FACTORS AFFECTING ICT ADOPTION FOR EDUCATIONAL SUPPORT ACTIVITIES IN SECONDARY SCHOOLS IN KENYA A SURVEY OF THIKA DISTRICT

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Factors affecting ICT adoption for educational support activities

in secondary schools in Kenya a survey

of Thika District

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DECLRATION

This thesis is my original work and has not been presented for a degree in any other University.

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DEDICATION

This thesis is dedicated to my parent's Mr Benson Nchunge Kujoga and Mrs Nchunge Eunice for their encouragement and continued positive inspiration and moral support.

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LIST OF ACRONYMS

ICT	Information and Communication Technology
OECD	Organization for Economic Co-operation and Development
MDGs	Millennium Development Goals
EFA	Education for All
LAN	Local Area Network
SPSS	Statistical Package for Social Sciences
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNCTAD	United Nation Conference on Trade and Development
CBIS	Computer-Based Information Systems
ATMs	Automated Teller Machines
GeSCI	Global e-Schools and Communities Initiative
ISCED	International Standard Classification of Education
ITU	International Telecommunication Union
WSIS	World Summit on the Information Society
VSAT	Very Small Aperture Terminals
TAM	Technology Acceptance Model
PEU	Perceived Ease of Use
PU	Perceived Usefulness

DEFINITIONS OF TERMS

Public schools: These are schools that are financed by tax revenues and other Government collected revenues and are administered exclusively by state and local government officials(GeSCI, 2009).

Private schools: Schools that are entirely owned and managed by individuals, non-governmental organizations or religious bodies.

Information Communication Technology (ICT): This is a collection of technologies and applications which enable electronic means of capturing, processing, storing, transfer and dissemination of information to a variety of users or clients. technologies involves computing, communication and internet (Duncombe et al 1999).

Educational support activities: Activities that focus in enhancing quality of education as regards teaching, learning and management of schools. For instance use of computers as tutors, tutorials, simulations, virtual laboratories and use of education management information system (EMIS) (GeSCI 2009).

ABSTRACT

The role played by Information and Communication Technology (ICT) in any institution cannot be over-emphasized. ICT has also been credited with the potential to integrate world economies thus demolishing the barriers created by time and distance. However despite it role in improving effectiveness and efficiency in service delivery, its adoption in most of the secondary schools has remained low and limited. This study sought to assess the factors affecting the adoption of ICT for education support activities in secondary schools in Kenya through a survey of Thika District.

The study used a total sample of 92 respondents selected from public and private secondary schools in Thika district through stratified, simple random sampling. Questionnaires were used to collect primary data. The data was analyzed using Statistical Package for Social Sciences (SPSS) whereby Descriptive Statistics such as frequency distributions, percentages, means and standard deviations as well as inferential statistics such as Pearson Correlation and ANOVA tests were utilized. The findings were presented using frequency tables, and bar graphs.

The survey established user's attitude, IT literacy, connectivity, cost and policy issues in information technology as the major factors affecting the rate of ICT adoption in secondary schools in Kenya. However the study found that the said aspects have strong association with pace of ICT adoption and their effect is similar in both public and private schools and that low IT literacy levels and inadequate psychological preparedness cuts across all teacher levels.

The study recommends the government through its agencies to intensify ICT in-service programs, e-learning workshops and conferences for teachers to enhance their integration capacity. More over stakeholders should put more effort towards improving and equipping the schools with ICT-literacy training facilities for both teachers and students to increase access. Government should coordinate the integration and subsidize the costs as well as monitor the implementation of a well focused frame work in line with the national education ICT adoption strategy for learning institutions.

Key words: Information and Communication Technology; Secondary Schools; ICT Adoption.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background information

Globalization and trade liberalization have facilitated intensive business competition which in turn has increased the need for adoption of new technologies to increase the efficiency in service delivery. According to Avgerou (2001), Information Communication Technology (ICT) is an absolute necessity for taking part in today's global economy and as such the role of ICT in the emerging global market cannot be overemphasized. ICT has also been credited with the potential to integrate world economies thus demolishing the barriers created by time and distance. In addition, ICT makes easier the trade in goods and services, encourages investment, creates new sectors for enterprise development and new revenue streams (Carayannis et al, 2005). Meng et al (2002) maintains that the role of the ICT industry in developing countries is far from clear. This might be due to the fact that developing countries are short of capital investment and knowledge. The developing countries therefore lag behind in ICT-industry development and diffusion in comparison to the industrialized nations.

According to Tieke (2005), ICT helps companies and other institutions to increase productivity and create attractive products to be sold on the world market. It improves the quality and decreases lead-times and costs. ICT technology has also fuelled sustainable development by reducing the environmental impact of business activities. ICT has wide application in public services: in administration, in the educational system, in the health care sector, and in transportation. This study will however focus on education sector specifically in secondary schools. However, ICT usage has limitations in the sense that it takes time to adapt to investment in ICT by changing organizational set-ups and worker-

specific skills (OECD, 2004). Firms that adopted ICT technologies several years ago, notably large firms, have already been able to make the technology work for them whereas more recent adopters are still adapting it in their organizational management.

Late adoption of ICT by developing countries however in a way might translate into a competitive advantage for the developing countries, as they have the opportunity to learn from the experience of the developed countries and at the same time adopt the latest generation technologies. The obvious benefit of this is that they need not incur the learning and experimentation costs that typically characterized the adoption of new technologies by the early adopters (Wong, 2002). Cohen et al. (2002) describe ICT "as a collection of technologies and applications which enable electronic processing, storing and transfer of information to a wide variety of users or clients". According to Quibria et al (2003) these technologies and applications are further broadly classified into three categories namely computing, communication and Internet.

The building blocks of ICTs are the communication processes and infrastructures. The communication processes can either be one-way or two-way. In one-way communication the information is disseminated to the receiver who does not have the opportunity to respond immediately. Examples of this include radio and television. Two-way communication allows for feedback between the sender and the receiver of information. The devices for this include telephones, telegraphs, faxes and pagers. Relatively recent communication technology like the Internet consists of a number of sub-networks that are connected to each other through which electronic communications are transmitted (Foros et al., 2005). The Internet represents the convergence of computing and communications, and forms the backbone of a knowledge-based economy and information society. The substantial improvements in computing power, speed, storage and overall capacity have boosted the development of knowledge-based economy and the information society. This

has manifested in the evolution of new innovations and developments in Software applications, sophisticated hardware and communications tools (SAITIS, 2005).

Duncombe et al (1999) defined ICTs as "electronic means of capturing, processing, storing and disseminating information". Since 1994, most development agencies, analysts and developing-country governments consider information and communication technologies (ICTs) marginal to the achievement of both national economic growth and the reduction of poverty. Today, ICTs are considered so central to development that governments have initiated national "e-strategies" and donor agencies have made them a mainstream item in national and international programmes (OECD, 2004).

Information and communication technologies (ICTs) have the potential to make vast amounts of information available to users located in various parts of the world and to facilitate rapid communication between them (McCormick et al, 2002). ICT offers a radically new means of enabling organizations to exchange information with each other regardless of where they are located geographically (Panagariya 2000; United Nations 2000; Xie 2000). ICT in the public institutions like parastatals and schools is being promoted as a means of enabling organizations in developing countries to become more integrated within the global economy on economic terms that are favourable for them. This enabling is achieved through reductions in transaction costs accompanying ICT implementations by using the available resources and networks. The end result is attainment of more efficient information exchange systems (Benjamin et al, 1995; Leebaert, 1998; Malone et al, 1998; Malone et al, 1987).

According to situational analysis by (GESCI 2009) Kenya has always prioritized education and training at all levels including public secondary schools as it is considered the foundation for social and economic development. Public schools are schools that are

financed by tax revenues and other government collected revenues and administered exclusively by state and local government officials. The number of secondary schools in Kenya has increased to over 5000 public schools and 2000 private with approximately 1.2 million and 0.17 million students respectively in 2009. Based on 1999 census data a total of 2.8 million boys and girls aged between 14 and 17 years who should have been in secondary school were not enrolled. This shows poor access to secondary education. Adoption of ICT in secondary schools would help increase access to secondary education manly through e-learning programs.

According to National ICT Strategy for education (Gok, 2006), the Process of ICT implementation in schools involves participation of a conglomeration of various individuals, agencies and stakeholders who perform specified roles in the implementation process. These includes; The Ministry of Education (MoE), Partners and Donors, Kenya ICT Trust Fund, Ministerial ICT Committee, Implementing agencies / individuals, Beneficiary institutions and Stakeholders. The Ministry of Education (MoE) is the lead agency and is responsible for the monitoring and evaluation of the implementation of the strategy at all levels of the education sector. The Ministry has three sets of documentation guiding the strategy: policy documents which spells out the overall government policies on education and ICT; Specific education strategic documents for delivering of its mandate (ERS and KESSP); and the global goals and principles (EFA, MDG and WSIS). Partners and Donors comprise of all the partners and development agencies that contribute towards the various ICT initiatives in the strategy. They provide guidance and support in funding as well as in the strategic planning, monitoring and evaluation. Kenya ICT Trust Fund is a non-governmental organization under the Ministry of Education and is expected to bring in the participation of the public and private/corporate actively involved in the support of the various ICT initiatives in the sector.

The Trust Fund has the mandate of resource mobilization for ICT in education initiative. Ministerial ICT Committee coordinates the implementation of ICT strategies. it make quarterly report on the status of implementation of ICT initiatives in the sector. It also approves ICT projects and programmes to be implemented. It's chaired by the Permanent Secretary, Ministry of Education, coordinated by Director of Higher Education and with the secretariat being ICT Unit. Implementing agencies / individuals are responsible for the strategy implementation. This include the Semi-Autonomous Government Agencies (SAGAs) under the MoE, consortia of NGOs undertaking ICT in the education sector (such as Network Initiative for Computers in Education – NICE), Individual NGOs having sound principles (transparent with a wider mandate), Civil Society Organizations undertaking ICT in education activities, academia and / or individuals with experience in ICT in Education projects. Beneficiary institutions are all education institutions delivering education and training to public or community led. They are responsible to the MoE in the usage, protection and utilization of benefits provided during strategy implementation. Stakeholders are usually engaged from time to time in the review of all the initiatives in the sector and strategy evaluation in line with global and technological dynamics in the ICT sub-sector.

According to GoK (2005) the use of information communication technology (ICT) in secondary schools is meant to widen access to secondary education, since it has a direct role to play if appropriately used. ICT's can bring many benefits to the classroom, teaching and learning process including offering opportunities for more student centred teaching, greater teacher-to-teacher and student-to-student communication and collaboration, lead to access to a wider range of courses and increased learning enthusiasm due to delivery of multiple technologies to teachers. The ICT can be harnessed to improve the efficiency, accessibility and quality of learning process by

enabling increased access to knowledge, more collaborative and interactive learning techniques. Additionally ICT data repositories, networks and school curricula can be developed collaboratively, Education materials can be procured more cost effectively; staff and student time can be scheduled more efficiently as well as monitor individual student performance more closely. Successful integration and use of ICT's in schools will play a critical role in disseminating skills to wider society, improve quality of curriculum, avoid duplication of effort and create positive impacts in the economy (GoK, 2004).

1.2 Problem Statement

The adoption and use of ICTs in education institutions in developing countries remains very elusive despite a decade of large investment in information and communication technologies (Trucano, 2005). Kenya like other developing countries struggles with high levels of poverty and this has an effect on the adoption and access to ICT (OECD, 2004). According to the ICT in education situational analysis of September 2009 by GeSCI, the initial aim to introduce ICTs in education was primarily at developing ICT skills, the focus has over time shifted to leverage ICTs to address issues of quality and to improve teaching and learning especially at secondary and post secondary levels. Despite the evident goodwill, interest and commitment where digital content for standard 4, 5, 6 and form one are finalised by KIE, the availability and use of ICTs at various levels is still patchy and limited. About 1,300 secondary schools out of more than 6,000 schools have computers, 213 of these received them from ministry of education and the rest from private and civil society organizations,(GeSCI, 2009). However, most secondary schools with computers use less than 40% of the available infrastructure and very few actually use ICT as an alternative method for the delivery of the curriculum. Some of ICT components whose use in schools is elusive includes; Education management information system (EMIS), Elimika learning management system (LMS), Cyber science software, computer

based cognitive tools and internet as government fails to meet its target of providing affordable internet access to all secondary schools by the year 2010, (Gok, 2005).

Kenya ICT survey, (2007) observed that many schools teachers are ill equipped to effectively integrate ICT in classroom due to inadequate number of computers, educational applications, training and acquisition of sub-standard, unfit or nearly obsolete equipment for use while teachers are left at the mercy of external partners for determining what they learn and how. Absence of adequate funding to purchase ICT equipment, retraining and developing requisite human capital for the whole sector, are critical indicators of technology lag and the process pace which is very slow and may lead to all benefits of ICT integration in schools un-equitably realized or not being realized in the near future. Therefore researcher found it worthy to find out how this factors affect the adoption of ICT for educational support activities in Kenyan secondary schools. This was achieved through a survey of Thika District.

1.3 Objectives of the Study

1.3.1 Broad Objective

The broad objective of this study was to establish the factors that affect ICT adoption for educational support activities in secondary schools in Kenya.

1.3.2 Specific Objectives

The study sought to address the following Specific objectives

1. To assess how the initial ICT installation and running cost affect the adoption of ICT for educational related activities in secondary schools in Thika District.
2. To assess how users' perceptions affect the adoption of ICT for educational support activities in secondary schools in Thika district.

3. To establish how the existing competency in Information Technology affects the ICT adoption for educational related activities in secondary schools in Thika district.
4. To establish how the existing technological infrastructure affect the adoption of ICT for educational related activities in secondary schools in Thika district.

1.4 Research Questions

1. How are various aspects of the initial ICT installation and running cost affect the adoption of ICT's in secondary schools in Thika District.?
2. How does the users' perception affect the adoption of ICT in secondary schools in Thika District?
3. How does the existing competency in Information Technology affect the adoption of ICT in secondary schools in Thika District?
4. How does the existing technological infrastructure affect the adoption of ICT in secondary schools in Thika District?

1.5 Significance of the Study

It is hoped that the findings of this study will provide information to education policy makers especially the Ministry of Education, Ministry of Higher Education, Science and Technology and Ministry of Youth Affairs and Sport, in regard to ICT policy regulations, formulation and implementation in learning institutions.

This study will also be of importance to schools management and students in preparing them to articulate the need for schools to keep abreast with the technology. Finally, the study will be useful to future researchers and scholars who might be interested to pursue this subject further on.

1.6 Scope of the Study

This study was conducted in secondary schools in Kenya, specifically in Thika District in Kiambu County. It is the immediate district bordering Nairobi Province to the North and is one of the districts in Central Province. The main activities in the rural area is farming dominated by coffee and flower industries while its urban center is dominated by various industries producing various products. This district has 62 public boarding secondary schools and 25 private secondary schools most of whom have not adopted ICT in their institutions. The study targeted school principals or deputy principal, dean of studies, heads of department involved on ICT matters and IT teachers of the secondary schools. These gave insight on the factors affecting the adoption of ICT in their respective schools.

1.7 Limitations of the Study

The study made use of primary data which was collected through the use of questionnaires administered to the respondents. Therefore the accuracy of the data collected depended on the honesty of the respondents.

Due to the sensitive nature of the information sought, the study was faced with the problem of concealment of information by the respondents. The respondents were suspicious of the motive of the study. To deal with this, the researcher obtained a research permit and an introductory letter from the university specifying the purpose of the study. This helped to increase the response rate.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

The review covered the past research studies carried out in Kenya and elsewhere on ICT development. It addressed the issues of possible factors affecting the adoption of ICT in the Kenya's learning institutions. The theoretical review, past studies and other relevant literature in the area were analyzed critically, highlighting the key areas in the reviews.

2.1 Empirical Review

2.1.1 Global Overview of ICT

In some developed countries, such as Finland and the United States, the technological innovation and high volumes of demand generated by an ICT-productive sector played an important role in achieving beneficial impact to the national economies. Countries with strong ICT service sectors are at an advantage over those countries where the ICT sector as a whole is weak. ICT investment has contributed to "capital-deepening" by increasing capital input per worker in addition to increasing labour productivity. In most developed countries, pervasive use of ICTs throughout the value chain has contributed to improved performance in firms, enabling them in particular to increase efficiency in combining capital and labour (OECD, 2004).

In African countries, the problem of inadequate access to affordable ICTs is due to the poor state of Africa's ICT infrastructure, the weak policy and regulatory frameworks, and human resource deficiencies in these countries. African countries have in recent years made some efforts to facilitate the ICT infrastructure deployment, roll-out and exploitation process in a number of areas. For example, in Kenya, significant

achievement has been made through the undersea Fibre Optics Cable. However, Africa still remains the continent with the least capability in ICT and other related facilities (New Partnership for Africa's Development NEPAD, 2002). The threat posed by the digital divide to the rapid development of African countries can on the whole be attributed to African countries' inability to deploy, harness and exploit the developmental opportunities of ICTs to advance their socio-economic development especially in the education sector (McCormick and Kinyanjui, 2002).

In a study on "*ICTs and Economic Growth in Developing Countries*", OECD (2004) established that the extent of diffusion, the use of ICTs, and their impact on business performance are influenced by a number of complementary factors in the business environment. Five factors were identified. The first factor entails the nature of the infrastructure in which individual firms are founded. In this case, some sectors particularly those dealing with services can make much more extensive use of ICTs to change processes and their relationships with customers and suppliers (for example, through the use of software applications in enhancing outcome). The second factor entails the extent of competition environment. In this regard, the more competitiveness in seeding innovation, the more user perception change in firms as they take advantage of ICT innovation to improve their performance. The third factor entails the relative costs of ICT deployment, including the costs of hardware, training and re-training, maintenance and other indirect costs related to technological changes, and the usage costs of networking facilities such as telecommunications networks. The fourth factor entails the amount and quality of human capital available. The OECD report argued that the better skilled the workforce and the better equipped a firm is to upgrade workforce skills to take advantage of ICTs, the more likely it is to achieve higher rates of ICT-related innovation

and increased productivity. Finally, the fifth factor entails the attitude of users to restructure and reorganize their working methods to take advantage of the new opportunities made available through ICTs – the OECD study confirmed evidence reported elsewhere that adaptability and organizational capital within firms play a crucial part in maximizing the value of ICT investment (OECD, 2004).

O'Brien (2000) emphasizes the inevitability of using computer-based information systems in organizations. O'Brien argues that information systems give an organization competitive advantage in the market place. Information and communications technology (ICT), a component of computer based information systems (CBIS), enhances the development of products, services, processes and capabilities that give business strategic advantages over the competitive forces it faces in its industry. These forces include not only a firm's competitors but also its customers and suppliers, potential new entrants into its industry, and companies offering substitutes for its products and services. Computer based information systems are also playing a greater role in the management of organizations (O'Brien, 2000). Organizations requiring ICTs to enhance their performance are therefore exposed to performance-related risk. In Kenya, this is so especially for organizations and learning institutions in the public domain where poor ICT usage has been evident over the years.

2.1.2 Information Communication Technology (ICT)

According to Cole (2003) the advent of computerization has revolutionized the nature and scale of human communications and information/data management. Combined with the computing and manipulation ability of computers, and global reach of telecommunications facilities, ICT has transformed people's ability to acquire, store, use and disseminate information. The information may be numeric, textual, pictorial or sound

form and can be applied in a wide range of texts. In workplaces the impact of IT can be seen from the number of computers and servers that are numerical to the amount of information available at touch of key board and the speed of availability of such information. Other gadgets that have come through the advent of IT include mobile phones, satellite communication, laptops, palmtops, electronic organizers and Automated teller machines (ATMs).

According to Mahathir (1996), the "Internet-worked" electronic global village offers opportunities for national and local problem resolution, although equity and universal access will continue to remain key issues in multiracial and multi-religious societies. According to Hudson (1997), the four major technological trends - capacity, digitization, ubiquity, and convergence - are driving the current telecommunications revolution, which parallels the emergence of a global economy. Investment in telecommunications could in itself contribute to economic, social, and political development. Reliable telecommunications networks could improve the productivity and efficiency of agriculture, industry, and social services. New approaches to financing telecommunications in the developing countries are also creating incentives for investment that should help to close the information gaps between the advanced and the developing regions.

Knight (1996), asserted that countries that fail to embrace the revolution are bound to become further marginalized and lack in technological development that is vital for economic growth. The new technologies are lowering the cost of storing, processing, and transmitting information and knowledge. Therefore, Knight contends that the less developed countries must build new learning systems, and mobilize international resources to create massive programs, community information and learning centers.

These countries should solve the organizational, political, and regulatory obstacles so they could attract the resources they need.

According to Hamelink (1994), the four major trends in today's world communication are digitization, consolidation, deregulation, and globalization. He argues that the accumulation of these trends have disempowered the people in important ways. He further adds that they make people powerless vis-à-vis the control of their own lives. They create a culture of silence in which people enslave others. Disempowerment matters because it represents a basic violation of human rights.

The proliferation of digital technologies, for instance, dis-empowers people through new forms of dependence and vulnerability. The solution would be a people's self-empowerment on a global scale - a global public sphere "in which people can freely express themselves, share information, opinions, ideas, and cultural experiences, challenge the accountability of power holders, and take responsibility for the quality of the 'secondary environment'". According to Marmaduke (1997), the Internet will bring not enlightenment, but a new dark age of exploitation of Third World peoples through downsizing and automation of the resource extraction network, both in raw materials and human labor. The present technological advances will serve only the clerical and burgher classes, excluding 95 percent of the world's people. According to Kuo (1993), computerization is an indicator that is commonly believed to be most closely associated with the level of informatization. Similar to telecommunications, computerization also has a mutually causal relationship with economic development and the level of per capita income.

