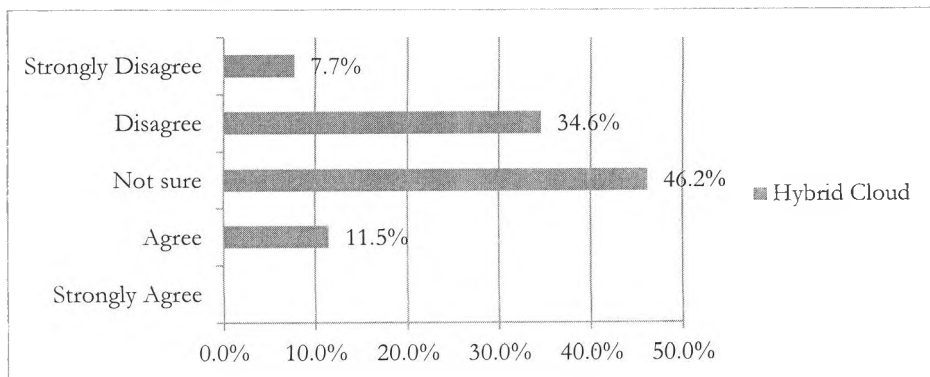
As per illustrated by figure 4.35, 42.3% of the respondents were indifferent if their organization had adopted the community cloud. 26.9% of the respondents were in agreement that their organization had adopted the community cloud model. However, 19.2% of the respondents were in disagreement that their organizations had adopted the community cloud model with a further 11.5% of the respondents were strongly in disagreement

Figure 4.19: Community Cloud



As per the data presented by Figure 4.36, an emphatic 46.2% of the respondents were indifferent if whether their organizations had adopted the hybrid cloud delivery model. 34.6% of the respondents were in disagreement with a further 7.7% who were strongly in disagreement. However, 11.5% of the respondents were in agreement that their organization had adopted the hybrid cloud delivery model.

Figure 4.20: Hybrid Cloud



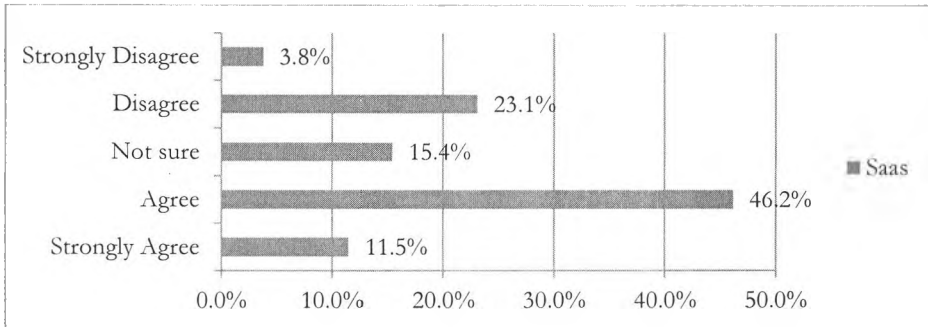
4.4.6 Service Models Adoptability

This sub section sought to collect information on the cloud computing service models that organizations in the NGO sector had adopted. This subtopic therefore presents the findings on software as a service, platform as a service and infrastructure as a service.

Software as a service was found out to be popular with the NGOs in Kenya according to the study revelations. As illustrated by data in Figure 4.37, 46.2% of the respondents were in agreement that their organizations had adopted software as a service cloud computing service model with a further 11.5% who were strongly in agreement. A significant 23.1% of the respondents were in disagreement with a

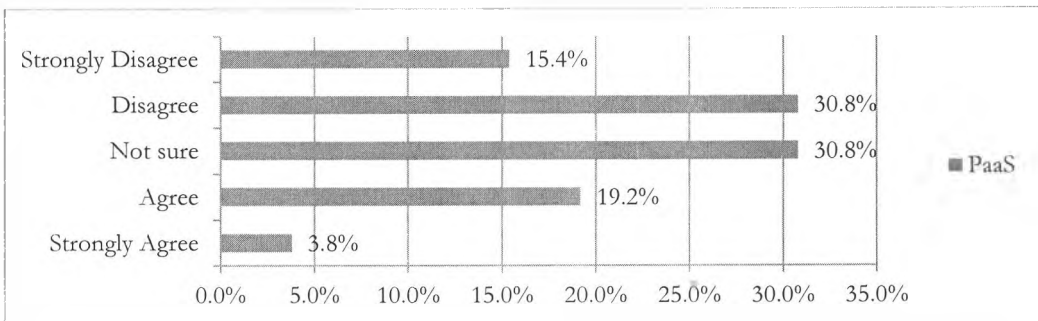
further 3.8% who were strongly in agreement. The remaining respondents accounting for 15.4% were indifferent whether their organizations had adopted software as a service cloud computing service model

Figure 4.21: Software as a service (SaaS)



A majority of NGOs were found not to have adopted the platform as a service cloud computing mode I as the study revealed. As illustrated by data presented in Figure 4.38, the study revealed that 30.8% of the respondents were in disagreement that their organization had adopted platform as a service cloud service model with a further 15.4% of the respondents who strongly disagreed. However, 19.2% were in agreement that their organizations had adopted platform as a service cloud service model with a further 3.8% who were strongly in agreement. The rest of the respondents accounting for 30.8% were indifferent if their organization has adopted platform as a service cloud service model.

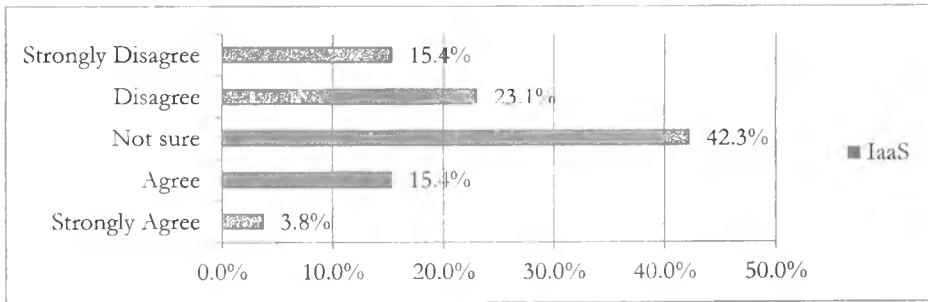
Figure 4.22: Platform as a service



Infrastructure as a service was found out to be unpopular with NGOs in Kenya according to the study findings. As per the data in Figure 4.39, the study revealed that 42.3% of the respondents were indifferent whether their organization had adopted the

infrastructure as a service cloud computing service model. 23.1% of the respondents were in disagreement that their organizations had adopted the infrastructure as a service cloud computing service model with a further 15.4% strongly disagreed. A significant 15.4% were in agreement that their organization had adopted the infrastructure as a service cloud computing service model with a further 3.8% who were strongly in agreement.

Figure 4.23: Infrastructure as a service



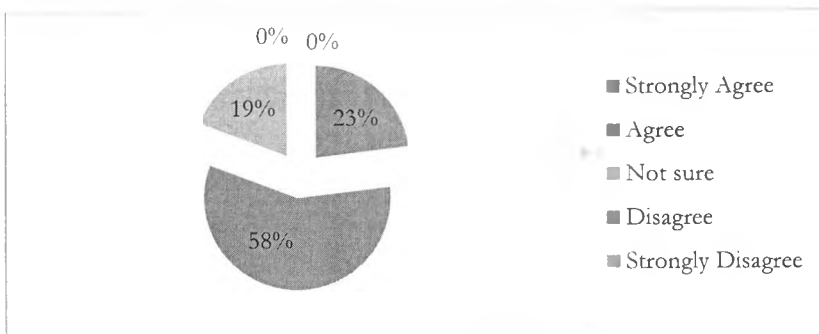
4.5 Drivers to Cloud Computing Adoption

The third focus of this study was to gather information on the drivers of cloud computing adoption by the NGO sector. This subtopic therefore presents the findings on economic, functional, technical and strategic factors.

