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FACTORS INFLUENCING IT IMPLEMENTATION IN SCHOOLS

THE CASE OF NAKURU MUNICIPALITY SECONDARY SCHOOLS

BY

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DECLARATION AND APPROVAL

Declaration

This Research Project Report is my original work and has not been presented before either in part or full for an award of a degree in any University

Signature: .....

Date 25th SEPT. 2006.

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APPROVAL

The Research Project Report has been submitted for examination with our approval as university supervisors.

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DEDICATION

This work is dedicated to my loving husband, Alexander N. Hungi, and my two lovely children, Deogratius and Nicollet. You showed great patience, love and understanding during this study.

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There are many to whom I am indebted to, as they assisted in many ways to make this study possible. Firstly and foremost, I want to thank my supervisors, Mr. Jackson G. Kabira and Mr. William. P. K. Korir for their tireless efforts in directing this study, and their valuable guidance and assistance.

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Finally, God is the giver of all things. I thank Him for life, time, opportunity, patience, resources and the ability to do this work. May your name be exalted forever, Amen.

ABSTRACT

This study investigated the nature and extent of IT development in schools in Nakuru Municipality. By using technology as a tool, IT has emerged as an enabler in creating, manipulating and distributing information and communication to improve the quality and effectiveness of both the public and private sector programs and services. Research in the area of adoption and implementation has traditionally focused mainly in organizations in developed countries, in particular United States and United Kingdom, without considering how these frameworks and models can be applied and extended to developing countries. Very few empirical studies have been conducted on the factors affecting the diffusion and use of IT in developing countries, particularly in schools.

In Kenya, some school management, partly through their own initiation or partly through pressure from stakeholders (e.g. parents) have introduced IT or computers in their schools. Among the main reasons for introduction of IT in schools are (i) general running of the school (e.g. accounting, keeping records and reporting) and (ii) for use in teaching and learning. Preparing learners to be IT skilled is especially attractive to parents and teachers since it is generally accepted that IT skills prepare students for further studies, employment, communication and socialization (e.g. email). However, some schools are yet to introduce any kind of IT in their schools. This is of concern because it implies that such schools are at disadvantage in management of the school as well as in teaching and learning. This is more so in teaching and learning because it might imply that students going through such schools are at disadvantage in, for instance, finding employment after completion of school.

This study used a four phase conceptual model of the process of adoption and implementation of IT. Two groups of factors were considered to have the potential to influence each phase of IT implementation processes; human and technological factors. The study was carried out in Nakuru Municipality, by use of survey research method. The target population for this study consisted of secondary schools in Nakuru Municipality. Specifically, this study targeted school head teachers since they are in a

position to (or not to) implement IT. The data were collected using two questionnaires, one for head teachers in schools with at least one computer and the other for head teachers in schools with no computers. In the data analysis, the study used quantitative research methods which included both descriptive and inferential methods. The key variables were tested by regression analyses, to determine the most important factors in the study. The study points out areas where policy measures will be required in the implementation of IT in schools.

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LIST OF ABBREVIATIONS

ATM – Asynchronous Transfer Mode

CD-ROM - Compact Drive - Read Only Memory

CFSK - Computers for Schools Kenya

DSL – Digital Subscriber Line

ICT - Information Communication Technologies

IT - Information Technology

ITU – International Telecommunication Union

KESSP - Kenya Educational Sector Support Programme

NCET - National Council for Educational Technology

OECD – Organization for Economic Co-operation and Development

R&D – Research and Development

SPSS – Statistical Package for Social Sciences

SONET – Synchronous Optical Network

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Chapter 1 : INTRODUCTION

A general introduction of the study is provided in this chapter. In particular, this chapter focuses on the following eight issues: a) background of the study; b) statement of the problem; c) purpose of the study; d) objectives of the study; e) research questions; f) significance of the study; g) scope and limitations of the study; and h) definition of terms used in this study.

1.1 Background of the Study

In an ideal world, schools should be at the forefront of promoting technological developments by teaching and using technology in their daily activities. This is because schools are the units within a national system that are entrusted with task of providing education to its citizens. Almost all scholars agree that education is important to a nation.

Education is undoubtedly a key ingredient in economic, social and political developments. As a result of the increasing global economic competition, education is increasingly being seen as a source of competitive advantage, closely tied to economic growth and a catalyst for a nation to attract investments and thus create jobs. In addition, education appears as one of the key determinants in sustaining a culture of lifelong earning's coupled with the ability to sustain ones chosen career. As a consequence, many countries invest heavily in education as a way of tackling poverty and empowering their citizens.

Moreover, in both developing and developed countries, education has been linked to many indicators of human development. For example, education influences health of citizens and family size. It gives girls in rural areas a leeway to escape from early marriages and unemployment. Education empowers individuals to make intelligent lifelong career decisions that ultimately influence the course of life in their social settings. In developed countries, as the workforce becomes older, education offers a way to update skills in order to remain relevant in a rapidly changing world. The value of education is indisputable. Thus, schools should be seen to be at the forefront of

gaining and promoting the technological developments by both teaching and using this technology in their curriculum, and daily activities of learning institutions.

Thus, given the importance of education, it is not hard to see why one would expect IT situation in education institutions to be of top level. However, in most cases (especially at primary and secondary school levels); education is seen as lagging behind other sectors in use of IT. Nevertheless, to be fair to the education sector, it is important to note that IT situation in education institutions is not completely pathetic. Indeed, computers began to appear in schools and university classroom in the more advanced countries in the early 1980s. Broadband connections such as fiber optic, SONET, ATM and DSL became commonplace in developed countries from 1995. In developing countries, particularly in Africa, computers and their related technologies are a relatively new phenomenon.

Initially, educators saw use of information technology (IT) mainly as a way of teaching computer literacy. Most educators now see IT playing a broader role; that of delivering many kinds of learning at lower cost and with higher quality than traditional methods of teaching would allow. In addition, schools, universities and organizations use IT to reduce costs and improve efficiency of administration. The competitiveness of any economy in the global marketplace is to a large extent determined by its effective use of ITs. In addition, the ability of any government to effectively administer a country and deliver on its social goals is also greatly enhanced by efficient use of ITs. Within this context, the growth of ITs in both the developed and developing countries has profoundly altered ways of communication, work, space and time. Education has been seen both as a solution to preparing citizens for the information age, and as a problem in not preparing them fast enough.

The Kenya government, recognizing the need for Kenya to participate in 'global marketplace' and the importance of education in contributing to effective participation, has run a number of initiatives aimed at addressing concerns in IT area. These have ranged from hosting a conference on the issue for developing countries, to the introduction of policies on ICT development in a range of sectors, including education.

This study aimed at identifying factors that could be regarded as enabling or restricting the use of IT in schools. In addition, the study examined the performance of the current system and issues important to stakeholders.

1.2 Statement of the Problem

The use of IT in teaching and learning in schools in Kenya, like in most developing countries in Africa, is generally disjointed, lacks clear direction and is highly fragmented. Although these problems are recognized, the ability to address them is severely hampered by a lack of informed and critical research in this area. With globalization and technological growth, schools in Kenya like any other organizations have found themselves in a situation that they can no longer ignore IT for their daily running.

Consequently, this study is expected to bring in research information that could help schools in decision making at various stages of IT implementation. In addition, the study will equip policy makers and other interested parties with information regarding technological and human factors affecting the initiation and implementation of IT in schools in Kenya.

1.3 Purpose of the Study

There were two general purposes of this study. The first purpose was to investigate the nature and extent of IT development in schools in Nakuru Municipality. It was hoped that the study would achieve this by mapping the IT resources that are presently being used in the schools and the manner in which they are being used. The study was also expected to identify the human and technological factors that play part in the initiation, adoption and implementation of IT in schools in Nakuru Municipality.

1.4 Objectives of the Study

The specific research objectives were as below.

a) To survey the current IT situation, availability and extent of IT usage in schools in Nakuru Municipality in teaching, learning and management.

b) To identify the relationships between human factors and technological factors with the various phases of the IT adoption and implementation in schools in Nakuru Municipality.

1.5 Research Questions

In order to achieve the above objectives, this study will endeavored to answer the following research questions.

a) What is the current IT state and usage in teaching, learning and management in schools in Nakuru Municipality?

b) What IT resources are presently being used in the schools and how are they being used?

c) What are the relationships between human factors and each phase of the IT adoption and implementation in schools in Nakuru Municipality?

d) What are the relationships between technological factors and each phase of the IT adoption and implementation in schools in Nakuru Municipality?

1.6 Significance of the Study

The study will provide research information to parties interested in IT adoption and implementation in schools. This study identifies facilitators and inhibitors of IT adoption and implementation in schools in Nakuru Municipality. From the identification of these factors, the Ministry of Education and schools are expected to be able to formulate better strategies for adopting and implementing IT in order to increase their service quality and productivity in terms of school results. This information can be used to provide insights into policy considerations around the creation of equity, facilitating quality in the use of IT and identifying key areas for strategic interventions.

The study provides research information that could help schools in Nakuru Municipality to prepare learners to enter the IT world. In addition, the findings of this study will be of interest to the government because the findings brings into light information regarding IT stage of development and IT usage in schools in Kenya. Moreover, the findings of the study are expected to equip the government with an

understanding in the way in which human and technological conditions impact on the adoption and implementation of IT in particular schools.

1.7 Scope and Limitations

This study was centered on human and technological factors that impact on IT adoption and implementation. However, there are other factors that impact on the adoption and implementation of IT in schools that were not examined in the study due to financial and time limitations. Some of these factors are environmental factors (e.g. organizational resources, interschool relations and private sector influence) and organizational factors (e.g. organizational context and organizational structure).

All secondary schools in Nakuru Municipality were to be used in this survey. However, it was not possible to get filled forms from all of them.

The researcher had to learn several data analyses methods within a very short time, and so there could be several interactions that may not have been tested, thus same data can be used for further analyses, especially to check further possible interactions.

The term Information Technology (IT) in this study was limited to the broad range of technologies involved in information processing and handling, such as computer hardware, software, and telecommunication.

1.8 Operational Definition of Terms

- ***Adoption phase:*** Starts when an organization decides to incorporate IT and ends with the acquisition of the technology.
- ***Digital divide***: Gap in technological developments
- ***Employees***: All workers in a school. Used to include all human resources in a school, apart from the students/pupils.
- ***Human factors***: Factors or characteristics to do with human being. The main ones considered in this study are age, education, communication channel, attitude toward change, and computer-related anxiety
- ***Implementation:*** Measured by actual IT utilization and the user satisfaction.

- ***Information Technologies***: Refers to the broad range of technologies involved in information processing and handling, such as computer hardware, software, and telecommunication.

- ***Initiation***: Represented by the identification of the pressure emerging from various internal and external sources, the recognition of a need for strategic change as well as a sense of urgency and felt responsibility on the part of key decision makers to change by adopting IT.

- ***ITU***: The ITU-T (Telecommunication Standardization Sector of the International Telecommunications Union) is the primary international body for fostering cooperative standards to telecommunications equipment and systems. It was formerly known as the CCITT. It is located in Geneva, Switzerland.

- ***"Learning" divide:*** Gap in knowledge

Chapter 2 : LITERATURE REVIEW

In this chapter, literature reviews of issues related to IT and education, human and technological factors that influence IT implementation, and the phases in IT implementation that are of interest to the current study are presented. These reviews are presented here in order to provide background information of the theories guiding this study and, therefore, facilitate the understanding of the discussions and analyses that are presented in subsequent chapters.

The structure of this chapter is as follows. The first section provides background information about IT and education. The second and third sections provide background information about human and technological factors that play important roles in IT implementation. The fourth section focuses on the innovation process while the fifth section outlines the conceptual framework employed in this study.

2.1 IT and Education

IT is the World's fastest growing Economic activity; the sector has turned the globe into an increasingly interconnected network of individuals, firms, schools and governments communicating and interacting with each other through a variety of channels and providing economic opportunities transcending borders, languages and cultures. Siegel (2003) observed that developing countries appear to be falling further behind in the digital divide, as well as in the "learning" divide.