In Kenyan context, Information and communications technology (ICT) has permeated many activities, Industries and different business environments such as supermarkets, banks, airlines, and hospitals. In addition, the *Report of the Sector working Group on Information Technology* (2001) recognized the need to leverage information and communications technology in its national priorities of growth and poverty reduction, and has mainstreamed ICT in the national planning process. In the *Proceedings of the National Investment Conference* held between 19th and 21st November 2003, the Government of Kenya committed itself to reviewing the legal framework to remove constraints that have discouraged adoption and use of e-commerce, and to develop a master plan for e-government. This means that ICT will play an increasing role in the performance of private, public and non-governmental organizations in Kenya. This will in turn increase the dependence of the organizations and learning institution on application software (Wachira, 2003).

2.1.3 Adoption of ICT in Schools

OECD Report (2004) concedes that since the 1980s, integration of ICTs in education has been compulsory in the developed nations. This is not so in developing nations such as Kenya, where ICT integration in education is considerably more recent, small-scale and experimental. While most developed countries have reported over 41% of integration of ICT to teaching and learning, the proportion remains substantially low in Africa, Kenya included. Integration aims at using ICT to support teaching and learning in the delivery of the various curricula to achieve improved education outcomes. According to GoK (2006), ICT in the education sector can broadly be categories into three main categories. These includes: E-Government which aims at mainstreaming ICT in all government operations and service delivery; Education Management Information Systems (EMIS) which aims at facilitating education managers and administrators with accurate and timely data for

better and informed decision-making; and E-Learning which aims at mainstream ICTs in the teaching and learning process (ICT as a tool). Since ICT is interactive media, it facilitates students to develop diversified skills needed for industrialization and a knowledge-based economy. It also allows teachers and learners to proceed at different paces depending on the prevailing circumstances.

There are huge challenges facing international community in meeting the Millennium Development Goals (MDGs) on education and the Education for All (EFA). The biggest challenge for many education systems is to be able to offer training or learning opportunities on a lifelong basis to all individuals, and more importantly to the traditionally under-served or marginalized groups, such as: girls and women, who face cultural and other barriers to schooling; rural populations that are too thinly dispersed to populate "regular" school cost effectively with reasonable class sizes; adult workers who have no time to attend regular courses; persons with disabilities having no access to learning centers; and speakers of minority languages and other culturally distinct groups (GoK, 2006). This situation is amplified by demands of rapidly evolving skills in a globalizing labour market. New paradigms are also emerging whereby education service delivery becomes: less about teaching and more about learning (less "magister-centric" and more "learner-centric" via self-tutoring and the use of individualized information research abilities); increasingly less confined within the sole geographical location of learners (a country) or less dependent upon a physical space (a classroom for pooling a critical mass of learners together); and more flexible, adjustable to learners' chosen time, with modular curricula no longer constrained by rigidly formatted schooling path or by rigidly predetermined certification goals. With these challenges, it seems illusory and probably unrealistic to assume that conventional delivery mechanisms will ensure equal and quality educational opportunities for all in affordable and sustainable ways by 2015.

While there is a wide range of innovations in ICT to support effective and quality delivery of education services and curricula, there is a considerable technology lag in educational institutions. Most institutions still use nearly obsolete systems and are consequently unable to exploit the educational potential of the emerging technologies. The government through the ministry of education needs to facilitate mechanisms that will encourage educational institutions to keep abreast and harness emerging technologies to enhance the process of teaching, learning and acquisition of knowledge and skills in tandem with the modern world. There is therefore need to come up with mechanisms to encourage educational institutions to keep abreast and to harness emerging technologies to improve effective and quality delivery of education services and curricula by promoting the establishment of centres of excellence, education exhibitions and science congress.

2.1.4 Cost of Installation and Investment in ICT

The speed with which scepticism has given way to enthusiasm has stimulated a good deal of innovative thought, but it also carries substantial risks. Investment in ICTs is expensive, and its impact largely un-researched and easily exaggerated (Xie, 2000). According to Wong (2002), many of the assumptions underpinning current thinking on ICTs in development are based on intuition rather than analysis – and on limited evidence from a narrow range of pilot projects rather than large-scale impact assessments. The danger is that, without better understanding of the real impact of ICTs on both national economies and community development, the pursuit of over-ambitious, unrealistic goals may mean that resources are misapplied and worthwhile objectives missed. Past disappointments, for example the failure of import substitution with industrialization strategies to transform economic growth, have not destroyed the yearning for a "magic bullet" for development, and the real capabilities (and limitations) of ICTs must be

properly understood if they are to be exploited effectively in both industrial activity, learning institution and in the overall national economic expansion (Zwick, 2002).

When compared to developing economies, ICT investment costs are generally much higher in Less Developing countries (LDCs) where almost all ICT equipment must be imported (often subject to high rates of taxation and non-tariff barriers), and where telecommunications usage charges are generally much higher (especially for international and Internet connectivity). Regulatory factors such as licence fees often also add to the cost of ICT investment. The net result is that every dollar of ICT investment in an LDC buys significantly less ICT equipment and usage than in the developed economies. This is therefore likely to have a significantly lower rate of return (OECD, 2004).

2.1.5 Users' Perception

Acccording to Zwick, (2002), ICT developments and computerization inventions have led to automation of major tasks that were usually undertake manually in most organizations. In addition, ICT adoption has been perceived to challenge the traditional management hierarchy and change both the location and the nature of decision making. The effectiveness and success of ICT systems seems to depend not only on the technology itself, but also on the ways in which the users are introduced to the concept. The support of employees in introduction of new innovations is highly dependent on the type of innovation as well as the employees' perception to the inventions to be introduced (Zwick, 2002).

The ICT development in education has changed the users' behaviours and their view on modern technology. However, most researchers have not addressed the state of perception and acceptance of ICT in learning institutions. A study in a Thai University showed that, attitude, Motive, Interest, expectation and past experience has a positive effect on

acceptance of ICT, and its ease in usage greatly effects its adoption. The Users' perception on the adoption and use of ICT can be explained by Technology Acceptance Model (TAM) which was developed by Davis in 1989. This model is discussed under the theoretical framework subheading below. It is imperative to note that in order for ICT adoption and implementation to succeed, it must gain user acceptability, the system/program must be secure (both in reality and consumer perception), convenient, easy to use and be offered at little or no additional cost to the consumer (Antovski and Gusev 2003).

2.1.6 Competency in Information Technology

The last two decades has seen major developments in computer hardware and software and increasing demand to integrate computers into education. It is now very vital for every nation to modernize its educational system on the basis of information and communication technologies (ICTs), as globalization and transformation to information society call for new literacy, (Unesco, 2002). Competency in information technology (IT) is initialized on attaining the awareness of the importance of viewing ICTs in education as computer based cognitive/learning tools rather than a vehicle for knowledge transmission. Issues of globalization and knowledge economy heavily rely on competent human capital with requisite capacity and expertise to enhance technology integration in social systems. IT competency enables one to usefully use computer cognitive tools and appropriate pedagogical strategies in computing, communication and internet applications to help the learner transcend the limitations of the mind in activities of thinking, learning, and problem solving (Pea, 1985). Computer cognitive tools like logo, micro worlds, semantic nets, concept mapping, idea processors, hypermedia, expert systems, prolog and computer – supported cooperative work application are paramount in enhancing development of metacognitive awareness and generalized self – regulatory skill (Lajoie and Derry, 1993;

Kommers et al, 1992; Orhun et al, 1997). Potential and competency of the ICTs for improving learning and teaching will not be realized unless teachers are well trained and retrained in the pedagogical use of technology in the classroom (OECD, 1992). Teachers in Kenya should be trained on basic IT skills such as; file management, word processing, spreadsheet, email and internet use since they will play a key role in developing requisite human capital which is paramount in ensuring attainment if vision 2030 and knowledge economy.

Proper Training is crucial for competency to be achieved. Cherrington (1995) describes training as the process that enables employees to acquire new knowledge, learn new skills, and perform behaviours in a new way. It refers to the acquisition of specific skills and knowledge. The author further concedes that training programs attempt to teach trainees how to perform particular activities or a specific job. Training is a learning experience in that it seeks a relatively permanent change in an individual that will improve his / her ability to perform on the job (De Cenzo & Robbins 1994:255). Staff training especially training geared towards establishes technological Competencies does not occur automatically or overnight, so a series of targeted interventions must be made. These may include workshops, training sessions, peer reviews and joint planning and implementation, as well as experts' visits and involvements. They should be designed according to the needs of the organization. To be successful, the interventions must be directly related to the groups' day-to-day tasks and continue over a significant period, (Kliger and Tweraser, 2001).

Staff training consists of both formal training events and on-the-job training (OJT). The importance of OJT is hard to overestimate, although at most firms it is organized haphazardly and therefore fails to realize its potential (Rothwell, 2001). The focus here is on formal training related to ICT. In principle, training needs are identified through

analysis of organizational needs and personal assessments. In the analysis of organizational needs, staff skills are improved so that employees are better able to do the particular jobs assigned to them, closing a "performance gap." This kind of training can also prepare staff for higher-level assignments in the future or help them take on a different assignment at a similar level of responsibility. This training is usually driven by the organization's future business strategy (explicit or implicit) and the corresponding staff requirements (Rothwell, 2001).

In personal assessments–based training, the training is geared more to increasing the human capital of the staff member; the training increases the employee's, skills but the new skills may be only generally applicable to current or future assignments at the workplace. To create and maintain a training program, the organization must make adequate provision for the expense of training in its annual budget and develop a training plan (Rothwell, 2001).

Usage of any digital technology requires inputs of manpower skills. Armstrong (2003) defines manpower skills as intellectual capital, which consists of stocks and flows of knowledge available to an organization. These can be regarded as intangible resources which together with tangible resources (money and physical assets), comprise the market or total value of business. Armstrong (2003) further conceptualizes workers as embodying a set of skills, which can be rented out to employers. For an employer the benefits of the decision to invest in human capital are expected improvements on performance, productivity, flexibility and capacity to innovate. This study hypothesizes that most learning institutions in Kenya have generally failed to adopt to ICT due to the lack of qualified personnel to manage, plan, and maintain such technologies. According to Parker (2004), the technology is relatively complex and requires skilled manpower that is unlikely to be available locally.

Some employees, teachers and even students in most of the learning institution do not have adequate ICT and IS knowledge thus if an institution installs digital systems such as E-learning, it becomes an impediment to access and usage, rather than a facilitation. Competency in IT include; computer awareness, competency with software applications and programming ability (Kay, 1990). Lack of competency in computer literacy de-motivates users.

There are four types of computer user: the emergent user, the progressive user, the high user, and the dependent user. Each definition describes a different set of behaviours such as range of software use, frequency of use and reliance on use. Blass and Davis (2003) reported a number of competence based reasons for high e-learning user dropout rates in the e-learning environment. It seems that computer experience and computer literacy play a key role in determining the success of ICT users and thus the computer skills of potential users must be taken into account. It is an imperative precondition for learners to benefit from technology-based learning. Research on computer literacy basically focuses on whether users possess the necessary computer skills. The computer literacy level seeks to measure the degree of proficiency of learners in basic computer oriented operations. This will be measured using questions that seek out ability to use basic computer application packages such as Microsoft Word, and graphic and spreadsheet packages (Teo and Gay, 2006).

According to OECD (2004), the most important long-term constraint on ICT investment and ICT-led growth in developing countries is likely to be the shortage of human capital. Most developing countries suffer from a shortfall of ICT-related skills, which acts as a substantial constraint throughout the economy. The result of inadequate human capital is too little understanding of ICTs; too little awareness of ICT opportunities amongst entrepreneurs; too little relevant content and too few relevant applications; too few

trainers able to pass on ICT skills to employees; too little computer literacy; too few trained computer programmers and maintenance personnel. ICT-skilled personnel in low-income countries can also usually earn much higher wages in other countries and so many leave. In Kenya, the challenge to growth of human capital in ICT-related disciplines has been due to slow upgrading of educational attainment and poor government's commitment in ensuring that ICT capability is incorporated in various educational strategies at all levels.

Communication is a very important component of ICT adoption and use. According to Cole (2003) communication involves understanding of people, listening, explaining, getting others talk, being tactful, tolerance of others mistakes, giving honest praise and honest criticism and keeping everyone informed. The success of ICT adoption is enhanced by incorporating continuing and open communication among the parties affected and involved in the adoption process. Where the participant have exceled in adoption, they should be congratulated and where weakness is evident, the school managers should offer the necessary remedial assistance to ensure successiful adoption and implementation process (Thompson, Strickland & Gamble, 2005:115).

2.1.7 Technological Infrastructure

Developments in ICT Technological Infrastructure have drastically influenced the competitive business environment as proved by the emergence and strengthening of the global economy, and the transformation of industrial economies to knowledge-and-information-based service economies (Laudon and Laudon, 2001). This has in turn encouraged most organizations especially in the developed countries to use computer-based information systems in order to remain competitive. McKay and Brockway (1989) define ICT infrastructure as the enabling foundation of shared information technology

capabilities upon which business depends. They viewed ICT infrastructure as the shared portion of the ICT architecture. Earl (1989) defines ICT infrastructure as the technological foundation of computer, communications, data and basic systems. He views ICT infrastructure as the technology framework that guides the organization in satisfying business and management needs. Duncan (1995) refers to ICT infrastructure as the set of IT resources that make feasible both innovations and the continuous improvement of IT systems.

According to Government of Kenya ICT policy (2005), lack of adequate ICT infrastructure has hampered provision of efficient and affordable ICT services in the country. There is therefore need to put more emphasis on provision of support infrastructure, such as, energy and roads; supporting software development; Promotion of local manufacture and assembly of ICT equipment and accessories; and Provision of incentives for the provision of ICT infrastructure.

Technological infrastructure is a major issue that stands as an impediment to access of information, most people are not able to access digital information due to lack of the necessary infrastructure. This has left a bigger part of the population unable to access the digital information hence discouraging the adoption of ICT. Learning institution need to enhance and upgrade current technical architectures to accommodate digital materials especially with the rapid changes in technology. The architecture will include components such as high-speed local networks and fast connections to the Internet, relational databases that support a variety of digital formats, full text search engines to index and provide access to resources, a variety of servers such as Web servers and FTP servers and electronic document management functions that will aid in the overall management of digital resources (Greenstein, 2001).

According to Jewell (2001), digital preservation has also posed a major challenge to the development and adoption of information systems in schools. He defined digital preservation as; the planning, resource allocation and application of preservation methods and technologies necessary to ensure that digital information of continuing value remains accessible and usable. Recording media for digital materials are vulnerable to deterioration and catastrophic loss and even under ideal conditions they are short lived relative to traditional format materials. Other teaching modes such as e-learning and adoption of electronic content delivery system can only be implemented in schools once proper technology infrastructure is in place. Therefore proper improvement in technological infrastructure will go along way in ensuring faster adoption of ICT in schools.

2.2 Theoretical Framework

Various models and theories have been used to explain ICT adoption in schools. Kerlinger (2002) defined a theory as a set of interrelated constructs, definitions and propositions that present a systematic view of phenomena by specifying relations among variables, with the purpose of explaining and predicting the phenomena. Pedersen (2003) claims that studies on ICT adoption have generally taken three possible approaches: a diffusion approach, an adoption approach and a domestication approach. The models and theories used in this study are discussed in the sections that follow.

2.2.1 Diffusion of Innovation Approach

Diffusion of Innovation theory was developed by Roger's in 1995. Rogers (1995:5) defines diffusion as "the process by which an innovation is communicated through certain channels over time among members of a social system". An innovation, according to

Rogers (1983:11), is “an idea, practice, or object that is perceived as new by an individual or other unit of adoption”.

The innovation-diffusion model states that an innovation (technology) is passed on from its source to end users through a medium of agents and its diffusion in potential users for the most part dependent on the personal attributes of the individual user. The model assumes that the technology in question is appropriate for use unless hindered by the lack of effective communication (Negatu and Parikh, 1999:208).

VanAkkeren and Harker, (2003:205) argues that media and interpersonal contacts provide information that influences a person’s opinion and judgement. The theory comprises four elements: invention, diffusion through the social networks, time and consequences. Information filters through the networks and depending on the nature of the networks and the roles of its opinion leaders, new innovations are either adopted or rejected. Opinion leaders influence an audience through personal contact while intermediaries such as change agents and gatekeepers also contribute to the process of diffusion. Rogers further claims that there are five adopter categories that include: innovators, early adopters, early majority, late majority, and laggards. Interestingly, the five categories follow a standard deviation curve where very little innovators adopt at the beginning (2.5%), early adopters constituting 13.5%, the early majority constituting 34%, the late majority another 34%, finally the laggards at 16%. The Roger’s diffusion model is shown in Figure 2.1.

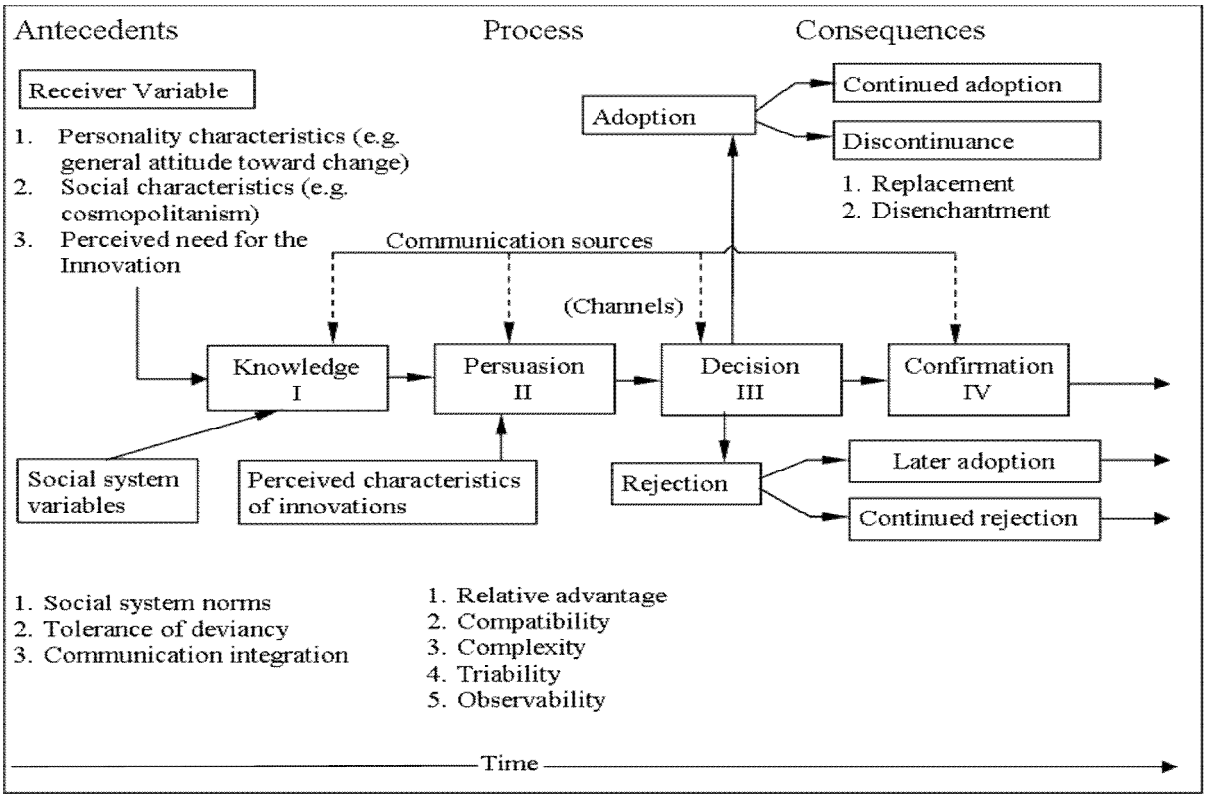

Figure 2.1 Diffusion of Innovation Model
(Source: Rogers, 1995)

2.2.2 The Adoption Approach

The adoption approach describes and explains the adoption decision of users applying different individual and social decision making theories. Three widely used models include the Technology Acceptance Model (TAM), the Theory of Reasoned Action (TRA), and the extension of TRA into a Theory of Planned Behaviour (TPB) (Pedersen, 2003). The Technology Acceptance Model (TAM) is a theoretical model that explains how users come to accept/adopt and use a technology. Original TAM was proposed by Davis in 1989. The model suggests that when a user is presented with a new technology, a number of factors influence their decision regarding how and when they will use it. This includes its perceived usefulness and its perceived ease of use. However, the TAM does not account for the influence and personal control factors on behaviour. Other factors such as economic factors, outside influences from suppliers, customers and competitors

are also not considered by the TAM (van Akkeren and Cavaye, 1999). This model adopts well established causal chain of “beliefs, attitude, intention, actual behaviour”, which was developed from the theory of reasoned action by social psychologists. In Davis’s study, two important constructs are identified; perceived usefulness and perceived ease of use. The perceived usefulness (PU) is defined as “the degree to which an individual believes that using a particular system/technology would enhance his/her performance” (Davis, Foxall and Pallister, 2002). The perceived ease of use (PEU) is defined as “the degree to which an individual believes that using a particular system would be free of physical and mental efforts”. These perceptions predict attitudes toward the system/technology adoption. Then the attitude develops the intentions to use and the intentions cause actual system usage. In many recent studies regarding technology, TAM is adopted extensively. TAM was adopted and showed that it contributes to the prediction of individual usage of technology (Fishbein and Ajzen, 1989).

