UNIVERSITY OF NAIROBI

SCHOOL OF COMPUTING AND INFORMATICS

ADOPTION OF CLOUD COMPUTING BY THE GOVERNMENT AS A TOOL FOR EFFECTIVE MANAGEMENT OF GOVERNMENT FUNDS IN KENYAN PUBLIC SCHOOLS

BY

MANJA LEMMY OLEWA

P54/65663/2013

Supervisor

Dr. Elisha Abade

July 2020

Submitted in partial fulfillment of the requirements of the Masters of Science in Information Technology Management

DECLARATION

I, undersigned, hereby declare that this research project is my original work and that it has not been presented to any other university for award of any academic qualification.

Manja Lemmy Olewa: ..... Date: 02/07/2020

(P54/65663/2013)

APRROVAL

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

Dr.Elisha Abade: ..... Date: 13/08/2020

Supervisor,

School of Computing and Informatics

TABLE OF CONTENTS

DECLARATION ..... **ii**

TABLE OF CONTENTS ..... **iii**

LIST OF FIGURES ..... **vi**

LIST OF TABLES ..... **vii**

LIST OF ACRONYMS ..... **viii**

DEFINITION OF TERMS ..... **ix**

ABSTRACT **1**

CHAPTER 1: INTRODUCTION **2**

1.1 Background of the study 2

1.2 Statement of the Problem 5

1.3 Objective of the Study 5

1.4 Research Questions 6

1.5 Project Justification 6

1.6 Assumptions and Limitations of the Research 6

CHAPTER TWO: LITERATURE REVIEW **8**

2.1 Introduction 8

2.2 Cloud computing characteristics 8

2.2 Deployment models 9

2.3 Cloud computing adoption Frameworks 13

2.4 Theoretical Models 16

2.5 Cloud Computing in Education 20

2.6 Challenges in cloud Computing Adoption 23

2.7 Common cloud computing concerns in public sector 24

2.8 Efforts by the government in securing Kenyan cyberspace 25
2.9 Summary of the Critique of existing cloud computing adoption Framework 27
2.10 A framework for adoption of a cloud computing system in public schools 27
CHAPTER THREE: RESEARCH METHODOLOGY 30
3.1 Introduction 30
3.2 Research Design and Justification 30
3.3 Target Population 31
3.4 Sampling Plan 31
3.5 Data Collection Methods and Procedures 32
3.6 Data Analysis Procedures 33
3.7 Limitations of Methodology and how they were overcome 33
CHAPTER FOUR: DATA ANALYSIS 34
4.1 Introduction 34
4.2 Response Rate 34
4.3 Demographic Characteristics of the Respondents 34
4.4 Adoption of Cloud Computing 38
4.5 Descriptive analysis of Technological Factors 39
4.6 Descriptive Analysis of Security Factors 42
4.7 Descriptive analysis of Organizational Factors 43
4.8 Descriptive analysis of Environmental Factors 44
4.9 Descriptive analysis of User Competency 45
4.10 Correlation Results 46
4.11 Model Validation without Moderation 47
4.12 Model Validation with Moderation 51
CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATION 54

5.1 Introduction 54
5.2 Summary of findings 54
5.3 Conclusions 56
5.4 Recommendations 57
REFERENCES 58
APPENDIX 60
APPENDIX I: QUESTIONNAIRE 60

LIST OF FIGURES

Figure 2.1 Introduction to Cloud Computing....12
Figure 2.2 AWS Cloud Adoption Framework....13
Figure 2.3 National Institute of Standards and Technology Cloud Framework....15
Figure 2.4 The Technology Acceptance Model....17
Figure 2.4 Technology, Organisation and Environment Framework....19
Figure 2.5 Cyber security strategy benefits....26
Figure 2.6 Conceptual Framework....29
Figure 4.1 Gender of the Respondents....35
Figure 4.2 Age of the Respondents....35
Figure 4.3 Respondents' Level of education....36
Figure 4.4 Respondents' experience in ICT operations....37
Figure 4.5 Whether Cloud computing could fit in organizational policy....38
Figure 4.6 Availability of Plans to adopt Cloud Computing....39
Figure 4.7 Whether available infrastructure can support Cloud Computing Adoption....40
Figure 4.8 Validated Model....50
Figure 4.9 Validated Model when Moderated by User Competence....53

LIST OF TABLES

Table 4.1 Availability of Infrastructure 40
Table 4.2 Descriptive Analysis of Technological Factors 41
Table 4.3 Descriptive Analysis of Security Factors 43
Table 4.4 Descriptive Analysis of Organizational Factors 44
Table 4.5 Descriptive Analysis of Environmental Factors 45
Table 4.6 Descriptive Analysis of User Competency 46
Table 4.7 Correlation Analysis 46
Table 4.8 Correlations: (Group number 1 - Default model) 48
Table 4.9 Regression Weights: (Group number 1 - Default model) 48
Table 4.10 Variances: (Group number 1 - Default model) 49
Table 4.11 Model Summary 50
Table 4.12 Regression Weights for Moderated Model 51
Table 4.13 Variances for Moderated Model 52
Table 4.14 Model Summary 53

LIST OF ACRONYMS

AWS	Amazon Web Services
BPOs	Business Productivity Online Suite
EACC	Ethics and Anti-Corruption Commission
IaaS	Infrastructure as a Service
IBM	International Business Machines
ICT	Information Communication Technology
IT	Information Technology
KACC	Kenya Anti-Corruption Commission
KDN	Kenya Data Network
KEMI	Kenya Education Management Institute
KICD	Kenya Institute of Curriculum Development
KISE	Kenya Institute of Special Education
MIDs	Mobile Internet Devices
NIST	National Institute of Standards and Technology
PaaS	Platform as a Service
SaaS	Software as a Service
SAP	Systems Applications Products
US	United States

DEFINITION OF TERMS

Kenya Vision 2030: This is the Kenya's development programme covering the period 2008 to 2030.

Basic Education: Refers to Pre-primary, Primary up to High school education in Kenya

Basic education act: An Act of Parliament to give effect to Article 53 of the Constitution and other enabling provisions; to promote and regulate free and compulsory basic education

Constitution: A body of fundamental principles or established precedents according to which a state or other organization is acknowledged to be governed

Primary education: Means education imparted to a child who has completed preprimary education

EACC: Ethics and Anti-Corruption Commission. It is the Anti-Corruption Agency in Kenya.

Orange book: This book has the list of approved books for use in primary and secondary schools conducting public education system in Kenya

ICT: Information and Communication Technology

Central government: Is the government of a nation-state and is a characteristic of a unitary state.

Kenyan County government: The units of devolved government in Kenya has 47 constituencies.

Cloud computing: The practice of using a network of remote servers hosted on the Internet to store, manage, and process data, rather than a local server or a personal computer.

NIST: National Institute of Standards and Technology. It is a federal technology agency that works with industry to develop and apply technology, measurements and standards.

iTAX: It is an online system developed to simplify revenue collection in Kenya by allowing taxpayers to simply update their tax registration

Cyber Security: also known as IT security, is the protection of information systems from theft or damage to the hardware, the software, and to the information on them, as well as from disruption or misdirection of the services they provide

Cyber Space **:** Is "the notional environment in which communication over computer networks occurs."

AWS (Amazon Web Services): Is a comprehensive, evolving cloud computing platform provided by Amazon.com

ABSTRACT

Misappropriation of funds set aside by the government for ministry of education to fund the free basic education is common in Kenya. The report revealed that Kenya is the seventh highest funder of education in the world and the leading in sub-Saharan Africa, the challenge is how these resources are managed. The study was guided by the following specific objectives; to carry out an analysis of the situation on government management of funds issued to public schools; to investigate the drivers of cloud computing for financial management of funds allocated to public schools in Kenya and to formulate and validate a framework for adoption of cloud computing financial management of funds allocated to public schools in Kenya. The study adopted a descriptive research design. In this study, the researcher used questionnaires as well as an interview guide as data collection instruments. The data collected was then used and analyzed to provide information used to describe and interpret current events. Questionnaires allow collection of large amounts of data from the target population. The target group of respondents included the employees in the Ministry of education whose duty is to oversee operations in both primary and Secondary schools, Information Technology departments within the Ministry, Center for curriculum development, KNEC, Special education program, TSC and School Heads of public schools. The study employed stratified sampling technique to sample participants who represent the population. Therefore sample size was hence 164 public schools in Nairobi City County. The researcher then used random sampling methods in selecting the samples of the study. Quantitative methods of analysis require either the use of descriptive statistics analysis or inferential statistics analysis. Descriptive statistical analysis included the analysis of means, frequencies and percentages and standard deviations. On the other hand, inferential statistics involves the use of correlation and regression analysis. SPSS-Amos software was used to assess the statistical significance of each hypothesis considering the path coefficient values that are standardized betas. The study established that technological factors had a negative and significant relationship with adoption of cloud computing. Security factors were found to a have a positive and significant effect on adoption of cloud computing. Organization factors had positive and insignificant while environmental factors had negative and insignificant effect on adoption of cloud computing in financial management of funds allocated to public schools in Kenya. The study also concludes that technological factors and security factors such as organization's ability to invest in security of cloud infrastructure, integrity of the services and data, confidentiality of government information, the need to have privacy, the liability of the service providers in case of security of data as well cloud compliance issues significantly influences adoption of cloud computing in public schools in Nairobi City County. The study recommends that since technological factors plays a significant role in adoption of cloud computing, the government policy makers should come up with policies which can involve heads of public schools to improve the existing technological situation by improving the existing technology architecture and existing IT systems so as to create an enabling environment for adoption of cloud computing.

CHAPTER 1: INTRODUCTION

1.1 Background of the study

Kenya vision 2030 is the social pillar that touches on education and training. It states that the education sector is expected to provide globally competitive quality education, training and research for sustainable development, which will position Kenya as a regional center of research and development in new technologies (Government of the republic of Kenya, 2007). The legislative framework that governs basic education in Kenya is comprised in the Basic Education Act No. 14, 2013 as well as the Constitution of Kenya, 2010.

Article 53 of the Constitution provides that every child has a right to free and compulsory basic education. The Basic Education Act of 2013, was enacted to encompass the framework for the management and implementation of basic education in the country. (Government of Republic of Kenya, 2013).

Responsibility of the Government

To achieve this Basic Education Act of 2013 (Government of Republic of Kenya, 2013) states that It shall be the responsibility of the government through Education Cabinet Secretary to:

i. Provide compulsory and free basic education to every child.

ii. Ensure compulsory enrollment of children to schools that offer basic education

iii. Ensure that there is no discrimination of children belonging to marginalized, vulnerable or disadvantaged groups prevented from pursuing and completing basic education;

iv. Provide adequate human resources of teaching and none staff according to the prescribed staffing practices.

v. Provide adequate infrastructure including schools, learning and teaching equipment and appropriate financial resources.

vi. Ensure quality in delivery of basic education that conforms to the set standards.

vii. Provide special education and training facilities for talented and gifted pupils this includes pupils with disabilities;

viii. Manage the functioning of schools.

ix. Advise the national government on planning and budgeting for financing of infrastructure development for basic education.

The government has set up bodies to oversee the delivery of its mandate in providing quality free basic education as stated in the constitution. However, this is not the case since there has been cases that involve the misappropriation of funds set aside by the government for ministry of education to fund the free basic education. According to the EACC annual report (Authority, 2012/2013) the following was pointed out that some of the funds being released to the ministry of education to fund the Free basic education are being misappropriated. In one case (KACC/FI/INQ/62/2010) an Inquiry was set to investigate into allegations of misuse of infrastructure funds by the Ministry of Education. 1,900,000,000

In the report released by the EACC (Commision, 2015/2016) presented to the Cabinet Secretary for education Dr. Matiangi, revealed glaring irregularities in the management and use of funds meant for free primary education and the purchase of textbooks by head teachers and principals in public schools.

Disbursement of funds to non-corresponding account was another area of concern. Funds meant for one school are disbursed into bank accounts of a different school. “For example in a primary school in Kilifi, money was being disbursed to another school’s account and despite several attempts to contact the ministry; no response on the issue was forthcoming. (Commision, 2015/2016)

The report revealed that Kenya stands at number seven as the highest funder of education in the world and the leading in sub-Saharan Africa, but the main challenge is how these resources are managed.

Other forms of fraud ranges from forged signatures, delivery of ghost books, overpricing and single sourcing of suppliers by the institution’s selection committees at the schools level.

The presented report blamed the roles played by school heads, school management committees and suppliers for the failure to achieve the 1:1 book-to-pupil ratio. The Cabinet Secretary for Education pointed out that although the government had allocated Sh10 billion for books in the last three years, but most schools did not have the required books. He estimated that the actual pupil-to-book ratio stood at 5:1 in primary schools. This reveled that there is low levels of book stocks in schools despite the billions of shillings spent by the government since free primary education was introduced in 2003. This has prompted the ministry to call for a rethink of the supply method. The report further revealed that there were cases where the signatures of committee members, chairmen and parents' representatives in the minute books were different from those in the order forms. Schools are required use guidelines issued by the ministry to identify booksellers and other suppliers through the committees. After conduction the investigations, the EACC noted that some of the contracted suppliers had not ben listed on the recommended orange book.

Recommendation:

The report by EACC (Commision, 2015/2016)recommended the following:

1. Tough measures should be introduced. This will ensure that head teachers who misuse allocated funds are held accountable
2. Training on accounting procedures should be carried out for all head teachers and principals to help in managing school funds.
3. The report recommended that the Education Ministry should seal the loopholes by preparing a comprehensive implementation plan that incorporate all issues raised.
4. Matiang'i has also invited education stakeholders and committees to propose reforms that will ensure textbook supplies are conducted in a transparent way.

1.2 Statement of the Problem

The government's commitment of providing free basic education has resulted into a high number of students being enrolled in public schools. This has led to most schools enrolling more students than the facilities provided by the government can support. As stated in the basic education act, it is now the sole responsibility of the Central government through the County government to provide free and quality education to all public schools. As much as the free education has been achieved, the quality of education has dropped significantly in all public schools due to:

1. Poor/ insufficient infrastructure
2. Lack of enough teachers
3. Lack of readily available teaching materials to all students and the faculty
4. Corruption
5. Unpredictable Government funding
6. Misappropriation of government funds meant for developing and funding education activities of public schools
7. Lack of centralized administration of activities in the education system

We propose cloud computing as the technology to be embraced by the ministry of education in managing its activities within public schools. This study sought to investigate how best the government can embrace cloud computing in managing activities in public schools to try and curb the above problems thus ensuring quality in provision and delivery of Basic education.

1.3 Objective of the Study

The study sought to provide an understanding of how the Kenyan Ministry of education can use cloud computing to enhance management and learning in public schools. To realize this goal, the study was guided by the following objectives:

1.3.1 General Objectives

The main objective of this study was to develop a cloud adoption framework that can be used for successful selection and deployment of Cloud computing services within the ministry of Education to for efficient management of funds meant to facilitate free basic education.