It is well recognized that a trained, skilled and well educated workforce is critical in enhancing work and economic performance and sustaining competitiveness (Zainol, 1999). Siegel (2003) concludes that IT has transformed the workplace in many industries and increased the returns to education in developed and developing countries (though to a lesser extent). He recommended that it is important for policy makers in developing countries to invest in infrastructure that complements or supports use of IT (physical and educational), thus ensure low-cost, high-bandwidth Internet connections, Internet Security and ensure that educational system addresses skill deficiencies. However, Adam (2003) observes that, with the necessary IT infrastructure in place, too often the user simply wonders how to make use of these services,

IT are best regarded as the facilitators of knowledge creation in innovative societies (OECD, 1996). The new economics looks at IT not as drivers of change but as tools for releasing the creative potential and knowledge embodied in people. Wealth-generation is becoming more closely tied to the capacity to add value using IT products and services.

The shift to knowledge economies, the convergence of telecommunications, microelectronics and computers have led to the emergence of ITs as the primary means through which information and knowledge – the primary commodities of our time – are transmitted. Increasingly, the dominant source of trade is information. Governments, businesses, public and private sectors alike are generating revenue from the sale of information and the production of knowledge. Information and knowledge are the thermonuclear competitive weapons of the modern time, thus the need to address IT urgently.

Global evidence shows that countries that have succeeded economically have also invested heavily in education and training. Dzvimbo (2005) contends that without heavy investments in education and training, it is impossible for African countries to develop a critical mass of people with science and technology skills that are pivotal in moving Africa from societies that are based on natural resources to knowledge economies. The emergence of ITs is connected to the transformation occurring in the knowledge domain and the world of production. Education is perceived to be the sphere that mediates and connects the world of knowledge with the world of work. Education and learning are emphasized because citizens require information competencies for the effective and efficient use of ITs, and because innovations in the IT sector are linked to learning. The link between education and economic growth places greater focus on national governments to increase levels and quality of education. There is a global trend towards 'quality education for all' coupled with encouragement of self-directed learning and shifts in approaches to teaching methodology.

There are two different perspectives on how countries can position education systems in relation to ITs. At the one extreme, is a euphoric and visionary embrace of the potential benefits of ITs (the optimistic view). At the other extreme, are those who oppose ITs believing that they further divide society, exacerbate inequity, and that

technology is beginning to rule people's lives and the world (the pessimistic perspective) and stresses the need for extreme caution. These views have been seen to influence the implementation of IT.

The major problem among African institutions today is the high cost of bandwidth and this in turn affects connectivity in Africa despite the fact that, there are about 48 satellites that cover every square inch of the African continent!(Dzimbo, 2005). As a result, access to the Internet is very critical for teaching and research purposes for both academics and students.

In Ethiopia, a study by the ITU of ICTs in education in late 2001 found extremely low internet access in schools: Only nine of the country's 12,000 primary schools and ten of its 424 secondary schools had Internet access.

Sub-Saharan Africa shows that 40 per cent of children under ten years receive no schooling at all, lack electricity and other basic facilities hence introduction of IT may take many years with exception of South Africa which has an initiative to equip classroom with computers, Internet and train teachers (UNESCO). Rwanda has launched an initiative to give connectivity to all secondary schools in Rwanda using wireless broadband and fiber optic during the next two years. The connectivity is viewed, among other things, as bringing down the cost of delivering school materials through an educational portal as part of the national development gateway. Several initiatives are underway for the use of ICTs in education in Rwanda. A Rwandan Alliance for Primary School Computerization has been established. In Kenya, Computers for Schools Kenya (CFSK) is an NGO that is sourcing and giving computers to schools. It is encouraging all its partner schools to invest in networking to realize the full potential of their labs as a pedagogical tool and for the enhanced management and maintenance facilities. The Kenya Educational Sector Support Programme (KESSP) is a five year program of the Kenya government and development partners, and together with NEPAD, aim at connecting all primary schools in ten years and secondary schools in five years, quite an ambitious project.

Perceived quality contribution to standards is a major contributor to IT implementation and usage. There is a growing body of evidence which suggests that use of IT can indeed help raise standards and enhance learning, particularly in some settings (e.g.

DfES, 2002), but until its use is more commonplace, further research regarding benefits to learning will be restricted. Ombui (2003) however notes that organizations should not equate IT to automation. It is about exploiting the latest capabilities of IT to achieve new goals, break old rules and create new ways of working. It is an important contributor to operational efficiency, employee productivity and effective decision-making by managers, he contends. Similarly also, by way of caution to schools, it should be noted that introduction of computers in schools may not necessarily result in improvement of scores, for example, introduction of computers to schools in Israel in mid 1990s found no evidence that use of computers improved children's test scores(Augmist, et al. 2002). Even where test scores are expected to improve, this improvement may take a couple of years to be realized. It is evident that effective adoption of computers in education takes time to have an effect.

A study done by Thomas Fuchs and Ludger Woessmann of the CESifo economic research organization in Munich using the test performance and background data from the 2000 PISA study involving tens of thousands of students in 31 countries, organized by OECD warned about the possible limitations of its findings but pointed to a positive relationship between students' interest in computers and their literacy. The belief that there is an educational benefit - and not just better work skills - has underpinned huge investment by governments, and many parents, in ICT. Fuchs and Woessmann found that the more computers there were in students' homes, the better their test performance. But more computers went with more affluent, better-educated families. So they took this into account in the statistical analysis. The result: the more computers in a student's home, the worse the student's mathematics performance. In schools, they found students performed worse in those which reported a significant lack of computers. But again, once they took into account the schools' general resources the same pattern emerged.

A major characteristic of IT is that it changes fast; this implies that there is danger of schools investing heavily on hardware and software that may become obsolete within a very short time. In this regard, technology planning guide released in January 2001 by California school of Education emphasized that "Technology planning needs to be comprehensive and include consideration of the long term implication of the choices

made. Hardware purchased should meet local needs and have the lowest cost of ownership over the long term".

Confidence in the use of IT may affect levels of use in the classroom and is itself affected by levels of training and support, and teachers' attitudes to technology. Mere acquisition of hardware and software in a school without training in IT should not be expected to result in improved learning and teaching. Teachers' confidence can relate both to their own competence in the use of technology and to their perceptions of possible educational benefits. Passey et al. (1997) suggested that educational benefits are linked to a teacher's ability to integrate IT resources with other classroom-based resources rather than by substituting traditional methods with technology.

Ayoma (2004) in his study states that little is known about the planning, development, implementation, utilization, exploitation, management, control and maintenance of information systems in Kenya. Hence there is lack of local standards and benchmarks. However, The International Development Research Centre is putting its pioneering experience in ICTs programming to good use in Kenya. In October 2003, a project to support the completion and implementation of a robust Information and Communication Technologies policy was started.

The following two sections will discuss human and technological factors that impact on IT adoption and implementation, followed by the conceptual framework.

2.2 Human Factors

Human factors play an important role in IT adoption and implementation in an organization. The major dimensions are age, education, communication channel, attitude toward change, and computer-related anxiety (Rogers, 1983). Studies have found early adopters of innovations are younger individuals with higher socio-economic status, higher levels of intelligence and rationality, more open to change, more knowledgeable about innovation, and with intensive communication patterns (Rogers, 1983). It seems that education generates a better receptivity to change, and the extent that the innovation meets the needs of the users can have a positive effect on initiation and adoption behaviour.

Relationships and interactions between staff members with different positions within an organization represent another relevant factor affecting implementation of information technology. The reasons for ignoring, resisting or even sabotaging new technology must also be considered, as they are inhibitor factors for the adoption of innovation. Resistance to change is a widely recognized phenomenon. At the individual level, the most important attitudinal factors are fear of change and feeling anxiety (Darmawan, 2003). The factors which were considered in this study are gender, age, education, attitude towards change, communication channel and computer related anxiety. Items used to capture age, level of education are:

a) age

b) highest education qualification attained, and

c) training in computers.

The items used to measure attitudes towards change are adopted from the modified version as used by Darmawan (2003) in his study. A higher score indicates greater tendency to prefer innovation.

For communication channel, source of information regarding the technology was sought, i.e. either from formal contacts, informal contacts, or written materials. For the computer-related anxiety, the items are:

a) apprehensiveness in use of computer

b) If given the opportunity to use a computer, I am afraid I might damage computer

c) I have avoided computers because they are unfamiliar to me.

d) I hesitate to use computers for fear of making mistakes that I cannot correct.

e) Computer terminology sounds like confusing jargon to me.

2.3 Technological Factors

Technological factors play a great role in IT adoption and implementation. Though Wanyebi (2002) argues that there is more often than not a bias towards the technical and less to the managerial on the utilization of computer technology, the technical bit must be there for adoption and implementation to take place.

Darmawan (2003) argued that the five most important attributes on innovations are (a) relative advantage, (b) compatibility with existing operational practices and values, (c) complexity, (d) and trialability, (e) observability. For this study, three attributes are considered, namely, relative advantage, compatibility with existing operational practices and values, complexity and traialability.

The technology has to offer clear benefits to the organizational members in order to be adopted. IT has to have a comparative advantage over previous practices used. The benefits that might be anticipated from the use of computing in an organization have been summarized in Darmawan (2003) and classified into three categories: information benefits, efficiency benefits, and effectiveness in serving the public.

IT is thought more likely to be used if compatible with organizational members' existing values and beliefs, need and previous experiences regarding computerized technology. The items that were used to measure compatibility are work style, personal values and beliefs, and personal experiences. Specifically, these items were:

a) Create more jobs than would eliminate

b) Fit well with the way I work

c) Compatible with aspects of my work and previous experiences

It is clear that new technologies or even ideas that are simpler to understand are more readily and rapidly accepted than those that require the adopting organization to develop new skills and understandings (Rogers, 1983). Complexity is associated with difficulty to understand and use the technology. Items that were used to operationalise technological complexity are the extent of respondents' feeling that IT would be:

a) Very difficult to understand, and

b) Very difficult to use.

Innovation that can be tried on an installment plan is expected to be adopted more quickly. Trialability was operationalised by using two items. The respondents were asked to what extent they agree that IT would be able to be tried in smaller version, and implemented module by module.

2.4 *Innovation Processes*

This study used a four phase conceptual model of the process of adoption and implementation of IT, namely initiation phase, adoption phase, implementation phase, and evaluation phase. The two groups of factors described above (human and technological factors) were considered to have the potential to influence each phase of IT implementation processes.

2.4.1 Initiation

A successful initiation phase is represented by the identification of the pressure emerging from various internal and external sources, the recognition of a need for strategic change as well as a sense of urgency and felt responsibility on the part of key decision makers to change, by adopting the new technology (Darmawan, 2003). The three factors used in this study are (a) need-pull, a need or change usually triggered by a performance gap, (b) technology-push, emergence of a new technology that promises to enhance performance, and social pressure.

2.4.2 Adoption

The adoption phase starts when an organization decides to incorporate IT and ends with the acquisition of the technology. The three components used in this study are (a) the speed of adoption (number of years IT has been utilized by the schools), (b) the level of commitment (total expenditure on IT as a percentage of total school expenditure), and (c) the extensiveness (the number of computer applications that are indicates as operational).

2.4.3 Implementation

Two dimensions of utilization and satisfaction are considered as major components of this phase. IT utilization and user satisfaction are considered to be two major factors that reflect the success of an IT implementation (Kim et al, 1998). IT utilization has been noted as an indicator of computer acceptance. IT utilization is frequently used for evaluating IT success.

User satisfaction reflects the interaction of IT with users. User satisfaction is frequently employed to evaluate IT success. A number of researchers have found that user satisfaction with the organization's computer information systems has a strong bearing

on IT utilization by employees or that there is a significant relationship between user satisfaction and information technology usage (Kim et al, 1998, Darmawan, 2003).

2.4.4 Evaluation

IT utilization and user attitudes towards IT have an impact on performance. This study evaluates the impact of IT utilization on individuals in terms of the perceived impacts of IT on user performance.

2.5 Conceptual Framework

An initial hypothesized conceptual model to be examined in this study is as shown in Figure 1. In this model, the adoption and implementation of information technology is viewed as a four-phase process which involves an initiation phase, an adoption phase, an implementation phase and an evaluation phase. It was hypothesizes that a number of the human and technological factors influence the formation of pressure at the initiation phase. These variables might affect the adoption phase, implementation phase, and evaluation phase either directly or through the previous phase as a mediator.

By adding various identified potential variables to the model, the hypothesized conceptual model Figure 1 is modified accordingly. The hypotheses are explicitly indicated as shown in Figure 2. For example, it hypothesized that the age or education of a person influences the initiation, adoption, utilization, satisfaction and performance of IT, both directly, and through the previous phase as a mediator. Each path in the model, with its arrowhead indicating direction, can be viewed as hypothesized effect that needs to be tested.