TAM assumes that perceived usefulness (“the degree to which a person believes that using a particular system would enhance his or her performance” and perceived ease of use (“the degree to which a person believes that using a particular system would be free of effort” with the influence of pre-existing external variables being the primary determinants for adoption of a new technology. Perceived ease of use has a direct effect on perceived usefulness and both determine the consumer's attitude toward use, which leads to behavioural intention to use the system and actual use of the system (Davis et al, 2002; Lu et al. 2003), as shown in Figure 2.2.

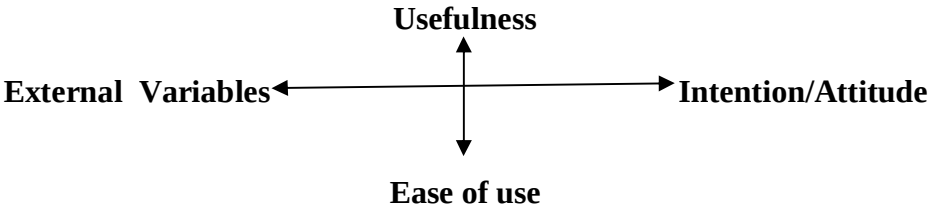

Figure 2.2: Technology Acceptance Model

(Source: Cloete and Courtney, 2002)

To overcome the limitations of the TAM, the TRA was introduced which is a more general theory than the TAM. The TRA model includes four general concepts namely: behavioural attitudes; subjective norms; intention to use; and actual use. The TPB is an extension of the TRA and deals with conditions where the individual has no control of their behaviour. The domestication approach focuses on the process in which technology becomes an integral part of our everyday habits. Conceptual context distinctions are applied to new phenomena. Three important distinctions include work and leisure context; end-users that belong or do not belong to a demographic group; and the private and the public. This view is dominated by sociologist researchers and are often characterised by demographic variables such as age and gender. (Pedersen, 2003).

Further adoption factors identified by Kirby and Turner (cited by van Akkeren and Cavaye, 1999) include: ICT literacy of small business owner, lack of knowledge of derived ICT benefits, and dependence of the small customer on supplier. Other follow-up research by Julien and Raymond (cited by van Akkeren and Cavaye, 1999) identified three other factors that include: the organisation's infrastructure sophistication; level of competency, rationality and attitude in business decision processes; and the organisation's design and perception.

2.2.3 Stages of Technology Adoption

The decision to adopt a particular innovation is subject to a number of factors, which could be personal, cultural or economic. Furthermore the nature and complexity of a given technology influences its probability of adoption. This is further reinforced by intervening factors such as exposure to an innovation through various agents and mass media (Chessa, 1992; Mbanefoh, 2001).

ICT adoption occurs in stages (levels). VanAkkeren and Harker, (2003) identified four main stages in ICT adoption process. They include: No ICT adoption, Basic ICT adoption, Intermediate ICT adoption, Advanced ICT adoption stage. In the "No ICT adoption" stage, the businesses/institutions have not adopted any ICT other than the traditional landline phones or a simple cellular phone. In the "Basic ICT adoption" stage, the businesses/institutions have adopted ICT such as the Internet for collecting information, use email, or use the latest cellular phones (such as the 3rd Generation, 3G) to send/receive emails and access the Internet. In the "Intermediate ICT adoption" stage, the businesses/institutions have a basic/static websites that are engaged in electronic commerce while in the "Advanced ICT adoption" stage, the business/institutions conduct business-to-business transactions electronically, business-to-customers transactions or have any complex ICT integration in their business processes. According to UNESCO Guide for measuring ICT's in education (2009), every stage has its characteristics and thus policy makers need to address specific requirements as regards adoption levels as shown in Figure 2.3.

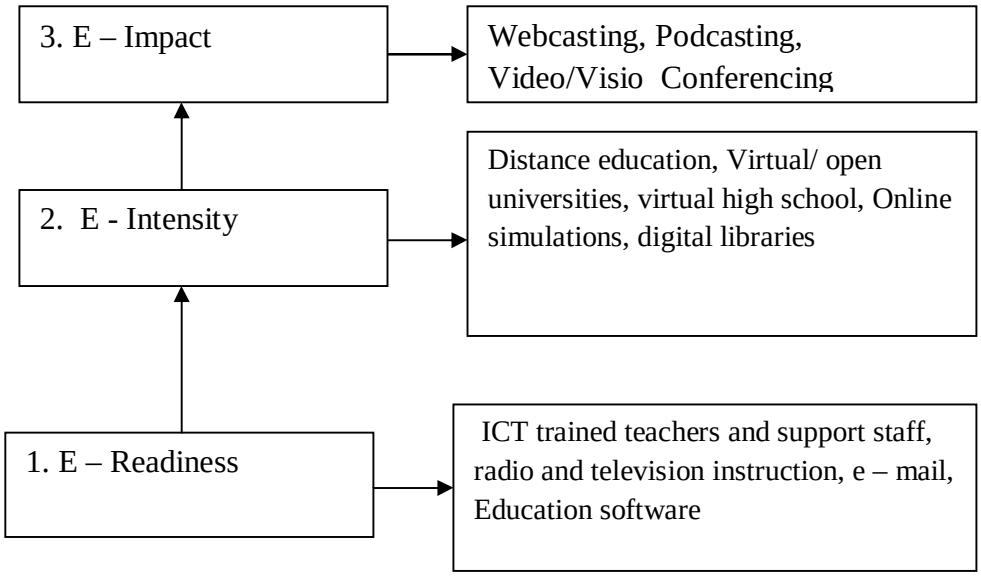

Figure 2.3 Characteristics of levels of ICT adoption in education system
(Source: UNESCO, 2009)

2.2.4 Conceptual Framework

ICT refers to information and communications technologies such as computers and the Internet, as well as fixed-line telecommunications, mobile phones, other wireless communications devices, networks, broadband and various specialised devices ranging from printers, scanners to computer animations, simulations and global positioning systems (New Zealand Ministry of Economic Development, 2004).

According to OECD (2004), shortage of human capital is a major constraint on ICT acceptance. The report further argues that perception, infrastructure and cost are key determinants of technology uptake. Acceptance and Use of a new technology by employees is widely dependent on the type of innovation as well as the employees perception towards the technology (Zwick, 2002). Negatu and Parikh (1999:208) observes that ineffective communication is a huge hindrance to appropriate use of technology, as Pederson (2003) considers perceived usefulness and ease of use as key determinant for ICT acceptance and use. Of the three approaches to understanding ICT adoption, only the diffusion approach is suitable for rationalising the uptake among Thika

secondary schools. The TAM model in the adoption approach has elements that are similar to the diffusion model but is less comprehensive. The TRA model includes more concepts but is still less comprehensive. Rogers' (1995) diffusion of innovation model is used to understand the adoption of ICT by secondary schools in Thika. The four elements of the diffusion theory include: the innovation, communication channels, time and the social system.

Further adoption factors identified by Kirby and Turner (cited by van Akkeren and Cavaye, 1999) include: ICT literacy of small business owner, leading researcher to Competency in Information Technology, lack of knowledge of derived ICT benefits, leading to Users' Perception, organisation's structural sophistication, leading to Technological infrastructure and sector economic status leading to Initial Cost of ICT installation as independent variables of the study, and the dependent variable as the adoption of ICT in schools as shown in Figure 2.4

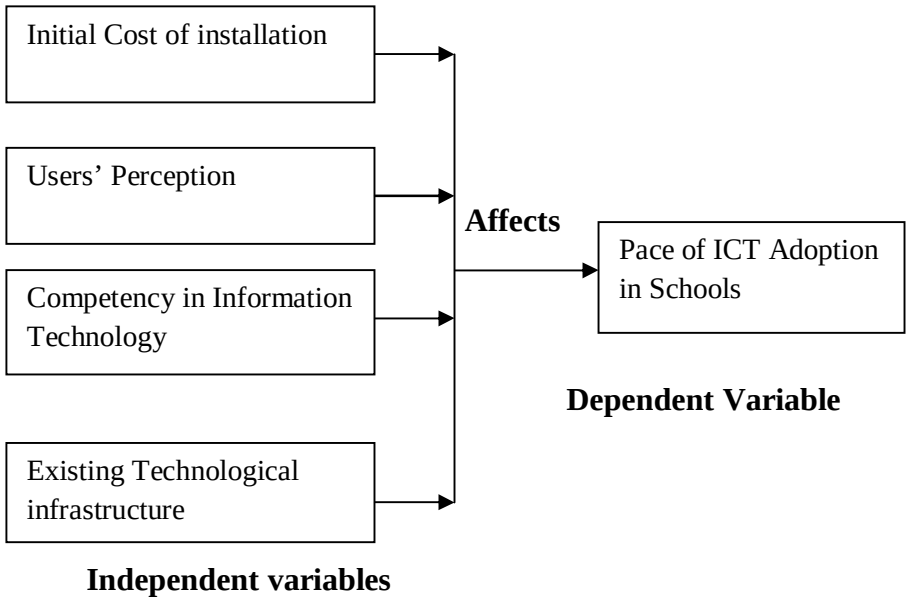

Figure 2.4: Conceptual Framework

2.3 Critique of Existing Literature

According to Westrup et al (2003), public schools and institutions in most developing countries are increasingly facing the difficulty of managing and using the multiplicity of new ICTs, such as e-mail, voice mail, worldwide web, cell phones, and videoconferencing. In addition, the sheer speed and ease of use of modern ICTs only serves to amplify these challenges. Hence, ICTs is viewed as being ubiquitous in most schools and organizations. Since most public learning institutions and other public organizations progressively intents to expand into global markets, it is critical for them to know how ICTs facilitate communication (Ross, 2001).

El Shinnaway and Vinze (1997) examined the impact of technology on the outcomes of group decision-making in the United States of America (U.S.A) and Singapore. They found out that ICTs do indeed have an impact on group decision outcomes such as polarization. However, the impact of ICTs is quite different on the culture that dictates the norms under which a group operates. Straub (1994) studied the effect of organizational culture on IT diffusion of e-mail and fax in Japan and the U.S.A. His findings suggest that culture plays an important role in the predisposition towards selection of ICTs. However, findings on the use of face-to-face and telephone were similar between these two countries.

Leidner, Carlsson, Elam, & Corrales (1999) drew on survey responses from managers using Executive Information Systems (EIS) across organizations in Mexico, Sweden, and the United States. Their study examined whether cultural differences influence perceptions of the relationship between EIS use and decision-making outcomes. The study found significant differences, predicted by cultural factors, in the impact of EIS use on senior management decision-making. Hofstede (2000) investigated the specific

attributes of organizations that influence ICT adoption speed. The findings established that cultural variables (individualism and uncertainty avoidance) might be used to predict the ease and speed of changes. Cultures of high uncertainty avoidance are slow in adopting new technologies.

The 'social context' of ICT development and use plays a significant role in influencing the way in which people use and develop information technologies (Cairns, 2003). A study by Cairns (2003) in local governments found that configurations of local computing packages (including support resources and information structures, as well as hardware and software) were influenced by the distribution of power within the department in question and often reinforce existing power relations. Technology acquisition therefore needs to be seen within the context of the inequalities, complexities and uncertainties of organizational life.

2.4 Research Gaps

The review has showed a high integration of ICTs in education institutions in the developed nations. The reverse is true in the developing nations such as Kenya, where ICT integration in education is considerably more recent, small-scale and experimental. Despite the importance that accrue as a result of ICT Integration in teaching and learning, its adoption remains limited in most schools in Kenya. There is absence of information about the nature of infrastructure available and its use in leveraging educational activities in secondary schools. Moreover, No study has been done to establish the factors affecting ICT adoption in secondary schools in Thika District. This posses a knowledge gap which this study sought to fill.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter focuses on the research methods used in the study. The chapter covers the following sections; research design, target population, data collection procedures, instrumentation, sampling methodology and data processing and analysis.

3.1 Research Design

This study adopted a descriptive survey design incorporating both qualitative and quantitative research approaches. The descriptive survey design was adopted because it described the state of affairs as it exists at present, (Kothari, 2003). The researcher applied this design to investigate the current situation on the factors affecting the adoption of ICT in secondary schools. Survey approach was adopted because the study population was scattered since the secondary schools are located away from each other. The findings of the study can be used as an input in decision making process both in public and private schools.

3.2 Population

Bless and Higson-Smith (1995:87) stated that a population is a set of elements that the research focuses upon and to which the results obtained by testing the sample should be generalized. The population of the study were the school management and the teachers involved in ICT adoption and implementation in secondary schools in Thika District. The target population included all the head teachers or deputy head teachers, the heads of curriculum, heads of ICT department and the IT teachers in the secondary schools in Thika District. The head teacher or deputy head teachers and the head of curriculum were selected because they are key decision maker in the schools, are involved in the day-to-

day running of the schools and that they are well vast with all the developments projects in the schools. The Head of ICT and ICT teachers were selected because they are key implementers of ICT's in schools and are usually consulted by the school management on issues relating to ICT in schools.

3.3 Sampling Frame

The target population were stratified into two categories namely; private and public schools. According to Kothari (2003), an optimum sample is the one that fulfils the requirements of efficiency, representativeness, reliability and flexibility. This sample should be in a range of 10%-30%. A sample percentage of 30% of the schools were chosen from each stratum where 30% of 62 public schools was computed to get 19 schools and 30% of 25 private schools was computed and truncated to get 7 schools resulting to a total of 26 schools as shown in Table 3.1.

Table 3.1: Sampling Frame

Institutions	**Total Number of schools**	**Sample Percentage**	**Schools Sampled in each category**	**Respondent sampled from each school**	**Sample size**
Public schools	62	30%	19	3	57
Private schools	25	30%	7	5	35
TOTAL	**87**	**30%**	**26**	**-**	**92**

The population targeted consisted teachers in all secondary schools in Thika District, which included national schools, provincial and district day and boarding secondary school. The samples drawn from this population involved the schools that had computers and computer laboratory for student use and were using ICT applications in supporting

learning and teaching activities in the school. However, it was observed that one of the sampled schools had dropped use of ICT's despite having basic facilities due to financial constraints, while another had no IT personnel and yet another revealed of power disconnection as reasons of not utilizing available resources, these schools were replaced.

From each of the sampled schools, five respondents were sampled randomly from private school while three respondents were sampled randomly from public schools because the public schools were more than private schools. This helped to reduce disparities for comparison purposes. Individual respondents sampled from schools included; the head teacher or deputy head teacher, the head of curriculum, head of ICT department and the ICT teacher. This resulted to a total sample size of 92 respondents as shown in Table 3.1. These were selected purposively since they are conversant with the school management and have the ICT related information being investigated in this study.

Stratified, simple random sampling technique was used to select a representative sample size for the study. Stratified techniques was used to group the target population (Thika secondary schools) into two main categories or strata namely; public and private schools. Then from each category, a 30% sampling percentage was computed to ascertain the number of schools to be sampled. The computed samples of schools were selected using simple random method. From each of the randomly selected school, the head teacher or the deputy, head of curriculum, head of ICT department and one IT teacher were selected purposively. These provided insights on the pace of ICT adoption in secondary schools in their respective schools.

3.4 Data Collection Instruments

The study made use of primary data. This was collected using questionnaires as the principal data collection instrument. This was administered to sampled respondents in their respective schools. The questionnaire contained both open and close ended

questions. The researcher visited each of the sampled schools at a time and administered questionnaires to the respondents. The questionnaire was used because it allowed the collection of large amounts of data from the target population within a short period of time (Mugenda and Mugenda, 2003).

3.5 Data Collection Procedure

The researcher obtained a Permit from the ministry of education as well as introductory letter from the university to help carry out a field study in the selected schools. The researcher made copies of the questionnaires based on the computed sample size. These were then administered to the sampled respondents through drop and pick method. To achieve high response rate the researcher made pre-arrangements with the prospective respondents through booking of appointment especially the head teachers and securing their informed consent to participate in the study. The researcher assured the respondents that strict confidentiality was to be maintained when dealing with their responses. This encouraged them to be honest.

3.6 Pilot Test

According to Bless and Higson-Smith (1995) pilot testing of questionnaires involves testing the actual instruments on a small sample taken from the communities with similar characteristic with the target population. It allows the evaluator/researcher to identify any difficulty with a method or materials to be used and to investigate the accuracy and appropriateness of any instrument that has been developed. Delport (2002) urges that it is essential that the newly constructed questionnaires be thoroughly piloted before being utilized in the main investigation. The questionnaire for this study was pretested with randomly selected teachers in Thika town. A total of 11 questionnaires administered in 2 public and 1 private schools with 6 and 5 questionnaires respectively. Those selected for

piloting were not included in the actual sample. They were requested to comment on the wording and the formulation of the questions, which improved the final questionnaire to ensure it obtained the richest data possible.

3.7 Data Processing and Analysis

Data from the field was tabulated, coded and entered in the computer. Data was analyzed using statistical package for social sciences (SPSS). The data was analyzed using both quantitative and qualitative techniques. Quantitative technique involved computation of descriptive statistics such as percentages, frequencies, mean and standard deviations. In addition, quantitative technique involved generation of inferential statistics such as correlation and ANOVA tests which enabled the researcher to establish the relationships of the variables in the study.

On the other hand, qualitative technique involved interpretational analysis approach. Interpretational analysis is the process of examining qualitative information keenly in order to identify constructs, themes and patterns that can be used to describe and explain issues being studied (Gall, Borg, and Gall, 1996). The research findings were presented using frequency tables, percentages, line and bar graphs among others.

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSION

4.0 Introduction

This chapter contains the results and presentation of the findings of the study. It presents the findings and discussion on Background information, Costs of installation and running ICT projects, User's perception, IT competency, Technological infrastructure and public / private schools adoption comparative aspects. The target population included; the head teachers or deputy head teachers, the heads of curriculum, heads of ICT department and the IT teachers from National schools; Provincial schools; Districts schools and low level private schools in Thika District. The study targeted a total of 92 respondents from both public and private schools, however due to study limitations; the study gathered a total of 86 responses which represents 93.5% response rate. These formed the basis of the analysis presented in this chapter. The data collected was coded and entered in SPSS package where analysis was done. Both descriptive statistics and inferential statistics were used in the analysis upon which interpretations and conclusions were made.

4.1 Background Information

The study sought to establish the demographic characteristic of the respondents. The demographic characteristic assessed included; Nature of the school whether public or private; Age category, gender, highest level of Education, duration of working and total number of students and teachers in the school. The respondents were grouped into three categories: IT teachers; Administrators; and Heads of ICT department, where principals, deputy principals and deans of studies were combined as administrators and findings were cross tabulated as follows;

Nature of the school versus Age Category

The findings show that the age of the IT teachers in most schools is below 40 years as accounted by 86.1%, with 87.5% in private and 40.7% in public schools being within 20–29 year range. Most administrators in both public and private schools were within 40 – 50 year age category as accounted by 77.8% and 70.0% respectively. The findings are shown in Table 4.1.

Table 4.1: Age category of the Respondent

Respondent / Nature of school n = 86		Age category					Total
		below 20 years	20-29years	30-39 years	40-50 years	above 50 years	
IT Teacher	Public	3.7%	40.7%	33.3%	22.2%		27 100.0%
	Private	6.3%	87.5%	6.3%	.0%		16 100.0%
	Total	4.7%	58.1%	23.3%	14.0%		N=43 100.0%
Administrator	Public			22.2%	77.8%	.0%	9 100.0%
	Private			20.0%	70.0%	10.0%	10 100.0%
	Total			21.1%	73.7%	5.3%	N=19 100.0%
HOD ICT	Public		.0%	29.4%	70.6%		17 100.0%
	Private		28.6%	71.4%	.0%		7 100.0%
	Total		8.3%	41.7%	50.0%		N=24 100.0%

On average, the heads of ICT departments were within the 30-39 year range in private (71.4%) and 40-49 age category in public (70.6%) schools respectively.

This shows that most public schools have a higher composition of older teachers than private schools in Kenya. These can be attributed to high teacher mobility in private

schools which attracts fresh job seeking graduates who are young and more IT sarvy but leave at earliest opportunity for greener pastures.

Nature of the School and Gender

The findings in Table 4.2, shows that on average, IT teachers are males in both public and private schools as accounted by 77.8% and 75.0% IT teachers respectively.

Table 4.2: Gender of the Respondent

Respondent / Nature of school n = 86		Gender		
		Male	Female	Total
IT Teacher	Public	77.8%	22.2%	100.0%
	Private	75.0%	25.0%	100.0%
	Total	76.7%	23.3%	100.0%
Administrator	Public	88.9%	11.1%	100.0%
	Private	70.0%	30.0%	100.0%
	Total	78.9%	21.1%	100.0%
HOD ICT	Public	64.7%	35.3%	100.0%
	Private	85.7%	14.3%	100.0%
	Total	70.8%	29.2%	100.0%

The findings also show that the female teachers in public and private schools accounted for 22.2% and 25.0% respectively, while most departmental heads in public and private schools were males as indicated by 85.7%, and 64.7%, as male administrators dominate the schools at 88.9% in public and 70.0% in private schools. This shows that there was almost equal distribution / proportions of the respondents in public and private schools and that most administration and IT teaching positions in schools are taken up by males. These may be attributed to fear of IT complexity especially by the girl child, who have been perceived to view sciences and technological courses as a preserve for male gender; a trend that needs to be reversed so as to improve access and enhance ICT integration in our institutions.

Nature of the School versus highest level of Education

The findings show that most IT teachers from both public and private schools had undergraduate degree as the highest level of education as accounted by 66.7% and 62.5%, and administrators 66.7% and 80.0% respectively. This is shown in table 4.3 below.