4.5.1 Economic Factors

The study revealed that 58% of the sampled respondents agreed with that cost savings is a driver to adoption and a further 23% strongly agreed. However, 19% of the respondents were not sure as per figure 4.9.

Figure 4.24: Cost saving



As illustrated in table 4.5, the study found out that 34.6% of the sampled respondents were in agreement that shift from Capital expenditure to Operational expenditure is a driver to adoption and a further 15.4% of the respondents were strongly in agreement. On the other hand, 11.5% of the respondents disagreed and a further 7.7% strongly disagreed. However, 38.5% of the respondents were unsure.

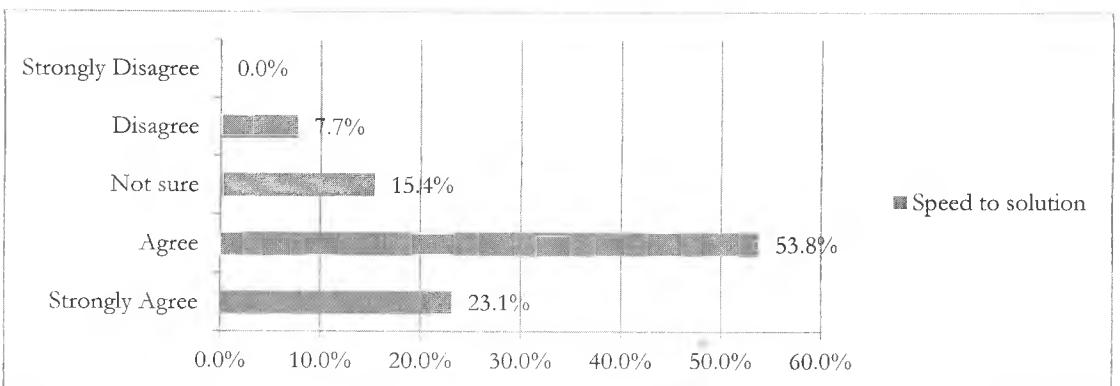
Table 4.8: Shift from Capital Expenditure to Operations Expenditure

Category	Frequency	Percent
Strongly agree	2	15.4
Agree	12	34.6
Not Sure	4	38.5
Disagree	6	11.5
Strongly-disagree	2	7.7
Total	26	100

4.5.2 Functional Factors

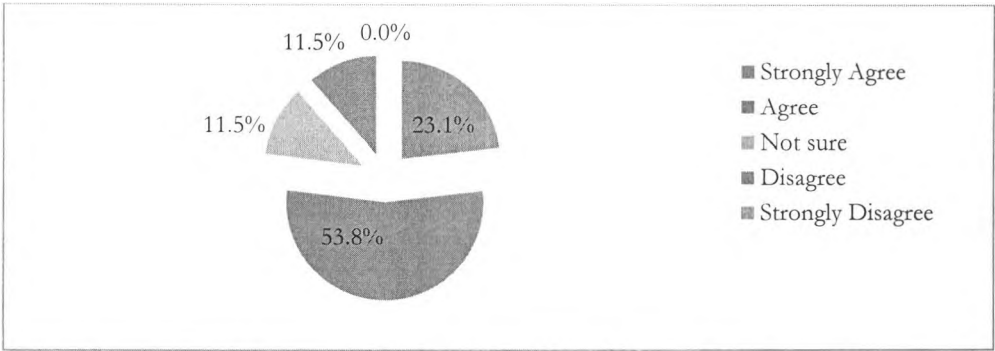
Regarding speed to solution as a factor, 53.8% of the study respondents agreed that it is a driver to adoption of the cloud with a further 23.1% strongly agreeing. Those who were not sure accounted for 15.4% of the respondents and those who disagreed were 7.7%. This data is presented in figure 4.10.

Figure 4.25: Speed to Solution



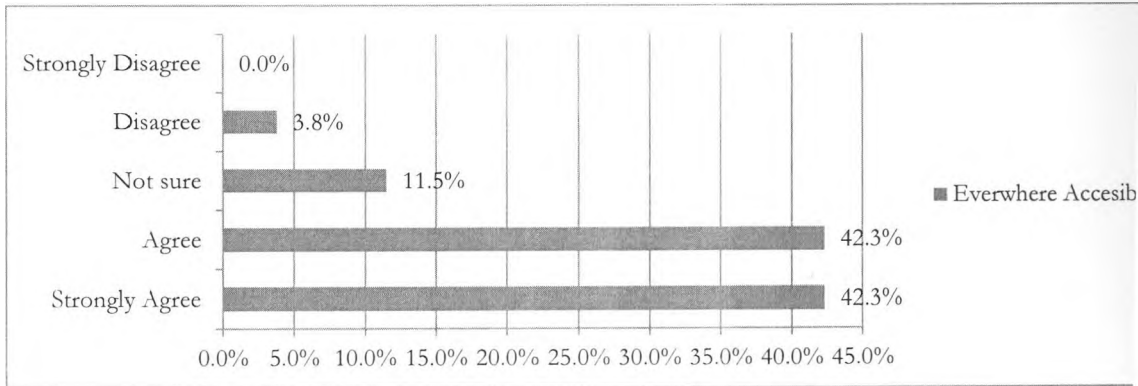
The study revealed that most respondents were in agreement that functional capability is a driver to adoption. As per data presented in figure 4.11, 53.8% of the respondents agreed and 23.1% strongly agreed. Only 11.5% of the respondents Disagreed while another 11.5% were unsure.

Figure 4.26: Functional capabilities



The study found out that 42.3% of the respondents agreed that everywhere access is a driver to adoption with a further 42.3% of respondents strongly agreeing. However 11.5% of the sampled respondents were not sure while another 3.8% Disagreed. This data is shown in Figure 4.12.

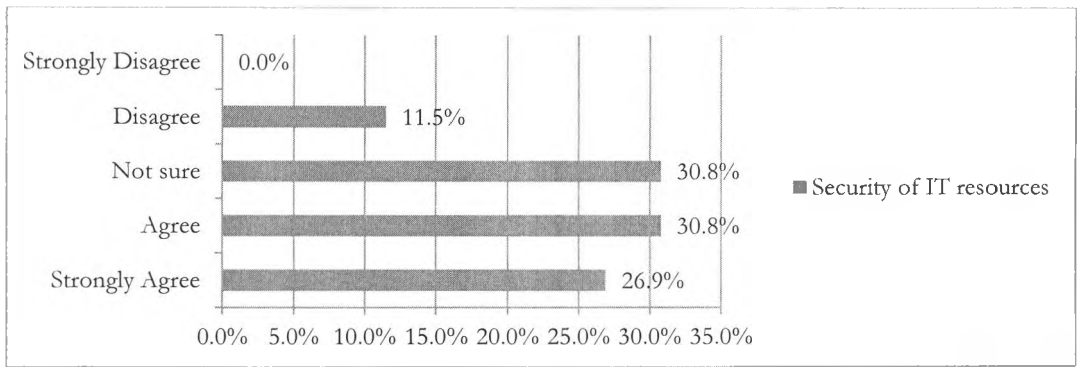
Figure 4.27: Everywhere Accessibility



4.5.2 Technical Factors

According to data in Figure 4.13, 30.8% agreed that security was a driver to cloud adoption and a further 26.9% strongly agreed. However, 11.5% of the respondent disagreed while another 30.8% were unsure.

Figure 4.28: Security of IT resources



It was found out that 57.7% of respondents agreed that simplicity of IT services is a driver to adoption while a further 19.2% strongly agreeing. However, 23.1% of the respondents were unsure as illustrated in Table 4.6.