1.3.2 Specific Objectives

1. To carry out an analysis of the situation on government management of funds issued to public schools
2. To investigate the drivers of cloud computing for financial management of funds allocated to public schools in Kenya
3. Formulate and validate a framework for adoption of cloud computing financial management of funds allocated to public schools in Kenya

1.4 Research Questions

1. What is the situation on government management of funds issued to public schools?
2. What are the drivers of adoption of cloud computing for financial management of funds allocated to public schools in Kenya?
3. What is the desired framework for adoption of cloud computing financial management of funds allocated to public schools in Kenya?

1.5 Project Justification

This study identified how best the government can embrace cloud computing in managing activities in public schools to try and curb the problem being experienced with the current management system and thus improving service delivery through effective management of government funds for public schools. It sought to achieve this by understanding the existing cloud frameworks and developing what is best for adoption.

1.6 Assumptions and Limitations of the Research

The findings of this study should be interpreted factoring in a number of limitations despite the fact that the researcher gave assurance using the appropriate documents to the institution

that the results of the study were strictly to be used for this research and for academic purposes only, there was a problem of non-response from unreturned questionnaires and uncooperative respondents which proved difficult. However, there were constant follow-ups to ensure that the rate of non-response was low. To further enhance the response rate, the respondents were constantly assured that the research was for the sole academic purpose only and that the information provided would not be used for any other purpose other than research.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This section reviews and confers relevant previous work and literature that is similar to the theme under this study. The chapter tracks the development of studies in cloud computing. This review includes the following key sections: cloud computing characteristics, deployment models, cloud computing adoption frameworks, cloud computing adoption in Kenya, cloud computing in education, challenges in cloud computing, common cloud computing concerns in Kenya, government efforts in securing Kenya cyberspace and the proposed conceptual framework mapping the research study.

2.2 Cloud computing characteristics

NIST, a body at the US Department of Commerce is generally recognized as the source of the commonly used definition of cloud computing. Their Special Publication (Mell and Grance, 2011) defines Cloud computing as a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources. It includes networks, servers, storage, applications, and services that can be rapidly provisioned and released with minimal management effort.

Cloud computing can be also defined as a set of Information technology services provided to a customer over a network on a leased basis and with the ability of scaling up or down the hosted services. Majority of cloud computing services are delivered by private 3rd party companies that own public cloud services and few by internal private cloud infrastructure.

Some of the advantages of cloud computing include resilience, scalability, flexibility, efficiency and outsourcing activities that are not core. Cloud computing offers to organizations an innovative business model for adopting IT services without upfront investment.

NIST suggests that the cloud model is composed of five key characteristics listed below (NIST, 2013):

I. On-demand self-service. A consumer can individually provision computing capabilities, such as processing, network, storage, server time as per the current need automatically with each service provider without requiring human interaction.

II. Resource pooling. The provider can pool computing resources together to serve multiple consumers using a multi-tenant model, having similar or different physical and virtual computer resources, this can be dynamically assigned and reassigned according to consumer requirements. The customer mostly can tell the location of the resource being accessed Examples of these resources include processing, storage, memory, and network bandwidth.

III. Broad network access. Capabilities of accessing from anywhere as long as you have internet or network connection and accessed through standard mechanisms that promote use by heterogeneous thick or thin client platforms (e.g., mobile phones, tablets, laptops, and workstations).

IV. Rapid elasticity. It can scale rapidly outward and inward proportionate with demand. Resources can be elastically provisioned and released, in some cases automatically.

V. Measured service. The use of resources provisioned can be monitored, controlled and reported while also providing transparency for both the consumer and the provider of the services.

2.2 Deployment models

The deployment Models as defined by the cloud community (NIST, 2013)these are:

1. Private Cloud
2. Public Cloud
3. Community Cloud
4. Hybrid Cloud

2.2.1 Private Cloud model

The cloud infrastructure is operated solely within a single organization and managed by the organization or a third party irrespective of its location either on premise or off premise. The computing infrastructure is dedicated to a specific organization and resources not shared with

other organizations. The users of a private cloud are considered to be the 'trusted' customers of service – they include members of staff, contractors and business partners (U Mahmud, 2012). There are two types of private clouds: Internal and externally hosted private clouds. Private cloud is usually ideal for organizations and institutions that require full control over mission-critical activities that reside behind their firewalls (Jamil & Zaki, 2011).

2.2.2 Community Cloud model

In this case, the cloud computing infrastructure is jointly constructed and shared by several organizations as well as requirements, policies, values, and concerns. For example the Kenyan government ministries may share computing infrastructure on the cloud to manage data related to its citizens, government budget and expenditure, projects, civil servants and so forth. The cloud community forms into a degree of economic scalability and democratic equilibrium. The cloud infrastructure may be hosted by a third-party service provider or within one of the organizations in the community.

2.2.3 Public Cloud model

This is the standard cloud computing model, in which a service provider offers resources, such as selected applications and storage, available to the general public over the Internet. (Gorelik, 2013) considers this as the most dominant form of current cloud computing deployment model. The public cloud is accessible to the general public cloud consumers like organizations. The cloud service provider has the full ownership of the public cloud with its own policy, value, and profit, costing, and charging model.

The computing infrastructure is hosted at the vendor's premises with the customer having no visibility and control over where the computing infrastructure is hosted. Many popular cloud services are public clouds. In Kenya the main international providers are Microsoft, Amazon, Google, SAP, IBM and Oracle. There are also local players like Safaricom, Access Kenya and Liquid Telecom.

2.2.4 Hybrid Cloud model

This model combines two or more clouds of either private, community, or public that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability. In order to optimize their resources, organizations use the hybrid cloud model to increase their core competencies by margining out peripheral business functions onto the cloud while controlling core activities on premise through private cloud. Organizations may choose to host critical applications on private clouds and applications with relatively less security concerns on the public cloud. The usage of both public and private clouds together is called hybrid cloud. A related term is 'cloud bursting'. In cloud bursting, organizations use their own computing infrastructure for normal operations, but access the cloud for high/peak load requirements. This ensures that a sudden increase in computing requirement is handled gracefully (Gorelik, 2013).

2.2.5 Service models

Cloud service models define how cloud services are made available to clients. Most essential service models include a combination of infrastructure as a service(IaaS), platform as a service (PaaS), and software as a service(SaaS). These service models may have interactions between each other and be interdependent – for example, PaaS is dependent on IaaS because application platforms require physical infrastructure (See figure 2.1). The IaaS model provides infrastructure components to clients. Components may include storage, virtual machines, networks, firewalls and many more. IaaS provides clients with direct access to the lowest-level software in the stack – that is, to the operating system loaded on virtual machines, or to the administrator dashboard of a firewall or load balancer (Chen, Paxson & Katz, 2010).

Amazon Web Services is currently one of largest providers of IaaS. The PaaS model delivers a pre-built application platform to the client; clients don't need to spend time building underlying infrastructure to host their applications. Depending on the application requirement PaaS automatically scales and provisions required infrastructure components on the backend. Typically, PaaS solutions provides an API that includes a set of functions for programmatic platform management and solution development. Google App Engine is a popular PaaS

provider. Amazon Web Services also provides some PaaS solutions in addition to IaaS offerings (Popović & Hocenski, 2010).

SaaS provides ready to use online software solutions. The software provider has complete control of application software that is offered under SaaS. Some of SaaS application includes online storage, mail, social platforms, project-management systems, ERPs, and CRMs(Eugene Gorelik, 2013)

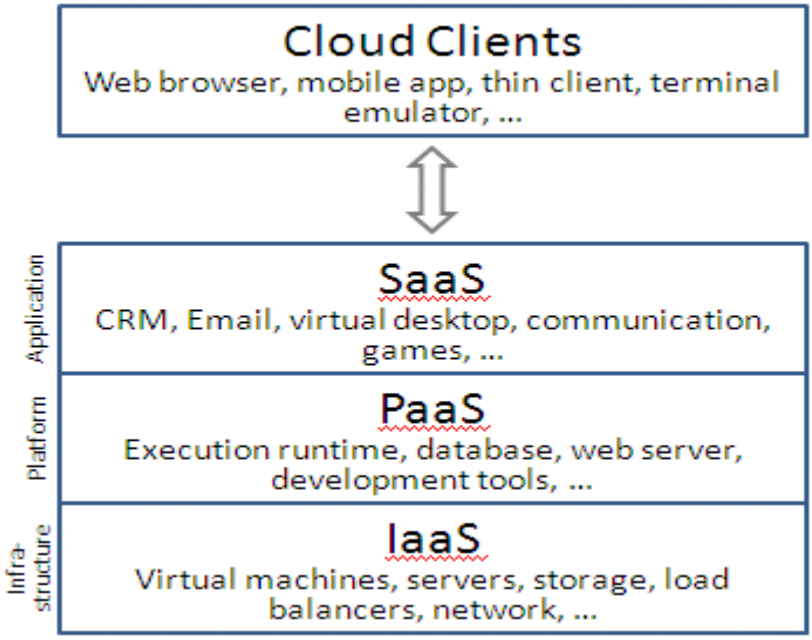


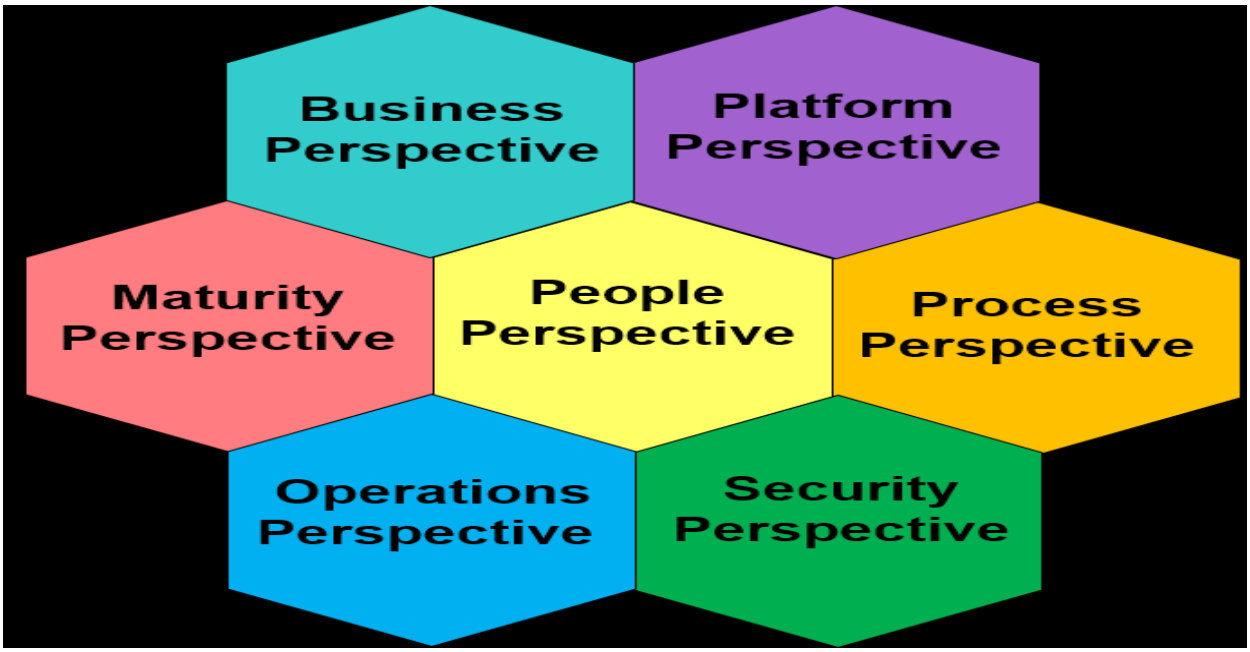
Figure 2.1 Introduction to Cloud Computing

Adopted from (William Broberg, 2011)

2.3 Cloud computing adoption Frameworks

2.3.1 Amazon Web Services (AWS) cloud adoption framework

In 2006, AWS began offering IT infrastructure services on subscription to businesses in the form of web services currently commonly known as cloud computing. One of the key benefits of cloud computing is the flexible costs that scale with your business which gives the clients the opportunity to replace up-front capital infrastructure. With the cloud, businesses no longer need to plan ahead procurement of servers IT infrastructure in advance. Instead, they can instantly spin up the required servers and services in minutes and deliver results faster (Miha Kralj, 2015)



Amazon Web services looks at cloud computing adoption framework in seven perspective (Figure 2.2)

Figure 2.2 AWS Cloud Adoption Framework

Adopted from Miha Kralj (2015)

1 **Business Perspective** – represents the business parts that you focus on to ensure that there is an optimum utilization of technology services to deliver maximum benefits.

2 **Platform Perspective** – represents the areas that you need to focus in ensuring solutions are designed and architected in an optimum way to achieve the functionality and quality that is expected while balancing the cost of developing and operating the solution.

3 **Maturity Perspective** – represents the areas that you need to put your attention on to ensure that an accurate early assessment of the current state is conducted and the desired target state is defined, and a feasible roadmap is formed to move the organization forward.

4 **People Perspective** – represents the areas that you focus on to ensure that the existing organizational structures and competencies can successfully support implementation, operation and management of an AWS cloud-based environment.

5 **Process Perspective** – represents the areas that you need to put your attention on to ensure business processes are in place to plan, implement, and operate a cloud environment.

6 **Operations Perspective** – represents the areas that you need to put attention on to with an aim of ensuring that the AWS environment can be efficiently operated to meet or even exceed the agreed service levels, with effective use of automation.

7 **Security Perspective** – represents the areas that you focus on to adopt a all-inclusive approach in implementing security within the AWS environment. Organizations should develop a strategy/plan and a roadmap to move from their current IT environment to a cloud environment based on AWS cloud services, or to implement a new cloud-based IT

2.3.2 Cloud Framework

Cloud computing reference architecture by NIST defines five major players namely: *cloud consumer*, *cloud provider*, *cloud broker*, *cloud auditor*, and *cloud carrier* (Figure 2.3) Each player is an entity that takes a role in a transaction or process and/or performs tasks in cloud computing.