Table 4.3: Highest level of Education Cross tabulation

Respondent / Nature of school n = 86		highest level of Education					
		secondary level	Certificate level	Diploma	Undergraduate	Postgraduate	Total
IT Teacher	Public	.0%	3.7%	22.2%	66.7%	7.4%	100.0%
	Private	6.3%	.0%	12.5%	62.5%	18.8%	100.0%
	Total	2.3%	2.3%	18.6%	65.1%	11.6%	100.0%
Administrator	Public			33.3%	55.6%	11.1%	100.0%
	Private			20.0%	60.0%	20.0%	100.0%
	Total			26.3%	57.9%	15.8%	100.0%
HOD ICT	Public			11.8%	52.9%	35.3%	100.0%
	Private			28.6%	71.4%	.0%	100.0%
	Total			16.7%	58.3%	25.0%	100.0%

However, 11.6% IT teachers, 15.8% administrators and 25.0% departmental heads had postgraduate qualifications but it does not imply that this is their level in IT competency though possibly they may be skillfully able to use IT as designated in the curriculum. Additionally quite a good number of high school workforce in both public and private schools have diploma certificates as accounted 33.3% and 20.0% administrators in public and private schools; 25.9% and 18.8% IT teachers as well as 11.8% and 28.6% heads of ICT departments in public and private schools respectively.

Nature of the School versus Duration of Working

The findings show that most IT teachers in public and private schools had been working in schools for less than 3 years as accounted by 48.1% and 81.3% respectively. On the other hand, majority of the administrators had been teaching in their schools for over 7 years as accounted by 77.7%, and 70.0% in public and private schools. Majority of heads of ICT departments in public schools had served for more than 7 years as accounted by 82.3% while in private schools had served for less than 3 years as indicated by 85.7%. This is shown in Table 4.4.

Table 4.4: Duration of Working in the school

Respondent / Nature of school n = 86		Duration of Working in the school					
		below 3 years	4 to 6 years	7 to 10 years	11 to 14 years	over 14 years	Total
IT Teacher	Public	48.1%	14.8%	18.5%	11.1%	7.4%	100.0%
	Private	81.3%	18.8%	.0%	.0%	.0%	100.0%
	Total	60.5%	16.3%	11.6%	7.0%	4.7%	100.0%
Administrator	Public	.0%	22.2%	44.4%	33.3%	.0%	100.0%
	Private	70.0%	.0%	.0%	10.0%	20.0%	100.0%
	Total	36.8%	10.5%	21.1%	21.1%	10.5%	100.0%
HOD ICT	Public	5.9%	11.8%	35.3%	17.6%	29.4%	100.0%
	Private	85.7%	14.3%	.0%	.0%	.0%	100.0%
	Total	29.2%	12.5%	25.0%	12.5%	20.8%	100.0%

This shows that private schools did not retain their staff for a longer duration as compared to public schools. This may be attributed to job sustainability where in public the majority of workforce is on permanent terms unlike in private schools.

Nature of the school versus Total number of teachers

The findings show that majority of the public schools had a total number of teachers below 20 or between 21 to 30 teachers as observed by 70.3% IT teachers; 77.7% administrators and 64.7% heads of ICT departments. On the other hand, most private

schools had less than 20 teachers according to 81.3% IT teachers; 90.0% administrators and 85.7% departmental heads, as shown in Table 4.5.

Table 4.5: Total number of teachers

Respondent / Nature of school n = 86		Total number of teachers					
		Less than 20	21 to 30	31 to 40	41 to 50	More than 50	Total
IT Teacher	Public	37.0%	33.3%	14.8%	11.1%	3.7%	100.0%
	Private	81.3%	18.8%	.0%	.0%	.0%	100.0%
	Total	53.5%	27.9%	9.3%	7.0%	2.3%	100.0%
Administrator	Public	33.3%	44.4%	22.2%			100.0%
	Private	90.0%	10.0%	.0%			100.0%
	Total	63.2%	26.3%	10.5%			100.0%
HOD ICT	Public	23.5%	41.2%	11.8%	17.6%	5.9%	100.0%
	Private	85.7%	14.3%	.0%	.0%	.0%	100.0%
	Total	41.7%	33.3%	8.3%	12.5%	4.2%	100.0%

This shows that most public schools had more teachers than private schools. This could be explained by the higher number of students in public schools due to affordability hence more teachers, where as in private schools cost may be high as profit scalability is entrenched on their day to day school running processes.

4.2 Initial Cost of ICT Installation and Running

The first objective of the study sought to assess how the initial cost of ICT installation and running affect the adoption of ICT's for educational related activities in secondary schools in Kenya through a survey in Thika District. To assess the factor, the respondents gave their views in eight variables discussed in the sections that follow.

4.2.1 Sufficiency of funds for ICT implementation

The findings in figure 4.1 below show that 9.4% public and 3.0% private of the respondents rated it very sufficient and 39.6% public; 45.5% private rated it as sufficient. This shows that less than half of the schools had sufficient funds to implement ICT to support education activities, while 41.5% public and 36.4% private responses indicated some degree of funds insufficiency.

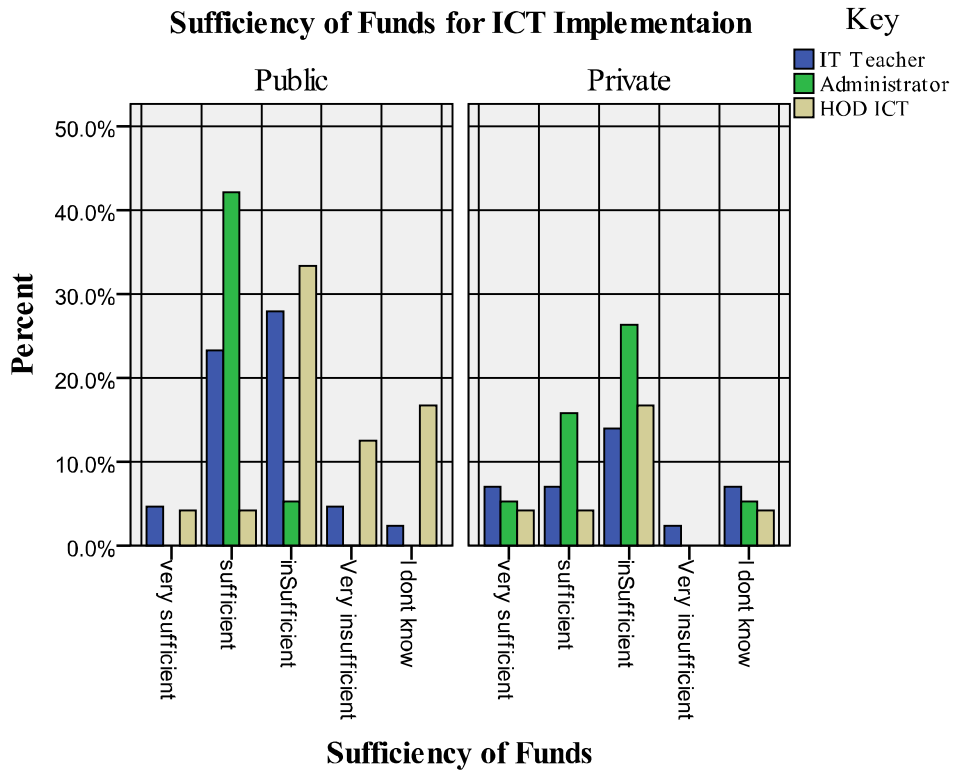

Figure 4.1: Sufficiency of Funds for ICT Implementation in Schools

This implies a good number of schools are experiencing funding gaps for ICT uptake as a cumulative public and private response show 24.6% of uncertainty. According to Rogers, characteristic of rejection was observed in one participating school, 3.85% of total sample which had earlier accepted technology, but due to maintenance costs during national examinations they changed their stand and equipment turned into e – waste.

4.2.2 Source of Funds for Installation of ICT Projects in Schools

Through multiple response analysis, the study established that the main source of funds for installation and running ICT projects in schools was School fees paid by parents as accounted by 81.2%. School fees paid by Government, Government support through CDF funds and donations by NGOs accounted for 21.2%, 5.9% and 4.7% respectively as shown in table 4.6 below.

Table 4.6: Sources of Funds for ICT projects in Schools

Sources of Funds	Frequency	Percentages (%)
School fees paid by parents	69	81.2%
School fees paid by Government	18	21.2%
Government through CDF funds	5	5.9%
Donation by NGOs	4	4.7%

This shows that parents support through payment of schools fees contribute immensely to the support of ICT projects in secondary schools. This calls for government to consider setting up an ICT integration fund parallel to the tuition fees per child to address the initial, sustenance and associated cost for ICT implementation. The schools require funds for hardware, software acquisitions, infrastructure–utilities, connectivity and services costs. For completeness of ICT adoption in secondary schools the issues of funding needs to be coordinated at national level to ensure equity and universal access so as to increase the rate of adoption and harness benefits of technology among National, Provincial, District and private schools in Kenya.

4.2.3 Factor Analysis on the Cost of ICT Installation and Running

To assess the key aspects that were significant in relation to cost of ICT Installation and Running, Factor analysis was conducted. Factor analysis is a statistical procedure which enables the underlying dimensions of variables to be determined (Kline, 2000).

An exploratory factor analysis (EFA) based on the principal component method with varimax rotation was conducted using SPSS package to detect the factor structure in the observed variables. To examine whether the data set was appropriate for a factor analysis, the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy was utilized, where the result as summarized in appendix II table A, imply that the correlation matrix was not an identity matrix which justifies the use of factor analysis for the scale items.

Only one component out of the 6 items was extracted with eigenvalues greater than 1.00, as summarized in table 4.7 below and table A in appendix III. However, to determine the minimum loading necessary to include an item in its respective construct the criterion for factor loading inclusion has 0.5 and above with factor analysis utilizing principal component analysis. The results of principal components extraction is shown in Table A appendix IV. This six factor variables were combined to form a new component named "ICT Cost", whose mean and items are listed in table 4.7 below, showing that there is high cost of funding ICT programmes in schools.

Table 4.7: ICT Cost Items

Items for ICT Cost; indicating that there is High cost of funding ICT programmes in schools with a factor mean of **2.56**
• High cost of ICT installation • High cost ICT maintenance • Lack of adequate ICT facilities and equipment • High cost of ICT support services • High cost of educational support soft-ware • Lack of funds to hire and sustain ICT personnel's

Key: 1.00 - 1.85 strongly agree, 1.86 – 2.65 agree, 2.66 – 3.45 neutral
3.46 – 4.25 disagree 4.26 – 5.00 strongly disagree

The study established, on average mean for ICT Cost as 2.56, implying that the views by most of the respondents agreed with the fact that high cost of funding ICT programmes was hindering its integration. This is supported by means of most of variables where respondent agreed that there is high cost of ICT installation, support services and requisite software as lack of adequate ICT facilities and equipment was seen as a barrier to ICT integration. On the other hand, a reasonable number of respondent were not certain of cost implications on ICT maintenance and funds for hiring and sustaining ICT personnel's during implementation process. This may be as a result of levels of confidentiality of financial transactions in schools.

4.2.3.1 Comparison of ICT cost in both Public and Private Schools

The study sought to compare ICT cost to asses if there was any significant difference in private and public schools. To achieve this, a null hypothesis was formulated which stated that:

H_0- *there is no significant difference in ICT cost between public and private secondary schools in Thika district* with the alternate hypothesis stating that:

H_1 - *there is a significant difference in ICT cost between public and private secondary schools in Thika district.*

Analysis of Variance (ANOVA) test showed that there was a significant difference as shown in table 4.9, where the means in table 4.8 for public is **2.32** implying agreement and mean for private as **2.95** an indicator of uncertainty, hence led to rejection of the null hypothesis and acceptance of the alternative hypothesis.

Table 4.8: Means for ICT Cost between nature of schools

Public schools ICT cost	private schools ICT cost
Funds Sufficiency with Factor mean of **2.32**	Funds sufficiency with Factor mean of **2.95**
very sufficient	very sufficient
Sufficient	Sufficient
Insufficient	Insufficient
very insufficient	very insufficient
Not sure	Not sure

KEY: 1.00–1.85, - very sufficient,2.66 – 3.45,- not sure,3.46 – 4.25, -insufficient

1.86 – 2.65, - sufficient, 4.26 – 5.00, - very insufficient

Table 4.9: ANOVA Test for ICT Cost between nature of schools

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	8.169	1	8.169	10.207	.002
Within Groups	67.229	84	.800		
Total	75.398	85			

This imply that there is a significant difference between public and private schools as regards cost of ICT implementation, with private school on top of neutrality as indicated by it mean of 2.95, while public agree that there are challenges of funds sufficiency due to high cost of funding ICT programmes, which may hinder fast diffusion of ICT's in secondary schools in Kenya.

However, the ICT cost ANOVA test between respondent groups gave a none significant F – statistics of 0.577 with $p>0.05$, indicating that there is no difference in views by either IT teachers; administrators or heads of ICT departments as regards cost implications on ICT integration.

4.3 Users' Perception

The second objective of the study sought to assess the effects of users' perception on the adoption of ICT for educational support activities in secondary schools in Kenya through a survey in Thika district. The researcher used general adoption perception overview for

ICT as an instructional tool, attendance frequency to e – learning conferences, and frequency of equipment and system maintenance to assess the effects.

The respondents were presented with various statements and were asked to rate the level to which they agreed or disagreed with the listed statements as relates to adoption of ICT for learning support activities in their respective secondary schools. The findings are discussed in the section that follows.

4.3.1 ICT Adoption Perceptions

A five-point Likert scale was used to measure the findings where by the means of the key aspects were computed. The findings in Table 4.10 show that on average the respondents disagreed with the fact that using ICT activities in class was not too complex, manual teaching mode to electronic as well as opinion that ICT adoption would reduce job opportunities as accounted by means 3.70, 3.55 and 3.47 respectively. However, a number of respondents were un sure as regards observable variables including; teachers re-training on ICT which may waste a lot of class time, reduction of teacher student touch as well as fear of ICT support sustainability when adopting it in the school as accounted by the following means 2.97, 3.34, 2.95 respectively. The responses were interpreted and the findings are presented in Table 4.10. The diffusion of innovation includes time as an essential element of the theory. Time starts with the innovation's antecedents, its process, and ends with its consequences. The antecedents include the receiver's personal and social characteristics, perceived need for the innovation, the social system practices that they adhere to, their willingness to change, and the communication integration within their social system. There are three time factors namely: the innovation-decision process, relative time required for the adoption of the innovation, and the innovation's rate of adoption. For secondary schools in Thika, the timeframe for the diffusion of innovation may take more time and occur at a slower rate.

Table 4.10: Users' Perceptions on the Adoption of ICT

N = 86	Mean	Level of Agreement
I prefer manual teaching methodology to electronic method of instruction in class.	3.55	Disagree
ICT adoption will make most students to lack touch with their teacher since they will be able to communicate electronically.	3.34	Not sure
Using ICT activities in class is not too complex	3.70	Disagree
Adoption of ICT will reduce job opportunities	3.47	Disagree
Adoption of ICT will require teachers to be re-trained and this will waste a lot of class time	2.97	Not sure
There is a lot of fear of ICT support sustainability when adopting its educational activities in this school	2.95	Not sure

KEY: 1.00 – 1.85, - strongly agree, 2.66 – 3.45, - neutral, 3.46 – 4.25, - disagree
1.86 – 2.65, - agree, 4.26 – 5.00, - strongly disagree

This implies that the teachers had no preference on manual teaching methodology to electronic method of instruction in class and do not fear losing jobs due to ICT adoption but using ICT support activities in class was viewed as too complex. Thus teacher's psychological preparedness is vital for ICT integration in schools, as it will make them adjust perception towards ease of use and its usefulness to enhance adoption. The findings agrees with Rogers (1995) five stages for the innovation decision process. This begins with knowledge of the innovation, followed by the formation of an attitude about the innovation, and then the decision to adopt or reject. If the decision to adopt is chosen then implementation of the innovation occurs, and finally the confirmation of the decision.

4.3.2 Teachers Attendance to E-Learning Workshop/ Conferences

Table 4.11 shows that public schools have higher teacher attendance to E-learning Workshops and Conferences to private schools.

Table 4.11: Attendance to E-learning Workshop and Conference

Respondent / Nature of school n = 86		Attendance of E-learning Workshop and Conference				
		Less than 3	4 to 6	7 to 10	None	Total
IT Teacher	Public	29.6%	29.6%	14.8%	25.9%	100.0%
	Private	43.8%	6.3%	6.3%	43.8%	100.0%
Total		34.9%	20.9%	11.6%	32.6%	100.0%
Administrator	Public	22.2%	33.3%		44.4%	100.0%
	Private	10.0%	20.0%		70.0%	100.0%
Total		15.8%	26.3%		57.9%	100.0%
HOD ICT	Public	35.3%	29.4%	11.8%	23.5%	100.0%
	Private	42.9%	14.3%	.0%	42.9%	100.0%
Total		37.5%	25.0%	8.3%	29.2%	100.0%

The findings shows that in public schools, 44.4% of administrators observed that no teacher had attended E-learning workshops/conferences as 22.2% say less than 3 teachers had attended, while in private 70.0% of administrators say none of teachers had attended. IT teachers in public had 29.6% for none attendance and 25.9% for below 3 teachers while 43.8% IT teachers in private were for none attendance and same for less than 3. However as per ICT departmental heads, 23.5% of public and 42.9% of private noted none of their teachers had attended a e-workshop, as 35.3% in public and 42.9% in private say less than 3 had attended the e-workshop. This shows little effort by the teachers and the schools' management to encourage teachers to attain e-learning skills. Perception that ICT is not relevant to national examinations, coupled with absence of a clear policy frame work on integration as influenced teachers negatively in search of requisite pedagogical skills. The current main focus of curriculum is almost exclusively on learning outcomes rather than instructional methods. This causes lack of a significant component that would inculcate positive perception for ICT integration.

4.3.3 Frequency of Performing ICT Equipments and Systems Maintenance

The study established in Table 4.12 unawareness of 29.4% and 57.1% by heads of ICT department in public and private schools respectively, 37.0% and 50.0% of IT teachers in public and private, as well as 33.3% and 30.0% of administrators in public and private schools on how frequent the schools performed ICT equipments and systems maintenance such as upgrade, diagnostic and repair to enhance their performance in learning activities. This is due to the fact that most of the respondents in both public and private schools were not sure of the frequency of system maintenance, implying that system upgrades are not frequently done. However 70.6% public and 42.9% private ICT heads; 66.7% public and 70.0% private administrators, together with 63.0% public and 50.0% private IT teachers were well informed on trends of systems upgrades as shown in Table 4.12.

This implies that ICT equipments and systems maintenance was not carried out on regular basis by the schools, thus hindering access to more reliable, efficient and content rich resources for teachers and students.

Table 4.12: Frequency of ICT Equipment Maintenance

Respondent / Nature of school n = 86		Frequency of ICT equipment Maintenance					Total
		Once per month	Once per term	Once per year	Any other	Note sure	
IT Teacher	Public	3.7%	22.2%	14.8%	22.2%	37.0%	100.0%
	Private	6.3%	37.5%	.0%	6.3%	50.0%	100.0%
Total		4.7%	27.9%	9.3%	16.3%	41.9%	100.0%
Administrator	Public	11.1%	33.3%	22.2%	.0%	33.3%	100.0%
	Private	10.0%	40.0%	10.0%	10.0%	30.0%	100.0%
Total		10.5%	36.8%	15.8%	5.3%	31.6%	100.0%
HOD ICT	Public	.0%	41.2%	29.4%		29.4%	100.0%
	Private	14.3%	28.6%	.0%		57.1%	100.0%
Total		4.2%	37.5%	20.8%		37.5%	100.0%

System maintenance seems to be done once per term by most of schools in both public and private followed by a few who performs the upgrades once in a year.

However the high level of maintenance frequency unawareness shows that teachers in both public and private schools are not eager to familiarize with new technology and have low or no interest on the ICT applications as they look at it as a subject rather than as an enabler. Negative user's perception has slowed ICT adoption in secondary schools in Kenya, since its usefulness as instructional tool is not yet clear and is viewed as a complex tool to use by teachers.

4.3.4 Factor Analysis for ICT User's Perception

This section shows an exploratory factor analysis (EFA) based on the principal component method with varimax rotation, conducted using SPSS package to detect the factor structure regarding the user's perception. To examine whether the data set was appropriate for a factor analysis, the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy was utilized, where the result are summarized in appendix II table B. The section shows the means result of factor variables and ANOVA test for the User attitude, which the variables reduced to.

4.3.4.1 Factor Variable Reduction

Two components out of the 6 items were extracted with eigenvalues greater than 1.00, during the first rotation, where "fear of ICT support sustainability" loading was less than 0.5 and so it was removed. The second rotation extracted only one component with all the factor variables loadings greater than 0.6 as shown in appendix IV table C. The factor variables of the extracted component were combined and formed a new variable "User attitude" whose items overall mean 3.49 and other means are listed in Table 4.13, showing that teacher's attitude affects the pace of ICT integration rate in schools.

Table 4.13: User Attitude Items

Items for User Attitude that shows Teacher's attitude affects use of ICT's in schools as a tool for instruction with overall factor mean of **3.49**
• Manual teaching preferred to Electronic mode • ICT Make student lack physical touch with their teachers • ICT use in class is not too complex • Adoption of ICT reduces job opportunities • ICT requires teachers to be re-trained which wastes class time

KEY: 1.00 – 1.85, - strongly agree, 2.66 – 3.45, - neutral, 3.46 – 4.25, - disagree

1.86 – 2.65, - agree, 4.26 – 5.00, - strongly disagree

In general the overall mean for user attitude was established as 3.49, which shows a high level of uncertainty on ICT use in class, implying complexity perceptions as a challenge in usage. A disagreement on fear of job loss and manual teaching to electronic mode preference while electronic delivery is not effectively and adequately used is an indication of other intervening barriers. This result's implies that usage of e-tools is unclear and patchy as respondents were not certain on ICT integration needs and benefits. On average the respondent disagreed that "use of ICT in class was not too complex" indicating that they perceived ICT use in class as complex, an attitude that may slow it pace of adoption in classroom as an instructional tool.