Table 4.9: Simplicity of IT resources

Category	Frequency	Percent
Strongly agree	5	19.2
Agree	15	57.7
Not Sure	6	23.1
Total	26	100

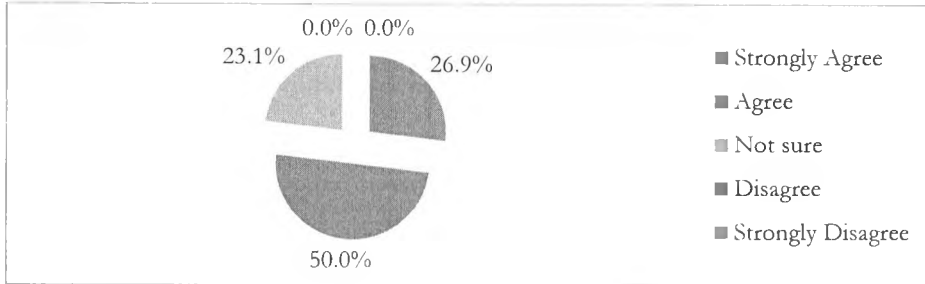
According to the data in table 47, 42.3% of the sampled respondents agreed that scalability of IT services is one of the drivers to adoption with a further 30.8% strongly agreeing. However, 26.9%of the respondents were unsure if scalability is a driver to cloud adoption by their organization.

Table 4.10: Scalability of IT resources

Category	Frequency	Percent
Strongly agree	8	30.8
Agree	11	42.3
Not Sure	7	26.9
Total	26	100

As per data presented in figure 4.14, the study revealed that 50% of the sampled respondents agreed that flexibility of IT services is a driver to adoption with a further 26.9 strongly agreeing. 23.1% of the respondents were unsure.

Figure 4.29: Flexibility of IT services.



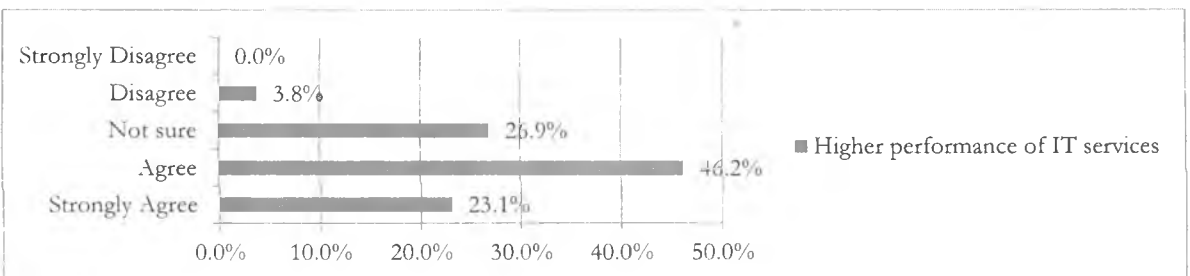
The study found that 42.3% of respondents sampled agreed that enhanced uptime/high availability of IT services is a driver to adoption with a further 30.8% strongly agreeing. Another 26.9% of the respondents were unsure on this factor as illustrated by Table 4.8.

Table 4.11: Enhanced uptime/high availability of IT resources

Category	Frequency	Percent
Strongly agree	8	30.8
Agree	11	42.3
Not Sure	7	26.9
Total	26	100

According to data in figure 4.15, 46.2% of the sampled respondents agreed that higher performance of the IT services is a key driver to adoption of the cloud with a further 23.1% strongly agreeing. 3.8% of the respondents disagreed while 26.9% were unsure on this factor.

Figure 4.30: Higher performance of IT services



4.5.3 Strategic Factors

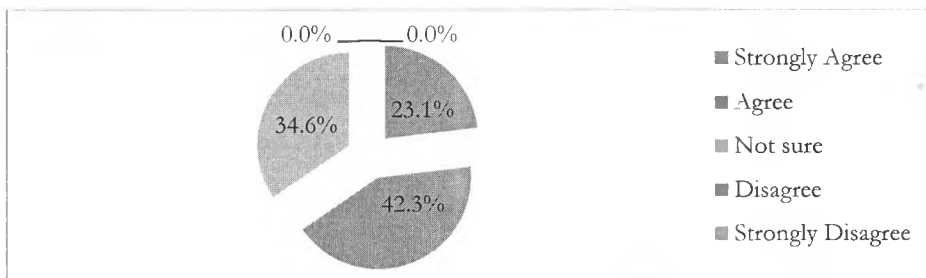
The study found that most respondents supported focus on core competencies by the organization is a driver to adoption. As per data in Table 4.9, 46.2% of the respondents agreed and a further 30.8% strongly agreed. However, 7.7% of the respondents disagreed on this factor as 15.4% of the respondents were unsure.

Table 4.12: Focus on core competencies by the organization

Category	Frequency	Percent
Strongly agree	8	30.8
Agree	12	46.2
Not Sure	4	15.4
Disagree	2	7.7
Total	26	100

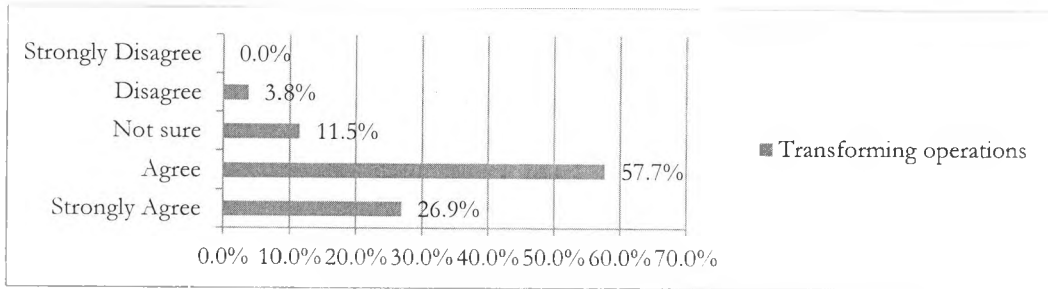
As per data in figure 4.16, most respondents concur that speedy linkage to stakeholders was a driver to cloud computing adoption. among the respondents, 23.1% strongly agreed and 42.3% agreed. However, 34.6% of the respondents were not sure about this factor.

Figure 4.31: Speed linkage to stakeholders



This study found out that 26.9% of the respondents strongly agreed that transforming operations is one of the drivers to adoption of cloud computing with a further 57.7% agreeing. However, 3.8% of the respondents disagreed with it while 11.5% of the respondents were unsure of this factor. This data is shown in Figure 4.17.

Figure4.32: Transforming operations



As per data illustrated in Table 4.10, the study found that diversification of IT systems and resources is a driver to cloud computing adoption. Among the respondents, 53.8% agreed and a further 26.9% strongly agreed. However, 7.7% of the respondents disagreed while 11.5% were unsure.

Table 4.13: Diversification of IT systems and resources

Category	Frequency	Percent
Strongly agree	7	26.9
Agree	14	53.8
Not Sure	3	11.5
Disagree	2	7.7
Total	26	100

4.6 Barriers to Cloud Computing Adoption

The fourth and last focus of this study was to gather information on the barriers of cloud computing adoption by the NGO sector. This subtopic therefore presents the findings on confidentiality, control and ownership, strategy. Bandwidth, work practices, vendors lock-in, security, cost, maturity level and culture of the organizations.

4.6.1 Loss of Confidentiality

This study found that loss of confidentiality as one of the barriers to adoption of the cloud. On this, as illustrated in Table 4.11, 50% of the respondents agreed and with a further 15.4% that strongly agreed. Conversely, 19.2% of the respondents disagreed with the factor while another 15.4% were not sure.