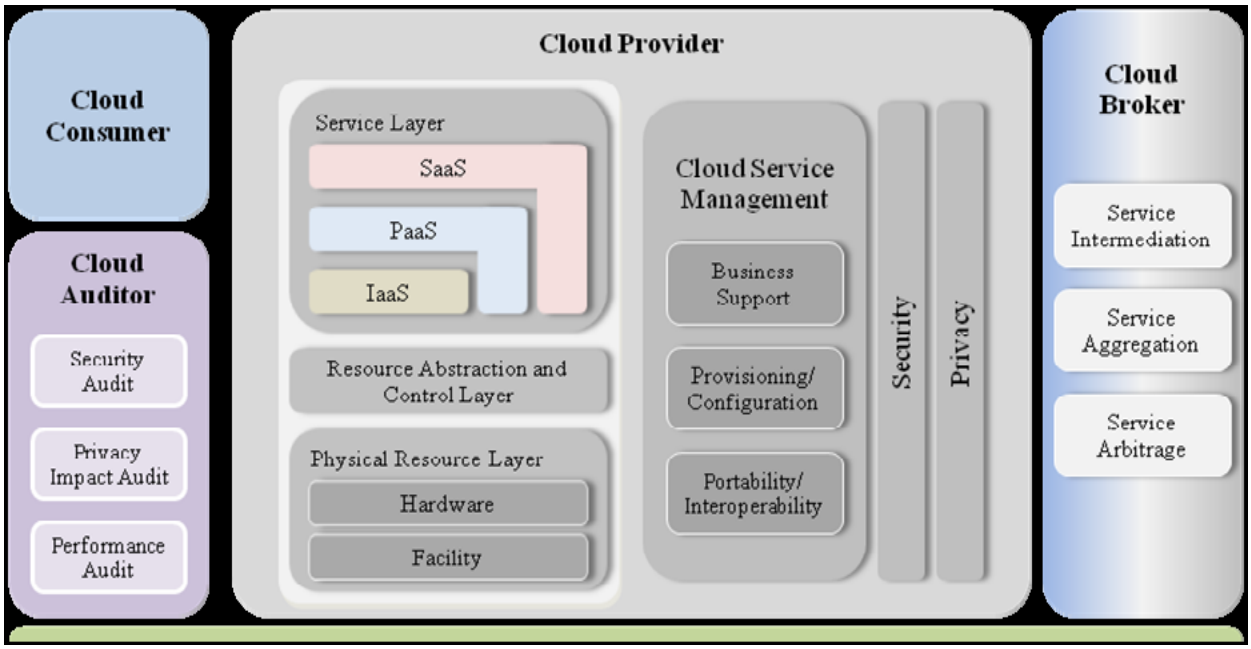


Figure 2.3 National Institute of Standards and Technology Cloud Framework

Adopted from NIST (2013)

2.3.2.1 Cloud Consumer

The cloud consumer is the targeted consumer of cloud computing service. A cloud consumer can be a person or organization that uses the service from, a cloud provider. A cloud consumer selects/ requests the services he wants to consume from a catalog that is issued by a cloud. The consumer will set up service contracts with the cloud provider for the selected service/ services. The cloud consumer may be billed for the selected service and needs to arrange payments as per the agreement (NIST, 2013).

2.3.2.2 Cloud Provider

A cloud provider is an entity, person or organization responsible for making a service available to cloud consumers. A cloud provider is responsible in building, provisioning and managing the required software/platform/ infrastructure services. He is responsible in providing the services as pe the agreed- upon service levels. and protects the security and privacy of the services (NIST, 2013).

2.3.2.3 Cloud Auditor

A cloud auditor is the authorized party that can carry out an independent assessment of cloud services for a given client or cloud provider. Some of the areas that are audited include information system operations, performance, and security of a cloud implementation. A cloud audit reports helps in improving performance of a cloud system(NIST, 2013).

2.3.2.4 Cloud Broker

As cloud computing advances, the combination of cloud services can be too complex for cloud consumers to manage. Instead of contacting a cloud provider directly a cloud consumer may go through a broker to request for cloud services. A cloud broker negotiates relationships between cloud providers and cloud consumers. It is an entity that manages the use, performance, and delivery of cloud services and negotiates existing/new relationships (NIST, 2013)

2.3.2.5 Cloud Carrier

A cloud provides connectivity and transport of cloud services between cloud the cloud provider and consumers. Cloud carriers provide access to consumers via network, telecommunication, and other access devices. For example, cloud consumers can obtain cloud services through network access devices, such as computers, laptops, tablets, mobile phones, mobile Internet devices (MIDs), etc. The distribution of cloud services is normally provided by network and telecommunication carriers or a *transport agent*. Transport agent refers to a business organization that provides physical transport of storage media

2.4 Theoretical Models

This study is hinged on the technology acceptance model which guides in establishing the factors of adopting new technology. The model indicates that what will determinant the adoption and acceptance of new technology is perceived usefulness, ease of use, external factors and user attitude.

2.4.1 The Technology Acceptance Model

Fred Davis developed the Technology Acceptance Model (TAM) in 1989. Two aspects are addressed by the model that influence the level of technology acceptance which are Perceived Usefulness (PU) and Perceived Ease of Use (PEOU).

Perceived usefulness is the level to which the user perceives the technology in terms of efficiency. Perceived ease of use is how user friendly the technology is to the targeted users (Davis, 1989). The theory argues that the consumers' attitude towards using new technology is influenced by perceived usefulness and perceived ease of use. The theory uses psychometric scales to measure perceived ease of use and usefulness.

Perceived usefulness is measured on scales of how fast work is done, job performance, increased user productivity, system effectiveness and usefulness. Perceived ease of use scales included whether the technology is easy to learn and understandable, easy to become skillful controllable easy to use and remember. Apart from PU and PEOU, the model also considers any external factors that influences the intention to use and the actual use of technology (Davis, 1989). The main criticism for studies that adopt TAM model is that self-reported use data are used to measure system use instead of real actual use data. Self-reported use data is a subjective measure and is thus unreliable in measuring actual use of a system (Auerbach, 2003; Cheng, 2005; Rahul, 2014).

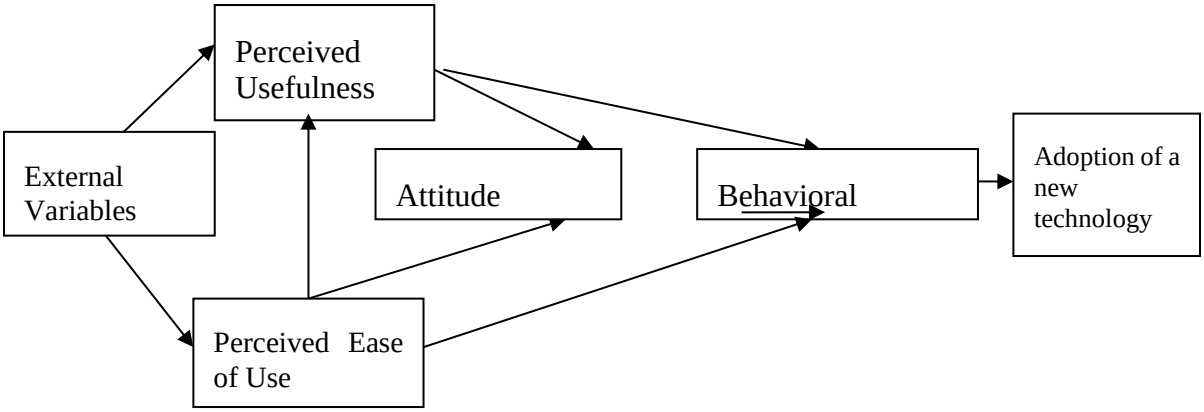


Figure 2.4 The Technology Acceptance Model

Adopted from Davis (1989)

2.4.2 The Technology Organization and Environment Model

In 1990, Tornatzky and Fleischer developed Technology Organization and Environment (TOE). The model identifies three aspects of an enterprise's context that influence the process by which it adopts and implements a technological innovation in the following context: technological, organizational, and environmental.

Organizational context includes organization's business scope, senior management support, culture, managerial structure centralization, vertical differentiation and formalization, among other factors (Jeyaraj, Rottman & Lacity, 2006; Sab-herwal, Jeyaraj, & Chowa, 2006). Environmental context is the ground in which an organization carries out its business its industry, competitors, and dealings with the government (Tornatzky & Fleischer, 1990). This model has been widely used in IT adoption studies at the organizational level (Hart, 2012). In Lipert's (2006) study of TOE antecedents to web services adoption, he noted that many empirical studies (Chau & Tam, 1997; Zhu, 2004; Gibbs & Kraemer, 2004; Thong, 1999; Zhu, 2003; Zhu & Kraemer, 2005) have used the TOE model as a theoretical foundation for investigating how organizations adoption new technologies (Mishra, Mathur, Jain & Rathore, 2013).

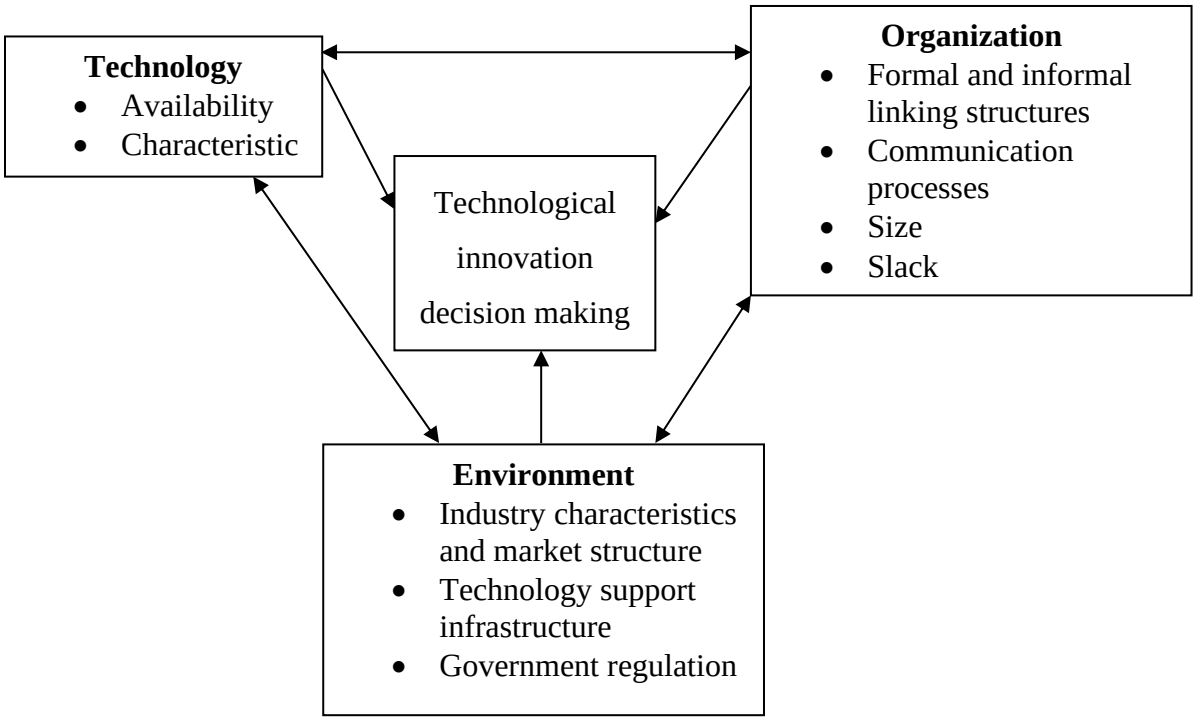


Figure 2.4 Technology, Organization and Environment Framework

Adopted from Tornatzky and Fleischer (1990)

Technology Adoption Life cycle theory by Moore, proposes that there are different motivations for adopting innovations. Moore's Technology Adoption Life Cycle (Moore & Benbasat, 1991) states that the total influence of population choices as outlined by the S curve develops distinct patterns of technology enabled markets (Mazhelis, Luoma & Ojala, 2012).

Sometimes adoption is not a direct process and therefore you cannot clearly tell the stage of adoption a product is. The relevance of this theory to the adoption of MCS system is that you are not able to tell whether the small and medium size companies are early adopters or late adopters of technology.

2.5 Cloud Computing in Education

Each of these three models plays an important role in the transformation of education system. By use of IaaS in running complex IT infrastructure, cloud vendors avail advanced computing tools to organizations at low prices, This is what contributed to a rapid adoption of cloud services. Additionally, new provisioning models have triggered explosion of various lower cost collaborative platforms, business intelligence software solutions, and web applications. The adoption of which is often seen as a major form of innovation in different settings like education (Crucial Cloud Hosting, 2014).

The major cloud providers have realized the importance of adjusting their computing services to meet the needs of educational institutions. These would include customized software packages for the schools at low prices that more institutions can afford. Below are some of the most used platforms for Education.

2.5.1 Microsoft for Education

Microsoft is one of the key companies whose services and products have reformed education for more than three decades. The Microsoft's cloud is currently available to the educational institutions in form of Office 365 for Education, Business Productivity Online Suite (BPOS), Exchange Hosted Services for emails, Microsoft Dynamics, Teams and Office Web Apps (Crucial Cloud Hosting, 2014).

Microsoft unveiled Student Advantage under office 365 for education in Kenya, this is to help prepare the students for the technology skills required in the workiplace (CIO East Africa, 2013). This is coming as a benefit to institute that qualifies. Microsoft cloud service enables students to communicate (Emails and Chats), collaborate where they can work on assignments as individuals and with groups, access applications.

2.5.2 Google Apps for Education

Google Apps for Education is a widely used online platform for Emailing and google classroom where the teacher can post assignment, hold online classes and exams. Google has initiated two important campaigns for introducing improvements in the education sector.

Chromebooks for Education is one of the most important Google's projects aimed at education innovation. Malaysia joined the google for education project and introduced 4G network and Samsung Chromebooks in 10,000 national schools in 2013(Crucial Cloud Hosting, 2014).

Another important Google's initiative is Tablets with preinstalled Google Play for Education. This enable educators to smoothly build and implement the latest technology solutions into classrooms and make useful apps available to their students

2.5.3 AWS in Education

AWS by amazon cloud has an education-friendly set of services which offers cost-efficient solutions to leaning institutions. AWS users can choose computing and storage resources that contribute to a creation of flexible online IT infrastructure in these institutions (Crucial Cloud Hosting, 2014)

Learning institutions are among many organizations that find cloud computing systems useful for simplifying various processes within the institutions like communication, admission and administration processes. Educational institutions can benefit in terms of both reducing running and improving efficiency by outsourcing infrastructure, platform or software as a service, (Feng, Zhang, Zhang & Xu, 2011).

2.5.4 Digital Literacy Programme

The Integration od ICT in Primary Education (Government of the Republic of Kenya, 2015) forms major part of key flagship Programmes highlighted in the Jubilee Manifesto. The main purpose of the project is to align the integration of ICT into teaching and learning starting with pupils in standard within primary schools. The areas mentioned for improvement to support this programe are: ICT infrastructure, Digital content development, Training teachers on ICT skills and procurement of ICT devices.

During the fiscal year 2013/2014, the Ministry of education received Ksh 24.5 Billion to cater for the four components of the project. In the fiscal year 2014/2015, an additional Ksh.17.5 billion was allocated to fund the project. The following was achieved during this period: -

i. 150 teachers trained as Master Trainers at the National level. The teachers were drawn from education agencies mandated with training, namely; Kenya Education Management Institute (KEMI), CEMASTEA, Kenya Institute of Special Education (KISE) and Kenya Institute of Curriculum Development (KICD). The rest were secondary school teachers who had undergone prior training in ICT integration in teaching and learning.
ii. 2,555 teachers trained as Trainer of Trainers. All the 47 Counties presented. The Master Trainers took this group through the training at the county level. The ToTs were then expected to carry out training of teachers in their respective Sub-Counties.
iii. 62,784 teachers nationally drawn from all public schools were trained by the ToTs at the Sub-County Level. The County Directors of Education and Sub – County Directors of Education coordinated the training. The digital Content for class 1 and 2 was developed (Government of the Republic of Kenya, 2015). By the end of the fiscal year this content had been piloted in 40 primary schools
iv. Kenya Institute of Curriculum Development had been given the mandate to develop software for Special Needs Learners.
v. School Infrastructure Readiness - The Ministry carried out a need's assessment with a aim of ensuring that the learning institutions have appropriate infrastructure to support the roll out of the ICT integration. Each public primary school received a minimum of

KShs 60,000.00 to be used in refurbishment of a classroom, Purchase of Storage Cabinets and Installing Window and door grills.