4.3.4.2 Comparison of the User Attitude in both Public and Private Schools

The study sought to compare the user attitude to asses if there was any significant difference in private and public schools. To achieve this, a null hypothesis was formulated which stated that:

$\mathbf{H_0}$. *there is no significant difference in user attitude between public and private schools in Thika district* with the alternate hypothesis stating that:

H_1 . *there is a significant difference in user attitude between public and private schools in Thika district.*

Analysis of Variance (ANOVA) test in Table A appendix V shows that there was no significant difference, where mean for public was **3.53** and that for private was **3.44** both indicating uncertainty hence the acceptance of the null hypothesis.

This implies that there is no significant difference between teachers' attitude in public and private schools towards ICT integration in class as an instructional tool.

The assumptions of the test were that the data was collected from a normally distributed population and that the variances were equal. Similarly an ANOVA Test between respondent groups in Table C appendix V gave a non-significant F-statistic of 0.220 at $p>0.5$, implying the negative attitude on ICT usage cuts across all schools and teacher levels and is not dependent on nature of school or on the title or level of the user. This shows that administrators, ICT heads of departments and teachers in both public and private schools in Kenya have similar perception of complexity towards ICT integration in classroom.

4.4 Competency in Information Technology

The third objective of the study sought to assess how the existing competency in Information Technology affects the ICT adoption for educational related activities in secondary schools in Kenya through a survey of Thika district. The attribute used to assess competency and its effects included: access to literacy courses by both staff and students, ease of use of computer aided applications, reliability of computers for information repository; exchange and retrieval, relevance of internet materials to school curriculum, use of internet enabled communication and personnel size with requisite skills in a school. Following is the discussion of the findings.

4.4.1 ICT Literacy Training for Teachers

The study shows that most of the schools did not have ICT-literacy training for teachers as accounted by opinions of 51.9% and 68.8% IT teachers in public and private school, 77.8% and 80.0% administrators in public and private as well as 82.4% and 71.4% of ICT departmental heads. According to administrators only 22.2% and 20.0% of teachers in public and private schools may be having access to ICT literacy training courses. This is a strong indicator of low levels of IT competency in schools, leading to absence of ICT driven instructions in classes and widening digital divide between the developed and developing economies, which may slow full realization of information society in the country and Vision 2030. The findings are presented in Table 4.14.

Table 4.14: ICT Literacy Training for Teachers

Respondent / Nature of the school n = 86		Availability of ICT Literacy Training for Teachers		
		Yes	No	Total
IT Teacher	Public	48.1%	51.9%	100.0%
	Private	31.3%	68.8%	100.0%
	Total	41.9%	58.1%	100.0%
Administrator	Public	22.2%	77.8%	100.0%
	Private	20.0%	80.0%	100.0%
	Total	21.1%	78.9%	100.0%
HOD ICT	Public	17.6%	82.4%	100.0%
	Private	28.6%	71.4%	100.0%
	Total	20.8%	79.2%	100.0%

This shows a trend of having no ICT literacy training for teachers in secondary schools implying that teachers continue to hold on their existing beliefs on content matter and delivery methods acquired during their formal training, where learning was text book centred and teachers as transmitters of knowledge through chalkboard, discussion, lecture, and/or listening to radio transmitted programmes. The current trend involves teachers as facilitators of learning through interactive white boards, computer aided

lessons, overhead projectors and internet enabled content. Educational change depends significantly on what teachers do and think, hence the need to be retrained on pedagogical use of technology in the classroom if the potential of the new technologies is to be realised in improvement of teaching and learning. Unavailability of the ICT literacy training in schools is a wide barrier for attaining requisite skills and a huge impediment for ICT integration.

4.4.2 Ease of Use of Computer Applications

The respondents rated the ease of use of computer applications in class for content delivery as complex. According to 33.3% of IT teachers, 44.4% administrators and 29.4% heads of departments, the use of computer applications in class for content delivery is very complex. This was further supported by 56.3% IT teachers in private schools who rated it as complex.Very easy and easy responses accounted for 18.5% and 37.0% by IT teachers in public and 6.3% and 37.5% in private respectively, 60% by administrators in private schools rated it easy while 52.9% and 85.7% heads of ICT department in public and private schools rated it usage as easy as shown in Table 4.15.

Table 4.15: Ease of Use of Computer Applications

Respondent / Nature of school n = 86		Ease of use of Computer Applications				
		Very easy	Easy	Complex	very complex	Total
IT Teacher	Public	18.5%	37.0%	11.1%	33.3%	100.0%
	Private	6.3%	37.5%	56.3%	.0%	100.0%
	Total	14.0%	37.2%	27.9%	20.9%	100.0%
Administrator	Public		22.2%	33.3%	44.4%	100.0%
	Private		60.0%	10.0%	30.0%	100.0%
	Total		42.1%	21.1%	36.8%	100.0%
HOD ICT	Public	29.4%	23.5%	17.6%	29.4%	100.0%
	Private	.0%	85.7%	.0%	14.3%	100.0%
	Total	20.8%	41.7%	12.5%	25.0%	100.0%

This shows that on average teachers have varied opinion on perception of ease of computer applications in class for content delivery with neary equal numbers for those who view it as easy as well as those who view it as complex. This could be as a result of low level of knowledge and skills on use of computer applications by those who are not IT literate as compares to trained IT personells. The perceived complexity may delay technology acceptance and in long run affects education outcome which may slow full realization of knowledge economy. The high response rate of complexity in use of computer applications shows lack of use due to poor access and inadequate technical skill readiness.

4.4.3 Adequacy of Computer Literacy Course for Students

The findings show that most of the respondents in both public and private schools rated the adequacy of computer literacy course for students in supporting their learning activities as adequate as accounted by 55.5% and 62.5% of IT teachers in public and private schools, very adequate and adequate combined response. In support of adequacy is 22.2% and 60% of public / private schools administrators with 53.0% and 42.9% of departmental heads in public and private rated it adequate. However, according to 55.6% and 40.0% administrators in public and private schools and 57.1% heads of ICT department the computer literacy course for students is inadequate as in Table 4.16.

Table 4.16: Adequacy of Computer literacy course for students

Respondent / Nature of school n = 86		Adequacy of Computer literacy course for students					
		Very adequate	Adequate	Inadequate	Very inadequate	Not applicable	Total
IT Teacher	Public	33.3%	22.2%	22.2%	14.8%	7.4%	100.0%
	Private	12.5%	50.0%	25.0%	.0%	12.5%	100.0%
	Total	25.6%	32.6%	23.3%	9.3%	9.3%	100.0%
Administrator	Public	.0%	22.2%	55.6%		22.2%	100.0%
	Private	10.0%	50.0%	40.0%		.0%	100.0%
	Total	5.3%	36.8%	47.4%		10.5%	100.0%
HOD ICT	Public	5.9%	47.1%	23.5%	5.9%	17.6%	100.0%
	Private	14.3%	28.6%	57.1%	.0%	.0%	100.0%
	Total	8.3%	41.7%	33.3%	4.2%	12.5%	100.0%

This shows that both public and private schools were experiencing similar challenges on literacy courses for students and that different schools have varied efforts and perceptions towards this courses. Computer literacy for students to support their learning activities in schools may be adequate to a few schools and also inadequate to others while still some are far from embracing the technology, thus the real benefit is far from being realized.

4.4.4 Satisfaction with the School's Policy on Computer Literacy for Students

The findings show that most of the respondents in both public and private schools were satisfied with the school's policy on computer literacy for students in support of educational activities as accounted by 59.1% and 60.5% IT teachers, 66.6% and 70.0% administrators, as well as 58.8% and 42.9% heads of ICT departments, in public and private schools respectively as shown in Table 4.17.

Table 4.17: Satisfaction with the School's policy on computer use for students

Respondent / Nature of school		Satisfaction with the School's policy on computer use for students					
		Very satisfactory	Satisfactory	Un satisfactory	Very unsatisfactory	Not sure	Total
IT Teacher n= 43	Public	11.1%	48.1%	25.9%	3.7%	11.1%	100.0%
	Private	18.8%	43.8%	18.8%	.0%	18.8%	100.0%
	Total	14.0%	46.5%	23.3%	2.3%	14.0%	100.0%
Administrator n =19	Public	22.2%	44.4%	22.2%	11.1%		100.0%
	Private	30.0%	40.0%	20.0%	10.0%		100.0%
	Total	26.3%	42.1%	21.1%	10.5%		100.0%
HOD ICT n = 24	Public	17.6%	41.2%	17.6%	5.9%	17.6%	100.0%
	Private	42.9%	.0%	28.6%	.0%	28.6%	100.0%
	Total	25.0%	29.2%	20.8%	4.2%	20.8%	100.0%

The Schools shows a trend of having a satisfactory Policy on Computer usage towards enhancing computer literacy for students learning activities in the schools. On average both public and private schools have available ICT policy statements on student literacy course. The question is whether the policy is operational since other observable indicators point out a very low level of ICT usage and only one subject is taught via ICT aided devices in most of secondary schools. However, 30.0% on average across the groups view the policy as unsatisfactory or lopsided due to absence of integration inclusion of other disciplines, and a further 25% were not aware of any available policy guidelines. This shows that there is absence of a proper working ICT policy in schools and is a major drawback towards bridging the digital divide in secondary schools.

4.4.5 Computer-Aided Educational Activities

The respondents stated the educational activities that were computer aided in their school. The findings show that the computer aided activities in most schools included; Time tabling (52.3%), examination result (89.5%), teachers and students information (68.6%) and production of examination (97.7%). These are shown in Table 4.18.

Table 4.18: Computer-Aided Educational Activities

Computer-aided educational activities	Yes	No
	%	%
Production of examination	97.7%	2.3%
Examination result	89.5%	10.5%
Teachers and students information	68.6%	31.4%
Time tabling	52.3%	47.7%

This shows that the main educational activities which are Computer-aided include; Production of examination, Examination result analysis and Teachers and students information storage. This shows a great change from convectional storage mechanism of filling and manual processes of all educational activities, though an indicator of computer use in offices and not in classroom.

Use of database management systems, EMIS management software has not only improved school management capability but it has also hastened production of vital documents like students termly report forms, news letter's, budget statements and has enhanced their quality. Those who have positively embraced the new technology are already experiencing the global benefits of seamless communication, time saving, elimination of duplication of efforts and reduction of data redundancy. The most current trend is application of ICT's as pedagogical tools in class to leverage teaching and learning process. Absence of observable electronic aided class activities is a major drawback to ICT integration and makes the country to lag behind on real diffusion of computers for instruction in secondary schools.

4.4.6 Reliability of Computers for Information Storage and Retrieval

The findings showed that most respondents rated the reliability of computers as reliable as accounted by 62.8% IT teachers, 52.6% administrators and 62.5 ICT heads and their very reliable responses were; 34.9%, 31.6% and 29.2% respectively as shown in Figure 4.2.

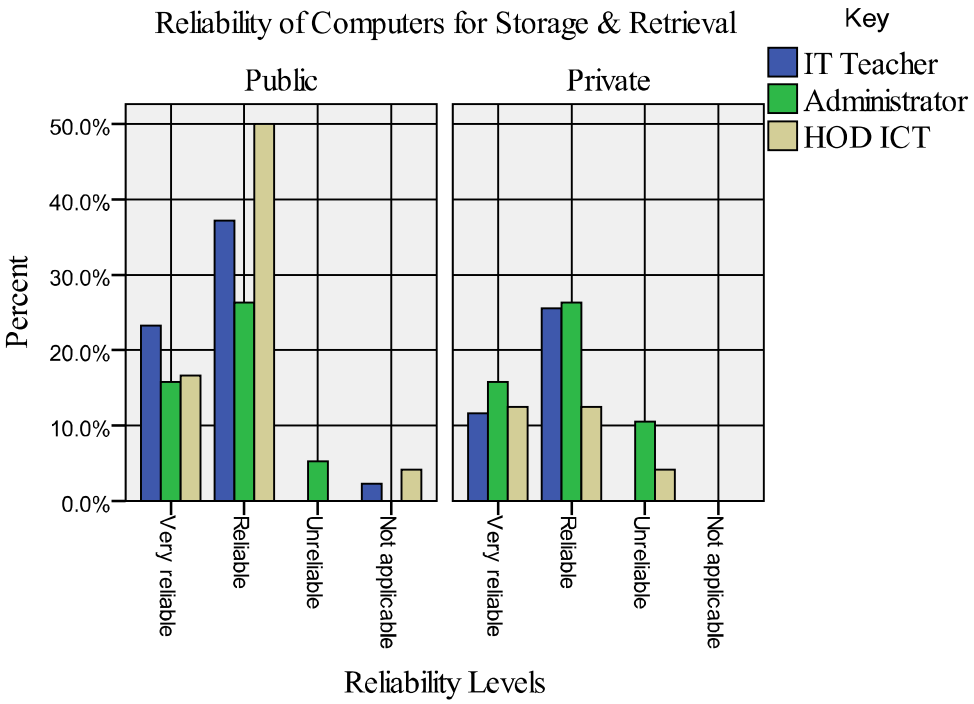

Figure 4.2: Reliability of Computers for Information Storage and Retrieval

This shows that the computers are very reliable in storage and retrieval of educational information and examination preparation in the secondary schools. Reliability findings is a strong indicator of the innovations relative advantage over the convectional tools, and shows its compatibility among learning processes ranging from way of communication, pedagogy tools and materials. Though there is high level of reliability of ICT's in use in our social systems, the real diffusion is far from being attained due to perceived barriers of complexity, costs and low literacy levels.

4.4.7 Relevance of Internet Materials to School Curriculum

The findings shows that majority of the respondents rated the relevance of internet educational materials such as online tutorials and references in regards to lesson preparation and instruction in the school as very relevant as accounted by 60.5% IT teachers, 73.7% administrators and 54.2% ICT heads. This is shown in Figure 4.3. Though one participants revealed that old teachers are against use of internet because students can access pornography from it.

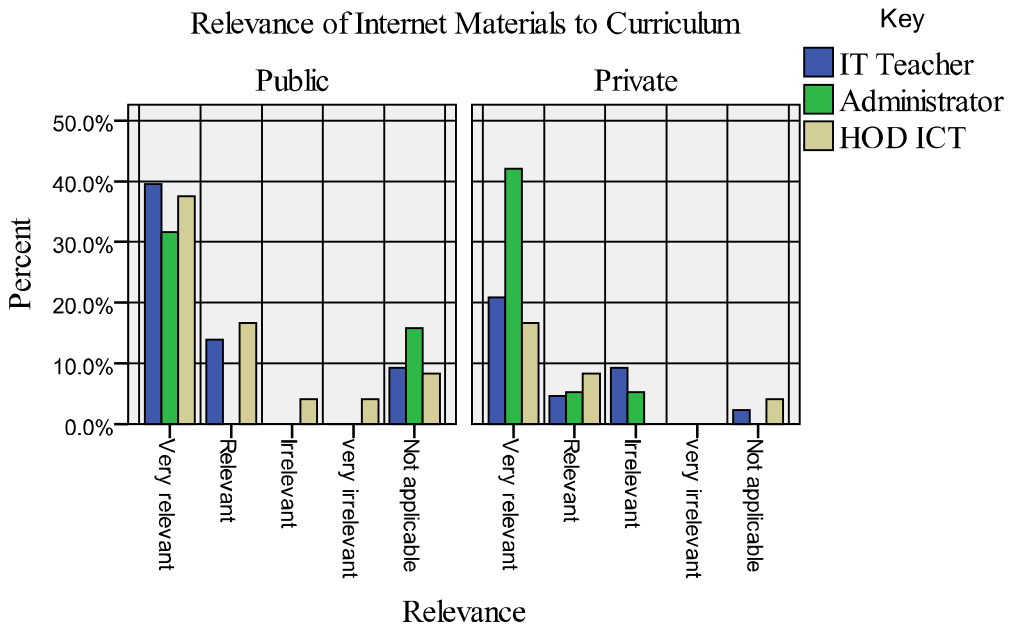

Figure 4.3: Relevance of Internet Materials to School Curriculum

Internet resources have been highly rated as very relevant to curriculum by teachers in both public and private secondary schools. Schools that have embraced internet technology are not only enhancing staff capacity and morale but also opening up the institution to global trends in education and human development. However less than 20.0% of respondent could not be able to rate relevance of the internet material indicating lack of it utilization. This emphasizes the importance of internet to school curriculum in that it enriches content and makes learners more enthusiastic during learning process.

4.4.8 Appropriateness of use of e-mail as a means of communication to Schools

The findings show that the use of e-mail in both public and private schools were not widely used as a means of communication for educational purposes in many schools according to 44.4% and 37.2% of IT teachers in public and private schools respective response that schools had no e-mail system. This was further confirmed by 44.4% and 30.0% administrators, 35.3% and 57.1% heads of departments in public and private schools respectively. The private schools viewed use of e-mail as an appropriate means of communication as supported by 60.0% of administrators, 62.6% IT teachers, and 28.6% rating of heads of departments from private schools. In public schools only 33.3% of teachers, 41.1% departmental heads and 33.3% administrators rated e-mail as appropriate means of communication while others rated it as none-appropriate system. The findings are shown in Table 4.19.

Table 4.19: Appropriateness of email as a means of communication

Respondent / Nature of school n = 86		Appropriateness of email as a means of communication					
		Very appropriate	Appropriate	In appropriate	Very in appropriate	Not applicable	Total
IT Teacher	Public	11.1%	22.2%	22.2%	3.7%	40.7%	100.0%
	Private	31.3%	31.3%	12.5%	.0%	25.0%	100.0%
	Total	18.6%	25.6%	18.6%	2.3%	34.9%	100.0%
Administrator	Public	11.1%	22.2%	22.2%		44.4%	100.0%
	Private	20.0%	40.0%	10.0%		30.0%	100.0%
	Total	15.8%	31.6%	15.8%		36.8%	100.0%
HOD ICT	Public	23.5%	17.6%	23.5%	5.9%	29.4%	100.0%
	Private	14.3%	14.3%	14.3%	.0%	57.1%	100.0%
	Total	20.8%	16.7%	20.8%	4.2%	37.5%	100.0%

Electronic mails are used on average by both public and private schools which have access to internet resources. The respondent rated email communication as very appropriate and appropriate depending on infrastructure capacity and availability while

schools with no or low connectivity rated email use as not applicable and inappropriate respectively. However, email is not a frequently used means of communication in support of curriculum for content sharing and corporate work due to gaps in connectivity in both public and private schools. This further shows low levels of internet connectivity and use as a means of leveraging educational related activities in secondary schools.

4.4.9 Qualified IT Personnel in the School

Most public and private schools had only one qualified information technology personnels/computer teachers according to majority of the responses; 55.6% and 62.5% by IT teachers in public and private, 33.3% and 60.0% administrators in public and private, and 41.2% and 71.4% of departmental heads in public and private secondary schools respectively. The findings are presented in Table 4.20.

Table 4.20: Qualified IT Personnel in the school

Respondent / Nature of school n = 86		Qualified IT Personnel in the school				
		1	2	3	4	Total
IT Teacher	Public	55.6%	25.9%	3.7%	14.8%	100.0%
	Private	62.5%	18.8%	18.8%	.0%	100.0%
Total		58.1%	23.3%	9.3%	9.3%	100.0%
Administrator	Public	33.3%	33.3%	.0%	33.3%	100.0%
	Private	60.0%	10.0%	20.0%	10.0%	100.0%
Total		47.4%	21.1%	10.5%	21.1%	100.0%
HOD ICT	Public	41.2%	29.4%	29.4%	.0%	100.0%
	Private	71.4%	14.3%	.0%	14.3%	100.0%
Total		50.0%	25.0%	20.8%	4.2%	100.0%

This shows a trend in secondary schools of one IT personel in every school with a few schools having two and is replicated in both public and private schools. Which implies a challenge in requisite ICT integration skills and low IT teacher, pupil ratio indicating inadequancy human capital in learning institutions leading to low levels of IT competencies in both public and private secondary schools. The government has faced challenges of teacher shortage of over 60,000 for a decade and with increasing enrolment

in schools due to free primary education the teacher pupil ratio continues to dwindle. However a few schools had two or more IT teachers as supported by an average of 30.0% responses, indicating that ICT usage and adoption levels is not uniform in all secondary schools.

4.5 Technological Infrastructure

The fourth objective of the study sought to establish how the existing technological infrastructure affects the adoption of ICT for educational related activities in secondary schools in Kenya through a survey in Thika district. To establish the effects of infrastructure on adoption, the researcher dealt with general infrastructure overview, placement mechanisms, internet connectivity and electric power reliability aspects. The findings are discussed in the sections that follow.

4.5.1 Reliability of Electrical Power Source

The findings show that the electrical power source for educational support in the schools was reliable as accounted by (reliable and very reliable) cumulative responses of 97.7% IT teachers, 100% administrators and 87.5% ICT heads as shown in Figure 4.4. This shows that the electrical power source is not a challenge to the adoption and implementation of ICT in secondary schools. However a school was observed to have all the basic ICT equipment but could not use due to electrical power blackout as a result of disconnection whose reason was not pursued by the researcher.