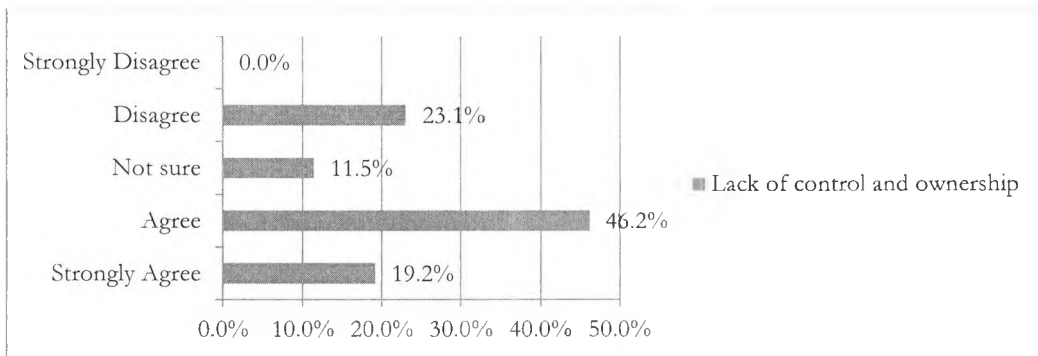
Table 4.14: Loss of confidentiality

Category	Frequency	Percent
Strongly agree	4	15.4
Agree	13	50
Not Sure	4	15.4
Disagree	5	19.2
Total	26	100

4.6.2 Lack of Control and Ownership

Lack of control and ownership was also found to be a barrier of adoption through this study. As per data in figure 4.18, 19.2% of the respondents strongly agreed and 46.2% agreed.

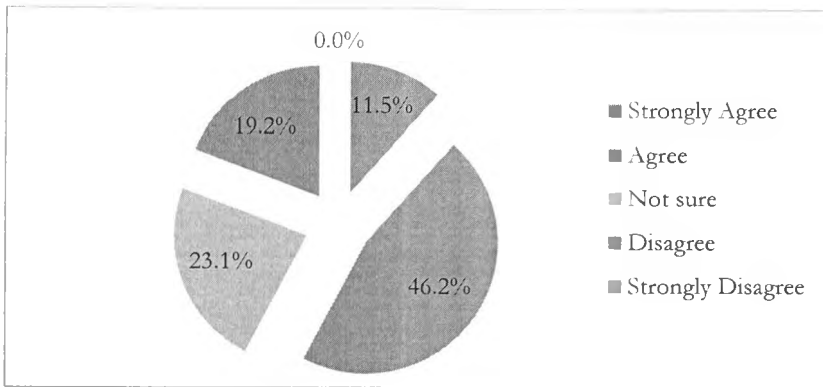
Figure 4.18: Lack of control and ownership



4.6.3 Lack of Clear Strategy on Cloud Computing

Lack of clear strategy was a barrier to cloud computing adoption by the NGOs as revealed by the study. According to data in Figure 4.19, lack of clear strategy was cited as a barrier to cloud computing adoption by most respondents. Slightly above 46% agreed and 11.5% strongly agreed. This is against 19.2% who were in disagreement with a further 23.1% who were uniquely indifferent if lack of clear strategy is a barrier to cloud computing adoption.

Figure4.34: Lack of clear strategy on cloud computing



4.6.4 Insufficient Internet Bandwidth

The study found out that bandwidth was not a dominant barrier for adoption of the cloud in the NGO sector. As illustrated in Table 4.12, 53.8% of the respondents disagreed that insufficient bandwidth is a barrier to adoption in their organizations with a further 3.8% of respondents strongly disagreed to this factor. However, 11.5% of the respondents were in agreement that internet bandwidth is a barrier to adoption in their organization. A solid 19.2% of the respondents were indifferent on this factor.

Table 4.15: Insufficient Internet Bandwidth

Category	Frequency	Percent
Strongly agree	3	11.5
Agree	3	11.5
Not Sure	5	19.2
Disagree	14	53.8
Strongly-disagree	1	3.8
Total	26	100

4.6.5 Impact on Work Practices

The study found that most respondents did not support impact on work practices as a barrier to cloud computing adoption. As per data in Figure 4.13, 34.6% of the respondents were in disagreement while 30.8% of the respondents were indifferent.

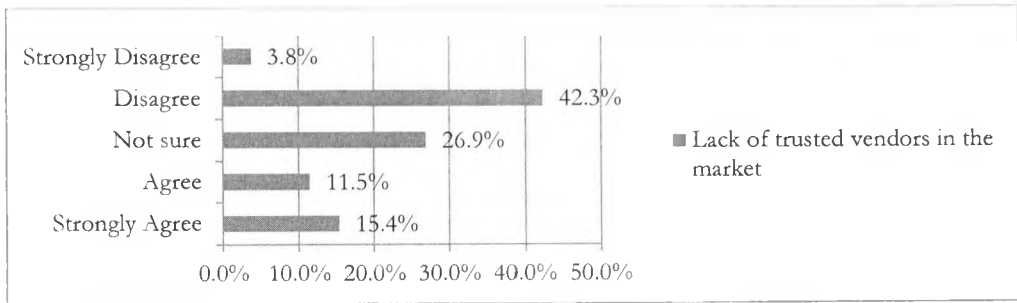
Table 4.16: Impact on work practices

Category	Frequency	Percent
Strongly agree	3	11.5
Agree	6	23.1
Not Sure	8	30.8
Disagree	9	34.6
Total	26	100

4.6.6 Lack of Trusted Vendors in the Market

Lack of trusted vendors was not cited as a barrier to adopting. As per data presented in the Figure 4.20, 42.3% disagreed that lack of trusted vendors in the market was a barrier to adoption of the cloud with a further 3.8% strongly disagreed,

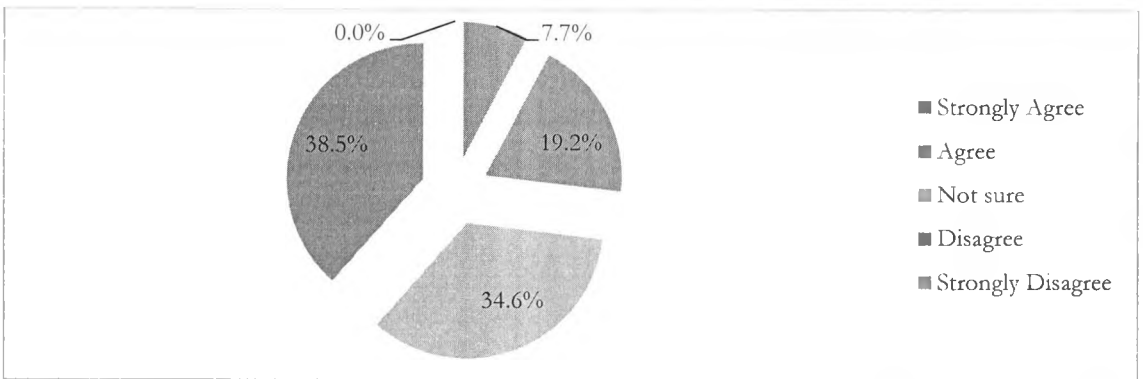
Figure 4.35: Lack of trusted vendors in the market



4.6.7 Lock in to a Specific Infrastructure Vendor

The study revealed that 38.5% of the respondents disagreed that lock-in to a specific vendor is a barrier to adoption. However, 19.2% of the respondents were in agreement that lock –in to a specific infrastructure vendor is barriers to adoption with a further 7.7% of the respondents were strongly in agreement and 34.6% were in indifferent on this factor as illustrated in Figure 4.21.

Figure 4.36: Lock in to a specific infrastructure vendor



4.6.8 Lack of Security and SLAs

The study found out that 42.3% of the respondents disagreed that lack of security and SLAs is a barrier to adoption in their organization with 30.8% who agreed with a further 15.4% strongly in agreement. However, 11.5% respondents were indifferent if lack of security and SLAs was a barrier to adoption. This data is available in Table 4.14.