Given the constraints on time and other resources, this study did not seek to examine all possible links.

The proposed model (Figure 2) of this study shows two dimensions of utilization and satisfaction that is hoped to constitute the implementation phase. At the evaluation phase, this study proposed to evaluate the impact of IT utilization on individuals in terms of the perceived impacts of IT on user performance.

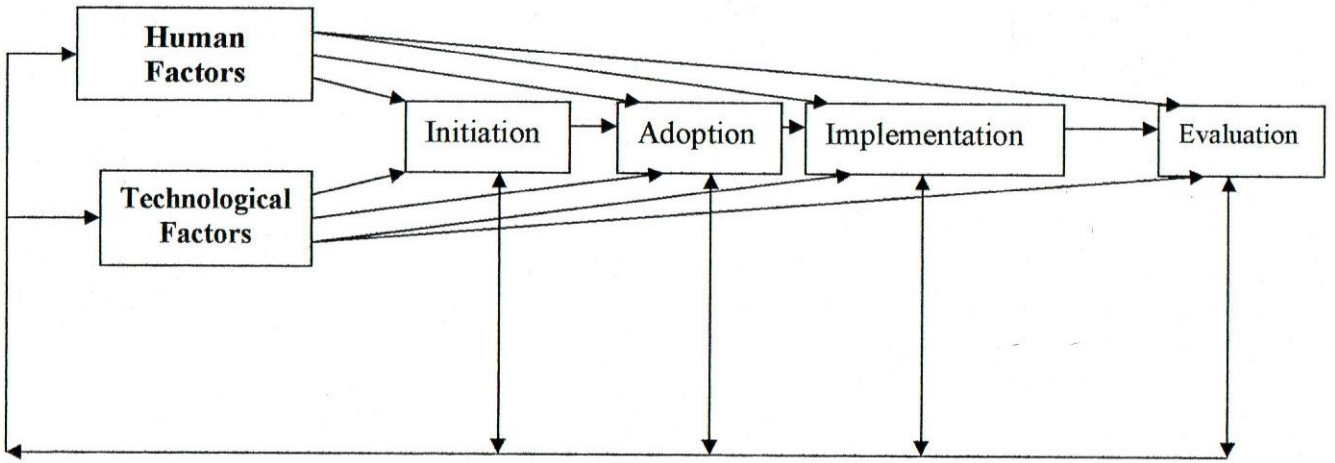


Figure 1: Hypothesized Conceptual Model for Investigating Factors and Relationships

(Source: Darmawan, 2003)

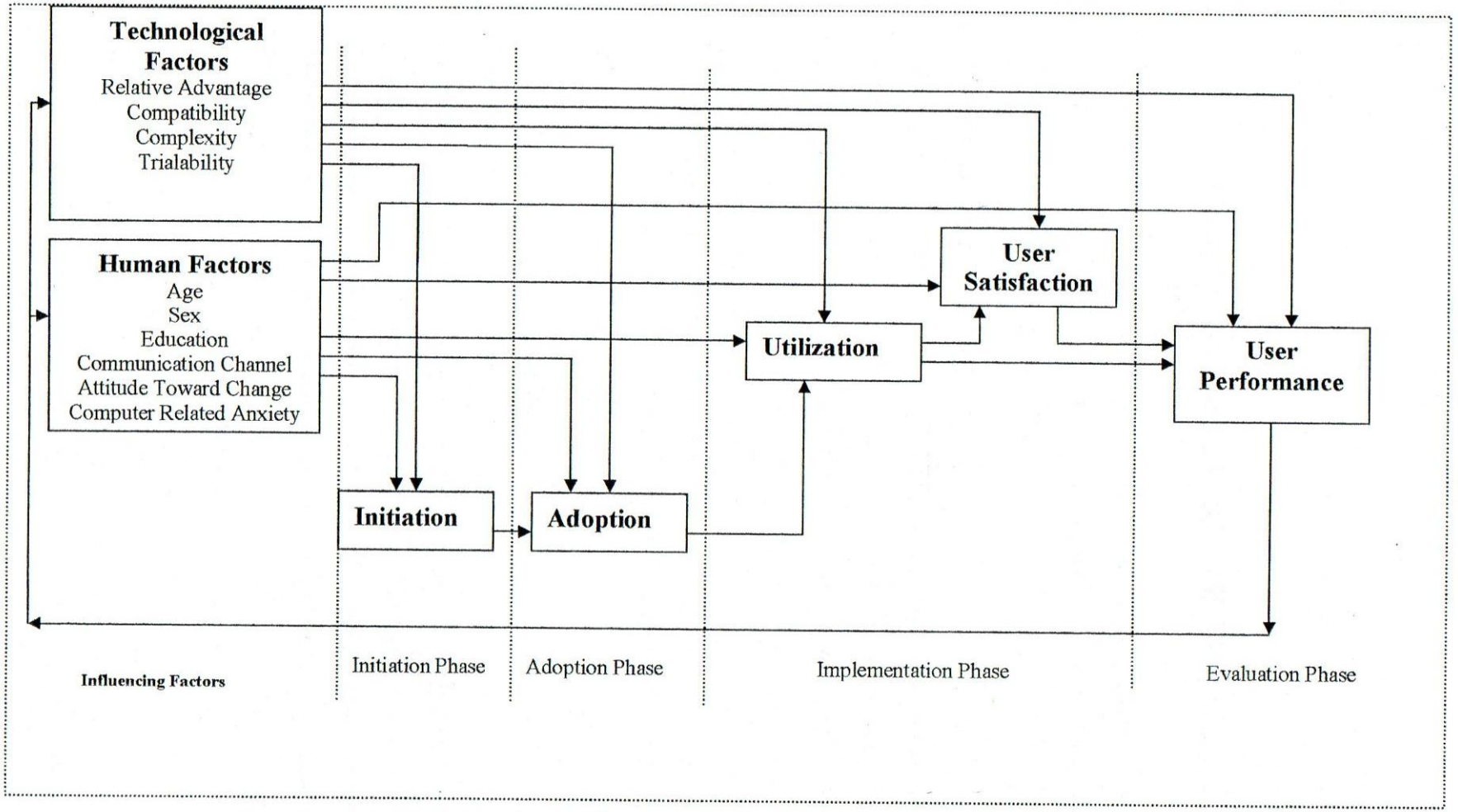


Figure 2: Modified Hypothesized Conceptual Model (Source: Darmawan, 2003)

Chapter 3 : RESEARCH METHODOLOGY

This chapter describes the research design, the target population, the sample, the instrument used to collect data, the procedures used to collect the data and the methods used to analyze the data in this study.

3.1 Research Design

This study was carried out in Nakuru Municipality, by use of survey research method. This is one of the 22 districts in the Rift Valley province, and one of the three municipalities, the others being Kitale and Eldoret. Nakuru Municipality was chosen because it had a big number of secondary schools and was also highly cosmopolitan with communities from the whole of Kenya as well as a good proportion of Kenyans of Indian origin. The district had all types of secondary schools (National, Provincial, District and Private) which would make it appropriate for the findings of the study to be generalized.

3.2 The Target Population

The target population for this study consisted of secondary schools in Nakuru Municipality. Specifically, this study targeted school head teachers since they are in a position to implement or not to implement IT. Head teachers are also supervisors of teachers and as such they can tell the extent of computers usage for teaching in the classroom. The head teachers also supervises the other school workers, thus they can tell the extent of IT usage in for example school accounts, records, and communication with outside world via say letters and email.

3.3 Sample Design and Procedure

Being a survey, all the 35 head teachers from all the secondary schools in Nakuru Municipality were included in the study. The preliminary stage of the study involved identification of schools with at least one computer. This stage served as a guide to decide which questionnaire was to be administered to the school. Questionnaire 'A'

was administered to those schools that had at least one computer, while Questionnaire 'B' was administered to those schools that did not have any computer.

3.4 Data Collection Instruments

It has been mentioned above that the data collection instruments used in this study were two head of school questionnaires (to be called 'Questionnaire A' and 'Questionnaire B'). These have been adopted and modified from the Performance Indicators on ICT Use in Education (UNESCO ICT in Education). Head teacher Questionnaire A was designed for head teachers in schools that have at least one computer. It was expected to collect information on the number of computers, their condition, how they were used in school, teachers and other workers attitude, and technological and human factors affecting initiation, adoption and implementation of IT. Head teacher Questionnaire B was designed for head teachers of schools that did not have any computer in their schools. It was expected to gather information on possible technological factors and human factors that hinder the initiation and adoption of IT in schools. The two questionnaires can be found in Appendix 1 and Appendix 2.

3.5 Data Collection Procedure

The data in this study were collected by use of the two questionnaires mentioned above and included in Appendix 1 and Appendix 2. These two questions sought information from the head teachers regarding their background characteristics (e.g. age, gender and academic qualifications), their views, attitudes and opinions regarding IT and innovation process in general, and information about their schools and the school community. About two weeks before administration of the questionnaires, the heads of all secondary schools in Nakuru Municipality were contacted either by phone calls or individual visits and requested to participate (see letter in appendix 3) in the study to which they all indicated they would. After the first contact, the head teachers were then formally invited to participate in the study in writing. The questionnaires were administered to the head teachers in about ten days after this formal invitation and the head teachers were requested to fill in their responses the soonest possible or at most within two weeks. A copy of the letter that was sent to the head teachers requesting for their participation in the study is can be found in Appendix 3.

However, in the actual collection of data from schools, some problems and difficulties were encountered. Some school heads initially refused to fill in the questionnaire giving various reasons. In some instances the school heads had to be followed and reminded several times before they could return the questionnaire. Even though the head teachers were given ample time to fill in the questionnaires, some school heads were not ready at the agreed collecting time. Some of them argued that they were too busy with other duties, and were yet to get time to fill in the questionnaire; others gave their deputies or computer teachers to fill on their behalf, while some said that the questionnaire forms were missing, and had to be replaced several times.

However, by employing a combination of data collecting techniques (e.g. collecting the completed forms personally on four consecutive occasions and asking the remaining responses to be sent or brought), a good level of return rate was achieved.

Data was then entered, and data cleaning procedures employed. A few variables had missing responses but generally the data were sufficient enough to proceed with the analyses without jeopardizing the validity of the findings. Data from the two questionnaires were merged into one file.

The next thing was to check the validity and reliability of all the constructs. Coding of a few items which were negatively stated was reversed.

3.6 Data Analyses Methods

The study uses quantitative research methods which includes both descriptive and inferential methods.

1. Descriptive statistics (e.g. mean, standard deviation and frequencies) are used to summarize the data using tables and graphs. For example, graphs are used to present information about IT facilities per school.

2. Multiple regression analysis is used to examine and then summarize the effects of technological and human factors in initiation and adoption of IT in schools. A brief summary of the general model and theories behind multiple regression analysis in this study can be found in Appendix 4.

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Chapter 4 : DATA ANALYSES, RESULTS AND DISCUSSIONS

The research questions in this study are addressed in the current chapter and in next chapters. Several analytical techniques have been employed, including reliability analysis, regression analysis, factor analysis, as well as descriptive statistics. The first part of this chapter deals with descriptive statistics, which aims at answering the first two of the four research questions that were raised in Chapter 1. Microsoft Excel software was used for these descriptive statistics. In order to answer the other two research questions raised in Chapter 1, multiple regression techniques using SPSS computer software were employed. In other words, multiple regression analyses techniques were used to examine the relations between various factors, specifically between human and technological factors with the various phases of IT implementation.

4.1 Construction of Variables

The two questionnaires had more than 150 different variables. In order to make it easier to handle the information from the questionnaires and also in order to adequately handle the research questions raised in Chapter 1, it was necessary to combine some of the simple variables from the questionnaires to construct the so-called composite variables. Two techniques were considered for combining variables in this study, namely; i) averaging scores of the variable, and ii) factor analyses. These two techniques are defined in the paragraphs below.

Averaging variables: Before averaging the score of simple variables in construction of composite variables, it was necessary to carry out reliability analyses to check if it was appropriate or not to combine the simple variables together. As the name suggests, reliability analysis is used for checking the consistency or dependability of scales. In other words, the reliability of measurement indicates the stability and consistency with which the scores obtained from an instrument are measuring the concept (Sekaran, 1992). Where only two variables are involved in a scale, it usually appropriate to average the two variables without having to carry out reliability analyses so long as the correlation coefficient between the two variable is positive and strong or very strong (i.e. >0.70).