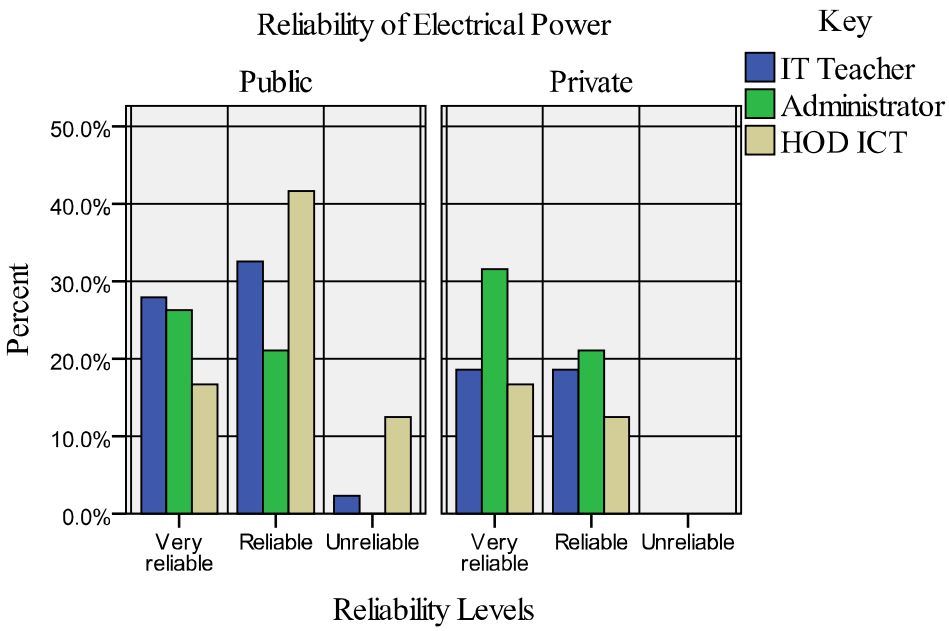

Figure 4.4: Reliability of Electrical Power Source

The trend on Electrical power reliability shows that on average there is reliable electricity connectivity in both public and private secondary schools.

This implies that there is a good foundation onto which ICT diffusion can be set in most of schools since power is a key prerequisite for ICT adoption and implementation.

4.5.2 Speed of Internet Connectivity

The findings in Table 4.21 show that most of the schools (both public and private) did not have any internet connection as accounted by 48.1% and 25.0% IT teachers in public and private schools respectively. Lack of internet connectivity is further supported by 55.6% and 50.0% of administrators, 41.2% and57.1% ICT heads in public and private schools. However, majority of the respondents with the internet rated the speed of internet connectivity as low speed in both public and private schools as accounted by 18.5% and 37.5% IT teachers in public and private respectively.

Table 4.21: Speed of internet connection

Respondent / Nature of school n = 86		Speed of internet connection					Total
		Very high speed	High speed	Low speed	Very low speed	No internet connection	
IT Teacher	Public	.0%	29.6%	18.5%	3.7%	48.1%	100.0%
	Private	12.5%	25.0%	37.5%	.0%	25.0%	100.0%
	Total	4.7%	27.9%	25.6%	2.3%	39.5%	100.0%
Administrator	Public	11.1%	.0%	33.3%		55.6%	100.0%
	Private	.0%	20.0%	30.0%		50.0%	100.0%
	Total	5.3%	10.5%	31.6%		52.6%	100.0%
HOD ICT	Public	5.9%	17.6%	23.5%	11.8%	41.2%	100.0%
	Private	.0%	28.6%	14.3%	.0%	57.1%	100.0%
	Total	4.2%	20.8%	20.8%	8.3%	45.8%	100.0%

The observable trend on average in public and private secondary schools is that there is no internet connectivity for learning activities. Thus there is inadequate internet access in schools which limit usage of computers and emerging technologies in leveraging teaching and learning activities. However the few schools with access to internet experience challenges of connectivity speed as some heads of department in public 23.5% and 14.3% private schools rated the connectivity as low, and were supported by 33.3% and 30.0% administrators in public and private schools. Only 29.6% and 25.0% IT teachers , 11.1% and 20.0% administrators as well as 17.6% and 28.6% departmental heads who rated the connectivity as high. This shows that most schools have low speed internet connections hence hindering access, which limits use of internet enabled learning content and communication, which slows the pace of ICT integration in secondary schools.

4.5.3 Criteria for Placing ICT Infrastructure in Schools

The respondent were asked to rate the criteria used when placing ICT infrastructure for educational activities in the secondary school in the target region. Through multiple response analysis, the study established that the main criteria followed were the school

management support and electricity supply availability as accounted by 79.3% and 69.5% respectively. Availability of ICT literate teachers and adequate security accounted for 67.1% and 65.9% respectively as shown in Table 4.22. This shows that placement of the ICT infrastructure in the schools was manly dependent on the school management support and availability of electricity supply. This was confirmed where one school was observed to have stored computers in the store due to absence of a ICT skilled personnel.

Table 4.22: Criteria for Placing ICT Infrastructure in Schools

Criteria for Placing ICT Infrastructure in Schools	**Frequency**	**Percentages %**
School management support	65	79.3%
Electricity supply availability	57	69.5%
ICT literate teachers	55	67.1%
Adequate security	54	65.9%

4.5.4 Factor Analysis on ICT Technological Infrastructure

To assess the key aspects that were significant in relation to ICT Technological Infrastructure, principal component Factor analysis with varimax rotation was conducted. Below is a presentation of factor variable reduction, ANOVA test, and the discussion of all the variables used in assessing the effects of existing ICT technological infrastructure.

4.5.4.1 Factor Variable Reduction

Two components out of the 6 items were extracted with eigenvalues greater than 1.00, and their KMO test was significant as summarized in appendix II and III table C respectively. The rotation component matrix findings as in appendix IV table D show that the loading factors for the 3 variables namely; Poor state of ICT interconnectivity, low connectivity speed and low Internet access were rated as very important hence significant since their loading factors as the first component were greater than 0.5, hence they were

combined to form one compound factor "connectivity" whose mean and items are listed in Table 4.23, and shows that there is inadequate connectivity in secondary schools resulting to slow pace of ICT adoption.

Table 4.23: Connectivity and policy Items

Connectivity Items that shows inadequacy of ICT infrastructure with a factor mean of **2.51**
• Poor state of ICT interconnectivity • Low connectivity speed • Low Internet access
Items for Policy that shows absence of a clear guidelines on ICT integration in secondary schools with factor mean of 2.27.
• Lack of reliable educational support software • Absence of policy Guidelines regarding ICT • Lack of appropriate electronic educational contents

KEY: 1.00 – 1.85, - strongly agree, 2.66 – 3.45, - neutral, 3.46 – 4.25, - disagree,
1.86 – 2.65, - agree, 4.26 – 5.00, - strongly disagree

An overall mean of connectivity was established to be 2.51, which implies that on average respondent agreed that internet connectivity is a major challenge in schools though a key infrastructure component and that it inadequacy is a major drawback to the pace of ICT adoption.

On the other hand, the loading factors for; Lack of reliable educational support software, Absence of policy Guidelines regarding ICT and lack of appropriate electronic educational contents was found to be above the 0.5 threshold for second component, hence they were compounded to form one factor "policy', whose mean and items are listed in Table 4.23, showing that there is absence of a clear policy guidelines to schools on ICT integration.

This shows a significant agreement, that there is absence of policy guidelines in schools which is contributing immensely to the slow pace of ICT adoption. The overall mean for the policy component 2.27, imply that all the respondent were in agreement that policy

issues regarding support software, and electronic educational content and it operationalisation is affecting the ICT diffusion negatively and delaying ICT usage as a tool for instruction. This means that; technological infrastructure involving both connectivity and policy is among the most important aspects of ICT that affect the pace of it adoption for educational purposes in secondary schools in Kenya.

4.5.4.2 Comparison of Connectivity and Policy in both Public and Private Schools

The study sought to compare the connectivity as well as policy to asses if there was any significant difference in private and public schools. To achieve this, a null hypothesis was formulated which stated that there is no significant difference in connectivity and policy issues between public and private schools in Thika district with the alternate hypothesis stating that there is a significant difference in connectivity and policy issues between public and private schools in Thika district. Analysis of Variance (ANOVA) test in Table B appendix V showed that there was no significant difference, with mean of connectivity being **2.47** (agree) for public and **2.56** (not sure) for private, while policy mean was **2.16** (agree) for public and **2.45** (agree) for private.

The findings show a non-significant F–statistic hence the acceptance of the null hypothesis. This implies that the absence of policy guidelines on ICT technological infrastructure issues regarding internet connectivity, support software and electronic content are affecting both public and private secondary schools equally. Similarly an ANOVA Test for connectivity and policy between respondents groups in Table D appendix V resulted to a non-significant F-statistics; with connectivity F of 0.012 at $p>0.05$ and policy F of 0.705 at $p>0.05$. This indicate that there is no difference of opinion regarding connectivity and policy issues by IT teachers, administrators or heads of ICT departments, implying that the overall factors contributing to slow rate of ICT adoption apply to both private and public secondary schools in Kenya.

4.6 ICT Adoption in Secondary Schools

The study established that the pace of ICT adoption variable is slow, as supported by 62.9% and 56.3% IT teachers, 88.9% and 60.0% administrators as well as 76.5% and 42.9% heads of ICT departments cumulative of slow and very slow responses in public and private schools as shown in Figure 4.5.

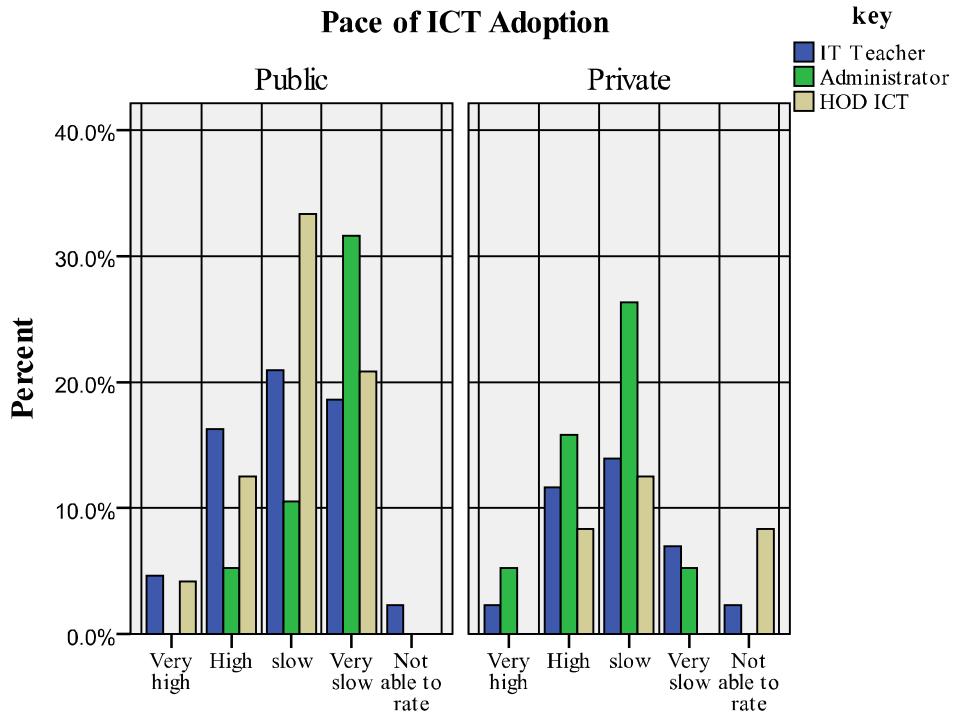

Figure 4.5: Pace of ICT Adoption for Educational Support

There is slow pace trend in secondary schools on ICT adoption as high and very high cumulative responses for all respondent groups were quite low with 33.3% and 37.6% IT teachers, 11.1% and 40.0% administrators as well as 23.5% and 28.6% ICT heads in public and private schools respectively. This shows that the ICT integration rate is quite low in secondary schools and is supported further by a low ratio for IT teachers to students of 1:300 with most of schools having one IT teacher at 55.6% and 62.5% in

public and private schools respectively. computer to student ratio was low with most of schools having only one computer laboratory with twenty (20) computers, and offering only one subject via ICT driven practices. In terms of internet connectivity; 55.6% public and 57.1% private schools had no internet access implying that they had no e-mail access/use for educational purposes in schools. More over, 39.6% public and 39.4% private schools had neither ICT policy framework nor basic guidelines on ICT implementation, a condition that leave schools with too little awareness on ICT opportunities, potential and it operationalization mechanisms.

4.6.1 Pace of ICT adoption and Gender of respodents

There were 65.1% of slow and very slow rating of respondents combined, implying that most of teachers viewed rate of ICT uptake as slow. Respodents below age of 20 years formed 2.3 % of total sample of which 50 % rated ICT uptake as high and the remaining 50% rating it as very slow as shown in Table 4.24.

Table 4.24: pace of adoption and Age category of respondents

		Pace of ICT Adoption for educational Support					
		Very high	High	Slow	Very slow	Not able to rate	Total
Age category	below 20 years	.0%	50.0%	.0%	50.0%	.0%	100.0%
	20-29years	7.4%	37.0%	37.0%	11.1%	7.4%	100.0%
	30-39 years	.0%	16.7%	37.5%	41.7%	4.2%	100.0%
	40-50 years	9.4%	18.8%	40.6%	28.1%	3.1%	100.0%
	above 50 years	.0%	.0%	100.0%	.0%	.0%	100.0%
Total		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

The results shows that most of teachers were between age of 20 years and 50 years, with 44. 4 % of 20 – 29 years rating ICT adoption as very high and high respectively. On

average teachers within age 30 to 50 % rated pace of adoption as slow and very slow respectively. There was only respondent above 50 years who rated pace as slow.

4.6.2 The Pace of ICT adoption and Gender of the Respondents

The Table 4.26 show distribution of various responses with male dominating at 75.6% of which 7.7% rated pace as very high, while26.2, 41.5 and 21.5% rated it as high, slow and very slow as shown in the Figure 4.25.

Table 4.25 Pace of ICT adoption and Gender of Respondents

		Pace of ICT Adoption for educational Support					
		Very high	High	Slow	Very slow	Not able to rate	Total
Gender	Male	7.7%	26.2%	41.5%	21.5%	3.1%	100.0%
		5.8%	19.8%	31.4%	16.3%	2.3%	75.6%
	Female	.0%	19.0%	28.6%	42.9%	9.5%	100.0%
		.0%	4.7%	7.0%	10.5%	2.3%	24.4%

This shows disparity in the teacher involvement in ICT basic operations with only 24.4% of teachers being female and of which 17.5% rated pace of adoption as slow or very slow.

6.6.3 Pace of ICT adoption and Respondents Level of Education

Table 4.26 Pace of ICT adoption and Respondents Level of Education

		Pace of ICT Adoption for educational Support					
		Very high	High	slow	Very slow	Not able to rate	Total
highest level of Education	secondary level	.0%	100.0%	.0%	.0%	.0%	100.0%
		.0%	1.2%	.0%	.0%	.0%	1.2%
	Certificate level	.0%	.0%	.0%	100.0%	.0%	100.0%
		.0%	.0%	.0%	1.2%	.0%	1.2%
	Diploma	17.6%	29.4%	41.2%	5.9%	5.9%	100.0%
		3.5%	5.8%	8.1%	1.2%	1.2%	19.8%
	Undergraduate	3.8%	24.5%	35.8%	30.2%	5.7%	100.0%
		2.3%	15.1%	22.1%	18.6%	3.5%	61.6%
	Postgraduate	.0%	14.3%	50.0%	35.7%	.0%	100.0%
		.0%	2.3%	8.1%	5.8%	.0%	16.3%

The findings in Table 4.26 shows that majority of teachers had undergraduate level of education at 61.6% of which 22.1% rated ICT adoption as slow and supported by 18.6% of very slow. Out of 16.3 teachers with postgraduate education 8.1% rated pace as slow and 5.8 rated it as very slow, Implying that technology is yet to be fully realized in schools for teaching and learning experiences.

4.6.4 PACE OF ICT ADOPTION AND NATURE OF SCOOLS RELATIONSHIP.

This section seeks to establish the relationship between the dependent and independent variable in private and public schools. To establish this, the null and alternate hypothesis was formulated and a correlation analysis for public, private and combined public and private schools performed whereby the correlation coefficient was computed. George and Mallery, (2003) explains that correlation coefficient ranges from -1 to +1. The sign of the correlation coefficient indicates the direction of the relationship (positive or negative). The absolute value of the correlation coefficient indicates the strength, with larger absolute values indicating stronger relationships. If the significance level (P-value) is very small (less than 0.05) then the correlation is significant and the two variables are linearly related. If the significance level is relatively large (greater than 0.05) then the correlation is not significant and the two variables are not linearly related. Even if the correlation between two variables is not significant the variables may be correlated but the relationship is not linear.

4.6.4.1 Correlations for Public Schools Only

The study sought to establish the nature of the correlation between the pace of ICT adoption and independent variables for public schools only. To achieve this a null hypothesis was formulated which stated that:

H_0 - *there is a significant positive correlation between the pace of ICT adoption and independent variables for public schools* with alternate hypothesis stating that:

H_1 - *there is no significant positive correlation between pace of ICT adoption and independent variables for public schools.*

Pearson Correlation test was performed whereby the correlation coefficient was computed and interpreted with respect to the hypothesis. The findings in Table 4.27 show a positive Pearson correlation regarding ICT cost, connectivity, and IT Literacy.

Table 4.27: Correlation For public schools only

		ICT Adoption Pace	Deductions
ICT Cost	Pearson Correlation	.062	
	Sig. (2-tailed)	.660	Positive correlation
	N	53	
User Attitude	Pearson Correlation	-.033	
	Sig. (2-tailed)	.817	Negative correlation
	N	53	
IT Literacy	Pearson Correlation	.341*	
	Sig. (2-tailed)	.012	Positive correlation
	N	53	
Connectivity	Pearson Correlation	.362**	
	Sig. (2-tailed)	.008	Positive correlation
	N	53	
Policy	Pearson Correlation	-.388**	
	Sig. (2-tailed)	.004	Negative correlation
	N	53	

This implies that there is significant and a positive linear correlation between pace of ICT adoption and two independent variables; IT literacy and connectivity for public schools, thus leading to acceptance of null hypothesis for IT literacy and connectivity. However, the positive correlation for ICT cost is not significant.

In addition, the findings show a significant and a fairly strong negative linear correlation between pace of ICT adoption and policy, leading to acceptance of null hypothesis implying that absence of ICT policy hinders appropriate diffusion pace. The negative correlation of user attitude was not significant. Though the two shows inverse relations implying that teacher's attitude and absence of ICT policy was negatively affecting ICT adoption in public schools.

4.6.4.2 Correlations for Private Schools Only

The study sought to establish the nature of the correlation between the pace of ICT adoption and independent variables for private schools only. To achieve this a null hypothesis was formulated which stated that there is a significant linear correlation between the pace of ICT adoption and independent variables for private schools with alternate hypothesis stating that there is no significant linear correlation between pace of ICT adoption and independent variables for private schools. Pearson Correlation coefficient was computed and the findings presented in Table 4.28.

Table 4.28: Correlations for private schools only

		ICT Adoption Pace	Deductions
ICT Cost	Pearson Correlation	-.460**	
	Sig. (2-tailed)	.007	Negative correlation
	N	33	
User Attitude	Pearson Correlation	-.371*	
	Sig. (2-tailed)	.033	Negative correlation
	N	33	
IT Literacy	Pearson Correlation	.608**	
	Sig. (2-tailed)	.000	Positive correlation
	N	33	
Connectivity	Pearson Correlation	-.258	
	Sig. (2-tailed)	.147	Negative correlation
	N	33	
Policy	Pearson Correlation	-.345*	
	Sig. (2-tailed)	.049	Negative correlation
	N	33	

The study shows a significant and a strong positive correlation between pace of ICT adoption and IT literacy for private schools, hence accepting it null hypothesis implying that high levels of IT literacy increases the rate of ICT adoption. This implies that IT literacy had a positive linear correlation with the adoption of ICT in private schools. In addition, there is a significant and fairly strong negative correlation between ICT

adoption and ICT cost, User attitude, and policy for private schools, leading to acceptance of their null hypothesis indicating that they influences ICT adoption negatively. A non significant negative correlation between pace of ICT adoption and connectivity in private schools was established. This shows inverse relationships which mean that high cost of funding ICT programmes, negative user attitude and absence of ICT policy were negatively affecting ICT adoption in private schools.

4.6.4.3 Correlations for both Public and Private Schools Combined

The study sought to establish the nature of the correlation between the pace of ICT adoption and independent variables for both public and private schools. To achieve this a null hypothesis was formulated which stated that

H_0 - *there is a significant linear correlation between the pace of ICT adoption and independent variables in secondary schools* with alternate hypothesis stating that

H_1 - *there is no significant linear correlation between pace of ICT adoption and independent variable in secondary schools.*

Pearson Correlation test was performed whereby the correlation coefficient was computed. The findings shows that there is a significant and a strong positive correlation between pace of ICT adoption and IT literacy for all secondary schools, hence accepting the null hypothesis implying that high levels of IT literacy increases rate of ICT adoption in secondary schools. The findings were as shown in Table 4.30.