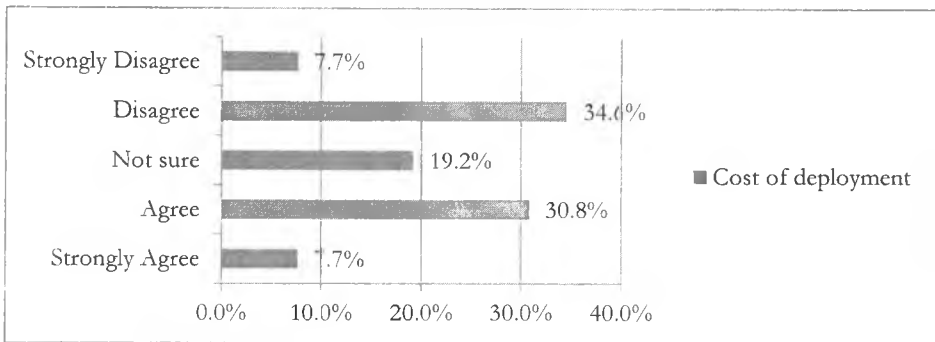
Table 4.17: Lack of security and SLAs

Category	Frequency	Percent
Strongly agree	4	15.4
Agree	8	30.8
Not Sure	3	11.5
Disagree	11	42.3
Total	26	100

4.6.9 Cost of Deployment

As per data captured in Figure 4.22, 34.6% of the respondents were in disagreement that cost of deployment of the cloud is a barrier to adoption with a further 7.7% strongly in disagreement. However, 30.8% of the respondents were in agreement that cost of deployment is a barrier of adoption with a further 7.7% strongly in agreement. A solid 19.2% of the respondents however were indifferent if the cost of deployment was a barrier to adoption of cloud computing.

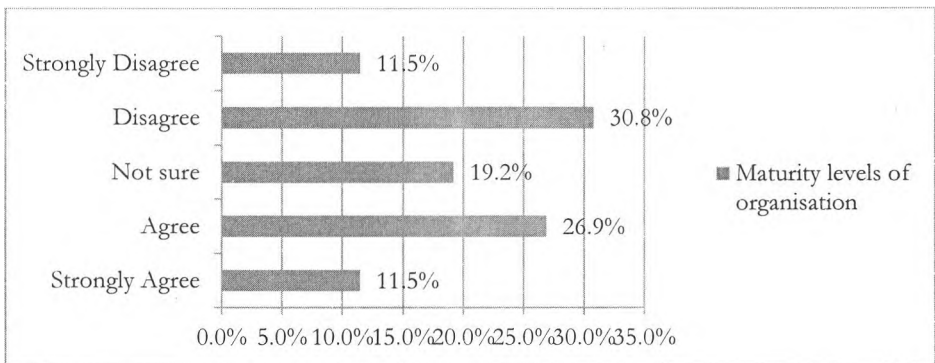
Figure 4.37: Cost of deployment



4.6.10 Maturity Levels of the Organization

The study revealed that 30.8% of the respondents were in disagreement that maturity levels of the organization was a barrier to adoption with a further 11.5% strongly in disagreement. 26.9% of the respondents were in agreement and a further 11.5% of the respondents strongly in agreement. However, 19.2% of the respondents were not sure if maturity levels of the organization affect adoption of cloud computing in their organization. These findings are illustrated in Figure 4.23.

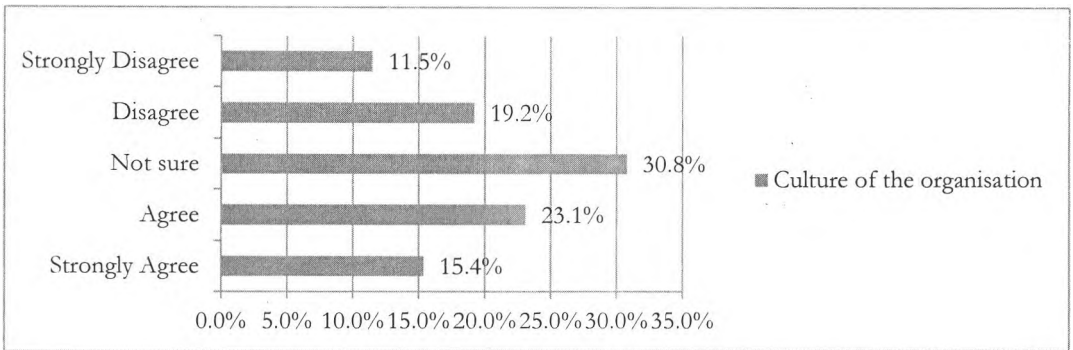
Figure 4.38: Maturity levels of the organization



4.6.11 Culture of the Organization

The study found out that 30.8% of the respondents were indifferent if the culture of the organization was a barrier to adoption of cloud computing. The study further revealed that 23.1% of the respondents were in agreement that culture of the organization is a barrier to adoption with a further 15.4% strongly in agreement. Those in disagreement accounted for 19.2% of the respondents with a further 11.5% strongly in disagreement. These findings are presented in Figure 4.24.

Figure 4.39: Culture of the Organization



4.7 Chapter Summary

This chapter has presented the findings of the research including the demographics of respondents, awareness of cloud computing, drivers to cloud computing adoption, barriers to cloud computing adoption and the extent of cloud computing adoption.

CHAPTER FIVE: DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter begins with a summary of research questions and methods followed by a discussion of the findings of the case study presented. This is followed by conclusions based on the study. Finally, the chapter includes recommendations for cloud computing technology adoption as well as for further research.

5.2 Summary

The purpose of this study was to assess the awareness levels of cloud computing in the NGO sector and the extent to which the NGO sector has adopted the technology. The study was also aimed at establishing the drivers as well as barriers of cloud computing adoption by the NGO sector. The study attempted to answer the following research questions:

- a) Assess the level of awareness of cloud computing in the NGO sector in Kenya.
- b) Assess the extent to which the NGO sector has adopted cloud computing.
- c) Establish the drivers of cloud computing adoption by the NGO sector in Kenya
- d) Determine the barriers of cloud computing adoption by the NGO sector in Kenya.

The research design in this study was based on cross sectional study approach focusing on the international NGOs in working in Kenya. The population of study consisted of 30 NGOs as provided in appendix II. Random sampling without replacement was employed to select nine NGOs for the study from the population given. The data was collected through questionnaires administered by the researcher. The questionnaire was pre-tested on 3 NGO employees whose feedback was not included in the findings. Email and online questionnaires coupled by telephone calls and correspondences were used to reach where the researcher was unable to physically visit. The data analysis was based on quantitative approach using descriptive statistics. The data analysis tool utilized was the statistical package for social sciences. The results were presented in tables, charts and bar graphs. Cross tabulation was also used to make comparisons between desired variables.

Cloud Computing has become one of the most talked about technologies in recent times and has received lots of attention from analysts because of the opportunities it is offering. It is also a prism that organizations want to concentrate their resources on core business and not in supporting IT services hence the need to reduce unnecessary costs related to operations. Cloud Computing is still at its infant stage especially in Kenya and a very new technology for the organizations especially the NGOs. Therefore, most of the enterprises are not very confident to adopt it. Therefore assessing the awareness levels and finding out the factors affecting and drivers would provide interested stakeholders a point of reference when adopting cloud computing to ensure successful and sound practices whilst adopting such technologies.

5.3 Discussion

5.3.1 Awareness of Cloud Computing in the NGO Sector

From the findings of this study, it was concluded that that the NGO sector in Kenya was aware of the cloud computing. An overwhelming 96.2% of the respondents had heard of the term cloud computing with a further 88% of the 96.2% able to define it. The study also found out that the internet bandwidth was sufficient to support cloud computing service and delivery models with an impressive 46.2% of the respondents stating so. The study also revealed that a majority of NGOs had formally discussed cloud computing and it was part of their IT strategy with a solid 42.3% of the respondents supporting stating this.