In May 2015, the president issued an executive order to review the roles of the implementing agencies Order No. OP/CAB.58/4A. The Ministry of Information, Communication and Technology was then given the mandate of procurement while the Ministry of Education, Science and Technology is to conduct capacity building, development of digital content and improvement of ICT infrastructure in the public primary schools (Government of the Republic of Kenya, 2015).

2.6 Challenges in cloud Computing Adoption

One of the major challenges that companies providing cloud computing services are facing is how to protect information assets belonging to their customers and other sensitive data. Just like any new technology platform, the cloud brings risks in the areas of data management, privacy and security, integration and quality of service. Continued success with the cloud thus will require careful planning, ongoing adaptation and smart innovation. Accenture recommends that cooperation's take additional steps toward this new environment so they can reap early benefits for applicable business situations while learning how to deal with the associated risks (John K Tarus, 2015).

Security issues keeps users tremendously anxiety about security risks in the cloud. Companies worry if they can trust their employees or need to implement additional internal system security controls in the private cloud, and whether third-party cloud providers can provide adequate security in multitenant environments that may also store competitor data (Krutz & Vines, 2010). There's also ongoing concern about the safety data that is moved between the enterprise and the cloud, as well as how to ensure that no residual data remnants remain upon moving to another cloud service provider. Unquestionably, the private cloud and virtualized environment involve new challenges in securing data, mixed trust levels, and the potential weakening of separation of duties and data governance (Zissis & Lekkas, 2012).

The public cloud compounds these challenges with data that is readily portable, accessible to anyone connecting with the cloud server, and replicated for availability. And with the hybrid

cloud, challenge kicks in on how to protect data as it moves back and forth from the organization to a public cloud. To deal with these issues, the cloud provider must build up enough controls to provide higher level of security than if the organization would not have used the cloud (Brodkin, 2008).

The major security challenge is that the customer/ owner of the data has no control on their data processing. Due to involvement of many integrated technologies including networks, operating systems, databases, transaction management, resource scheduling, concurrency control and memory management various security issues arises in cloud computing (Gillwald, 2015).

2.7 Common cloud computing concerns in public sector

The public sector my experience several issues when they consider to transition to cloud computing. Some prominent Cloud computing concern in public Sector (Fernando Macias, 2011):

- Reliability: The reliability and resilience of its cloud implementation must be trusted by the customer, especially when it supports mission-critical applications.
- Control: Issues of ownership and accountability always come up since naturally the management would want to know how and where elements of the ICT system are deployed and used.
- Quality: The heads of ICT concerns are that consistency and quality should never be compromised and that service-level agreements can be observed.
- Security: The systems should be safe from intrusions, and they need to safeguard information security.
- Ownership: Data governance always becomes an issue when data is stored in locations outside institutional and territorial boundaries.
- Interoperability: Cloud model must be able to support integrated with legacy solutions. The reliance on separate system infrastructures makes cloud technology an uncommon option in the public sphere.
- Portability: When you adopt the cloud model, It should support a wide spectrum of applications, equipment, or services provided by various vendors

- Standards: Cloud technology is still and evolving technology, industry standards and best practices are still being developed.
- Vendors: The cloud market is complicated by competing platforms and proprietary approaches. In addition, there is a view among some IT heads that cloud-oriented vendors still do not fully understand the needs of public sector organizations.
- Governance: The ICT team must select what new organizational approaches are needed, this include need to focus more on supporting interactions among business groups and integrating services.
- Culture: Organization that fall withing the Public sector may resist methods that make it appear that they are privatizing their resources. Resistance to change in another issue that affects transition to cloud systems or fear that well-established procedures could be compromised.
- Compliance: Public Organizations must be certain that they can comply with all relevant government regulations. Examples include regulations pertaining to user/system privacy, accountability and legislation
- Risk: Assessment of risks needs to support the consequences that a cloud service provider would face incase of bridge of contract

2.8 Efforts by the government in securing Kenyan cyberspace

There is an increase evolving around cyber threat landscape as Kenya matures into an information society. The criminal organizations, and hackers' activists from all over the world currently are and will continue to exploit the vulnerabilities in ICT within Kenya (Ministry of Information Communications and Technology, 2014) this is the current reality that every nation with large ICT infrastructure faces. While cybercrimes seek to illicitly access, alter, disrupt, or destroy sensitive business, government information and personal. The government is working diligently to develop structures and policies that will ensure protection of information in order to counter todays and future threats.

ICT plays a critical role in driving Kenya's economy; the Kenyan government developed the National Cybersecurity Strategy. This Strategy supports the three major pillars of the Vision 2030 and supports the National ICT Master Plan (Figure 2.5).

The purpose of the Strategy is to clearly defined Kenya's cybersecurity vision, goals, and objectives to secure the nation's cyberspace, while continuing to promote the use of ICT to enable Kenya's economic growth.

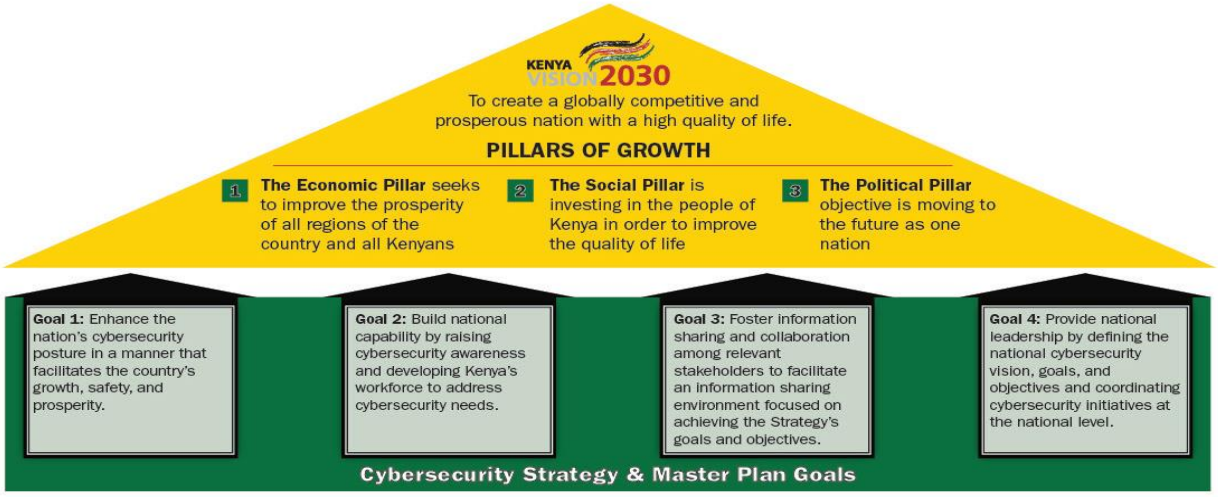


Figure 2.5 Cyber Security Strategy Benefits

Adopted from the (Ministry of Information Communications and Technology, 2014)

2.8.1 National cyber security strategy

NCS strategy includes four strategic goals that promotes the government's commitment to cybersecurity:

1. Enhance the national cyber security space in a manner that facilitates cloud computing growth in the country growth.

2. Provide national leadership by defining the national cybersecurity vision, goals, and objectives and coordinating cybersecurity initiatives at the national level.

3. Support raising cybersecurity awareness and developing country's ICT professionals to address cybersecurity needs.

4. Foster sharing of information and collaboration between relevant actors to facilitate information sharing environment focused on achieving goals and objectives of a strategy.

2.9 Summary of the Critique of existing cloud computing adoption Framework

By definition the purpose and cause of the government in providing free basic education is purely supported by funds allocated to the ministry of education. The alignment of the cooperate strategy and the ICT strategy should provide enabling technology to efficiently and effectively with cost cautiousness deliver the government core mandate, in review of existing cloud computing adoption frameworks the following gaps were noted:

1. The Frameworks are not aligned to the core strategy of governmental institutions and therefore the framework focuses on the technology but not geared towards alignment of core strategy and technology as an enabler.
2. External factors like Data security and privacy issues have not been addressed by the current adoption frameworks
3. The frameworks assume the technical capability human resource capacity to adopt cloud computing by the government whose core business is not ICT.
4. The frameworks provide a thin line for the key stakeholders to contribute or participate in the strategy to adopt cloud computing
5. The frameworks are designed to be a generic adoption of cloud computing and not architecture towards a certain industry since the needs, purposes and intentions are quite different.

In summary the adoption models as highlighted have summed up the adoption of ICT technology to be driven by the following key factors: Attitude, behaviors, Social Influence and norms other adoption models Model of PC Utilization and Motivational Model (MM) which as well are driven by perceived behaviors, conditions, attitudes and norms which limits the need of the technology and the purpose and match to the core purpose and requirements.

2.10 A framework for adoption of a cloud computing system in public schools

In the review of the different adoption frameworks and their applications in different sectors which mainly focused on the behaviors, perception and social aspect the study has however focused and reflected on the factors that surround a better adoption framework of cloud computing technology from a holistic view in this study; the factor includes:

1. Technological factors (scalability, flexibility, compatibility and cost)
2. Security factors (Security of cloud infrastructure, security of data in the cloud, cloud compliance)
3. Environmental factors this includes (External support, regulatory pressure, legal concern)
4. Organization Factors (Stakeholders Influence, Financial factors, e-readiness, ICT strategy, Attitude, technology experience, innovativeness). Figure 2.6 below further illustrates the conceptual framework:

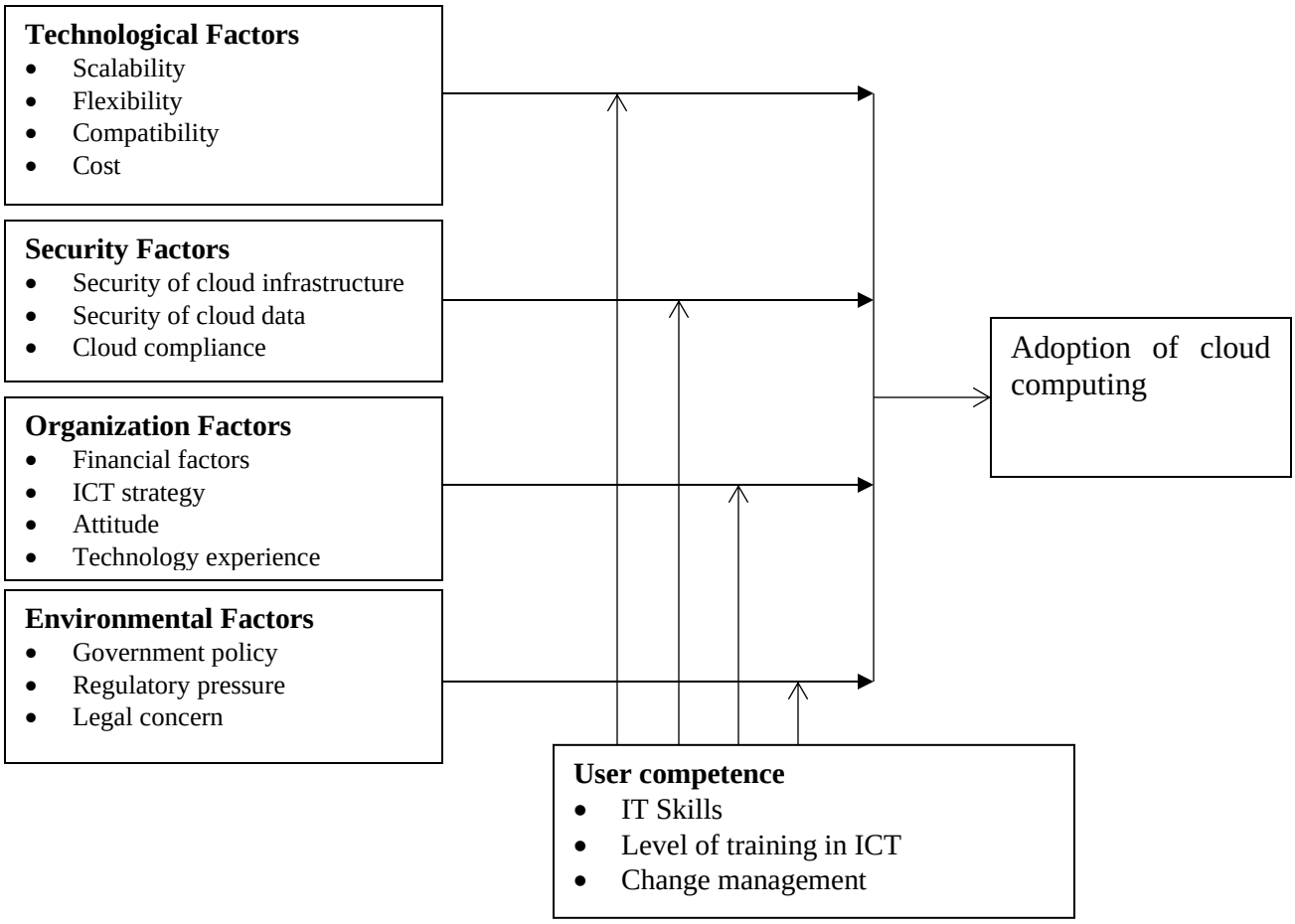


Figure 2.6 Conceptual Framework

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

The chapter describes the methodology that researcher used as an aid to carry out the research study. It constitutes the blueprint for the collection, measurement, and analysis of generated data. Research methodology is a plan for selecting the sources and types of information that is used to answer the research questions. There are two types of research approaches, quantitative and qualitative. Clear comprehension of both approaches is needed to identify the suitable approach for the study. As stated by (Kothari, 2004), the quantitative approach measures quantity or amount based on collecting data that is in the form of numerical variables. It can be implemented for areas that convey quantity. It can be implemented to determine the operation of occurrences, the thoughts, feelings and ideas of people. The qualitative collects data in the form of text for the purposes of deeper understanding problematic characteristics of a research area. The research methodology applied for this study incorporated quantitative and qualitative approaches.

3.2 Research Design and Justification

The research design refers to the strategy that the researcher used in collecting and analyzing data in order to answer the research questions or test the research hypothesis (Kothari, 2004). The study adopted a descriptive research design which included surveys and fact-finding enquiries of different kinds. The main reason of using descriptive research design in this study was to ensure the description of the current state of affairs on how the Ministry of education manages public schools in the country.