Table 4.29: Overall Correlation for Secondary Schools

		Pace of ICT Adoption for educational Support	Deductions
ICT cost	Pearson Correlation	-.142	
	Sig. (2-tailed)	.193	Negative correlation
	N	86	
User Attitude	Pearson Correlation	-.249*	
	Sig. (2-tailed)	.021	Negative correlation
	N	86	
Connectivity	Pearson Correlation	-.086	Negative correlation
	Sig. (2-tailed)	.430	
	N	86	
Policy	Pearson Correlation	-.326**	
	Sig. (2-tailed)	.002	Negative correlation
	N	86	
IT Literacy	Pearson Correlation	.516**	
	Sig. (2-tailed)	.000	Positive correlation
	N	86	

The findings also show a significant and a negative correlation between pace of ICT adoption and user attitude and policy, leading to acceptance of the null hypothesis implying that negative user attitude and absence of policy influences the ICT adoption negatively indicating that the two have a significant linear relationship. The ICT cost and connectivity aspect had a non-significant negative correlation with pace of ICT adoption. However, the near average values for the Pearson Correlation statistics indicate that the association between the variables is fairly strong, and that low IT literacy levels and absence of ICT policy are major components of ICT adoption that are contributing to its low diffusion rate in secondary schools in Kenya.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This study aimed at establishing the factors that affect ICT adoption for educational support activities in secondary schools in Kenya. Four specific objectives and corresponding research questions were used to guide the study. Both empirical and theoretical literature was reviewed and a conceptual framework developed. A research methodology was designed, primary data collected, analyzed and findings presented. This chapter is organized in the following sub-sections; Introduction, summary of the findings, conclusions, recommendations and suggestions for further research.

5.1 Summary of the Findings

The position taken by Information and Communication Technology (ICT) in education sector is critical for enhancing teaching and learning. ICT has seamless potential to integrate; political, economic and social aspects of developing economies thus demolishing the barriers created by time and distance. However despite recognition of it role by government through national ICT policy, e-government and ICT for education strategies in improving effectiveness and efficiency in service delivery, its adoption in secondary schools has taken a snail's pace. This study assessed the factors affecting the adoption of ICT for education support activities in secondary schools in Kenya through a survey of Thika District.

The study was conducted in public national, provincial, district and private secondary schools in Thika district. Questionnaires were distributed to 19 public and 7 private secondary schools to collect primary data. The data was analyzed using Statistical Package for Social Sciences (SPSS) whereby Descriptive Statistics such as frequency

distributions, percentages, means and standard deviations as well as inferential statistics such as Pearson Correlation and ANOVA tests were utilized.

There is high student to IT teacher ratio, with one IT personnel against entire school population including other teachers in need of basic skills; high student to computer ratio, with most of schools having only one computer laboratory containing 20 computers against a population of between 400 to 600 students. However the schools with this facilities, very few have internet access and utilize less than 40% of available infrastructure due to lack of connectivity and requisite human capital.

The findings show a significant and a fairly strong positive linear correlation between pace of ICT adoption with: IT literacy, connectivity and policy for public schools. For private schools, there was a significant and a strong positive linear correlation between the pace of ICT adoption and IT literacy, while there was a significant and a fairly strong negative linear correlation between pace of ICT adoption and ICT cost; user attitude and policy and none significant negative correlation between adoption and connectivity. Additionally the study established that there is a similarity between the constraints hindering the adoption in both public and private secondary schools. The aspects used to assess the pace of ICT adoption are summarized below.

5.1.1 Initial Cost of ICT Installation and Running

The findings show lack of sufficient funds for ICT driven activities in secondary schools in Kenya. There are few resources that are directed towards ICT enabled programmes with less than half of the schools in both public and private showing some sufficiency of funds to implement ICT to support education activities. However, the high cost of funding ICT programmes is immensely slowing the rate of its integration in learning

institutions. Through multiple response analysis, the study established that the main source of funds for installation and running ICT projects in schools is School fees paid by parents, therefore there is a great need to adequately address the importance of ICT uptake to parent so as to enhance their support. In addition, the significant and a fairly strong negative correlation between ICT cost and pace of ICT adoption for private schools imply that there is strong agreement that the pace of ICT adoption is very slow as a result of insufficient resources while the none significant positive correlation for public schools is an indicator of unclear growth and low usage of the new technology in secondary schools which may be attributed to inadequate access due to high cost implications.

The public / private schools ANOVA test shows a significant F statistic for ICT cost, implying that financial constraints experienced when initiating ICT projects and approaches towards the key cost aspects including; High cost of ICT installation, high cost ICT maintenance, lack of adequate ICT facilities and equipment, high cost of ICT support services, high cost of educational support soft-ware and funds to hire and sustain ICT personnel's are very different among the two categories. This means that high cost of funding ICT related programmes is an immense barrier to universal access, usage and adoption of ICT for educational programmes in secondary schools in Kenya. For all secondary schools to fully embrace ICT the high cost has to be addressed critically by all stake holders and interest groups for realization of a mutual social, economic and political growth that is all inclusive irrespective of social class, gender, religion or race. The government should develop a mechanism of schools ICT Fund subsidy which should be forwarded yearly to all schools specifically for ICT programmes.

5.1.2 Users' Perception

The findings show that on average teachers are not certain about the potential benefits of ICT integration in classroom as pedagogy tool as they acknowledged the use of ICT activities in classroom as too complex to adopt. This implies inadequate psychological preparedness that leads to a somehow disfigured user attitude which slows the rate of new technology acceptance and ICT diffusion in schools. The low number of teachers attending e-workshops/conferences coupled with none attendance from many schools, portrays unclear focus on ICT usage in leveraging education outcomes, implying that the digital divide between developed and developing economies may not narrow in the near future. This may limit and delay access to quality educational services to citizenry. Additionally, on average teachers are less informed on trends taking place on ICT environment, indicating high levels of none usage and access to ICT tools in secondary schools.

There is negative perception on ICT usage as instructional tool for content delivery in classroom, an attitude that can be changed through requisite policy measures.

The findings further show that there is no significant difference in user attitude between public and private schools or among the respondent groups (IT teachers; administrators and ICT heads). The negative linear correlation between pace of ICT adoption and user attitude for both public and private schools is a strong indicator of low pace of ICT integration in schools, which may be attributed to implementation policy gaps where teacher psychological preparedness was not a priority. There is a low level of ICT use in secondary schools, partly due to inadequate psychological preparedness and complexity of use perceptions which need to be adequately addressed to enhance, ease of usage, the technology acceptance and increase access of quality education in the country. This survey proposes that for full acceptance of technology in schools core activities including

instruction, rigorous psychological and technical preparation of teachers should precede other stages of implementation. Development of electronic content should be made hand in hand with teachers electronically rather than confining a pool of expert under a roof, this will not only motivate teachers but will enhance usability and ease usage complexity.

5.1.3 Competency in Information Technology

Thorough knowledge of computing, communication and internet use is an educational ingredient for the 21st century that schools can't just ignore. Despite wide awareness of it high potential, secondary schools are yet to fully embrace ICT in their core educational activities. This has left teachers with no requisite skill on ICT usage in their teaching subject while school managers seem to be silent and slow on the issue, since on average, schools which have embraced some ICT does not have any ICT-literacy related training for teachers. This has not only hindered access to more rich content but has made teachers to view ICT as a complex subject which should be handled just like other subject of the curriculum.

Currently, computers are widely used in schools for office work mainly in examinations processing, analysis and data repository. However, schools which have embraced ICT have adequate literacy course for students, though offered as a subject rather than a tool of learning, putting the policy guidelines on literacy course for student in question. On the other hand use of internet for educational materials such as online tutorials and references in regards to lesson preparation and instruction was very relevant though most of schools are yet to establish a website and an e-mail system which emphasizes the importance of improving internet connectivity in learning institutions. However, the use of e-mail as a means of communication for educational purposes in most schools was not applicable, implying that email is not a frequently used means of communication within the schools. In terms of IT competent personnels in the schools, the findings shows that most of the

schools had only one qualified information technology personnel/computer teacher against the entire school population . This limit use of a very reliable and compatible tool of learning as established by this study, thus disadvatiging the leaner and future human capital who are key for knowledge economy.

The significant positive linear correlation between pace of ICT adoption and IT literacy in secondary schools imply that the higher the levels of IT literacy in secondary schools the more quality and enhanced applications that are used and the higher the rate of ICT adoption in these learning institutions. To promote IT literacy in secondary schools the study proposes that, the schools , governments and civil society should work together in leveraging IT workshops and conferences for teachers through incetives, constant monitoring, and evaluation of implementation mechanisms as well as offering alternate affordable solutions. Retraining of secondary school teachers in IT courses is paramount for the nation to drive the economy from developing to a middle level economy.

5.1.4 Technological Infrastructure

The ICT infrastructure refers to technological foundation of computer, communication, internet, data and a framework that guides users in efficiently satisfying organizational needs Earl (1989). For knowledge economy to grow and be sustained a continuous flow of capable human capital with requisite skills in dynamic IT systems is paramount for both developed and developing economies; contrary, secondary school management and teachers have remained adamant on manual instructional methods. This has been cultivated by inadequate IT infrastructure foundation characterised by insufficient ICT connectivity, low connectivity speed and limited internet access coupled with absence of an enabling policy framework that is characterised by Lack of relevant educational support software and electronic content. Despite many schools being connected to

electrical power, the ICT infrastructure is patchy and underutilized in most secondary schools where most schools did not have any internet connection while those who had internet have very low connectivity speed. This has hampered access to internet resources and use of electronic enabled communication and corroboration in secondary schools. The findings further show that the placement of the ICT infrastructure in the schools was mainly dependent on the school management support and availability of electricity supply, which means that every schools has equal opportunity of laying a basic foundation for ICT infrastructure to support educational programmes centeris paribus.

The significant and a fairly strong positive linear correlation between connectivity and pace of ICT adoption for public schools imply that better connectivity would result to a higher ICT adoption rate, which would enhance access to quality educational services. The significant and a fairly strong negative linear correlation between ICT adoption pace and policy aspect in both public and private schools is a strong indicator that pace of ICT adoption is very slow due to inadequacy or absence of an enabling policy framework in secondary schools. However there is no significant difference in connectivity and policy aspects of infrastructure for both public and private secondary schools in Kenya, meaning that all secondary schools are experiencing great challenges in area of ICT infrastructure. To deal with this challenge; the survey proposes that, the government and parent to partner and ensure all schools have requisite basic ICT infrastructure through setting achievable targets and timelines.

5.1.5 : ICT adoption in secondary schools

The convergence of technologies including computers, telecommunications and internet as not only changed ways of carrying out business and communication but as led to

immense seamless opportunities in social, economic and political pillars of life. Integration of these highly potential technologies in learning institutions and in particular secondary schools is not only important but a necessary requirement for a visionary nation that is keen in achieving a techno-savvy workforce sufficient for knowledge economy creation and sustenance.

This survey established a big lag in use and adoption of these technologies in secondary schools in Kenya, where on average schools which have adopted ICTs use it for support on office processes and not as tool of enhancing learning activities. Further findings show that entirely all schools perceive and handle ICT as a separate discipline and have one computer laboratory containing 20 computers, which are not networked and with only one IT personnel. This implies that secondary schools are on e-readiness level of integration, a level that needs mass training of teachers on basic ICT skills, a goal that remains to be a visionary dream in MOE ICT Strategy for education, coupled with unmet targets in national ICT policy like “the government will provide all secondary schools with affordable internet access by the year 2010” among others.

The ministry of education developed ICT strategy for education to guide integration in education sector and the strategy point that ICT policy for education is embedded in national ICT policy and e-government strategy a condition that has made the policy document and strategy inaccessible to secondary schools. Despite this documents being accessible on-line, very few schools have the requisite infrastructure and human capacity to efficiently inter-twine it content.

National ICT policy recognizes the importance of integration of emerging technologies in education sector through general and hanging statements on electronic learning and infrastructure, for instance the policy statement like, “there is need to encourage the use of IT in schools, colleges, universities and other educational institutions in the country so

as to improve the quality of teaching and learning" lacks the how-to aspect. This calls for the ministry of education to develop a more focused policy since their current strategy contains mainly unclear general and hanging statements just a borrow from the national policy. The education ministry ICT strategy is a bold step in the right direction though it contains a lot of mix-up of objectives for its staff, tertiary, secondary and primary schools thus it is necessary to make adjustments and address every institutional level separately for easier distribution and implementation of identified strategies.

The ICT strategy for education has rich objectives for education sector such as "ICTs adoption and utilization to improve access, quality and equity in delivery of education services through: deployment of ICT equipments to schools and conduct workshops/seminars as well as review the policies" the question here is how is operationalization being undertaken? Since most of the objectives timelines has already passed and very little is happening in learning institutions. This implies that the document is formulated by ministry officials and for their offices and the few with capacity to access the internet, while it use has not been realized.

However as ICT permeates education system, the indicators that are used for assessing adoption pace may vary and thus learning outcomes depends on concomitants variables which have to change or be changed to accommodate the expected or the actual impact of ICT integration.

From an operational perspective, while we expect students learning outcomes to be influenced by pedagogical practices, we need to acknowledge that the outcomes influence the successive instructional decisions of the teacher. Where the school and system factors influences teacher characteristic, the later influences pedagogy and learning outcome of a system. Thus integration of ICT in education involves inter-relationships between;

policy/strategy – input – process –output / outcomes of the system. The following statements illustrate ICT inputs and expected outcome in education sector.

1. Provision of ICT policy for education, goals and incentives – this would raise education standards.
2. Provision of ICT facilities to schools – would increase access and enhance usage of ICT in teaching and learning activities.
3. Training teachers on ICT enabled pedagogy – results to a more enhanced learners performance evaluation, monitoring and improved achievements.
4. Digital content provision – makes teaching and learning more efficient.

This survey identified key aspects affecting adoption of ICTs for educational support activities in secondary schools as: high cost of funding required, user's complex perception in usage, low IT literacy, inadequate connectivity and absence of a sufficient policy framework that addresses ICT implementation in schools. Despite having promulgated the national ICT policy half a decade ago, and having formulated ICT strategy for education sector, these policy documents does not adequately address ICT implementation needs in secondary schools. While the national ICT policy remains silent on the cost, perception and competency, the ICT strategy for education is unclear, patchy and inconclusive on areas of infrastructure, cost, and IT literacy as it remains silent on user's attitude and how it shall be operationalized in secondary schools. Out of initial 26 total sample two schools making of 7.69% of the sample could not be assessed due to users negative attitude and low opinion on ICT applications, where one revealed they had no IT teacher while another complains of power disconnection, while 3.85% had rejected technology after some use due to cost of technical support constraints.

5.2 Conclusion

On basis of these findings the researcher concludes that the pace of ICT adoption in secondary schools in Kenya is very slow, as characterized by inadequate IT literacy, high cost of funding ICT programmes, inadequate infrastructure, lack of psychological and technical readiness and insufficient policy guidelines. Accordingly the major factors affecting ICT adoption in public secondary school are the IT literacy; connectivity and policy aspect since they had a significant linear correlation with ICT adoption pace. On the other hand ICT cost; user attitude; IT literacy and policy aspect are major attributes affecting ICT adoption in private schools as they had a significant linear correlation. The statements below respond to research questions that guided this study.

- High cost of funding ICT programmes as start-up or running cost has lead to a considerable technological lag in secondary schools in Kenya.
- Inadequate psychological preparedness has dragged perception change which as hampered technology acceptance and usefulness in secondary schools.
- Low levels of information technology literacy in secondary schools as limited the usage of emerging technologies in leveraging teaching and learning.
- Inadequate connectivity and network infrastructure as hindered full access to internet resources, e-mail use and resource sharing in secondary schools in Kenya.

5.3 Recommendations

1. This study recommends to the ministry of education to improve the current ICT strategy for education to make it a three tier policy frame work to address specific needs of individual levels of institutions., with first tier being the policy for tertiary institutions, second for secondary schools and finally for primary schools. These levels in education

sector have different needs, both in their core duties, infrastructure and human capacity requirement and thus need to have specific targets, mechanisms and timelines addressed separately for Education Sector to attain any tangible and observable ICT diffusion levels. Accordingly different institutions within levels may be at different stages of adoption hence the policy frame work should be whole inclusive to address needs of different adoption stages.

2. The study recommends the government to increase the ICT budget to address adoption challenges in secondary schools as the survey found that high cost of funding ICT programmes is immensely influencing ICT integration. Adequate ICT budget should be provided to empower the operations of ministry of information and communication as well as the ministry of education with a focus of bringing down the cost of ICT adoption. In addition, the government need to set an ICT funds kitty alongside the free education tuition fees to address specifics like; maintenance cost of ICT, cost of facilities and equipments, cost of support services that enhance ICT learning activities, prices of educational support software and funds to hire and sustain ICT personnel in schools since these were found to slow the rate of ICT adoption and implementation in secondary schools.

3. The study recommends adoption of internet connectivity in the learning institution to empower resource sharing among them. Establishment of standard local area networks (LANs), wireless systems such as VSAT technologies and operationalization of EMIS should be prioritised. The government to reconsider her policy target of ensuring all secondary schools and tertiary institutions have affordable internet access by the year 2010 to make a reality. This should be done through use of strong and effective servers that are able to transfer data at high speed or use of the recently launched internet through the use of fibre optic connection for improving the connectivity efficiency, learning

environment, e – mail access and enhance sharing of resource like; online examinations and online dissemination of other educational curricula.

4. The study established that negative user attitude hinders timely realization of ICT potential and it was also observed that there is very low IT literacy levels in secondary schools, thus researcher recommends the government through its ministries, agencies and other stake holders to improve the ICT infrastructure in schools especially in relation to; educational support software, ICT interconnectivity, internet connectivity speed, and policy guidelines regarding ICT workshops and conferences as well as retraining programmes for high school teachers to enhance it adoption in schools. This will ensure both psychological and technical skill readiness of teachers are addressed so as to reverse the slow rate of ICT adoption trend and improve the pace of diffusion in the secondary schools in Kenya.

5.4 Suggestions for Further Research

Study recommends that similar researches be undertaken in other secondary schools preferably in marginalised areas, to assess whether the factors hindering adoption of ICT are similar in all institutions. This will help in policy formulation as well as increase the adoption and implementation of ICT in the education system.

More research need to focus on the adoption of internet, it application in learning activities and as a means of communication and its impact in the institutions of higher learning, since this study found low internet connectivity and that the use of e-mail was not applicable as a means of communication for educational purposes in most secondary school Kenya. This study recommends a holistic study on the best practices regarding training and retraining of teachers for effective ICT adoption and policy framework for conceptualizing ICT Didactics at secondary school level, since it was established that most teachers have not attended any e-learning workshops or adequate literacy courses.

REFERENCES

Armstrong M. (2003). *A handbook of Human Resource Management*. Eighth Edition. Free press

Athanasios Nikas (2003). *Network Information Infrastructures in the construction Industry:* Emergence and impact on work and management arrangements. Department of Management Science and Technology: Athens University of Economics and Business

Avgerou C. (2001). The significance of context in information systems and Organizational Change. *Information Systems Journal*. Volume 11, Issue 1, January 2001, Pages 43 – 63.

Blass E. and Davis A. (2003). Building on Solid Foundations: Establishing criteria for e-learning development. *Journal of Further and Higher Education*, 27 (3).

Benjamin, R. and R. Wingand (1995). Electronic Market and Virtual Value Chains on the Information Superhighway. *Sloan Management Review*, 36(2): 62-72.

Bless C. and Higson-Smith, C. (1995). *Fundamentals of Social Research Methods.* An African Perspective. Cape Town: Juta and Co. Ltd.

Cairns Ben (2003). *The challenges of introducing new ICTs to the voluntary sector* (Technology Take-Up).Open University Press, Buckingham.

Carayannis E.G. and Popescu D (2005). *Profiling a methodology for economic growth and Convergence:* learning from the EU e-procurement experience for central and eastern European countries. Technovation Volume 25, Issue 1, January, Pages 1-14.

Cherrington, D.I. 1994. *The Management of Human Resource*. 4th edition. London: Prentice Hall international Limited.

Cohen G., Salomon I. & Nijkamp P. (2002). Information Communications Technologies (ICT) and transport: does knowledge underpin policy? *Telecommunications Policy* Volume 26, Issues 1-2 , February-March 2002, Pages 31-52.

Cole, G (2003), Management Theory and Practice, 6th Edition Book Power Publishing, London.

Conner and James G. Clawson (2004). *Creating a Learning Culture*: Strategy, Practice and Technology. May, Cambridge.

Davis J., Foxall G. and Pallister J. (2002). *Beyond the intention-behavior mythology*: An integrated model of recycling, Marketing Theory 2 (1), pp.29-113.

De Cenzo, D.D. Robbins,S.P. 1994. Human Resource Management: Concepts and Practices. New York: John Wiley & Sons Publishers.

Delport.C.S.L. 2002. *Quantitative Data Collection Methods:* For the Social Sciences and Human Service Professions. 2nd edition. Pretoria: JL van Schaik Publishers

Dessler, G. 1994. *Management Fundamentals*. 4th edition. UK-London: Prentice Hall international editions.

Duncan, N.B. (1995). *The Invisible Weapon: A Study of Information Technology Infrastructure as a Strategic Resource.* Dissertation, Texas A&M University.

Duncombe, Richard, and Heeks, Richard (1999), *Information, ICTs and Small Enterprise: Findings from Botswana,* Institute for Development Policy Management, University of Manchester, United Kingdom: Manchester

Earl, M.J. (1989). *Management Strategies for Information Technology*. United Kingdom: Prentice-Hall.

El-Shinnawy, M., and Vinze, A. S. (1997), Technology, culture and persuasiveness: A study of choice-shifts in group settings. *International Journal of Human-Computer Studies, 47,* 473-496.

Fishbein M. and Ajzen, I., 1989. *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice-Hall.

Foros Q., Kind H.J. & Sand J.Y. (2005). Do internet incumbents choose low Interconnection quality? *Information Economics and Policy.* Volume 17, Issue 2, March, Pages 149-164.