According to Furrer (2008) cloud computing adoption is determined by the level of knowledge on services, and solutions will take advantage of expertise and how best to implement this cloud technology. This can be inferred from this study as the awareness levels are impressive thus setting the right platform for adoption of the cloud computing model since an organization cannot adopt what its unknown to it.

A formal strategy is required to be put in place for adopting new technologies like cloud computing (Furrer, 2009). With a majority of non-governmental organization stating that cloud computing is part of their strategy from the findings of this study is apposite sign that points to awareness and readiness of adoption of the cloud services.

Gartner (2009) points out that adoptability of the cloud services depends on whether the existing internet connection will cope with the additional bandwidth requirements, the reliability of the service provider and a backup line if the main one fails. Therefore having an overwhelming majority of respondents endorsing their internet connection has being sufficient and available according to the findings of this study points to readiness to adoption by the NGO sector in Kenya.

5.3.2 Extent of Cloud Computing in the NGO Sector

Findings from this study concluded that a majority of NGOs Kenya have overwhelmingly computerized their operations with an emphatic 65.4% of the respondents quoting that the over 71% of their operations had been computerized with a further 34.6% ranking their computerization levels at between 41-70% thus setting up a stage of moving their computerized services to the cloud. Only 35.5% the respondents who placed their organization computerization levels at Over 71 percent also went ahead to state that their organizations had more than 10% of their computerized services on the cloud.

The study also found out that more than 10percent of computerized services were on the cloud with 26.9% of the respondents stating this which was a relatively lower percentage in relation with the computerization levels earlier stated. The study further revealed that 100% of the respondents who placed their organization's computerized services on the cloud to be more than 10% also cited that their IT budget allocation to cloud computing was more that 10% of their total IT budget followed by an impressive 80% stating that a budget allocation of between 5-10% of the total IT budget was allocated to cloud computing. An obvious reason for this discrepancy was revealed to be low or no funding since 42.3% of the respondents stating that none of their IT budget had been allocated to cloud computing.

This study also concluded that the most popular cloud service adopted by the NGOs in Kenya was email hosting with 61.5% of the sampled respondents validating the service. This was followed by web hosting cloud service which was ranked second with a 57.7% of the respondents; online data storage was third with 53.8 and application hosting cloud service coming forth with 52% of the respondents citing it. However, database hosting cloud service was found to be unpopular with NGOs in Kenya since it was cited with less than half of the respondents.

The majority of respondents cited private (owned internally) was the most popular delivery model as cited by 57.7% of the respondents with private (owned by a trusted third party) coming second cited by 42.3% of the respondents. All the other delivery models (Public, community and hybrid) that were brought forth by the literature baselines scored poorly in this study. The study further concluded that software as a service cloud computing service model was the most popular service model within the NGO sector in Kenya with a 57.7% of the respondents citing it. The other two service models (IaaS and PaaS) both scored a consolidated rating of below 43%.

5.3.3 Drivers of Cloud Computing Adoption

Findings from this research concluded that economic, technical, functional and strategic were drivers of cloud computing adoption by the NGO sector thus in agreement with the literature baselines in this study. Economic factors were endorsed with cost saving rated at 81% and shift from capital expenditure to operations expenditure rated at 50%.

Functional factors also scored highly as the drivers to adoption of the cloud computing model with speed to solution rated at 76.9%, functional capabilities also rated at 76.9%, everywhere accessibility rated an overwhelming 84.6%. Technical factors were also validated by the study as the drivers of cloud computing adoption with security of IT resources rated at 57.7%, simplicity of IT services rated at 76.9%, scalability of IT services rated at 73.1%, flexibility of IT services rated at 76.9%, enhanced uptime/high availability of IT services scored at 73.1% and higher performance of IT services scoring 69.3% and last but not least the strategic factors were validated with focus on core competencies by the organizations scoring 77%, speedy linkage to stakeholders rated at 65.4%, transforming operations rated at an overwhelming 84.6% and last but not least diversification of IT systems and resources rated at an impressive 80.9%.

The finding validated above agreed with the Klynveld Peat Marwick Goerdeler (KPMG's) global cloud Pulse survey that looked at what was driving the adoption of cloud computing by end-user organizations (KPMG, 2011). A primary driver typically cited in the market was reducing IT costs and this was supported by these research findings. The research ranked the listed findings as being economic,

functional, technical and strategic factors. Further Khajeh-Hosseini (2010) summarized the drivers to adoption to economic factors, functional factors, technical factors and strategic factors and further unpacked them to security, elasticity, virtualization, cost, mobility, collaboration, risk reduction, feedback and usability that this study has also validated being applicable to non-governmental organizations in Kenya.

5.3.4 Barriers to Cloud Computing Adoption in the NGO Sector

The study finding revealed mixed results for the barriers of adoption as per the data collected. As the sampled NGOs respondents validated lack of ownership, loss of confidentiality and lack of clear strategy as barriers of cloud computing adoption with 64.4%, 65.4% and 57.7% respectively. However, other barriers did not receive endorsement with the closest being lack of security and SLAs was ranked at 46.2% and the rest ranked below 38.5% (insufficient internet bandwidth, impact on workplace, lack of trusted vendors in the market, Lock-in to certain vendor, cost of deployment, maturity levels of the organization and culture).

Furrier (2009) argues that a formal strategy is required to be put in place for adopting new technologies like cloud computing, therefore lack of a clear formal strategy is a major barrier to adoption as validated by the this study that revealed that lack of clear strategy is a major barrier. The decision to adopt Cloud Computing is challenging because of the range of practical and socio political reasons coupled also by socio-technical factors like cost, confidentiality and control (Sullivan, 2009). This study partly agreed with Sullivan social- technical factors like confidentiality and lack of control but differed with it on cost.

Hayes (2009) points out that allowing a third party service to take custody of personal documents raises concerns about control and ownership more so when an organization changes service providers and the findings of this study validates Hayes opinions were validated as barriers to adoption in the NGO sector in Kenya. Gartner (2009) also pointed out whether the existing internet connection will cope with the additional bandwidth requirements to run the cloud is also another major barrier to adoption but this study finding differed with Gartner finding as the majority of NGOs endorsed their internet bandwidth as sufficiently able to handle the additional traffic.

5.4 Conclusions

Adoption of any technology is determined by the level of knowledge on services, and solutions will take advantage of expertise and how best to implement this cloud technology. Strategy is also very key in the process of adoption of the cloud computing technology since strategy gives direction on what is to be done and what shouldn't. Economic, technical, functional and strategic factors are key drivers of cloud computing adoption by organizations.

Lack of ownership, loss of confidentiality and lack of clear strategy have been validated as some of the key barriers to adoption of cloud computing. Therefore decision maker's need to make careful and informed trade-offs between the drivers and barriers once a decision to adopt cloud computing in their organization are evaluated and made. Vendors of the cloud must be deliberate to address the barriers that have been raised by this study to motivate penetration of their cloud services on offer. To encourage adoption of cloud computing, NGOs need to be deliberate to allocate budgets to cloud initiatives to motivate adoption.

One of the motivating benefits of cloud computing is its payment model where the users pay for what they use and not necessarily what they own. 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 organizations can benefit from this utility model is not very clear since it was not captured by the study as a research objective.

5.5 Recommendations

Successful adoption of cloud computing is key for realization of benefits promised by cloud computing environment. As organizations 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 organization as they consider adopting it. Issues such as security loss of ownership and confidentiality become more prevalent.