Quantitative research is one of the most time-honored approaches to investigating important information systems and organizational phenomena is Quantitative techniques have been frequently used. A set of standards as to what is acceptable have emerged and are generally expected by knowledgeable reviewers (Avison and Pries-Heje, 2005). In this research study, the researcher used questionnaires as well as an interview guide as data collection instruments. The data collected was then analyzed and used to provide information used to describe and interpret current events. Questionnaires allow the researcher to collect large amounts of data from the target sample group.

3.3 Target Population

A population is the total number of people within an organizations or institutions, area who poses certain common characteristics that are relevant to the purpose of the study. The target group of respondents included the employees in the Ministry of education whose duty is to oversee operations in both primary and Secondary schools, Information Technology departments within the Ministry, Center for curriculum development, KNEC, Special education program, TSC and School Heads of public schools. The employees in the Ministry of education, Information Technology departments within the Ministry, Center for curriculum development, KNEC, Special education program and TSC were involved in an interview while the school heads participated in filling the structured questionnaire. According to the data from Nairobi City County education department (2017), there were 60 public secondary schools and 225 public primary schools in the County which totaled to 285. In total, the target respondents were 285 public school heads in the County.

3.4 Sampling Plan

A sample is a selection of the population selected for a study. The chosen sample must be representative of the target population. Sampling is an important component of research for the reason that it has a significant role on the quality of the research findings (Kumar, 2011). The study employed stratified sampling technique to sample participants who represent the population. According to Black (2011). In stratified sampling the selected population is divided into groups called strata to enhance representativeness of the samples. This enables the researcher to select a random sample within the subpopulation. The stratified sampling technique minimizes sampling errors and therefore beneficial for the study. There were two strata that is secondary public and primary public schools.

To arrive at a sample size from the target population of 285, Krejcie & Morgan (1970) provide a formula to calculate sample sizes. The formula structure is as follows:

$$S = \frac{X^2 NP(1-P)}{d^2(N-1) + X^2P(1-P)}$$

Where:

S = Required Sample Size

X = Z value (1.96 for 95% confidence level)

N = Population Size

P = Population proportion (expressed as decimal) (assumed to be 0.5 (50%)

d = Degree of accuracy (5%), expressed as a proportion (0.05); It is margin of error

Substituting the values in the formula gives

$$= \frac{(1.96)^2(285)(0.5)(0.5)}{(0.05)^2(284) + (1.96)^2(0.5)(0.5)}$$

$$= 164$$

Therefore sample size was hence 164 public schools in Nairobi City County. The researcher then used random sampling methods in selecting the samples of the study.

3.5 Data Collection Methods and Procedures

In a general research, one or many techniques of data collection may be used. Naturally a researcher will decide on one or multiple techniques while considering overall relevance to the research, along with other common factors, such as: Ensuring quality of the collected data, costs estimates, predicted rate for those who will not respond, and length of the data collection period and the error measuring techniques.

The study adopted structured questionnaire to for collecting quantitative primary data from public schools, the employees in the Ministry of education, Information Technology departments within the Ministry, Center for curriculum development, KNEC, Special

education program and TSC. Primary data was preferred for its proximity to the truth, accuracy and control over error.

3.6 Data Analysis Procedures

3.6.1 Preliminary Data Analysis

Quantitative methods of analysis was used since the data collected using the questionnaires was quantitative in nature. Quantitative methods of analysis require either the use of descriptive statistics analysis or inferential statistics analysis. Descriptive statistical analysis includes means analysis, frequencies and percentages and standard deviations. On the other hand, inferential statistics involves the use of correlation and regression analysis. Regression analysis involves the estimation of effect of one variable on another. In this study, regression analysis was used in estimating the effect of technological, security, organization, environmental and use competency on adoption of cloud computing. The output of the model includes the r squared, F statistic, t statistic, standard errors and p values. The significance of the variables was tested against a critical p value of 0.05.

3.6.2 Assessment and Validation of the Proposed Research Model

Confirmatory Factor Analysis (CFA) technique was used model validation. This was conducted using structural equation model analysis. In this study the researcher used SPSS-Amos to analyze the collected data. They carried out CFA was carried out to ascertain the correlation between different items before the structural model is conducted. SPSS-Amos software was used to assess the statistical significance of each hypothesis considering the path coefficient values that are standardized betas. The total sample size was 164, samples were analyzed and used to evaluate the significance level of the relations between constructs. The path coefficients estimated in the structural models were indicated.

3.7 Limitations of Methodology and how they were overcome

The likelihood of misinterpreting or unable to comprehend written responses with regard to the open-ended questions in the interview during the process of analysis. This limitation was overcome by ensuring that the responders clearly wrote their responses when issuing the questionnaires.

CHAPTER FOUR: DATA ANALYSIS

4.1 Introduction

This section provides the findings of this study. It includes the socio-demographic characteristics of the respondents which include age, gender, education and level of experience in the use of ICT as well as the information about the organization. This section also provides Descriptive results for variables under study. The study used percentages and frequencies to analyse the demographic characteristics of the respondents while tables and charts were used to present the findings. Lastly, the section provides inferential results which include correlation and regression analysis as well as the structural equation modelling which was used to validate the conceptual model for adoption of cloud computing.

4.2 Response Rate

164 was the total number of questionnaires distributed for this study. Out of which 108 questionnaires were properly filled which representing a response rate of 66%. According to Mugenda and Mugenda (2003) a response rate of above 50% is adequate for a descriptive study. The response rate of 66% was hence adequate for the current study.

4.3 Demographic Characteristics of the Respondents

The study sought to find out the demographic characteristics of the respondents. These include age, gender, level of education and experience in the use of ICT.

4.3.1 Gender of the Respondents

From the report findings, it indicates that majority of the respondents who participated in this study were male represented by 59% of the respondents while the female respondents were 41% of the total respondents. The findings showed that majority of public school head in Nairobi City County are male.

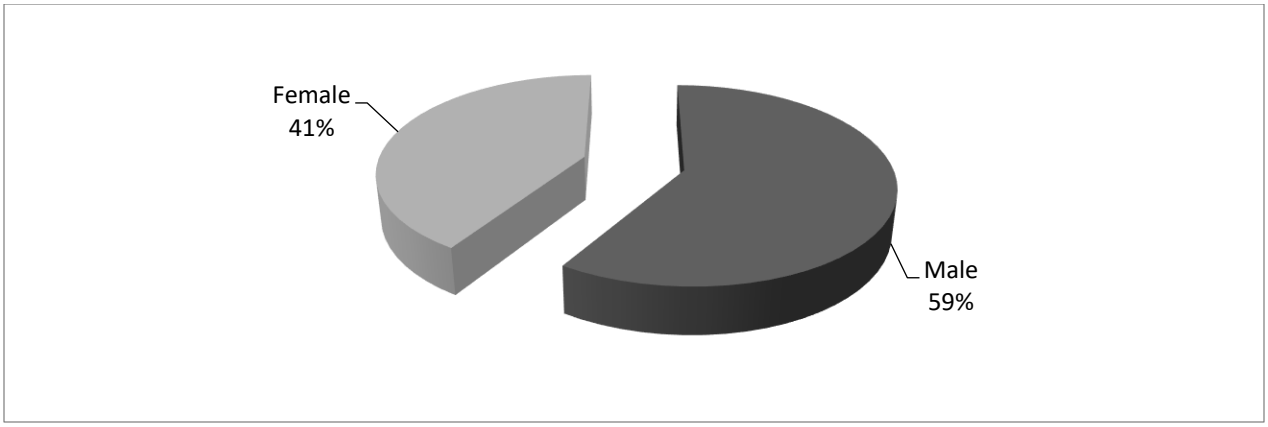


Figure 4.1 Gender of the Respondents

Source: Research Data (2017)

4.3.2 Age of the respondents

The study also sought to establish the age of the respondents. The findings indicated that majority, 33%, of the respondents were aged between 21 and 30 years, 32% were aged above 50 years while only 8% were between the ages of 31 to 40 years. The findings revealed diversity in the age of heads of public schools in Nairobi City County.

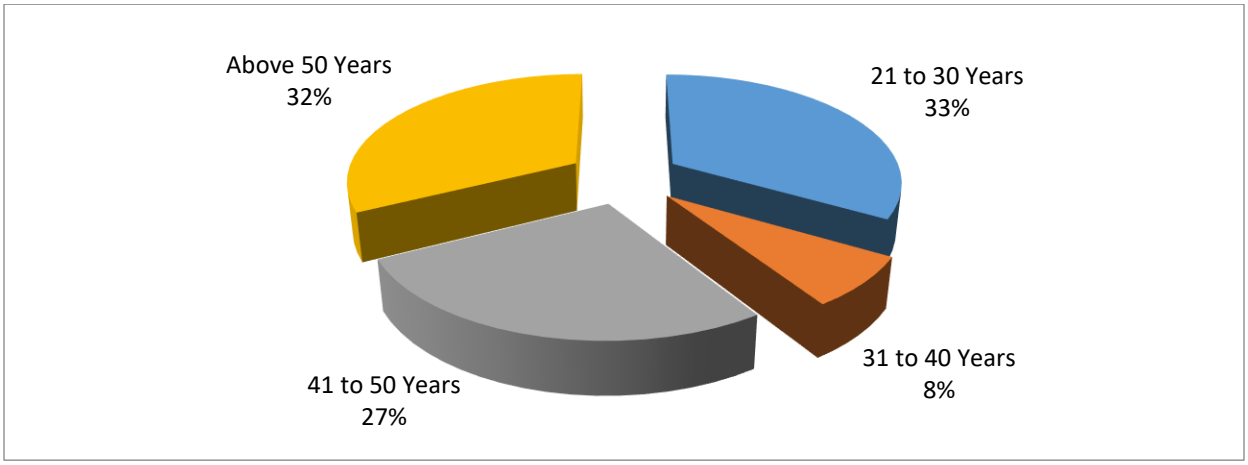


Figure 4.2 Age of the Respondents

Source: Research Data (2017)

4.3.3 Respondents' Level of education

The study also sought to establish the highest level of education of the respondents. The results indicated that 43% of the respondents had a bachelor's degree, 35% had diploma as the highest level of education while 22% had a master's degree or higher. The findings indicated that majority of the respondents have intellectual capacity.

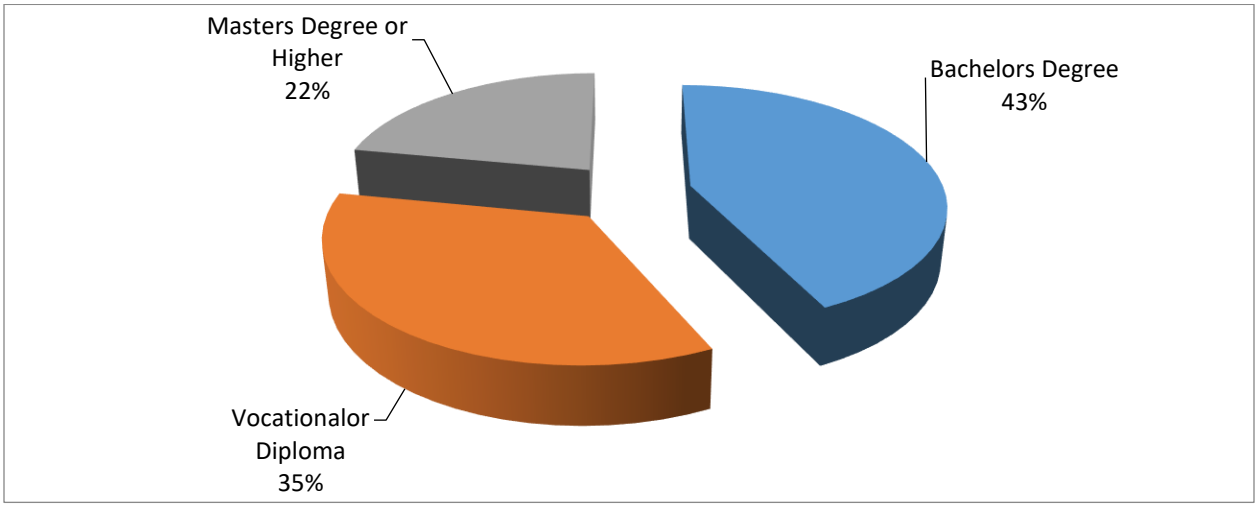


Figure 4.3 Respondents' Level of education

Source: Research Data (2017)

4.3.4 Respondents' experience in ICT operations

The study also sought to establish the respondent's experience in ICT operations. The results indicated majority of the respondents, 53.7% had over 5 years of experience in ICT operations, 26.9% had between 4 to 5 years of experience and only 6.5% had one year and less year experience in ICT operations. The findings show that majority of the school heads of both primary and secondary public schools in Nairobi City County are experienced in ICT operations.

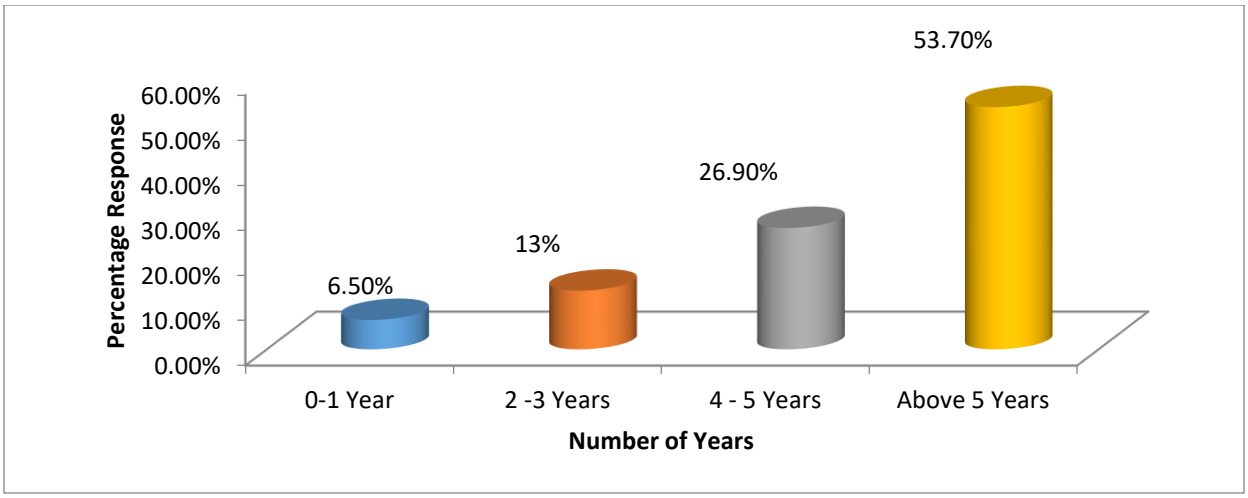


Figure 4.4 Respondents' experience in ICT operations

Source: Research Data (2017)

4.3.5 Information about the Schools

The study also sought to establish information about the schools in Nairobi City County. It sought to establish whether the organization have an ICT policy. The findings indicated that all the schools don't have an ICT policy. The study lastly sought to establish the respondents opinion on whether cloud computing could fit in their organizational policies. The findings showed that 74.10% of the respondents agreed that cloud computing could fit in the organizational policy while 19.4% indicated that it may not fit in the organizational policy. The findings however indicated that there is a will to adopt cloud computing among public schools when necessary, prerequisites are addressed.