Gall, Borg and Gall (1996) *Data Analysis for Research Designs:* Educational research: An introduction (6th Ed.).

Global e-Schools and Communities Initiative (GeSCI) (2009). Kenya: ICT in Education Situational analysis; ministry of Education. Government printers.

Goldstein, A. and D. O'Connor (2000). *E-commerce for Development: Prospects and Policy Issues',* OECD Development Centre Technical Papers No 164

` ,http:// www. Eod.org/dev/publication/tpla htm> (25 April 2009).

Government of Kenya (2007), Kenya Vision 2030: A Globally Competitive and Prosperous Kenya, government of Kenya, Nairobi, Kenya

Government of Kenya (2006). National information and communication technology (ICT) strategy for education and training. Ministry of Education. Government printer

Government of Kenya (2005), National information and communications technology (ICT) Policy. Ministry of information and communications. Government printer

Government of Kenya (2005), *Draft Sessional Paper on Privatization*; Nairobi: Government Press.

Government of Kenya (2003), *Proceedings of the National Investment Conference 19-21 November 2003,* Nairobi: Ministry of Planning and National Development.

Government of Kenya (2001). *Report of the Sector Working Group on Information Technology,* Nairobi: Government Printer

Government of Kenya (2004). *A policy framework for education, training and research.* Meeting the challenges of education, training and research in Kenya in the 21st century. Ministry of education, science and technology. Government Printers.

Hamelink, C. (1994). *Trends in world communication: On disempowerment and Self-empowerment.* Penang, Malaysia: Southbound Third World Network

Henry P (2001). *E-learning technology, content and services: Education and Training* Vol. 43 No.4, pp.249-55.

Hofstede, G. (1991). *Culture and organizations: Software of the mind.* London, UK: McGraw Hill.

Hudson, H. (1997), *Global connections: International telecommunications Infrastructure and policy.* New York: Van Nostrand Reinhold.

Knight, P. (1996). *The electronic revolution and developing countries.* Global Issues, September, 1 (12).

Kommers, P.A.M., Jonassen, D.H. and Mayes, J.T. (1992). (Eds) *Cognitive Tools for Learning*. NATO ASI Series, Vol. F 81, Berlin: Springer-Verlag

Kothari, CR (2004). *Research Methodology Methods of Techniques.*New Delhi, Vikas Publications.

Kuo, E. (1993), *Informatization among Asian NIEs: A comparative study*. In A. Goonasekera & D. Holaday (Eds.), *Asian communication handbook* (pp. 319-332). Singapore: Amic

Lajoie, S. P. and Derry, S. J. (Eds) (1993). *Computers as Cognitive Tools.* Hillsdale: Lawrence Erlbaum Assoc.

Laudon, K. C. and Laudon, J. P. (2001). *Essentials of Management Information Systems* .(Ed) New Jersey: Prentice Hall

Leebaert, D. (1998). *The Future of the Electronic Market Place*, Cambridge MA: MIT Press.

Leedy, P. D. & Ormrod, J. E.(2003). *Practical research*: Planning and design. 8th edition. NJ: Prentice-Hall.

Mahathir, M. (1996). *Speech by the prime minister*. Addressing Infotech Malaysia, Kuala Lumpur, December 19.

Malone, T. W. and R. J. Laubacher (1998). The Dawn of the E-lance Economy. *Harvard Business Review,* September-October: 145-152.

Malone, T. W., J. Yates and R. Benjamin (1987). Electronic Markets and Electronic Hierarchies', *Communications of the ACM* 30 (6): 484-497.

Marmaduke, R. (1997). *The third communication revolution* New York: The Wesley Brothers Inc.

McKay, D.T. and Brockway, D.W. (1989), "Building I/T infrastructure for the 1990s". *Stage by Stage*. Nolan Norton and Company, 9(3), 1-11.

Meng Q. & Li M. (2002). New Economy and ICT development in China". *Information Economics and Policy Volume 14, Issue* 2, June 2002, Pages 275-295

Mugenda, O.M and Mugenda, A.G. (2003). *Research Methods, Qualitative and Quantitative Approaches.* Nairobi: African Centre for Technology Studies.

Nelson, Samuel Mann and Noel Bridgeman (Eds) (NACCQ 2007), *20th Annual Conference of the National Advisory Committee on Computing Qualifications* New Zealand. www.naccq.ac.nz accessed on June 2012.

NEPAD (2002), *Short-Term Action Infrastructure;* Executive report for New Partnership for Africa's Development secretariat.

O'Brien, J. A. (2000), *Management Information Systems-Managing Information technology in the Internet worked Enterprise* (ed), New Delhi: Irwin/McGraw-Hill

Organization for Economic Co-operation and Development [OECD] (2004). *ICTs and Economic Growth in Developing Countries* Unclassified OECD report no. DCD / DAC/ POVNET (2004)6 /REV1

OECD (1992). Education and New Information Technologies: Teacher Training and

Research. Paris

OECD, (2003). Seizing the Benefits of ICTs in a Digital Economy. Meeting of the OECD at Ministerial Level, The Benefits of ICT are not immediate. Brochure, pp.

10.

Orhun, E., Hoyles, C., Bowerman, C. and Vivet, M. (Eds.) (1997). *Computer-Based Cognitive Tools for Teaching and Learning*. İzmir: COG-TECH Network

Panagariya, A. (2000), *E-Commerce, WTO and Developing Countries.* The World Economy 23 (8): 959- 978.

Pea, R. D. (1985). Beyond amplification: using the computer to reorganize mental functioning. *Educational Psychologist* 20(4), 167-182

Pearce, J. A. and Robinson, R. B. (2000). *Strategic Management: Formulation, Implementation and Control*, 8th edition. pp 46, McGraw Hill.

Quibria M.G., Ahmed N. S., Tschang T. & Reyes-Macasaquit M. (2003), "Digital divide: Determinants and policies with special reference to Asia". *Journal of Asian Economics*, Volume 13, Issue 6, January 2003, Pages 811-825

Ross, D. N. (2001). *Electronic communications*: Do cultural dimensions matter?" *American Business Review*, pp. 75-81. June.

Rogers, E.M. (1995). *Diffusion of innovations.* 5th edition. The Free Press. New York.

SAITIS (2005), *South African ICT Sector Development Framework.* Available on the Internet: http:/ www.dti.gov.za/saitis/docs/ictnov-00-summ.html. Accessed 20 July, 2009.

Straub, D. W. (1994). The effect of culture on IT diffusion: e-mail and fax in Japan and the US. *Information Systems Research, 5* (1), 23-47.

TIEKE Finnish Information Society (2005), "Know-How, The Best Resource in Global Competition. *ICT Cluster Finland Review.*

UNESCO Institute for Information Technologies in Education (2002)., Medium-Term Strategy for 2002-2007, Moscow, Russian Federation. Retrieved May 12, 2010, from http://www.iite.ru/docs/publications/Med_Term_Strategy.pdf

UNCTAD (2003), *E-commerce and Development Report 2003* New York and Geneva: United Nations

UNCTAD. (2001), *E-Commerce and Development Report, 2001*. New York and Geneva: United Nations.

United Nations (2000). *Report of the High-Level Panel on Information and Communication Technology.* New York: United Nations, April 17-20.

Van Akkeren J. and Cavaye, A.L., (1999). *Small business IT market readiness and overcoming their fear factor.* Proceedings of the 10th Australiasian Conference on Information Systems (ACIS99, p1071-1083). Wellington, New Zealand, Dec.

Van Akkeren J. and Harker, D., (2003). The mobile Internet and small business: An exploratory study of needs, use and adoption with full-adopters of technology. *Journal of Research and Practice in Information Technology,* 35(3), 205-220.

Wachira E. K (2003). *The practice of quality assurance by computer consulting firms in Kenya.* Unpublished MBA project paper, Faculty of Commerce, University of Nairobi.

Westrup, C, Liu, E., El Sayed, H., & Al Jaghoub, S. (2003). *Taking culture seriously*: ICTs, cultures and development. In: S. Krishna & S. Madon (Eds.), ICTs and Development: New Opportunities, Perspectives and Challenges, Ashgate (forthcoming).

Wong P. (2002). ICT production and diffusion: Digital dividends or digital Divide? *Information Economics and Policy.* Volume 14, Issue 2, June 2002, Pages 167- 187.

Xie, A. (2000). *The Internet Could also Give a Boost to Growth in Emerging Economies* – Internet Economics: A Thinker's Guide'. The Economist, 1 April.

Zwick, T. (2002). Employee resistance against innovation. *International Journal of Manpower,* Vol. 23. No. 6. , pp. 542-552.

APPENDICES

Appendix 1: Questionnaire

SECTION ONE: DEMOGRAPHIC INFORMATION

1. Name of the school.....optional

2. Nature of the school …… 1) Public ☐ 2) Private ☐

3. Your age category

1) Below 20 years ☐
2) 20-29 years ☐
3) 30-39 years ☐
4) 40-50 years ☐
5) Above 50 years ☐

4. Your gender? 1) Male ☐ 2) Female ☐

5. Your highest education qualifications attained?

1) Secondary level ☐
2) Cerificate level ☐
3) Diploma level ☐
4) Undergraduate degree ☐
5) Postgraduate degree ☐

6. How long have you worked in this school?

1) Below 3 years ☐ 2) 3 - 6 years ☐
3) 7 – 10 years ☐ 4) 11-14 years ☐
5) over 14 years ☐

7. What is the total number of teachers in this school?

1) Less than 20 ☐ 2) 21 – 30 ☐ 3) 31 – 40 ☐
4) 41 – 50 ☐ 5) More than 50 ☐

SECTION TWO –FACTORS AFFECTING ADOPTION OF ICT IN SCHOOLS

A. Initial Cost of Installation

8. In your opinion, does this school have sufficient funds for ICT implementation to support education activities?

1. Very sufficient ☐ 2. Sufficient ☐

3. Insufficient ☐ 4.Very insufficient ☐

5. I don't know ☐

9. Indicate the extent to which you agree or disagree with the following statements as relate adoption of ICT for educational activities in this school.(**1=Strongly Agree, 2=Agree, 3=Neutral, 4= Disagree, 5=Strongly Disagree)**

	Statements	**1**	**2**	**3**	**4**	**5**
a)	The high cost of installation has hindered ICT adoption of educational activities in this school					
b)	High maintenance cost of ICT For educational support has slowed its adoption in this school.					
c)	lack of adequate facilities and equipment key to ICT use in education has affected it adoption.					
d)	High cost of support services that enhance ICT learning activities has slowed down its adoption					
e)	Educational support software- high prices has contributed to slow ICT adoption in this School					
f)	Lack of funds to hire and sustain ICT personnel has delayed ICT integration for content delivery					

10. What is your source of funds for installation and running ICT projects for educational support activities in this school?

1) Government through CDF - funds ☐

2) school fees paid by Government ☐

3) School fees paid by parents ☐

4) Donations by NGO's ☐

5) Others please specify .....

B. Users' Perception

11. To what extent would you agree or disagree with the following as to affect the adoption of ICT for learning support activities in this school. Tick as follows; 1**=Strongly agree, 2=Agree, 3=Neutral, 4=Disagree, 5=Strongly disagree.**

		1	**2**	**3**	**4**	**5**
a)	I prefer manual teaching methodology to electronic method of instruction in class.					
b)	ICT adoption will make most students to lack touch with their teacher since they will be able to communicate electronically.					
c)	Using ICT activities in class may not be too complex					
d)	Adoption of ICT will reduce job opportunities					
e)	Adoption of ICT will require teachers to be re-trained and this will waste a lot of class time					
f)	There is a lot of fear of ICT support sustainability when adopting its educational activities in this school					

12. How many teachers from this school have attended an e-learning workshop/ conference? 1) Less than 3 ☐ 2) 4 – 6 ☐ 3) 7 -10 ☐

4) More than 10 ☐ 5) None ☐

13. How often does the school perform ICT equipments and systems maintenance such as upgrade, diagnostic and repair to enhance technology in learning activities?

1). Once per month ☐ 2). Once per term ☐ 3). Once per year ☐

4). Any other ..... 5). Not sure ☐

C. Competency in Information Technology

14. Do you have ICT-literacy related training for teachers in this school?

1) Yes ☐ 2) No ☐

15. If yes in 20 above, how would you rate ICT-literacy related training for teachers in this school as regards effectiveness of computer-assisted instruction?

1) very effective ☐ 2) effective ☐ 3) ineffective ☐

4) very ineffective ☐ 5) not able rate ☐

16. How easy/complex is use of computer applications in class for content delivery?

1) very easy ☐ 2) easy ☐ 3) complex ☐ 4) very complex ☐

5) Not applicable ☐

17. How would you rate the adequacy of computer literacy course for students in supporting their learning activities?

1) very adequate ☐ 2) Adequate ☐ 3) Inadequate ☐

4) very inadequate ☐ 5) not sure ☐

18. How satisfying is this school's policy on computer literacy for students in support of educational interractive activities?

1) very satisfactory ☐ 2) satisfactory ☐

3) un-satisfactory ☐ 4) very un-satisfactory ☐ 5) not sure ☐

19. Are the following educational activities computer aided in this school?

a) Time Tabling Yes ☐ No ☐

b) Examinination result analysis Yes ☐ No ☐

c) Teachers and students information storage Yes ☐ No ☐

d) Production of examinations and office letters Yes ☐ No ☐

e) Others specify, ...

20. How reliable are computers as regards storage and retrieval of educational information and examination preparation in this school?

1) very reliable ☐ 2) reliable ☐ 3) unreliable ☐

4)very unreliable ☐ 5) Not applicable ☐

21. How relevant are internet educational materials such as online tutorials, and references in regards to lesson preparation and instruction in this school?

1) very relevant ☐ 2) relevant ☐ 3) irrelevant ☐

4)very irrelevant ☐ 5) not applicable ☐

22. How appropriate is use of e-mail as a means of communication for educational purposes in this school?

1) very appropriate ☐ 2) appropriate ☐ 3) inappropriate ☐

4) very inappropriate ☐ 5) not applicable ☐

23. Other than e-mail, which other form of computer aided communication does the school use?

.....

.....

24. How many qualified information technology personnels/computer teachers does the school have ?

a) 1 ☐ b) 2 ☐ c) 3 ☐ d) 4 ☐ e) others.....

D. Technological Infrastructure

25. Indicate to what extent you agree or disagree with the following statements in relation to adoption of ICT for educational purposes in this school**. (1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, 5=Strongly Disagree).**

	Statements	1	2	3	4	5
a	Lack of reliable educational support software has contributed to slow rate of ICT integration in this school.					
b	The poor state of ICT interconnectivity affects its adoption rate.					
c	Low connectivity speed has contributed to slow rate of ICT adoption in this school.					
d	Low internet access, has contributed to slow rate of ICT adoption.					
e	Absence of policy guidelines regarding ICT adoption in schools has affected its integration.					
f	Absence of appropriate electronic educational content has contributed to slow rate of ICT adoption in this school.					

26. How reliable is electrical power source for educational support in this school?

1) very reliable ☐ 2) reliable ☐ 3) unreliable ☐ 4) very unreliable ☐

5) no power source at all ☐

27. How would you rate the speed of internet connectivity in meeting the teaching staff access needs for educational purposes in this school?

1) very high speed ☐ 2) high speed ☐ 3) low speed ☐

4) very low speed ☐ 5) no internet connection ☐

28. Which is the criteria for placing ICT infrastructure for educational activities in school?(please tick all aplicable)

1) Adequate security ☐
2) Electricity supply ☐
3) ICT literate teachers ☐
4) School management support ☐
5) Others (specify) .....

E. ICT Adoption in schools

29. How many computers are connected to the internet for teacher preparation and delivery in this school?

1) None ☐
2) Below 10 ☐
3) 11 - 20 ☐
4) 21 – 30 ☐
5) All ☐

30. How many computer laboratories for students practice and learning does this school have?

1) None ☐ 2)1 lab ☐ 3) 2 labs ☐ 4) 3 ☐ 5) above 4 labs ☐

31. How many computers for students use do you have in every computer laboratory?

1) Below 10 ☐
2) 11 – 20 ☐
3) 21 - 30 ☐
4) 31 – 40 ☐
5) More than 40 ☐

32. How would you rate the pace of ICT Adoption for educational activities in this school?

1) Very high ☐
2) High ☐
3) Slow ☐
4) Very slow ☐
5) Not able to rate ☐

33. Is school policy for ICT adoption and utilization in enhancing learning and teaching activities relevant to school curriculum requirements ?

1) very relevant ☐ 2) relevant ☐ 3) irrelevant ☐

4) very irrelevant ☐ 5) no ICT policy ☐

34. How supportive are the school Board of Governors, parents and other stake holders as regards the ICT policy for enhancing, school educational activities out come?

1) very supportive ☐ 2) supportive ☐ 3) not supportive ☐

4) Not able to rate ☐

35. What recommendation would you make that would enhance fast ICT adoption and utilization for teaching delivery and other educational purposes in this school?

_____

_____

Appendix II: Meyer – Olkin (KMO) and Bartlett's Test of Sphericity

Table A: KMO and Bartlett's Test for ICT installation and running cost

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.827
Bartlett's Test of Sphericity	Approx. Chi-Square	167.211
	Df	15
	Sig.	0.000

Table B: KMO and Bartlett's Test for ICT User's perception

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.816
Bartlett's Test of Sphericity	Approx. Chi-Square	120.775
	Df	15
	Sig.	.000

Table 4.C: KMO and Bartlett's Test for ICT technological infrastructure

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.735
Bartlett's Test of Sphericity	Approx. Chi-Square	143.625
	Df	15
	Sig.(P-Value)	0.000

Appendix III: Variance Component Extraction

Table A: Total Variance Explained, for ICT installation and running cost

Component	Initial Eigenvalues		
	Total	**% of Variance**	**Cumulative %**
1	3.248	54.134	54.134
2	.833	13.891	68.025
3	.637	10.610	78.634
4	.508	8.475	87.109
5	.407	6.791	93.900
6	.366	6.100	100.000

Extraction Method: Principal Component Analysis.

Table B: Total Variance Explained for rotation one: user's perception

Component	Initial Eigenvalues		
	Total	**% of Variance**	**Cumulative %**
1	**2.844**	**47.396**	**47.396**
2	**1.002**	**16.708**	**64.104**
3	.647	10.779	74.883
4	.573	9.544	84.427
5	.489	8.147	92.574
6	.446	7.426	100.000
Extraction Method: Principal Component Analysis.			

Table C: Total Variance Explained, for ICT technological infrastructure

Component	Initial Eigenvalues		
	Total	**% of Variance**	**Cumulative %**
1	2.865	47.755	47.755
2	1.077	17.955	65.710
3	.815	13.586	79.296
4	.460	7.660	86.956
5	.442	7.366	94.322
6	.341	5.678	100.000

Extraction Method: Principal Component Analysis.

Appendix IV: Factor Variable Loading – Component Matrix

Table A : ICT installation and running cost: Component Matrix

Factor variables	Factor loading
High cost of ICT installation	0.769
High cost ICT maintenance	0.740
Lack of adequate ICT facilities and equipment	0.649
High cost of ICT support services	0.757
High cost of educational support soft-ware	0.756
Lack of funds to hire and sustain ICT personnel	0.738

- **Extraction Method: Principal Component Analysis.**

Table B: Rotated Component Matrix 1, for ICT User's perception

Factor variables	Factor loading	
	1	2
Manual teaching preferred to Electronic mode of teaching	.782	.188
ICT Make student lack physical touch with their teachers	.795	.167
ICT use in class is too complex	.628	.460
Adoption of ICT reduces job opportunities	.621	.395
ICT requires teachers to be re-trained which wastes class time	.580	.502
There is fear of ICT support sustainability	.000	.896

Table C: Rotated Component Matrix Two, for ICT User's perception

Factor variables	Factor loading
	1
Manual teaching preferred to Electronic mode of teaching	.615
ICT Make student lack physical touch with their teachers	.796
ICT use in class is too complex	.767
Adoption of ICT reduces job opportunities	.736
ICT requires teachers to be re-trained which wastes class time	.747

- Extraction Method: Principal Component Analysis.

Table D: ICT technological infrastructure: Rotated Component Matrix.

Factor Variables	Factor Loading	
	1	**2**
Lack of reliable educational support software	.129	**.833**
Poor state of ICT interconnectivity	**.789**	.180
Low connectivity speed	**.878**	.140
Low Internet access	**.825**	.094
Absence of policy Guidelines regarding ICT	.039	**.870**
Lack of appropriate electronic educational contents	.187	**.789**

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Appendix V: ANOVA – TEST.

Table A: ANOVA Test for User Attitude between nature of schools

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.161	1	.161	.145	.704
Within Groups	93.086	84	1.108		
Total	93.247	85			

Table B: ANOVA Test for Connectivity and policy between nature of schools

		Sum of Squares	df	Mean Square	F	Sig.
connectivity	Between Groups	.161	1	.161	.126	.724
	Within Groups	107.586	84	1.281		
	Total	107.747	85			
Policy	Between Groups	1.760	1	1.760	1.470	.229
	Within Groups	100.569	84	1.197		
	Total	102.328	85			

Table C: ANOVA Test for User Attitude between respondent groups

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.491	2	.246	.220	.803
Within Groups	92.756	83	1.118		
Total	93.247	85			

Table D: ANOVA Test for Connectivity and policy between respondent groups

		Sum of Squares	df	Mean Square	F	Sig.
connectivity	Between Groups	.031	2	.015	.012	.988
	Within Groups	107.716	83	1.298		
	Total	107.747	85			
policy	Between Groups	1.709	2	.855	.705	.497
	Within Groups	100.619	83	1.212		
	Total	102.328	85			