The NGO stakeholders are encouraged to promote cloud based solutions as they grow more familiar with the cloud based technologies based on the impressive awareness levels of the technology that this study revealed. The intersection of cloud computing and ICT4D would be extremely beneficial to their interventions. The benefits of cloud computing in Kenya demonstrated in this paper are just a part of the dynamic world of cloud computing. As fast as the cloud is evolving in terms of services on offer, so does the speed of progress need to be harnessed in NGOs in Kenya to embark and encourage the uptake of cloud based solutions.

The study found out that there was low or no funding of their IT budget to cloud computing. This explains glaring discrepancy of having a majority of organizations computerizing most of their operations but insignificant percentages having their operations on the cloud. Therefore, NGOs should be deliberate to allocated sufficient budgets to motivate cloud computing adoption to have the sectors from the primary benefits of migrating to the cloud.

Due to uniqueness of their operations from the rest of the sectors requiring at times requiring specialized IT infrastructure, non-governmental organizations can consider banding together for their IT needs so they can maximize their organization's impact in their core specific mandates. This will provide them with an opportunity to off load their IT operations to shared trusted community cloud providers thus freeing up resources and time to better pursue their organization's core missions.

The cloud providers need to address the barriers to adoption revealed by this study to enhance adoption of their cloud services. Key among the issues that the cloud providers' need to prioritize is security, the perceived loss of ownership and fear of confidentiality breach so as to encourage organizations to take up more of the cloud services on offer. NGOs should also be deliberate to discuss and put their organizations in perspective regarding the strategy to motivate adoption. Providers on the other hand should focus on removing and or working around the complexities surrounding cloud computing and provide clear direction on the value it can bring to specific organizations like NGOs to motivate adoption and more uptake of the cloud services on offer.

5.5.1 Suggestion for Further Studies

As the discipline of cloud computing is still immature in this part of the world, the scope for future research is wide, listed below are some of the immediate areas that might add value to this area of study;

1. A study can be conducted on the impact of cloud computing to the social-technical and economic aspects of the organizations.
2. The data collection method was based on questionnaires. Further research can be carried out using qualitative data collection methods such as focused group discussions for the organizations. This would help bring out the more in particular and help generate or contextualization of strategies for adopting new technologies like cloud computing.
3. The research design was focused on International NGOs in Kenya. Future Studies can be carried out on local NGOs in Kenya as well as extend the study to cover the region - East African region.

5.5.2 Limitations of the study

- i. Cloud computing phenomena is relatively new in Kenya and literature baselines around the area of cloud computing is still limited.
- ii. The questionnaire administered was somewhat technical for the Non-Technical staff of the NGOs which might have affected the accuracy of the data collected in one way or another.
- iii. The limited size of the sample may relatively make the data statistically unreliable

REFERENCES

- Armbrust, M. (2009). *Above the Clouds: A Berkeley View of Cloud Computing. Technical Report.* University of California at Berkeley.
- Boss, G., Malladi, P., Quan, D., Legregni, L., Hall, H. (March, 2007), Cloud Computing. <http://www.ibm.com/developerworks/websphere/zones/hipods/>.
- C Mitchel and Smith, D. (2008). *Cloud computing confusion leads to opportunity.* A Gartner Reserch Special Report.
- Cloud Security Alliance. (2009). *Security Guidance for Critical Areas of Focus in Cloud Computing*, 8-9, 11.
- Cloudtweaks. (03,June 2011). InsideCloud.*From Areas best suited for cloud Computing.* Retrieved July 04, 2012, Website: <http://www.cloudtweaks.com>
- Cloudtweaks. (26,Jan 2012). InsideCloud. *Survey on Barriers to Adoption of Cloud Computing.* Retrieved July 04, 2012, Website: <http://www.cloudtweaks.com/2012/01/survey-examines-barriers-to-adoption-of-cloud-computing/>
- Cooper, D., & Schindler, P. (2001). *Business Research Methods.* Newyork: McGraw Hill.
- Cowhey, Peter F. And Jonathan D. Aronson. *Transforming Global Information Communication Markets.* MIT Press, Cambridge, 2009.
- Creeger, M. (2009). "CTO roundtable: cloud computing," *Comm. of the ACM*, vol. 52.
- Darlyn C. P. (2009). Cool vendors in Cloud Management. *Infrastructure Resource Management*, 3.
- Ellison, J. (2010, March). *Oracle's Ellison nails cloud computing.*Cnet-News Retrieved July 05,2012, from Cnet News: http://www.cnet.com/8301-13953_10052188-80.html
- Fellowes, W. (2008). *Partly Cloudy, Blue-Sky Thinking About Cloud Computing. Whitepaper.* 451 Group.
- Furrier, J(2008). "What is "Cloud Ready"?. Silicon Angle.
- Gartner, J. (2008, March). Gartner.*Seven cloud-computing security risks.*Retrieved June 30, 2012, from <http://www.infoworld.com/d/security-central/gartner-seven-cloud-computing-security-risks->
- Gartner. (2010). Gartner. *Key issues facing the cloud survey report.* Retrieved June 30, 2012, from Gartner: <http://www.gartner.com/it/page.jsp?id=1438813>
- Gubala, C. (2011). Data Management. *Why you should adopt the cloud.* Retrieved July 2, 2012, from: <http://www.wallstreetadtech.com/data-management/231000518.html>
- Hayes, B. (2009). Communications of the ACM. *Cloud Computing*, 9-11.

Hurwitz, Judith, Robin Bloor, and Marcia Kaufman.(2010). *Cloud Computing for Dummies*. Wiley Publishing.

Isom, P and Holley, K. *Is your company ready for the cloud? Choosing the best adoption strategy for your Business*. IMB press, San Francisco,2012.

Khajeh-Hosseini, A (2010). *Cloud Migration: A Case Study of Migrating an Enterprise IT System to IaaS*. IEEE CLOUD.

Khera, M. (2006). Global services delivery practice. *Paper on ICICI Bank Extends Reach to Rural India*,18.

King, R. (2008, August). Businessweek.*How Cloud Computing is changing the World*. Retrieved July 01, 2012, from http://www.businessweek.com/technology/content/aug2008/tc2008082_445669.html

Kothari, C. R.(2000) *Research Methodology: Methods and Techniques*. New Delhi: Wiley

KPMG Global,(2012.April),KPMG. *Clarity in the Cloud and KPMG Global Cloud Pulse Survey*. Retrieved July 02, 2012, from: <http://www.kpmg.com/global/en/issuesandinsights/articlespublications/pages/cloud-clarity.aspx>

Licklider, J.C (1969).*The revolution that made computing personal. The dream machine (1st ed)*. M. Mitchell Waldrop

Miller, M. (2009) *Cloud Computing: Web-based Applications that change the way you work and collaborate online*. Indianapolis, Que.

Mohamed, A. (2009, April). Service Oriented Architecture (SOA)and web services. *history of cloud computing.htm* Retrieved July 15, 2012 from <http://www.computerweekly.com/Articles/2009/06/235429/A>

NGO Coordination Board. (1990). NGO Coordination Board. *NGO Coordination Act (1990)*. Retrieved July 2, 2012, from: <http://www.ngobureau.or.ke/Opinion matters 2008>

Plummer. (2008). A Gartner's Research Special Report. *Cloud computing confusion leads to opportunity*, 14-16.

Pokharel, Manish J. S. Park(2009,November) Cloud computing: future solution for e-governance.” 3rd International Conference on Theory and Practice of Electronic Governance. *Let's use video to reinvent education*”. Retrieved July 2, 2012, from <http://www.ted.com>. July 2012.

Rayport, J. (2009). Educause. *Focusing on Cloud Computing*. Retrieved June 30, 2012, from: <http://www.educause.edu/blogs/agould/focusing-cloud-computing>

Retrieved on 13th July, 2012.

Rosenthal, A. (2009). Journal of Biomedical Informatics. *Cloud computing: A new business paradigm for biomedical information sharing*, 23.