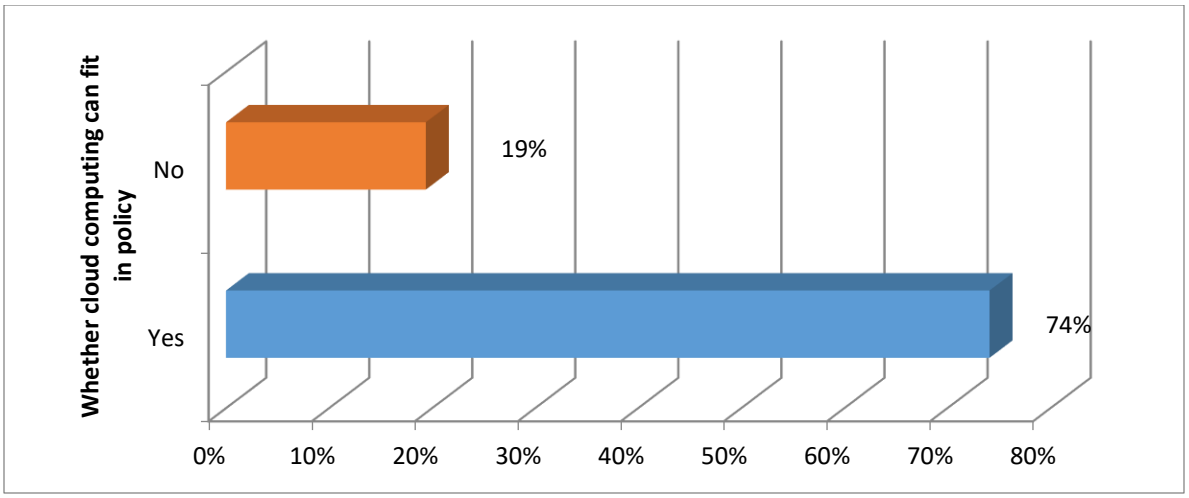


Figure 4.5 Whether Cloud computing could fit in organizational policy

Source: Research Data (2017)

4.4 Adoption of Cloud Computing

The study sought to find out the respondent's opinion on whether adopting cloud computing could aide in funds management. All the respondents, 108, agreed that if cloud computing was adopted; it could play a significant role in management of funds in the schools. The study then sought to establish whether there were necessary plans by the schools to adopt cloud computing technology. The results showed that those who agreed to the presence of necessary plans were only 27% while majority of the respondents, 73%, indicated that there were no necessary plans to adopt cloud computing. These results showed that cloud computing adoption for funds management by public schools still faces challenges and it was necessary to establish what the challenges were.

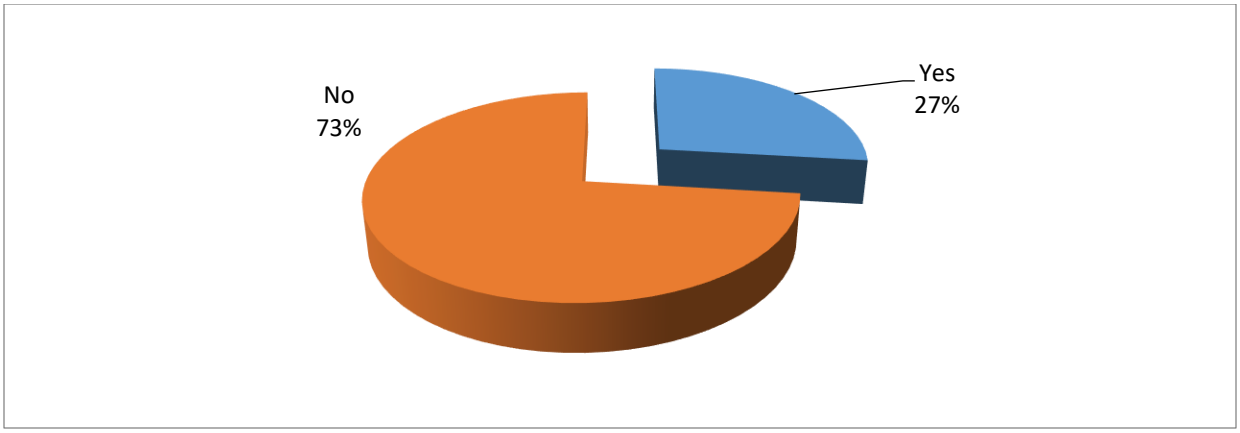


Figure 4.6 Availability of Plans to adopt Cloud Computing

Source: Research Data (2017)

After establishing that those schools that had plans to adopt cloud computing to be used for funds management were few, 27%, the study sought to establish the willingness to adopt the technology if the necessary prerequisites for adoption of a new technology were considered as well as if the necessary top management support as given. All the respondents, 108, agreed that if the prerequisites for adoption of the cloud computing technology were considered, then they would be more than willing to adopt the technology. These results implies that so far, there is low adoption of the cloud computing technology among the public schools as a result of lack of will and due to existing challenges.

4.5 Descriptive analysis of Technological Factors

The study sought to establish whether the existing infrastructure in various public schools in Nairobi City County had the ability to support cloud computing. The results showed that majority of the respondents, 86%, indicated that the available infrastructure cannot support adoption of cloud computing technology. This indicates that one of the reasons for low adoption of the technology in the public schools is infrastructural challenges.

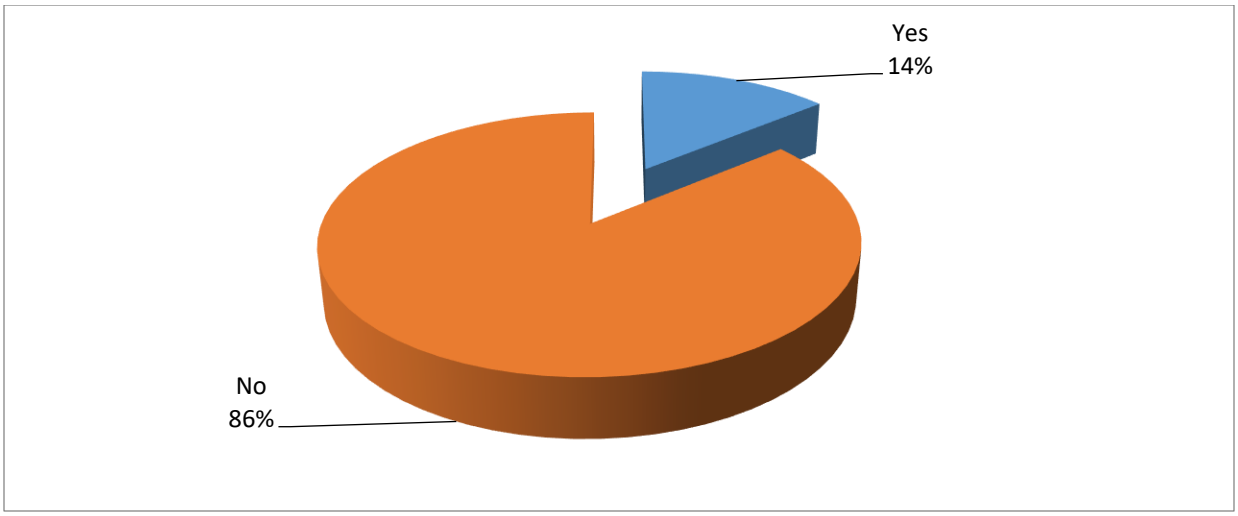


Figure 4.7 Whether available infrastructure can support Cloud Computing Adoption

Source: Research Data (2017)

Furthermore, the respondents were asked to indicate the existence of various infrastructural systems in the schools. On average, majority of the respondents, 61.35% indicated that they don't have the necessary infrastructure necessary for adoption of cloud computing such as data security measures, wireless networks, enough computers as well as data centres. Only 38.65% on average, agreed to having required infrastructure for adoption of cloud computing.

Table 4.1 Availability of Infrastructure

Infrastructure	Exists	Doesn't Exist
Data security measures	39.80%	60.20%
Wireless network	41.70%	58.30%
Enough computers	32.40%	67.60%
Data centers	40.70%	59.30%
Average	**38.65%**	**61.35%**

Source: Research Data (2017)

The respondents were asked to rate their level of agreement on statements on technological factors on a scale of 1 to 5 ranging from, 1=strongly disagree, 2=disagree, 3=Neutral, 4= Agree and 5= strongly agree. The findings of the study revealed that majority of the respondents , 67.6%, agreed that the existing technology architecture determines the need for adoption of

cloud computing, 87.1% agreed that the existing IT systems support exchange and making use of information, all the respondents (100%) agreed that cost is a key factor in determining adoption and utilization of technology, 73.1% agreed that the existing computing process has the ability to be used or produced in a range of capabilities that can also include cloud computing, 73.2% agreed that the operation of this technology is not considerably complicated to implement and be used while 79.6% indicated that this (cloud computing) technology is not difficult to learn.

The results also showed that 73.2% of the respondents indicated that there is no resistance within the organization towards the use of this technology due to its complexity, 93.5% agreed that using this technology fits well with how the organization operates, 79.7% indicated that using this technology is consistent with the organization's values and beliefs, 73.2% agreed that this technology is compatible with the organization's IT infrastructure and those who revealed that the changes introduced by this technology are compatible with existing operating practices were 80.5%.

Table 4.2 Descriptive Analysis of Technological Factors

Statement	SD	D	N	A	SA	Mean	Standard Deviation
Existing technology architecture determines the need for adoption of cloud computing	0.00%	13.00%	19.40%	26.90%	40.70%	3.95	1.06
The existing IT systems support exchange and making use of information	0.00%	13.00%	0.00%	60.20%	26.90%	4.01	0.89
Cost is a key factor in determining adoption and utilization of technology	0.00%	0.00%	0.00%	13.90%	86.10%	4.86	0.35
The existing computing process has the ability to be to be used or produced in a range of capabilities that can also include cloud computing	6.50%	6.50%	13.90%	47.20%	25.90%	3.80	1.10
The operation of this technology is not considerably complicated to implement and used	0.00%	7.40%	19.40%	60.20%	13.00%	3.79	0.76
This technology is not difficult to learn	0.00%	0.00%	20.40%	46.30%	33.30%	4.13	0.72

Statement	SD	D	N	A	SA	Mean	Standard Deviation
There is no resistance within the organization towards the use of this technology due to its complexity.	0.00%	0.00%	26.90%	52.80%	20.40%	3.94	0.69
Using this technology fits well with how the organization operates.	0.00%	0.00%	6.50%	61.10%	32.40%	4.26	0.57
Using this technology is consistent with the organization's values and beliefs	6.50%	0.00%	13.90%	59.30%	20.40%	3.87	0.96
This technology is compatible with the organization's IT infrastructure	13.00%	0.00%	13.90%	34.30%	38.90%	3.86	1.30
The changes introduced by this technology are compatible with existing operating practices.	13.00%	0.00%	6.50%	61.10%	19.40%	3.74	1.17
Average						**4.02**	**0.87**

Source: Research Data (2017)

4.6 Descriptive Analysis of Security Factors

The respondents were asked to rate their level of agreement on statements on security factors on a scale of 1 to 5 ranging from, 1=strongly disagree, 2=disagree, 3=Neutral, 4= Agree and 5= strongly agree. The findings of the study revealed that only 26.9% agreed that the organization has the ability to invest in security of cloud infrastructure, 73.1% agreed that the integrity of the services and data influences the decision to adopt cloud computing, 78.3% agreed that confidentiality of government information influences the decision to adopt cloud computing, 73.2% agreed that the need to have privacy influences the decision to adopt cloud computing, 60.2% indicated that the liability of the service providers in case of security of data influences the decision to adopt cloud computing and those who agreed that cloud compliance issues influences the decision to adopt cloud computing were 86.1%.

Table 4.3 Descriptive Analysis of Security Factors

Statement	SD	D	N	A	SA	Mean	Standard Deviation
The organization has the ability to invest in security of cloud infrastructure	19.40%	26.90%	26.90%	20.40%	6.50%	2.68	1.19
The integrity of the services and data influences the decision to adopt cloud computing	0.00%	6.50%	20.40%	39.80%	33.30 %	4.00	0.90
Confidentiality of government information influences the decision to adopt cloud computing	6.90%	7.90%	6.90%	34.70%	43.60 %	4.00	1.21
The need to have privacy influences the decision to adopt cloud computing	0.00%	7.40%	19.40%	46.30%	26.90 %	3.93	0.87
The liability of the service providers in case of security of data influences the decision to adopt cloud computing	0.00%	7.40%	32.40%	60.20%	0.00%	3.53	0.63
Cloud compliance issues influences the decision to adopt cloud computing	0.00%	13.90%	0.00%	65.70%	20.40 %	3.93	0.87
Average						**3.68**	**0.95**

Source: Research Data (2017)

4.7 Descriptive analysis of Organizational Factors

The respondents were asked to rate their level of agreement on statements on organizational factors on a scale of 1 to 5 ranging from, 1=strongly disagree, 2=disagree, 3=Neutral, 4= Agree and 5= strongly agree. The findings of the study revealed that only 32.4% indicated that the organisation has the technological resources to adopt this technology, 13.8% indicated that the organization can provide financial resources to adopt this technology, 46.3% agreed that the organization can provide other organizational resources (e.g. training, IT support) in order to build higher levels for this technology adoption, 86.2% agreed that the employees have a positive attitude towards adoption of new technology to ease their work schedule, 86.1% agreed that the organization's experience with other IT technologies makes adoption of cloud

computing feasible and 60.1% of the respondents stated that the organization's ICT strategy and policies support adoption of new technologies.

Table 4.4 Descriptive Analysis of Organizational Factors

Statement	SD	D	N	A	SA	Mean	Standard Deviation
The Organisation has the technological resources to adopt this technology.	0.00%	40.70%	26.90%	25.90%	6.50%	2.98	0.97
The organization can provide financial resources to adopt this technology.	6.90%	50.50%	28.70%	6.90%	6.90%	2.56	0.97
The organization can provide other organizational resources (e.g. training, IT support) in order to build higher levels for this technology adoption.	6.50%	25.90%	21.30%	39.80%	6.50%	3.14	1.08
The employees have a positive attitude towards adoption of new technology to ease their work schedule	0.00%	0.00%	13.90%	59.30%	26.90%	4.13	0.63
The organization's experience with other IT technologies makes adoption of cloud computing feasible	0.00%	0.00%	13.90%	66.70%	19.40%	4.06	0.58
The organization's ICT strategy and policies support adoption of new technologies	0.00%	13.00%	26.90%	40.70%	19.40%	3.67	0.94
Average						3.42	0.86

Source: Research Data (2017)

4.8 Descriptive analysis of Environmental Factors

The respondents were asked to rate their level of agreement on statements on environmental factors on a scale of 1 to 5 ranging from, 1=strongly disagree, 2=disagree, 3=Neutral, 4= Agree and 5= strongly agree. The findings of the study revealed that 79.6% of the respondents stated that the degree of competition in the industry places pressure on the organization's decision to

adopt this technology, 87.0% of the respondents agreed that the organization needs to utilize this technology to have an efficient finance management, 82.8% agreed that it is a strategic necessity to use this technology, 86.1% agreed that the government policy towards adoption of new technology influences the decision to adopt cloud computing, 79.6% indicated that the funds regulatory pressure in the government parastatals influences the decision to adopt this technology and 72.2% indicated that the continuous mismanagement of funds in the ministry creates a need to adopt cloud computing to manage the funds.