Factor analysis: This technique was employed in this study primarily to construct composite variables (or factors) from several closely related simple variables. The factors analysis model expresses each factor as a linear combination of items, which are not actually observed. These composite variables were used in subsequent analyses and to represent items by a small number of hypothetical variables, called factors.

The specific procedures followed to construct various variables in this study are described in the next sections together with item responses.

4.1.1 Construction of Human Factors

The following six human factors were considered in this study:

- Sex
- Age
- Education qualification
- Communication channel
- Computer related anxiety
- Attitudes toward change

Information on the above human factors was obtained from Questionnaires A and B. Brief descriptions of factors are provided below.

1. Sex of head teacher (HSEX)

The variable HSEX denotes the gender of the head teacher with a one (1) indicating male and a two (2) indicating female. This information was obtained from the responses to question 1 of the last section of the two questionnaires. All the 25 head teachers who participated in this study responded to this item and therefore there are no missing data on this variable.

The numbers of males and females head teachers who participated in this study were 17 and 8 respectively.

2. Age of head teacher (HAGE)

The age of the head teacher HAGE was a single manifest variable, and reflected by a single indicator. HAGE denotes the age level of the head teacher. Head teachers' whose

age was 30 years (or below) were coded 1; those 31-40 years were coded 2; those 41-45 years were coded 3 and those 46 years (or above) were coded 4. There are no missing data on this variable.

3. Highest Education qualification (HEDUC)

HEDUC denotes the highest level of education reached by the head teacher. This was reflected by a single indicator. Head teachers whose highest level of education was high school were coded 1, diploma were coded 2, university undergraduate degree 3, and postgraduate degree 4. Among the 25 head teachers, none had high school as highest qualification, three had diploma as highest qualification, 16 had university undergraduate degree, and six had postgraduate degrees.

4. Communication channel (COMMCHAN)

A decision was made to drop the variable communication channel from the model. The variable was dropped because there was no much variability among the head teachers involved. This was because most of the head teachers had obtained information about IT through informal channels with only a few receiving the information through formal channels and none through written channels.

5. Computer related anxiety (ANXIETY)

ANXIETY denotes head teacher's computer related anxiety. This variable was constructed by averaging each head teacher's responses to the five items listed in Table 1 below. Table 1 shows the frequencies of the responses to the five computer related anxiety items. The missing responses in these five variables (i.e. code'9' in Table 1) were replaced by the means of the variables.

It should be noted that it was necessary to carry out reliability analysis to check whether it was appropriate to average the above five items. That is, reliability analysis was carried out to check if the five items could be used to form a single scale (or a single score) of head teacher's computer related anxiety and whether some of these items needed to be dropped from the scale or needed to have their coding reversed.

Table 1: Anxiety Items Responses

Questionnaire		Variable label	Variable statement	Not at all (code 1)	Low (code 2)	Mode-rate (code 3)	High (code 4)	Miss-ing (code 9)
Q 'A'	Q'B'							
9(q)	12(q)	PERSON17	I feel apprehensive about computers	10	5	6	1	3
9(r)	12(r)	PERSON18	If given chance to use a computer, I am afraid I might damage it in some way	14	4	1	5	1
9(s)	12(s)	PERSON19	I have avoided computers because they are unfamiliar to me	16	6	0	2	1
9(t)	12(t)	PERSON20	I hesitate to use computers for fear of making mistakes that I cannot correct	15	5	2	1	2
9(u)	12(u)	PERSON21	I do not understand computer terminology	11	7	3	3	1

Notes: Q 'A' and Q 'B' are Questionnaires A and B respectively.

Table 2 below show a summary of results of the reliability analysis of the ANXIETY scale carried out using SPSS program. The complete results of this analysis are presented in Appendix 5 Table A1.

Table 2: Reliability Analysis of the ANXIETY Scale

Variable label	Item- Total Correlation
PERSON17	0.1843
PERSON18	0.6627
PERSON19	0.7890
PERSON20	0.5609
PERSON21	0.5020
Reliability Coefficients (Alpha) =	0.7516

In reliability analysis, item-total correlation is the measure of the fit of the item to the scale with items with high values (near unity) considered as 'better' fitting when compared to items with low values (near zero). In addition, the appropriateness of the scale is indicated by the reliability coefficient (alpha) with values near unity considered as adequate.

In this study a decision was made to include an item in the scale if its item-total correlation is 0.15 or more and the reliability of the scale was considered as adequate if

0.70 or above. It is important to note that negative item-total correlation indicates that the item is not fitting the scale (that is, does not belong to that scale) and therefore such an item can not be used in that scale. It is also important to note that the negatively stated items should be recoded before carrying out reliability analysis.

From the results presented in Table 2 above, it can be seen that all the five items in the ANXIETY scale had adequate fit to the scale (item-total correlation ≥ 0.15) and therefore it was appropriate to average the head teachers' scores on these five items to get a single score for each head teacher on the ANXIETY scale.

6. Attitudes toward Change (ATTITUDE)

In order to measure the perceived attitude towards change (ATTITUDE), respondents were asked to what extent they agreed to 16 statements [See appendices Questionnaire A items 9(a) to 9(p) and Questionnaire B items 12(a) to 12(p)].

This variable was constructed using the procedure described for ANXIETY scale above. Reliability analysis revealed that all the 16 items in the ATTITUDE scale had adequate fit to the scale (item-total correlation ≥ 0.15). The alpha value of this scale was 0.81 and therefore it was appropriate to average the head teachers' scores on these 16 items to form the ATTITUDE scale. All items were therefore included in the scale. The results of the reliability analysis involved in construction of this variable are in Appendix 5 Table A5.

4.1.2 Construction of Technological Factors

The following four technological factors were considered in this study:

- Relative advantage
- Compatibility
- Complexity
- Trialability

Table 3 shows the frequencies of the responses to the technological factors (relative advantage, compatibility, complexity and trialability) related items. There were no

many missing responses (i.e. code'9' in Table 3) on these items and the few that were there were replaced by the means of these variables.

Table 3: Technology Items Responses

Variable group	Variable label	Variable statement	Not at all (code 1)	Low (code 2)	Mode-rate (code 3)	High (code 4)	Miss-ing (code 9)
Efficiency Benefits (EFFECTIV)	BELIEF01	a) reduce the number of people necessary to perform tasks	2	3	11	8	1
	BELIEF02	b) reduce the cost of school operation	1	2	13	8	1
	BELIEF03	c) allow me to handle a greater volume of work	1	4	4	16	0
Effectiveness benefits (EFFICIEN)	BELIEF04	d) improve administration and management	1	1	10	12	1
	BELIEF05	e) improve results	1	7	12	5	0
	BELIEF06	f) enhance teaching and learning	1	3	10	11	0
Information benefits (INFORMA)	BELIEF07	g) make new information available to me and school	1	3	10	11	0
	BELIEF08	h) provide more up-to-date information	1	3	12	9	0
	BELIEF09	i) make it easier to get the information that I need	1	1	11	12	0
	BELIEF10	j) save me time in looking for information	2	2	13	8	0
Compatibility (COMPATIB)	BELIEF12	l) fit into my work style)	2	4	14	5	0
	BELIEF13	m) compatible with all aspects of my work	3	3	11	7	1
	BELIEF14	n) compatible with my previous experiences	4	10	9	2	0
Complexity (COMPLEX)	BELIEF15	o) be very difficult to understand	9	5	6	4	1
	BELIEF16	p) be very difficult to use	8	4	7	4	2
Trialability (TRIALABI)	BELIEF17	q) be able to be tried out in smaller version	3	7	11	2	1
	BELIEF18	r) be able to be implemented module by module	1	6	13	4	1

1. Relative advantage (RELADV)

The perceived relative advantage (RELADV) of information technology was a variable that was constructed by averaging the head teachers' responses to the items in three groups of variables, namely efficiency benefits (EFFICIEN), effectiveness benefits (EFFECTIV) and information benefits (INFORMA). Information regarding the items in these three groups of variables can be seen in Table 3 above. The information about these variables was collected from responses to Questionnaire A [(items 7(a) to 7(j)] and Questionnaire B [(items 11(a) to 11(j)].

From Table 3, it can be seen that there were three items included under 'efficiency benefits' (labeled BELIEF01 to BELIEF03 in Table 3 and namely; reduce number of human resource, reduce cost, and allow greater work volume). Likewise, there were three items included under 'effectiveness benefits' class (labeled BELIEF04 to BELIEF06 in Table 3 and namely; improve administration, improve results and enhance teaching and learning), and there were four items in the 'information benefits' class (labeled BELIEF07 to BELIEF10 in Table 3 namely; avail new information, provide up-to-date information, make it easier to get information needed, and save time in looking for information).

Reliability analysis was carried out to check if it was appropriate to average the responses to the 10 variables (BELIEF01 to BELIEF10 in Table 3) under the three groups mentioned above (EFFICIEN, EFFECTIV and INFORMA) to form a single score for each head teacher on the relative advantage scale (RELADV), and whether some of these items needed to be dropped from the scale or needed to have their coding reversed.

Table 4 below show a summary of results of the reliability analysis of the RELADV scale carried out using SPSS program. It should be noted that two items (BELIEF02 and BELIEF10) were deleted from the RELADV scale because their item-total correlation was below the 0.15 cutoff value. The complete results of this analysis are presented in Appendix 5 Table A3.

Table 4: Reliability analysis of the RELADV Scale

Variable group	Variable label	Item - Total Correlation
Efficiency Benefits (EFFECTIV)	BELIEF01	0.1741
	BELIEF03	0.2952
	BELIEF04	0.5065
Effectiveness benefits (EFFICIEN)	BELIEF05	0.2370
	BELIEF06	0.4701
Information benefits (INFORMA)	BELIEF07	0.5510
	BELIEF08	0.6853
	BELIEF09	0.5392
	Reliability Coefficients (Alpha) =	0.7231

NOTE:
Two items (BELIEF02 and BELIEF10) were deleted from RELADV scale because their item-total correlation were low (<0.15)

From the results presented in Table 4 above, it can be seen that all the items included in the final RELADV scale had adequate fit (item-total correlation ≥0.15). Therefore, it was appropriate to average the head teachers' scores on these items to form the RELADV scale, with the composite variables having factor loadings as below.

EFFECTIV	.84731
EFFICIEN	.72475
INFORMA	.93241

2. Compatibility (COMPATIB)

Compatibility (COMPATIB) was reflected by three items, namely; compatibility with work style (BELIEF12), compatibility with all work aspects (BELIEF13), and compatibility with previous experiences (BELIEF14). Information on these three items was derived from Questionnaire A number 7 and Questionnaire B number 12. Frequencies of responses to these three items are presented in Table 3 above.

Reliability analysis was also carried out and all items were found to be fit to be included in the scale, as they had item – total correlation of 0.6741, 0.7988 and 0.7408 for BELIEF12, BELIEF13 and BELIEF12 respectively, and an alpha value of 0.8593. The full results of this reliability analysis are included in Appendix 5 Table A4.

3. Complexity (COMPLEX)

Complexity (COMPLEX) was reflected by only two items, namely difficult in understanding IT (BELIEF15) and difficulty in using IT (BELIEF16). Frequencies of responses to these two items are presented in Table 3 above. The correlation coefficient between these two variables was very strong (0.85) which indicated that it was appropriate to average the responses on these variables to form a single score. Consequently, the head teachers' scores on the items were averaged to form scores on the COMPLEX scale.

4. Trialability (TRIALABI)

This was also reflected by only two items, namely; can be able to be tried out in smaller version (BELIEF17) and can be implemented module by module (BELIEF18). The frequencies of responses to these two items are presented in Table 3 above. The correlation coefficient between these two variables was strong (0.75) and therefore the two variables were averaged to form the TRIALABI variable.

4.1.3 Construction of Phases of IT- Implementation Indicators

Descriptions of how the variables of the phases of IT implementation were constructed are presented in this section.

1. Initiation (INTIATN)

The level of pressure at the initiation stage was reflected by four items, labeled CFACTOR01 to CFACTOR04. Information regarding these four items can be seen in Table 5. The few missing responses in Table 5 (code '9') were replaced by the means of the responses on each item. Head teachers who had no computers in their schools were placed in the 'Not at all' category in Table 5 (i.e, code '1').