SalesForce.com(2011). SalesForce. *Trusted cloud apps and platform for the Social Enterprise Proven cloud platform*. Retrieved July 15,2012, From <http://www.salesforce.com/company/awards>

Springboard Research.(2010). Cloud computing in Asia Pacific 2010. *End user adoption trends*, 9.

Sullivan, T. (2009 December). CIO. *The ways cloud computing will disrupt IT*. Retrieved July 2, 2012, from http://www.cio.com.au/article/296892/nick_carr_ways_cloud_computing_will_disrupt_it.

West, D. (2010). *Saving Money Through Cloud Computing*.Colorado,Mitre

Youseff, L (2008). Grid Computing Environments Workshop. *Toward a Unified Ontology of Cloud Computing*, 1-10.

Appendix I: Questionnaire

Questionnaire

This questionnaire on Cloud Computing adoption by the NGO sector in Kenya and it aims to determine the level of awareness on cloud computing in the organization as well as assess the Drivers and Barriers to adoption of the technology and finally assess the extent to which the technology has been adopted.

NOTE:

- Please answer all the questions as required to the best of your knowledge.
- Do not indicate your name as all feedback should be anonymous.
- Information provided will not be disclosed to unauthorized parties.
- This research is for academic purposes only and your cooperation will be highly appreciated

SECTION A: DEMOGRAPHICS

Please provide the following information:

1. Gender Male Female
2. Age: Below 29 years 30 – 44 years 45 years and above
3. How long have you worked with the organization?
 Less than a year 1-5 years 5 years and above
4. Role in organization?
 IT Non-IT

SECTION B: AWARENESS OF CLOUD COMPUTING

1. Have you heard of the term cloud computing before?
 Yes No
2. When you hear the term "cloud computing", what definition first comes to mind?
(Select one)
 Fundamental change in how technology services are provided
 A tool that might work for another organization
 Another buzzword
 Unsure/No idea

3. Which statement best describes your organization's strategy towards cloud computing? (*Select one*)
- Cloud computing has been discussed formally and it is part of our IT strategy
 - Cloud computing has been discussed formally but no adoption plan in the pipeline
 - Cloud computing has only been discussed informally
 - Cloud computing has not been discussed as a topic within your organization
4. Does your organization have an internet connection?
- Yes
 - No

To the best of your knowledge, give the position of your organization in regards to the following statements. (*Single response per statement*)

Questions	Please rate				
	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
5. Your organization has trained staff on cloud computing?	1	2	3	4	5
6. Your organization's internet resource can support the cloud computing model	1	2	3	4	5

SECTION C: EXTENT OF CLOUD COMPUTING ADOPTION

7. What is the level of computerization on the activities in your organization? (*Single response*)
- 0-20%
 - 21 – 40%
 - 41 – 70%
 - Over 71%
8. What is the percentage of services that are at the cloud? (*Single response*)
- None
 - Less than 2%
 - 2-5%
 - 5 – 10%
 - More than10
9. What percentage of your IT budget was set aside for cloud computing usage? (*Single response*)
- None
 - Less than 2%
 - 2-5%
 - 5 – 10%
 - More than10

The following services are hosted on the cloud by your organization currently. (Single response per statement)

Question	Please tick the most appropriate answer				
	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
10. Web hosting	1	2	3	4	5
11. Email hosting	1	2	3	4	5
12. Database hosting	1	2	3	4	5
13. Application hosting	1	2	3	4	5
14. Online data storage	1	2	3	4	5
15. Other.....					

The following cloud computing delivery models have been adopted by your organization so far. (Select all applicable)

Question	Please tick the most appropriate answer				
	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
16. Public- owned and managed by a third party	1	2	3	4	5
17. Private – owned internally	1	2	3	4	5
18. Private – owned by a trusted third party	1	2	3	4	5
19. Community cloud – shared by trusted partners	1	2	3	4	5
20. Hybrid cloud – a comb. of delivery models	1	2	3	4	5

The following cloud computing service models have been adopted by your organization so far. (Select all applicable)

Question	Please tick the most appropriate answer				
	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
21. Software-as-a Service (SaaS) applications are hosted by the provider.	1	2	3	4	5
22. Platform-as-a-Service (PaaS) - rent hardware, OS, storage and network capacity	1	2	3	4	5
23. Infrastructure-as-a-Service (IaaS) – outsource equipment	1	2	3	4	5

SECTION D: DRIVERS TO CLOUD COMPUTING ADOPTION

To the best of your knowledge, what are the Economic factors for your organization to adopting cloud computing? *(Single response per statement)*

Question	Please tick the most appropriate answer				
	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
24. Cost savings(pay only for what you use)	1	2	3	4	5
25. Shift from capital expenditure to Operation expenditure	1	2	3	4	5

To the best of your knowledge, what are the Functional factors for your organization to adopting cloud computing? *(Single response per statement)*

Question	Please tick the most appropriate answer				
	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
26. Speed to solution	1	2	3	4	5
27. Functional capabilities	1	2	3	4	5
28. Everywhere accessibility	1	2	3	4	5
29. Other.....	1	2	3	4	5

To the best of your knowledge, what are the Technical factors for your organization to adopting cloud computing? *(Single response per statement)*

Question	Please tick the most appropriate answer				
	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
30. Security of IT resources	1	2	3	4	5
31. Simplicity of IT resources	1	2	3	4	5
32. Scalability of IT resources	1	2	3	4	5
33. Flexibility of IT resources	1	2	3	4	5
34. Enhanced uptime/high availability of IT	1	2	3	4	5
35. Higher performance of IT services	1	2	3	4	5
36. Other.....	1	2	3	4	5

To the best of your knowledge, what are the Strategic factors for your organization to adopting cloud computing? (Single response per statement)

Question	Please tick the most appropriate answer				
	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
37. Focus on core competencies by the organization.	1	2	3	4	5
38. Speed linkage to stakeholders	1	2	3	4	5
39. Transforming operations	1	2	3	4	5
40. Diversification of IT systems and resources	1	2	3	4	5
41. Other.....	1	2	3	4	5

SECTION E: BARRIERS OF CLOUD COMPUTING ADOPTION

To the best of your knowledge, rate the factors affecting adopting of cloud computing in your organization. (Single response per statement)

Question	Please tick the most appropriate answer				
	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
42. Loss of confidentiality	1	2	3	4	5
43. Lack of control and ownership	1	2	3	4	5
44. Lack of clear strategy on cloud computing	1	2	3	4	5
45. Insufficient internet bandwidth	1	2	3	4	5
46. Impact on work practices	1	2	3	4	5
47. Lack of trusted vendors in the market	1	2	3	4	5
48. Lock-in to a specific infrastructure vendor	1	2	3	4	5
49. Lack of security and SLAs	1	2	3	4	5
50. Cost of deployment	1	2	3	4	5
51. Maturity levels of your organization	1	2	3	4	5
52. Culture of your organization	1	2	3	4	5
53. Other.....	1	2	3	4	5

Appendix II: Introduction Letter

Appendix III: List of NGOs

- 1 Accord
- 2 Action Aid Kenya
- 3 AfriAfya
- 4 AMREF
- 5 Care International
- 6 Catholic Relief Services
- 7 Child Fund
- 8 Christian Aid
- 9 Compassion International
- 10 Concern Worldwide
- 11 Diakonia Sweden
- 12 Feed the Hungry
- 13 Food for the Hungry
- 14 GOAL
- 15 Israel for Africa
- 16 Kenya Red Cross
- 17 Lutheran World Federation
- 18 Medecins Sans Frontieres
- 19 Mercy Corps
- 20 Opportunity International
- 21 OXFAM
- 22 Pact
- 23 Path International
- 24 Pathfinder
- 25 Plan International
- 26 Techno Serve
- 27 Trocaire International
- 28 World Concern
- 29 World Fund
- 30 World Vision