Table 4.5 Descriptive Analysis of Environmental Factors

Statement	D	N	A	SA	Mean	Std Dev
The degree of competition in the industry places pressure on the organization's decision to adopt this technology	0.00%	20.40%	47.20%	32.40%	4.12	0.72
The organization needs to utilize this technology to have an efficient finance management	0.00%	13.00%	53.70%	33.30%	4.20	0.65
It is a strategic necessity to use this technology	0.00%	17.20%	57.50%	25.30%	4.08	0.65
The government policy towards adoption of new technology influences the decision to adopt cloud computing	7.40%	6.50%	66.70%	19.40%	3.98	0.75
The funds regulatory pressure in the government parastatals influences the decision to adopt this technology	0.00%	20.40%	60.20%	19.40%	3.99	0.63
The continuous mismanagement of funds in the ministry creates a need to adopt cloud computing to manage the funds	13.90 %	13.90%	32.40%	39.80%	3.98	1.05
Average					**4.06**	**0.74**

Source: Research Data (2017)

4.9 Descriptive analysis of User Competency

The respondents were asked to rate their level of agreement on statements on user competency on a scale of 1 to 5 ranging from, 1=strongly disagree, 2=disagree, 3=Neutral, 4= Agree and 5= strongly agree. The findings of the study revealed that majority of the respondents, 93.5% agreed that the users level of education influences adoption of the new technology, 86.1% agreed that the users change management ability influences the decision to adopt a new

technology, all the respondents (100%) indicated that the users level of education influences the decision to adopt of a new technology and that the users IT skills influences the decision to adopt of a new technology while 93.5% agreed that the users level of training influences the decision to adopt of a new technology.

Table 4.6 Descriptive Analysis of User Competency

Statement	D	N	A	SA	Mean	Standard Deviation
The users level of education influences adoption of the new technology	6.50%	0.00%	47.20%	46.30%	4.33	0.79
The users change management ability influences the decision to adopt a new technology	0.00%	13.90%	52.80%	33.30%	4.19	0.66
The users level of education influences the decision to adopt of a new technology	0.00%	0.00%	52.80%	47.20%	4.47	0.50
The users IT skills influences the decision to adopt of a new technology	0.00%	0.00%	52.80%	47.20%	4.47	0.50
The users level of training influences the decision to adopt of a new technology	6.50%	0.00%	67.60%	25.90%	4.13	0.71
Average					**4.32**	**0.63**

Source: Research Data (2017)

4.10 Correlation Results

The results after testing the variables in this study for presence of multicollinearity indicated that there was no multicollinearity among the study variables. The presence of multicollinearity is detected when the correlation value is above +/- 0.7. The findings also showed that security factors, organizational factors and user competency significantly influence adoption of cloud computing for effective management of funds in public schools.

Table 4.7 Correlation Analysis

		Technological factors	Security factors	Organizational factors	Environmental factors	User competency	Adoption of cloud

							computing
Technological factors	Pearson Correlation	1					
	Sig. (2-tailed)						
Security factors	Pearson Correlation	.349**	1				
	Sig. (2-tailed)	0.000					
Organizational factors	Pearson Correlation	.497**	.614**	1			
	Sig. (2-tailed)	0.000	0.000				
Environmental factors	Pearson Correlation	.302**	.591**	.464**	1		
	Sig. (2-tailed)	0.002	0.000	0.000			
User competency	Pearson Correlation	.521**	.506**	.683**	.340**	1	
	Sig. (2-tailed)	0.000	0.000	0.000	0.000		
Adoption of cloud computing	Pearson Correlation	0.022	.553**	.343**	.303**	.305**	1
	Sig. (2-tailed)	0.997	0.000	0.000	0.001	0.001	
	N	108	108	108	108	108	108
** Correlation is significant at the 0.01 level (2-tailed).							

Source: Research Data (2017)

4.11 Model Validation without Moderation

This section presents the results of regression analysis which was conducted by the use of SPSS Amos v 25 software. The section presents the regression results in two categories. The first model was conducted without the moderating variables to test the relationship between independent variables and the dependent variable. The second model sought to determine the moderating effect of user competencies on the relationship between technological factors, security factors, organisation factors and environmental factors and adoption of cloud computing systems.

4.11.1 Correlations

This section presents the correlations analysis between the independent variables in the model. The results showed that security factors and organisation factors were highly correlated (r=0.614). However, there no problem of multicollinearity between the independent variables hence the variables were adequate to be used in regression analysis.

Table 4.8 Correlations: (Group number 1 - Default model)

			Estimate
Technological factors	<-->	Security factors	.349
Security factors	<-->	Organizational factors	.614
Organizational factors	<-->	Environmental factors	.464
Security factors	<-->	Environmental factors	.591
Technological factors	<-->	Environmental factors	.302
Technological factors	<-->	Organizational factors	.497

Source: Research Data (2017)

4.11.2 Regression Weights-Default Model

Table 4.9 presents the findings of the regression weights of all the predictor variables in the model. Regression estimates denotes the amount of change in adoption of cloud computing caused by a unit change in predictor variables. The results further present the significance of the relationship between the predictor variables and the dependent variable.

Table 4.9 Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P
Adoption Cloud Computing	<---	Technological Factors	-.248	.086	-2.879	.004
Adoption Cloud Computing	<---	Security Factors	.452	.086	5.265	***
Adoption Cloud Computing	<---	Organizational Factors	.103	.088	1.179	.239
Adoption Cloud Computing	<---	Environmental Factors	-.015	.082	-.185	.853

Source: Research Data (2017)

The findings revealed that technological factors (β= -0.248) and environmental factors (β= -0.015) were found to have a negative relationship with adoption of cloud computing. However, the relationship between technological factors was adoption was statistically significant (p=0.004) while the relationship between environmental factors was found to be insignificant

(p=0.853). The findings implied that technological factors such as scalability, flexibility, compatibility and costs of the cloud computing technology negatively affect its adoption. Similarly environmental factors such as government policy regulatory pressure and legal concern limits the adoption of cloud computing in financial management of funds allocated to public schools in Kenya.

On the other hand, security factors and organisational factors were found to have a positive relationship with adoption of cloud computing in financial management of funds allocated to public schools in Kenya. The relationship between security factors and adoption was positive and significant while that of organisational factors was insignificant. These findings imply that security features and organisational factors such as financial factors, ICT strategy and attitude positively affect the adopting of cloud computing.

4.11.3 Variance Explained by Independent Variable

Table 4.10 presents the results of variance in adoption of cloud computing explained by each independent variables without the effect of the moderating variable (user competence).

Table 4.10 Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P
Technological factors	.214	.029	7.314	***
Security factors	.319	.044	7.314	***
Organizational factors	.293	.040	7.314	***
Environmental factors	.278	.038	7.314	***
e1	.126	.017	7.314	***

Source: Research Data (2017)

The results showed that security factors explained the most variance in adoption of cloud computing technology in financial management of public funds. Security factors explained 21.4% of adoption of cloud computing, followed by organisational factors which explained 29.3%, followed by environmental factors which explained 27.8% and finally technological factors which explained 21.4% of adoption of cloud computing. The remaining percentage was explained by the error term which includes all other factors not included in this model.

4.11.4 Validated Model

The results presented in figure 4.8 shows the validated model without the moderating variable. The model revealed that a small increase in security factors results to large positive change in adoption as compared to other variables while an increase in technological factors result to negative change in adoption of cloud computing.

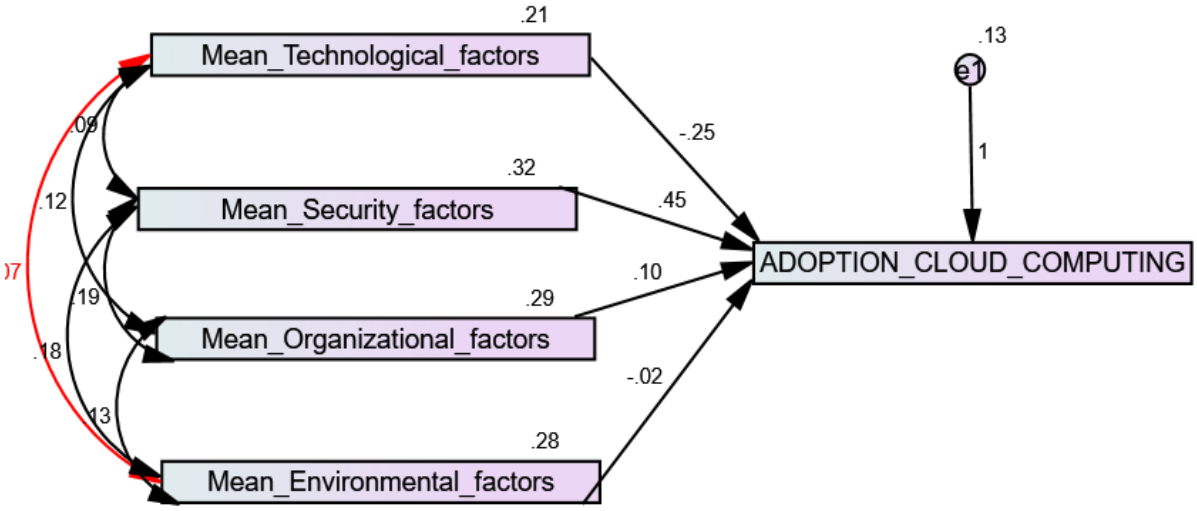


Figure 4.8 Validated Model

Source: Research Data (2017)

The overall model fit is good. The chi square ($\chi 2$) test yields a value of 182.161 which, evaluated with 19 degrees of freedom, has a corresponding p-value of .132. This p-value is greater than 0.05 hence the null hypothesis of a good fit cannot be rejected.

Table 4.11 Model Summary

Result (Default model)
Chi-square = 182.161
Degrees of freedom = 19
Probability level = 0.132

Source: Research Data (2017)

4.12 Model Validation with Moderation

This section presents the results for model validation with the in conclusion of the moderation effect of user competence. To test for the moderating effects, each variable was interacted with the moderating variable using the products to obtain interaction variables (TF*UC), SF*UC, OF*UC and finally EF*UC according to Baron and Kenny (1986). The study then ran the model using the interaction variables as the predictor variable to establish the moderating effect of user competence on the relationship between TF, SF, OF and EF and adoption of cloud computing in financial management of fund allocated to schools.

4.12.1 Regression Weights for Moderated Model

In the moderated model, the relationship between technological factors and security factors was still found to have a significant relationship with adoption of cloud computing regardless on the user competence. The relationship between OF and EF also remained insignificant regardless of user competence. However, the change in adoption of cloud computing caused by a unit change in technological factors, security factors, organisational factors and environmental factors reduced significantly in presence of user competence. These findings implied that user competence significantly moderated the relationship between technological factors, security factors, organisational factors and environmental factors and adoption of cloud computing technology. This further implied that increase in user competence will lead to adoption of cloud computing regardless of the change in technological, security, organisational and environmental factors.

Table 4.12 Regression Weights for Moderated Model

		Interaction Variables	Estimate	S.E.	C.R.	P
Adoption Cloud Computing	<---	TF*UC	-.066	.019	-3.443	***
Adoption Cloud Computing	<---	SF*UC	.098	.020	4.942	***
Adoption Cloud Computing	<---	OF*UC	.012	.021	.600	.549
Adoption Cloud Computing	<---	EF*UC	-.003	.018	-.156	.876

Source: Research Data (2017)

4.12.2 Variance Explained by Independent Variables when moderated by user competence

Table 4.13 presents the findings on the variance explained by the independent variables in presence of user competence. The results showed that user competence significant increased the variance change in adoption of cloud computing explained by all the independent variables. The findings further implied that user competence enhanced the relationship between technological factors, security factors, organisational factors, environmental factors and adoption of cloud computing in financial management of funds allocated in schools.

Table 4.13 Variances for Moderated Model

Interaction Variables	Estimate	S.E.	C.R.	P
TF*UC	10.073	1.377	7.314	***
SF*UC	12.920	1.766	7.314	***
OF*UC	12.738	1.742	7.314	***
EF*UC	11.501	1.572	7.314	***
e1	.129	.018	7.314	***

Source: Research Data (2017)

4.12.3 Validated Moderated Model

The results presented in figure 4.9 shows the validated model with the moderating variable (user competence). The model revealed that an increase in technological, security, organisational and environmental factors results to small changes in adoption in presence of competent users as compared to incompetent users.

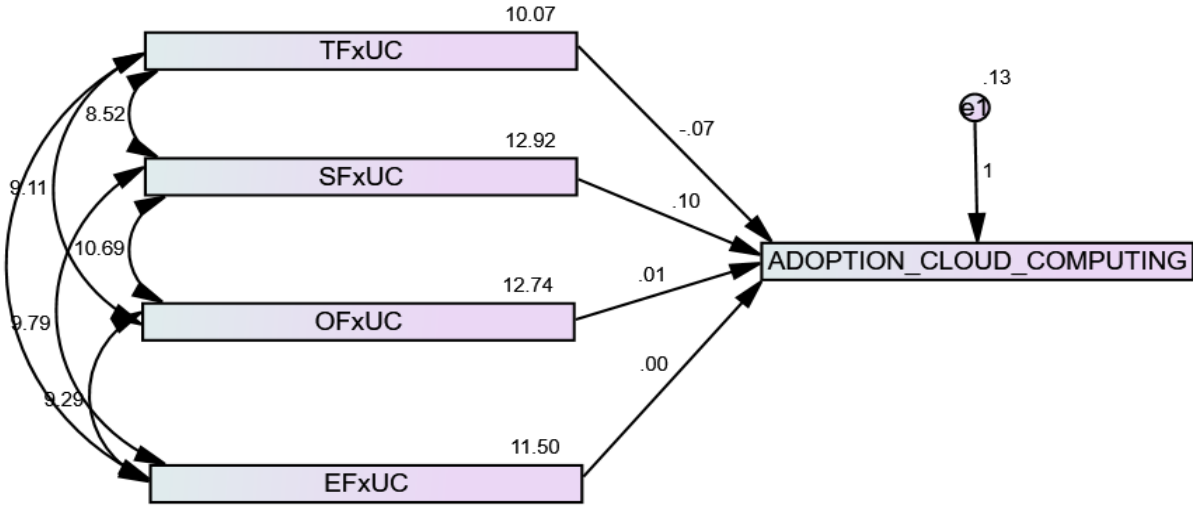


Figure 4.9 Validated Model when Moderated by User Competence

Source: Research Data (2017)

The overall model fit is good. The chi square ($\chi 2$) test yields a value of 182.161 which, evaluated with 19 degrees of freedom, has a corresponding p-value of .132. This p-value is greater than 0.05 hence the null hypothesis of a good fit cannot be rejected.