Reliability analysis of these items revealed that CFACTOR01 had insufficient fit (item-total correlation <0.15) to the initiation scale (INTIATN) and therefore these item was deleted. The remaining three items had adequate item-total correlations, 0.6745, 0.6290 and 0.2084 for CFACTOR02, CFACTOR03 and CFACTOR04 respectively. The alpha value of this scale was 0.6639, which missed the 0.70 cutoff set for use in the current study. Nevertheless, because of the importance of this construct (initiation) in this study, a decision was made not to drop the variable in subsequent analyses. The full results of this reliability analysis are in Appendix 5 Table A5.

Table 5: Initiation Items Responses

Item	Variable label	Variable statement	Not at all *(code 1)*	Low *(code 2)*	Mode-rate *(code 3)*	High *(code 4)*	Miss-ing *(code 9)*
6(a)	CFACTOR01	It was important that we should take advantage of technological developments by adopting them early	9	0	3	13	0
6(b)	CFACTOR02	There was pressure from the public, parents and students that we should modernize and upgrade our technology	10	3	6	4	2
6(c)	CFACTOR03	There was pressure from teachers that we should modernize and upgrade our technology	10	3	7	4	1
6(d)	CFACTOR04	Ministry of Education had initiated the interest in new technologies and we were keen that the school should seriously consider them further	11	2	6	6	0

2. Adoption (ADOPTION)

The indicator of level of IT adoption variable (ADOPTION) was constructed using factor analyses method following principal component technique. Three composite variables were used to construct this variable, namely; year the school acquired its first computer (ICT_YR), the school's level of commitment in IT (COMIT_LV), and the number of software used by employee (SSUSE).

The variable ICT_YR was derived from the first question in Questionnaire A, which asked when the school acquired its first computer. From this, the number of years a school has had a computer was calculated. A zero (0) was used to code schools that had no computers.

The variable COMIT_LV was computed by deriving the percentage of budget allocated to IT by schools to the total school budget. The information required to derive this variable was obtained from responses of head teachers to questions 15 and 16 in Questionnaire A. Schools that had no computers were coded '0' on this COMIT_LV variable.

The variable SSUSE was constructed by averaging head teachers responses to the frequencies of use of various computer programs in the school. The frequencies of availability and use of various computer softwares in schools are displayed in Table 6 below. The head teachers in schools with no computers were placed in the 'Not available' and 'Not used at all' under availability and use of softwares respectively.

Table 6: Computer Software Availability and Use Items Responses

	Availability		**Frequency of Use**		
Software	**Available** (code 1)	**Not Available** (code 2)	**Frequently Used** (code 1)	**Infrequently Used** (code 2)	**Not Used at All** (code 3)
Word	18	0	18	0	0
Excel	17	1	15	1	1
Presentation	13	5	6	7	0
Drawing	2	16	0	1	1
Internet	5	13	2	1	2
Programming	8	10	6	2	0
Administration	4	14	4	0	0
Database	12	6	11	1	0
WebPublish	6	12	3	2	1
Information Resource	5	13	2	2	1

Score on these three variables described above (i.e. ICT_YR, COMIT_LV and SSUSE) were used as inputs in factors analyses to construct the variable ADOPTION in SPSS computer program. The factor loadings of these variables were as follows.

Factor loadings	
ICT_YR	0.8578
COMIT_LV	0.7994
SSUSE	0.9101

3. Implementation

Implementation has two constructs, utilization, and user satisfaction.

i). Utilization (UTILISTN)

The indicator of level of IT utilization (UTILISTN) indicator variable was constructed from three composite variables, namely: IT use in curriculum area (ITCURR), number of IT-skills taught in schools (ITSKILL), and number of IT-tasks used by employees in the school (ITTASK). The steps followed to construct this variable were similar to those that were followed in the construction of the variable ADOPTION in the previous sub-section. First, the three variables (ITCURR, ITSKILL and ITTASK) were constructed individually and independently, and then the scores on these variables were used in construction of UTILISTN variable using factor analyses in SPSS software.

There were four items considered in the ITCURR scale (labeled ITUSE01 to ITUSE04), thirteen items were considered in the ITSKILL scale (labeled ITSKIL01 to ITSKIL13) and six items were considered in the ITTASK skill (labeled SITEMS01 to SITEMS06). Reliability analyses involving the items in the ITCURR, ITSKILL and ITTASK scales revealed that all the items in these scales had adequate item-total correlation values (>0.15). The reliability coefficients of these scales were 0.7015, 0.9607 and 0.7206 for ITCURR, ITSKILL and ITTASK respectively. Therefore, it was appropriate to average the head teachers' responses on each of these three groups of variables to compute scores on the ITCURR, ITSKILL and ITTASK scales.

The frequencies of responses for the items included in ITCURR, ITSKILL and ITTASK scales can be found in Appendix 5 Table A7 (a), (b) and (c) respectively. A summary of the results of reliability analyses involving items in the ITCURR, ITSKILL and ITTASK are presented in Appendix 5 Table 8.

The scores on the variables described above (ITCURR, ITSKILL and ITTASK) were used to construct the variable UTILSTN using factor analyses in SPSS. The factor loadings of these variables were as follow.

	Factor loadings
ITCURR	0.85206
ITTASK	0.86588
ITSKIL	0.87799

ii). User Satisfaction (SATISFAC)

User Satisfaction (SATISFAC) was reflected by 25 variables (labeled SSITU01 to SSTU25) in four broad groups, namely; vendor satisfaction, training satisfaction, IT satisfaction, and system performance satisfaction. This variable was constructed using the same procedure used to construct the variable ANXIETY described above. Reliability analysis involving the 25 variables considered in this scale showed that all but one (SSITU06) of these variables had adequate item-total correlations values (>0.15). Consequently, this misfitting item (SSITU06) was deleted from the scale and the responses of others 24 items were average to get scores on the SAFISFAC scale. The reliability coefficient of this scale was 0.9019.

The frequencies of the responses for these variables are presented in Appendix 5 Table A8 while the results of reliability analysis of the variables involved in this construct are presented in Appendix 5 Table A9.

4. Evaluation (EVALUATN)

User performance was used to measure evaluation. The impact of IT on user performance (EVALUATN) was reflected by the impact of IT and nine items (labeled CFEEL01 to CFEEL09) were considered in this scale. However, reliability analysis revealed that three of these nine items (namely CFEEL01, CFEEL02, and CFEEL06) had item-total correlation values below the cutoff value of 0.15 and consequently these three items were deleted. In addition, three items on this scale were recoded because they were negatively stated (i.e. CFEEL03, CFEEL05 and CFEEL06).

Final construct had an alpha value of 0.7331. The frequencies of responses to the items involved in this scale and the results of reliability analysis involved can be found in Appendix 5 Table A10 and Table A11 respectively. The procedures described in the

construction of the variable ANXIETY were followed in the construction of this variable.

4.2 Analyses and Results

This section provides a summary and discussion of the analyses carried out to answer the four specific research questions presented in Chapter 1. The first part of this section focuses on descriptive statistics while the second part focuses on multiple regression analyses carried out to examine the factors that influence various phases of IT implementation in secondary schools in Nakuru Municipality. The results of the variance explained in each phase of IT implementation are presented and discussed in the third part of this section.

4.2.1 Descriptive Statistics: Current IT Situation and Usage

Descriptions of the current IT situation and IT usage in teaching, learning and management in secondary schools in Nakuru Municipality are presented in this section.

4.2.1.1 Background of Respondents and Computer in School

Figure 3 displays information regarding the age groups of the 25 head teachers involved in this study and whether or not their schools had at least one computer while Figure 4 displays the same but for the genders of these head teachers.

From the information displayed in Figure 3, it can be seen that the largest group of respondents were in the age category '30 to 40 years' (36%), followed by those who were in the age category 'Above 45 years' (28%) and then those who were in age the category '41 to 45 year' (24%). Likewise, from Figure 4, it can be seen that 17 of the 25 respondents were male (68%).

It can also be seen from the information displayed in Figure 3 that, for example, five of the nine head teachers who were in the age category '30 to 40 years' had computers in their schools and that all the seven head teachers who were above 45 years had computers in their schools. Similarly, from Figure 4, it can be seen that 12 of the 17 male head teachers and 6 of the 8 female head teachers had computers in their schools.

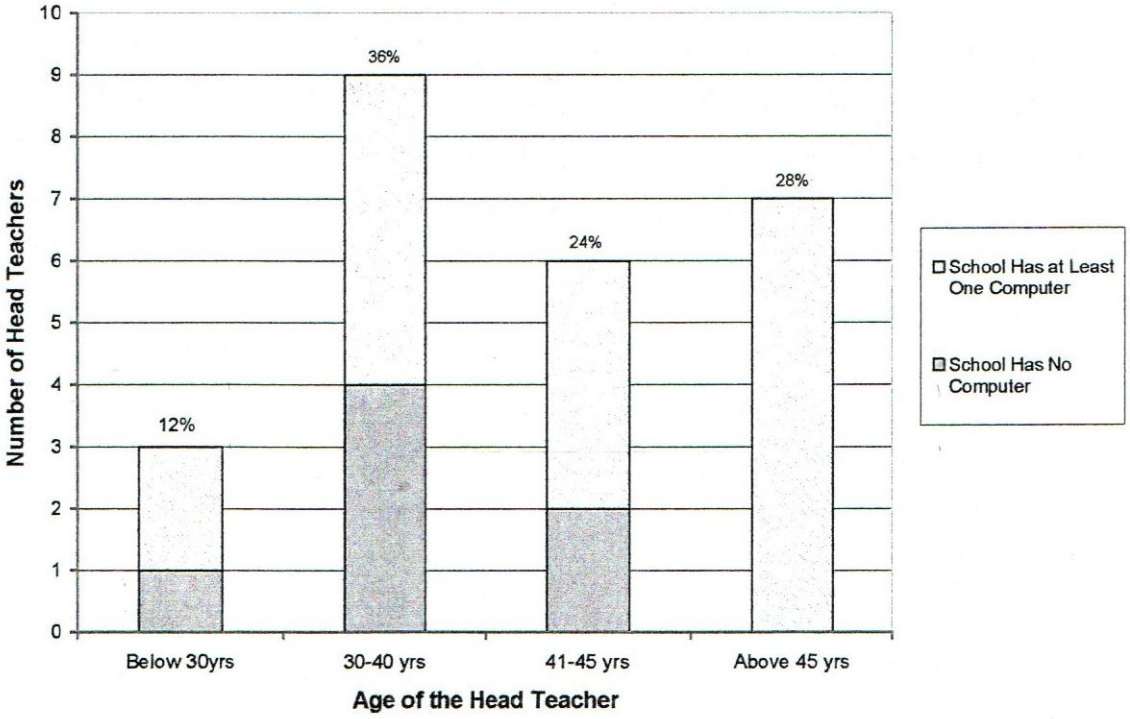


Figure 3: Age of Head Teachers and Computer in Schools

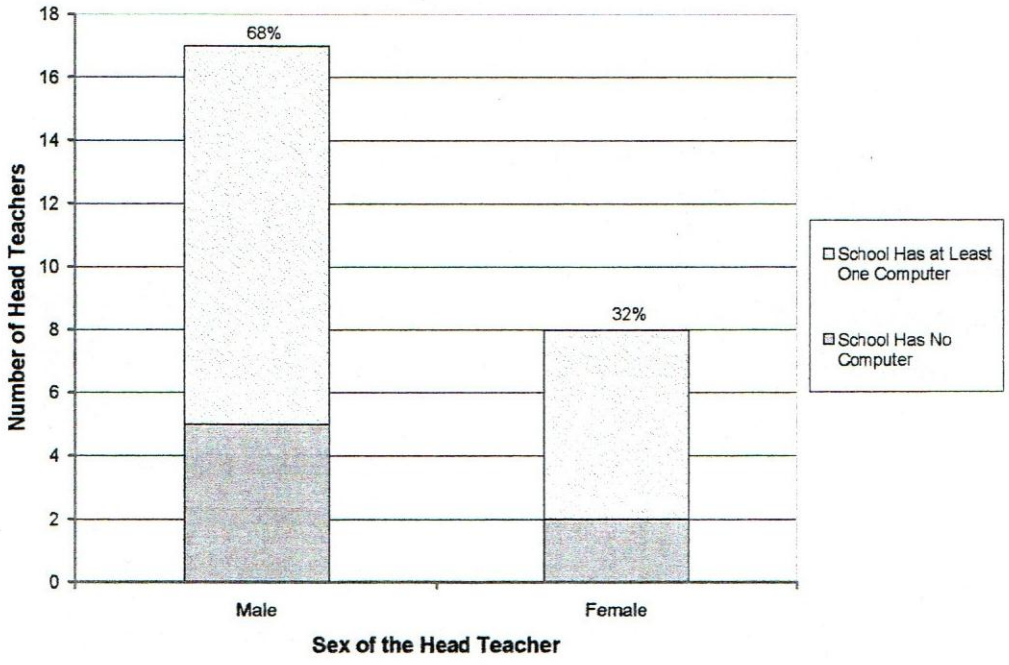


Figure 4: Sex of Head Teachers and Computer in Schools

4.2.1.2 Computer Acquisition

Figure 5 shows the cumulative numbers of schools that had acquired computers between 1998 and 2004. Out of the 25 sampled schools, 18 of them had computers. Of the sampled schools, the school which acquired computers the earliest was in 1998, while the years when many schools acquired computers were 2000, 2002, and 2004, as can be seen from the graph in Figure 5 below.

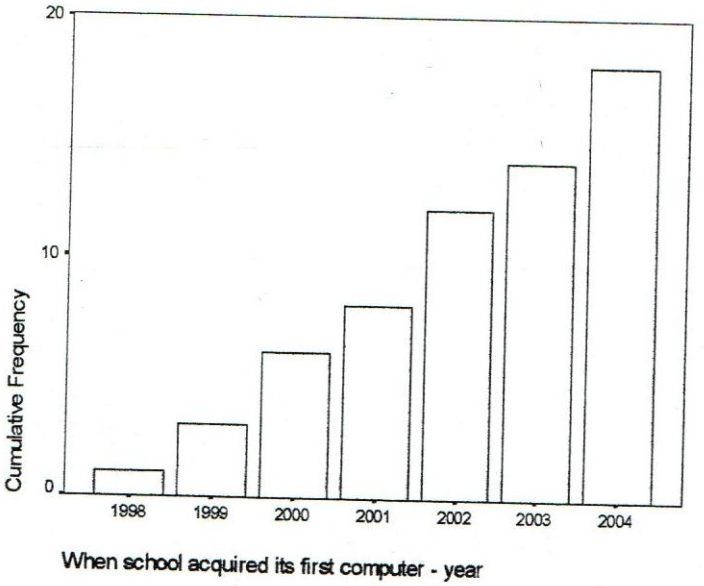


Figure 5: Cumulative Acquisition of Computers

4.2.1.3 Computer Use in Teaching and Learning

Total numbers of computers in the schools under study were 271 computers. Six of the schools which had four computers or less indicated that none of those were used for teaching and learning. This means that those were used for administration and management. Out of total 271 computers, over 80% were reported as being used for teaching and learning purposes.

Total number of computers	271
Total number of computers used for teaching	217
Percentage of computers used for teaching	80%

The graph in Figure 6 below shows the total numbers of computers per school, and out of those, the total numbers of computers that the head teachers claimed that were used in teaching and learning. Most of the schools with more than one computer indicated that majority of their computers were used for teaching and learning. However, on IT

usage in specific curriculum areas, on average, the sampled schools indicated as the extent of IT usage as 'few' in all areas asked, apart from on computer studies, which on average indicated 'some'. From this kind of data, it can be said that majority of the computers found in schools were used for teaching computer studies. Out of the 18 schools that had a computer, 11 offered computer studies while the remaining 7 did not offer any computer related studies.

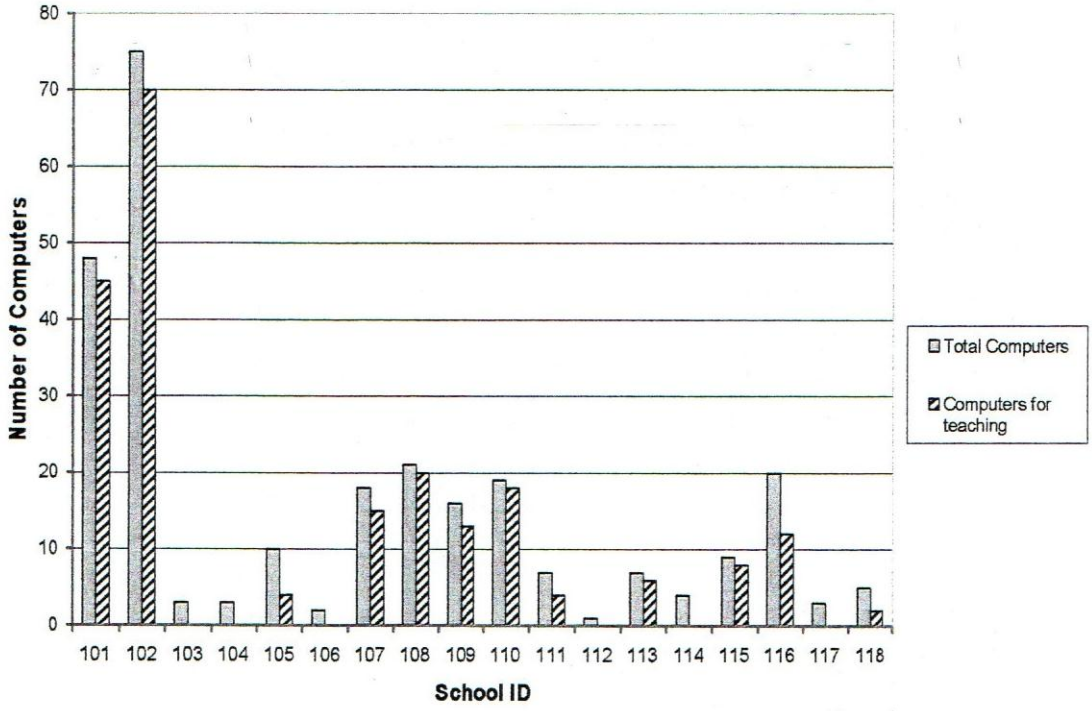


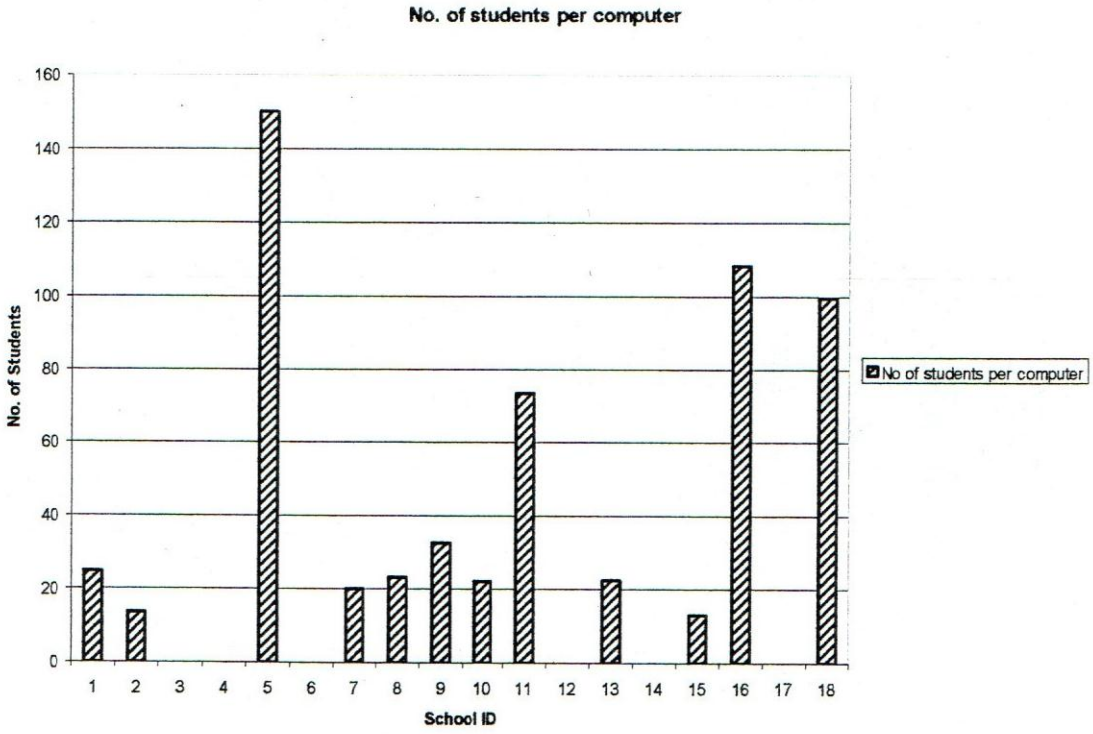
Figure 6: Total Computers and Computers Used for Teaching

The ratio of the computers to students in the sampled schools is as shown in graph below. Six schools of the schools with at least one computer did not use the computers available for teaching and learning, and thus had a ratio of zero. The schools that had a ratio of 20 students to one computer and below were only three, while those with between 20 and 40 students per computer were five. The others had a ratio of 60 and above students per computer, with one having 150 students per computer. Therefore, the computers available and used for teaching and learning purposes were too few for effective teaching and learning purposes.

4.2.1.4 Software Situation in Schools

The frequencies of availability and the frequencies of use of various computer softwares in schools were presented earlier in this chapter under the construction of

variable (in Table 6 below). These frequencies are summarized in Figures 7 and 8, for softwares available in school and usage respectively.



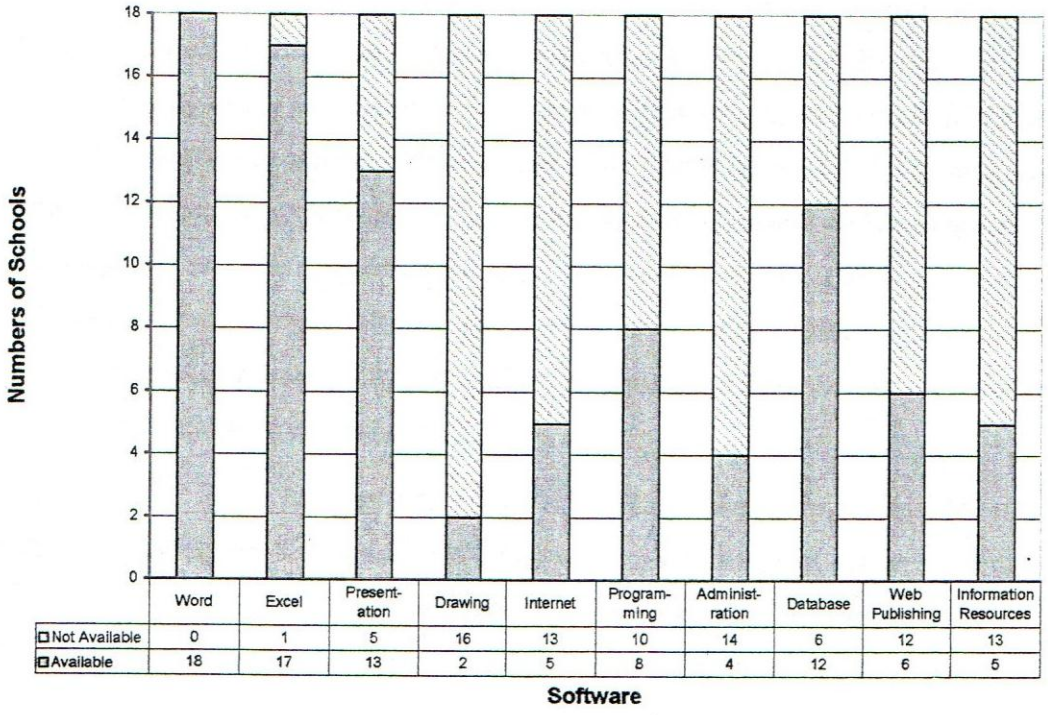
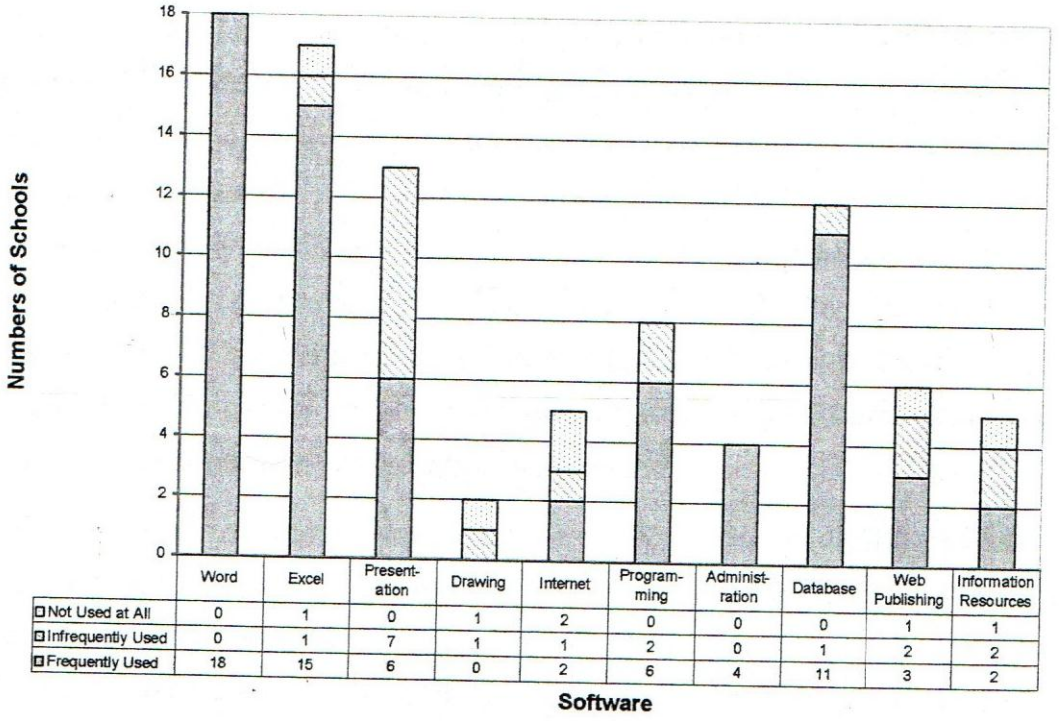