Table 4.14 Model Summary

Result (Default model)
Chi-square = 182.161
Degrees of freedom = 19
Probability level = 0.132

Source: Research Data (2017)

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter addresses the summary, conclusions and the recommendations as per the objectives of this study.

5.2 Summary of findings

The main objective of this study was to develop a cloud adoption framework that can be used for successful selection and deployment of Cloud computing services within the ministry of Education for efficient management of funds meant to facilitate free basic education. Specifically, the study sought to carry out an analysis of the situation on government management of funds issued to public schools, to investigate the drivers of cloud computing for financial management of funds allocated to public schools in Kenya and to formulate and validate a framework for adoption of cloud computing financial management of funds allocated to public schools in Kenya.

5.2.1 Analysis of the Situation on Government Management of Funds in Schools

To achieve the objective, the study conducted a literature review to establish the situation on government management of funds issued to public schools. It was revealed that up to 73% of the social sector expenditure and 40% of the national recurrent expenditure goes to education sector (KIPPRA, 2016). However, the education system in Kenya continues to be plagued with financial management risks that threaten the quality of education. This is despite the enactment of Public Officer Ethics Act of 2003 that stipulates that money given out as impress ought to be accounted for and any major purchases in schools be done through the tendering process (EACC, 2016).

It was also established that the school heads are responsible for efficient and effective management of school finances in order to promote delivery of services. However, the heads of schools, more than often underperform in financial management. This is due to employing less qualified staff who are inefficient and not adequately equipped in maintaining financial records, financial controls and fail to adhere to accounting procedures.

Among the reasons for poor financial management in public schools in Kenya was poor budgeting which lead to overspending or under spending which leads to misappropriation and mismanagement of school funds. Another factor is delay in disbursement of education funds which pose a challenge in management of finances due to late settlement of transactions. Other challenges that school administrators face in managing school funds include incompetency in procurement, inadequate and irregular auditing, lack of accounting supportive documents and records and inability to prepare end year financial statements among others.

5.2.2 Drivers of Cloud Computing Adoption in Public Schools

To achieve this objective, quantitative primary data was collected and analyzed using descriptive statistics as well as inferential analysis methods that is regression and correlation analysis. To validate the framework adopted in Chapter two, the study used AMOS software to establish the structural equation modeling (Mugenda & Mugenda, 2009).

The findings of the study revealed that technological factors as well as security factors had a significant influence on adoption of cloud computing in public schools in Nairobi City County. Technological factors had a negative influence on cloud computing adoption while security factors had a positive influence on cloud computing adoption. The influence of organizational factors as well as environmental on cloud computing adoption was not significant which implies that the most important factors to be considered in adoption of cloud computing in public schools are technological factors such as such as existing technology architecture, existing IT systems, existing computing process, complexity of the technology, organizational support, organization's values and beliefs towards technology and organization's IT infrastructure as well as security factors such as organization's ability to invest in security of cloud infrastructure, integrity of the services and data, confidentiality of government information, the need to have privacy, the liability of the service providers in case of security of data as well cloud compliance issues significantly influences adoption of cloud computing in public schools in Nairobi City County.

5.2.3 Framework for Adoption of Cloud Computing in Public Schools in Kenya

To achieve this objective, quantitative primary data was collected and analyzed using AMOS software to establish the structural equation modeling. The model established indicated that technological factors account for 24% of the variation in adoption of cloud computing in public schools while security factors accounts for 29% of the variation. On the other hand, organizational factors account for 2.8% of the variation in adoption of cloud computing while environmental factors account for 1% of the variation in adoption of cloud computing. The findings also showed that the moderating effect of user competence on the relationship between technological factors, security factors and organizational factors and adoption of cloud computing was positive and significant implying that user competence significantly improves how technological factors, security factors and organizational factors relates to adoption of cloud computing.

5.3 Conclusions

The study concludes that despite the enactment of Public Officer Ethics Act of 2003 that stipulates that money given out as imprest ought to be accounted for properly, the heads of schools, more than often underperform in financial management due to employment of less qualified staff who are inefficient and not adequately equipped in maintaining financial records, financial controls and fail to adhere to accounting procedures. The study also concludes that technological factors and security factors such as organization's ability to invest in security of cloud infrastructure, integrity of the services and data, confidentiality of government information, the need to have privacy, the liability of the service providers in case of security of data as well cloud compliance issues significantly influence adoption of cloud computing in public schools in Nairobi City County. The influence of organizational factors as well as environmental on cloud computing adoption was not significant in as far as adoption of cloud computing in public schools is concerned.

The study also concluded that the moderating effect of user competence on the relationship between technological factors, security factors and organizational factors and adoption of cloud computing was positive and significant while its moderating effect on the relationship

between environmental factors and adoption of cloud computing was positive but not significant.

5.4 Recommendations

The study recommends that since technological factors plays a significant role in adoption of cloud computing, the government policy makers should come up with policies which can involve heads of public schools to improve the existing technological situation by improving the existing technology architecture and existing IT systems so as to create an enabling environment for adoption of cloud computing.

Furthermore, government policy makers should come up with policies which can involve heads of public schools in improving the security measures such as improving the organization's ability to invest in security of cloud infrastructure since it has a significant role in adoption of cloud computing. This study recommends that any schools that intends to adopt cloud computing should ensure they have trained all the targeted users, have cloud computing experts in all the departments to enhance the adoption process.

REFERENCES

Authority, E. A., 2012/2013. Eacc Annual Report, Kenya: Government of Kenya.

Brodkin, J., 2008. Gartner: Seven cloud-computing security risks. *Infoworld*, *2008*, pp.1-3.

Chen, Y., Paxson, V. and Katz, R.H., 2010. What's new about cloud computing security. *University of California, Berkeley Report No. UCB/EECS-2010-5 January*, *20*(2010), pp.2010-5.

CIO East Africa, 2013. Student Advantage under office 365 for education in Kenya. *CLOUD COMPUTING*, 27 November, p. 14.

Commision, E. a. A., 2015/2016. *EACC ANNUAL REPORT*, s.l.: Government of the Republic of Kenya.

Crucial Cloud Hosting, 2014. *Cloud Computing in Education.* Available at www.crucial.com

Feng, D.G., Zhang, M., Zhang, Y. and Xu, Z., 2011. Study on cloud computing security. *Journal of software*, *22*(1), pp.71-83.

Fernando M., 2011. *Cloud Computing Concerns In Public Sector.* Available at: www.cisco.com

Gillwald, A., 2015. *Cloud Readyness in Selected African Countries.* Available at: http://www.researchictafrica.net

Gorelik, E., 2013. *Cloud Computing Models.* Available at: web.mit.edu

Government of Republic of Kenya, 2013. *Kenya Law.* Available at: www.kenyalaw.org

Government of the republic of Kenya, 2007. *VISION 2030.* Available at: http://www.konzacity.go.ke

Government of the Republic of Kenya, 2015. *Digital Literacy Programme,* s.l.: Governement Printers.

Jamil, D. & Zaki, H., 2011. Cloud computing security. *International Journal of Engineering Science and Technology*, *3*(4).

John K. & Tarus, D. G, 2015. *Challenges of Implementing E-Learning in Kenya: A Case of Kenyan Public Universities.* Available at: http://www.irrodl.org

Kothari, C., 2004. *Research Methodology Methods and Techniques.* 2nd Revised Edition ed. New Delphi: New Age International (P) Ltd., Publishers.

Krutz, R.L. & Vines, R.D., 2010. *Cloud security: A comprehensive guide to secure cloud computing*. Wiley Publishing.

Mahmud, U. F., 2012. Representing and organizing contextualdata in context aware environments. *Jornal of Computing*, 4(3), 61-67.

Mell,H. & Grance, G. 2011. *The NIST Definition of Cloud.* Special Publication 800-145 ed. Gaithersburg,: National Institute of Standards and Technology.

Miha,A. R., 2015. *AWS Cloud Adoption Framework.* Available at: d0.awsstatic.com

Ministry of Information Communications and Technology, 2014. *GOK-national-cybersecurity.*

Mishra, A., Mathur, R., Jain, S. & Rathore, J.S., 2013. Cloud computing security. *International Journal on Recent and Innovation Trends in Computing and Communication*, *1*(1), pp.36-39.

NIST, 2013. *Cloud Computing Standards Road Map.* Available at: http://www.nist.gov

Popović, K. and Hocenski, Ž., 2010, May. Cloud computing security issues and challenges. In *MIPRO, 2010 proceedings of the 33rd international convention* (pp. 344-349). IEEE.

William Broberg, J. B. R., 2011. *Introduction to Cloud Computing*, Boston: Insights.

Zissis, D. and Lekkas, D., 2012. Addressing cloud computing security issues. *Future Generation computer systems*, *28*(3), pp.583-592.

APPENDIX

APPENDIX I: QUESTIONNAIRE

Section I: Information about the respondent

Sub-section One: - Demographics.

Please tick the box that best describes yourself

1. Gender

□Male

□ Female

2. Age group (Years)

□ 18-20

□ 21 to 30

□31 to 40

□41 to 50

□ More than 50 years old

3. Highest level of education

☐ High school or equivalent

☐ Bachelor Degree

☐ Vocational or diploma

☐ Master degree or Higher

4. What is your experience in ICT operations (Years)

☐ 0-1

☐ 2-3

☐ 4-5

☐ Over 5 years

Section II: - About the Organisation

a. Does your organization have an ICT policy?

Yes ☐ No ☐

b. If yes, does the policy contain cloud computing?

Yes ☐ No ☐

c. Do you think cloud computing can align to your organizational policy?

Yes ☐ No ☐

SECTION II: ADOPTION OF CLOUD COMPUTING

a. Do you think adopting of cloud computing can aide in funds management?

Yes ☐ No ☐

b. Are there necessary plans to adopt the technology?

Yes ☐ No ☐

c. If the prerequisites for adoption of a new technology are considered and the necessary top management support given, is there a will to adopt the technology?

Yes ☐ No ☐

SECTION III: TECHNOLOGY FACTORS

a) Does the existing infrastructure have the ability to support cloud computing?

Yes ☐

No ☐

b) Indicate whether the following infrastructure exists

Infrastructure	Exists	Does not exist
Data security measures		
WAN infrastructure		
Enough computers		
Data centres		

Please indicate the extent to which you agree or disagree with each of the following statements on technological factors regarding adoption of cloud computing

Circle **(O)** a number from 1 to 5 that best represents your level of agreement with the statement, where 1 = 'strongly disagree', 2 = 'disagree', 3 = 'Neutral', 4 = 'agree' and 5 = 'strongly agree'

	Statement	Strongly disagree	**disagree**	Neutral	Agree	Strongly Agree
1	Existing technology architecture determines the need for adoption of cloud computing	1	2	3	4	5
2	The existing IT systems support exchange and making use of information	1	2	3	4	5
3	Cost is a key factor in determining adoption and utilization of technology.	1	2	3	4	5
4	The existing computing process has the ability to be to be used or produced in a range of capabilities that can also include cloud computing	1	2	3	4	5 5
5	The operation of this technology is not considerably complicated to implement and used	1	2	3	4	5 5
6	This technology is not difficult to learn	1	2	3	4	5 5
7	There is no resistance within the organization towards the use of this technology due to its complexity.	1	2	3	4	5 5
8	Using this technology fits well with how the organization operates.	1	2	3	4	5 5
9	Using this technology is consistent with the organization's values and beliefs	1	2	3	4	5 5
10	This technology is compatible with the organization's IT infrastructure	1	2	3	4	5
11	The changes introduced by this technology are compatible with existing operating practices.	1	2	3	4	5

SECTION IV: SECURITY FACTORS

a) Does the organization have well established infrastructure system to counter security threats?

Yes ☐ No ☐

Please indicate the extent to which you agree or disagree with each of the following statements on technological factors regarding adoption of cloud computing

Circle **(O)** a number from 1 to 5 that best represents your level of agreement with the statement, where 1 = 'strongly disagree', 2 = 'disagree', 3 = 'Neutral', 4 = 'agree' and 5 = 'strongly agree'

	Statement	Strongly disagree	**disagree**	Neutral	Agree	Strongly Agree
1	The organization has the ability to invest in security of cloud infrastructure	1	2	3	4	5
2	The integrity of the services and data influences the decision to adopt cloud computing	1	2	3	4	5
3	Confidentiality of government information influences the decision to adopt cloud computing	1	2	3	4	5
4	The need to have privacy influences the decision to adopt cloud computing	1	2	3	4	5
5	The liability of the service providers in case of security of data influences the decision to adopt cloud computing	1	2	3	4	5
6	Cloud compliance issues influences the decision t adopt cloud computing	1	2	3	4	5

Section V: Organizational Factors

	Statement	Strongly disagree	**disagree**	Neutral	agree	Strongly agree
1	The organisation has the technological resources to adopt this technology.	1	2	3	4	5
2	The organization can provide financial resources to adopt this technology.	1	2	3	4	5
3	The organization can provide other organizational resources (e.g. training, IT support) in order to build higher levels for this technology adoption.	1	2	3	4	5
4	The employees have a positive attitude towards adoption of new technology to ease their work schedule	1	2	3	4	5
5	The organization's experience with other IT technologies makes adoption of cloud computing feasible	1	2	3	4	5

6	The organization's ICT strategy and policies support adoption of new technologies	1	2	3	4	5

Section VI: Environmental Factors

	Statement	Strongly disagree	**disagree**	Neutral	Agree	Strongly agree
1	The degree of competition in the industry places pressure on the organization's decision to adopt this technology	1	2	3	4	5
2	The organization needs to utilize this technology to have an efficient finance management	1	2	3	4	5
3	It is a strategic necessity to use this technology	1	2	3	4	5
4	The government policy towards adoption of new technology influences the decision to adopt cloud computing	1	2	3	4	5
5	The funds regulatory pressure in the government parastatals influences the decision to adopt this technology	1	2	3	4	5
6	The continuous mismanagement of funds in the ministry creates a need to adopt cloud computing to manage the funds	1	2	3	4	5

Section VII: User competency

	Statement	Strongly disagree	**disagree**	Neutral	Agree	Strongly Agree
1	The users level of education influences adoption of the new technology	1	2	3	4	5
2	The users change management ability influences the decision to adopt a new technology	1	2	3	4	5
3	The users level of education influences the decision to adopt of a new technology	1	2	3	4	5
4	The users IT skills influences the decision to adopt of a new technology	1	2	3	4	5
5	The users level of training influences the decision to adopt of a new technology	1	2	3	4	5