Figure 7: Software Available in Schools



	Word	Excel	Present-ation	Drawing	Internet	Program-ming	Administ-ration	Database	Web Publishing	Information Resources
Not Used at All	0	1	0	1	2	0	0	0	1	1
Infrequently Used	0	1	7	1	1	2	0	1	2	2
Frequently Used	18	15	6	0	2	6	4	11	3	2

Figure 8: Frequency of Use of Available Software

From Figure 7, it can be seen that a wide variety of softwares were available in the 18 school which had at least one computer. However, only Word was available in all these schools. Excel was available in 17 out of the 18 schools (94%). The other softwares that were in majority of the schools were PowerPoint (Presentation) and Access (Database). All the other softwares were available in only a few of the 18 schools. It is worth noting that, the most common softwares in these schools were Microsoft Office programs and these programs come as a package and often come with the computer. It is very highly likely that all the Microsoft Office programs were available, but since they were either never put to use, or because the head teachers may not have been conversant with them, they indicated that they were not available.

From Figure 8, it can be seen that, of the available softwares in schools, Word was frequently used by all the 18 schools. Excel was put into frequent use by 15 of the 17 schools that had this software and Access (Database) was used frequently by 11 of the 12 schools that had it.

4.2.2 Multiple Regression Analyses: Factors Influencing IT Implementation in Schools

The results of the final regression model for each of the phases of IT implementation (i.e. *Initiation, Adoption, Utilization, User Satisfaction* and *User Performance*) are presented in the next five sub-sections together with their interpretations. The variables tested in each of these five models are summarized in Table 7 below. This table follows the hypothesized conceptual model shown in Figure 2. A tick symbol (√) in Table 7 is used to indicate that this variable was tested in a particular model. For example, the tick symbols in Table 7 show that human and technological variables were tested in all the five models. In addition to the human and technological variables, Table 7 shows that Initiation variable was tested in the *Adoption* model and so on.

The human variables tested in these models were age (HAGE), sex (HSEX), education (HEDUC), attitudes toward change (ATTITUDE) and computer related anxiety (ANXIETY). The technological variables tested in the models were relative advantage (RELADV), compatibility (COMPAT), complexity (COMPLEX), and trialability (TRIALABI). The analyses reported in this section were carried out using SPSS software multiple regression procedures following the stepwise technique.

Table 7: Variables Tested in each IT-Implementation Stage Regression Model

	Variables tested in the model					
Model	**Human variables** (HAGE HSEX HEDUC ATTITUDE ANXIETY)	**Technological variables** (RELADV COMPATIB COMPLEX TRIALABI)	**Initiation variable** (INITIATN)	**Adoption variable** (ADOPTION)	**Utilization variable** (UTILISTN)	**User satisfaction variable** (SATISFAC)
Initiation	√	√				
Adoption	√	√	√			
Utilization	√	√		√		
User Satisfaction	√	√			√	
User Performance	√	√			√	√

4.2.2.1 Initiation Model

Table 8 shows the results of the multiple regression analyses for the final *Initiation* model in the stepwise procedure. Thus, out of the ten variables tested in the *Initiation* model (listed in Table 7 above) only two variables (i.e. RELADV and ANXIETY) were

found to be significant (at $p \leq 0.05$) in this model. The full results of the various steps of this model in the stepwise procedure are presented in Appendix 6 Table A11.

Both standardized and unstandardized (also known as 'metric') regression coefficients are presented in Table 8. The standard errors given are those of the metric coefficients. It should be noted that the coefficients displayed in Table 8 are significant at $p \leq 0.05$ as indicated by their t-values and the associated p-values. It is worth noting that the signs of the coefficients (metric or standardized) indicate the directions of effects and can be interpreted meaningfully if the coding of the variables is considered.

Table 8: Initiation Model Regression Results

	Unstandardized		Standardized		
Variables in model	**coefficient**	**Std error**	**coefficient**	**t**	**p**
Mean (Constant)	1.557	0.533		2.920	0.013
Relative advantage (RELADV)	0.536	0.173	0.634	3.109	0.009
Computer related anxiety (ANXIETY)	0.581	0.257	0.460	2.258	0.043

NOTES: Dependent variable is Initiation (INITIATN)
p is the probability value
t is the t-statistic value

Based on the metric coefficients, the results in Table 8 can be written in equation format as follows:

$$INITIATN = 1.557 + 0.536*(RELADV) + 0.581*(ANXIETY) \quad \text{[Equation 1]}$$

The constant (1.557) in Table 8 (and also in Equation 1) is the mean IT initiation rate of the 25 head teachers involved in this study. The positive coefficients for RELADV in Table 8 indicate that, when all other factors were equal, head teachers who thought that IT had a relative advantage over existing technology were more likely to initiate IT when compared to head teachers who thought otherwise. On the other hand, the positive coefficients for ANXIETY indicate that that head teachers who were anxious about the use of IT were more likely to initiate it when compared to head teachers who

were less anxious about the use of IT. Interestingly, some amount of anxiety has also been linked to success in examination and other activities such as sports.

By way of caution, sizes of metric coefficients of the variables do not indicate the relative magnitude of effects and can not therefore be used to rank the variables in terms of their relative degree of influence on the outcome. Absolute values of standardized coefficients (also known as 'effect size') can be used to rank variables in terms of their relative degree of influence on the outcome within the same sample (see Hox, 1995, p.26). Thus, based on the standardized coefficients given in Table 8, it would appear that the RELADV (0.634) was a better predictor of IT initiation among the 25 head teachers in Nakuru district when compared to ANXIETY (0.460). In other words, if everything else was held equal, the relative advantage of IT over exciting technology was a better drive for IT initiation when compared to head teacher's computer related anxiety.

4.2.2.2 Adoption Model

Table 9 shows the results of the multiple regression analyses for the final *Adoption* model in the stepwise procedure. Out of the variables tested in the *Adoption* model (see Table 7 above) two variables (i.e. INTIATN and TRIALABI) were found to have significant (at $p \leq 0.05$) effects in this model. The full results of the various steps of this model in the stepwise procedure are in Appendix 6 Table A12.

Table 9: Adoption Model Regression Results

	Unstandardized		Standardized		
Variables in model	**coefficient**	**Std error**	**coefficient**	**t**	**p**
Mean (Constant)	0.714	0.499		1.430	0.167
Initiation (INTIATN)	0.512	0.094	0.721	5.433	0.000
Trialability (TRIALABI)	-0.615	0.180	-0.452	-3.407	0.003

NOTES: Dependent variable is Adoption (ADOPTION)
p is the probability value
t is the t-statistic value

Based on the metric coefficients, the above results can be written in equation format as follows:

$$ADOPTION = 0.714 + 0.512*(INTIATN) - 0.615*(TRIALABI) \ldots\ldots\ldots\ldots \text{[Equation 2]}$$

When interpreting the constant (0.714) in Table 9 and Equation 2, it is important to bear in mind that the outcome variable in this model (ADOPTION) was constructed using factor analysis principal component procedure. This means that this outcome variable has a mean of zero and a standard deviation of one. Thus, the mean adoption rate of 0.714 (i.e. the constant in Table 9) indicates that the likelihood of these head teachers adopting IT was slightly above average. That is, these head teachers were general more likely to adopt IT rather than not to adopt it.

The positive coefficients for INTIATN in Table 9 indicate that head teachers who were initiators of IT were more likely to be the adopters of IT, which makes a lot of sense. On the other hand, the negative coefficients for TRIALABI indicate that head teachers who believed that IT can not be tried module by module or can not be tried in small scales were highly likely to adopt IT when compared to those head teachers who believed that IT could be tried module by module or could be tried in small scale. The latter findings were somewhat surprising because one would expect the adopters of IT to be those who believe that IT can be tried module by module or can be tried in small scales. Thus, it would be profitable to repeat this study with a different sample of head teachers from other districts to verify the results.

In terms of relative effects, the standardized coefficients in Table 9 indicate that INITIATN (0.721) was a better predictor of adoption when compared to TRIALABI (0.452, taken in absolute). That is to say that, if everything else was taken to be equal, being an IT initiator was a more powerful drive towards adopting IT when compared to beliefs regarding IT on whether IT can be tried module by module and in small scales.

4.2.2.3 Utilization Model

Table 10 shows the results of the multiple regression analyses for the final *Utilization* model in the stepwise procedure. Only one variable (ADOPTION) was significant (at $p \leq 0.05$) in this model out of the variables tested (see Table 7 above).

Table 10: Utilization Model Regression Results

	Unstandardized		Standardized		
Variables in model	**coefficient**	**Std error**	**coefficient**	**t**	**p**
Mean (Constant)	-0.005	0.115		-0.043	0.966
Adoption (ADOPTION)	0.845	0.117	0.839	7.228	0.000

NOTES: Dependent variable is Utilization (UTILISTN)
p is the probability value
t is the t-statistic value

Based on the metric coefficients, the above results can be written in equation format as follows:

UTILISTN = -0.005 + 0.845(ADOPTION)*..... [Equation 3]

The outcome variable in the above model (UTILISTN) was constructed using factor analysis principal component procedure, which means that this variable has a mean of zero and a standard deviation of one. Consequently, the mean utilization rate of -0.005 (i.e. the constant) and the associate p-value of 0.966 indicates that the utilization rate of these head teachers was not significantly different from zero which is the average of the variable UTILISTN.

The positive coefficients for ADOPTION in Table 10 indicate that head teachers who were adopters of IT were more likely to utilize IT, which makes sense. From this model, it can also be concluded that human and technological factors did not play a part in IT utilization. In other words, factors such as age, gender, IT relative advantage and IT compatibility did not influence IT utilization and what actually mattered in IT utilization was whether the head teacher was an adopter or not.

The SPSS multiple regression output for the *Utilization* model can be found in Appendix 6 Table A13.

4.2.2.4 User Satisfaction Model

Table 11 shows the results of the multiple regression analyses for the final *User Satisfaction* model in the stepwise procedure. Only two variables (UTILISTN and COMPATIB) out of the variables tested in this model (see Table 7 above) had significant (at $p \leq 0.05$) influence on user satisfaction. The full results of the various steps of this model in the stepwise procedure can be found in Appendix 6 Table A14.

Table 11: User Satisfaction Model Regression Results

	Unstandardized		Standardized		
Variables in model	**coefficient**	**Std error**	**coefficient**	**t**	**p**
Mean (Constant)	3.654	0.701		5.216	0.000
Utilization (UTILISTN)	0.967	0.178	0.689	5.429	0.000
Compatibility (COMPATIB)	-0.597	0.252	-0.301	-2.371	0.027

NOTES: Dependent variable is Satisfaction (SATISFAC)
p is the probability value
t is the t-statistic value

The above results can be written in equation format as follows:

$$SATISFAC = 3.654 + 0.967*(UTILISTN) - 0.597*(COMPATIB) \ldots\ldots\ldots \text{[Equation 4]}$$

The positive coefficients for UTILISTN in Table 11 and in Equation 4 indicate that head teachers who were utilizing IT were more likely to have higher user satisfaction, which makes sense. The negative coefficients for COMPATIB indicate that head teachers who thought that IT was not compatible with their previous experiences or those who thought that IT was not compatible with aspects of their work or those who thought that IT did not fit into their work style were more likely to have higher user satisfaction during IT implementation when compared to the head teachers who thought

otherwise. Thus, it appears that the head teachers who expected very little from IT were the ones who were getting more satisfaction perhaps after discovering what IT had to offer.

4.2.2.5 User Performance Model

Table 12 shows the results of the multiple regression analyses for the final *User Performance* model in the stepwise procedure. Four variables (SATISFAC, UTILISTN, HAGE and COMPATIB) out of the 12 tested in this model (see Table 7 above) had significant (at $p \leq 0.05$) effects on user performance. The full results of the various steps of this model in the stepwise procedure are presented in Appendix 6 Table A15.

Table 12: User Performance Model Regression Results

	Unstandardized		Standardized		
Variables in model	**coefficient**	**Std error**	**coefficient**	**t**	**p**
Mean (Constant)	1.095	0.552		1.982	0.062
User satisfaction (SATISFAC)	0.585	0.099	0.528	5.911	0.000
Utilization (UTILISTN)	0.582	0.125	0.374	4.641	0.000
Head teacher's age (HAGE)	0.289	0.080	0.192	3.605	0.002
Compatibility (COMPATIB)	-0.282	0.132	-0.128	-2.135	0.046

NOTES: Dependent variable is Evaluation (EVALUATN)
p is the probability value
t is the t-statistic value

The above results can be written as follows in equation format:

EVALUATN = 1.095 + 0.585(SATISFAC) + 0.582*(UTILISTN) + 0.289*(HAGE) - 0.289*(COMPATIB)* ..... .[Equation 5]

The positive coefficients for the variables SATISFAC and UTILISTN in Table 12 indicate that head teachers who had higher user satisfaction were more likely to have higher user performance and that head teachers who were utilizing IT were more likely

to have higher user performance. For the variable HAGE, the positive coefficients indicate that the older (and perhaps more experienced or more senior) head teachers were more likely to have higher user performance when compared to younger (and perhaps less experienced) head teachers.

Like in the *User Satisfaction* model described in the previous sub-section, the variable COMPATIB has negative coefficients in this model too. This indicates that that head teachers who thought that IT was not compatible with their previous experiences or with their work aspects or those who thought that IT could not fit into their work style were the ones who were more likely to have higher user performance after IT implementation when compared to head teachers who thought otherwise. Thus, it would appear that the head teachers who expected little from IT had not only higher use satisfaction but also higher user performance after IT implementation.

In terms of relative effects, the standardized coefficients in Table 12 indicate that best predictor of user performance was SATISFAC (0.528), followed by UTILISTN (0.374), HAGE (0.192) and COMPATIB (0.128, taken in absolute) in that order.

4.2.2.6 Summary of the Models

The five models of IT implementation phases described above are together presented in Figure 9. The numbers displayed in Figure 9 are the metric coefficients of the variables and their standard errors (in parenthesis).

From Figure 9 it can be seen that, in this study, *Initiation* was influenced by computer related anxiety and IT relative advantage while *Adoption* in turn was influenced by IT initiation and IT trialability. *Utilization* was influenced by Adoption while *User Satisfaction* was influenced by IT utilization and IT compatibility. Finally, *Use Performance* was influence by IT utilization, User satisfaction, IT compatibility and age of the head teacher.

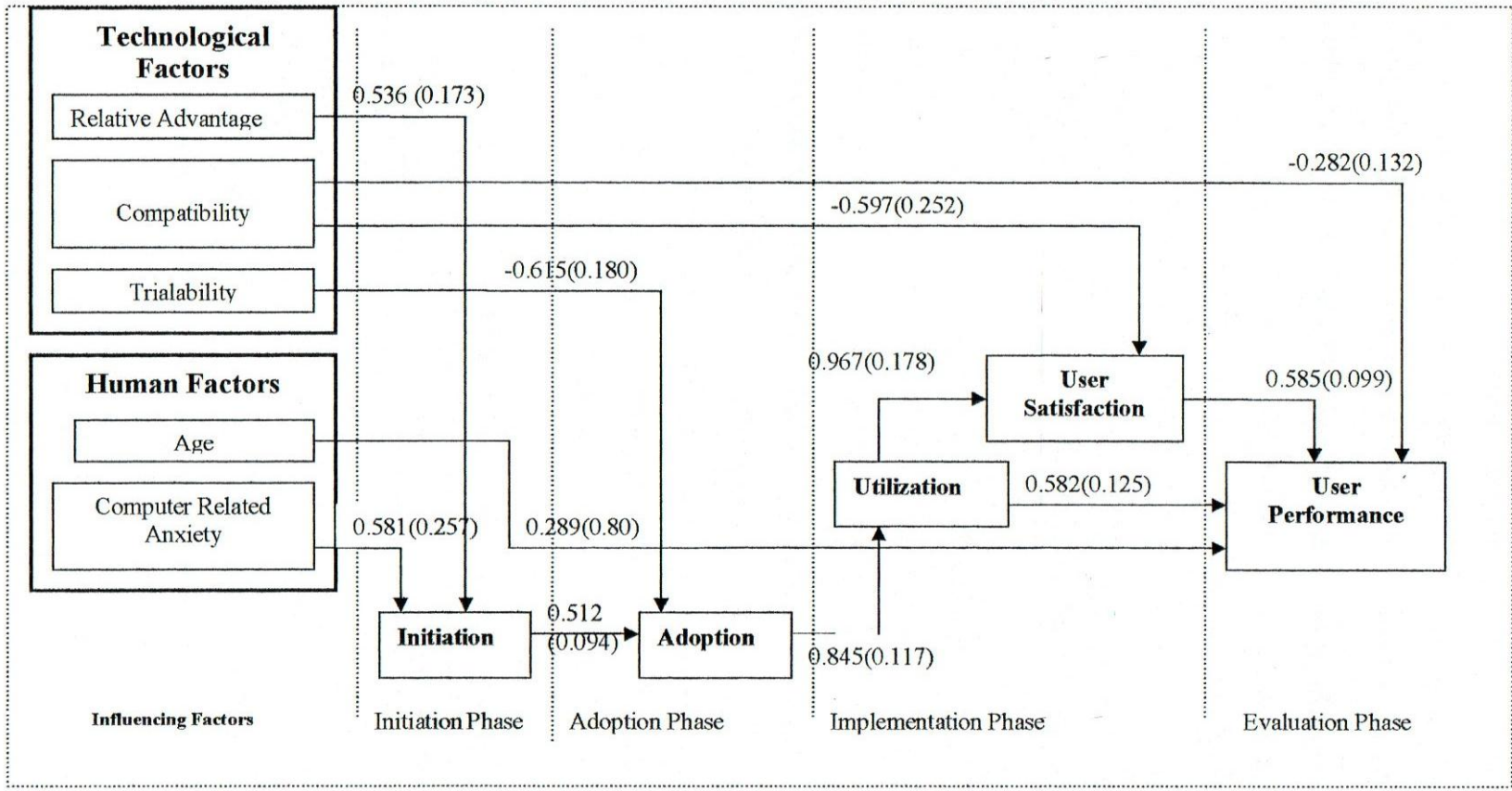


Figure 9: Final Model of Factors Influencing Adoption and Implementation of IT

4.2.3 Variance Explained

The aim of this section is to present the results of the variance explained in each of the IT implementation models discussed above. The results of variance explained in various models from the regression analyses are presented in Table 13 below.

From the results in Table 13, it can be seen that only 43.5 per cent of the variance has been explained by the factors influencing initiation phase. This implies that initiation is influenced by other factors that are not included in this study.

Factors found to influence adoption in this study explained 60.2 per cent of the variance. This is much higher than initiation, and this is because most have been explained in the initiation phase, which is included in the regression model for adoption.

In utilization, factors have explained 69 per cent. This is much higher because only the prior phase has been found to influence, and at whose point much of the variance (60%) has been taken into consideration.

User satisfaction, which was found to be influenced by both the utilization and compatibility, has 66.6 per cent of its variance explained. This implies that there are other factors which influence this phase and have not been included in this study.

User performance, which has been found to be influenced by age, compatibility, and user satisfaction, has 94.5 per cent of it variance explained.

Table 13: Percentages of Variance Explained in Various Models

Model	R^2	Variance explained
Initiation	0.435	43.5%
Adoption	0.602	60.2%
Utilization	0.690	69.0%
User Satisfaction	0.666	66.6%
User Performance	0.945	94.5%

Chapter 5 : CONCLUSIONS AND RECOMMENDATIONS

The concluding remarks and recommendations arising from this study are presented in this chapter.

5.1 Conclusions

There were two general purposes of this study. The first purpose was to investigate the nature and extent of IT development in secondary schools in Nakuru Municipality. The second purpose of the study was to identify the human and technological factors that play part in the initiation, adoption and implementation of IT in secondary schools in Nakuru Municipality.

The data used in this study were collected from 25 head teachers of secondary schools in the municipality using two questionnaires, one specially designed for head teachers in schools with at least one computer and the other specially designed for head teachers in schools without computers. These two questionnaires sought information from the head teachers regarding their background characteristics (e.g. age, gender and academic qualifications), their views, attitudes and opinions regarding IT and innovation process in general, and information about their schools and the school community.

In order to achieve the first purpose mentioned above, descriptive statistics of the characteristics of head teachers and the IT situations in their schools were examined. These statistics showed that 18 out of the 25 schools involved in this study had at least one computer while seven had no computers at all. Among the 18 schools with computers, the earliest school to acquire a computer did so in 1998 while a vast majority of these schools acquired their first computers in 2002 and a thereafter.

Seventeen of the schools involved in this study were headed by male teachers while eight were headed by female teachers. Twelve of the 17 male head teachers and six of the eight female head teachers had computers in their schools.

In regard to computer usage in teaching and learning, most of the head teachers of schools with more than one computer claimed that majority of the school computers were used for teaching and learning. However, on computer usage in common school subject (e.g. mathematics, languages and sciences) the school heads indicated that the extent of computer usage in these subjects was low and that most of the school computers were used in computer studies subject.

The descriptive statistics further showed that a wide range of softwares were available in schools that had computers. However, the most common softwares were Microsoft Office programs such as Word, Excel, PowerPoint and Access, which in most cases are bought with the computer. Word was the only software that was put in frequent use by all the 18 schools that had at least one computer. The second popular software was Excel with 15 of these schools indicating they use this software frequently. Perhaps most of these schools were using the computers simply as advanced typewriters or simple calculators.

In order to achieve the second purpose of this study, a general model of the relationship of the factors involved in innovation process was hypothesized. This general model was then broken into five sub-models (i.e. a model each for initiation phase, adoption phase and evaluation phase, and two models for the implementation phase [i.e. utilization and user satisfaction]) and each model was analyzed using multiple regression procedures in SPSS. A summary of the results of multiple regression analyses of the five models are displayed in Table 14 below.

Table 14: Summary of the Factors Influencing Various Phases of IT Implementation in School

Phase	Outcome variable in the model	Factors influencing
Initiation	*Initiation*	Relative advantage
		Anxiety
Adoption	*Adoption*	Initiation
		Trialability
Implementation	*Utilization*	Adoption
	Use Satisfaction	Utilization
		Compatibility
Evaluation	*User Performance*	User satisfaction
		Utilization
		Head teacher's age
		Compatibility

Thus, when all other factors were equal, the findings of this study were as follows.

Initiation: *Initiation* was positively influenced by computer related anxiety; with the head teachers who thought that IT had a relative advantage over existing technology being the ones who were more likely to initiate IT when compared to the

head teachers who thought otherwise. In addition, the head teachers who were anxious about the use of IT were more likely to initiate it when compared to head teachers who were less anxious about the use of IT.

Adoption: Initiation had positive effect on *adoption*; with the head teachers who were initiators of IT being the ones who were more likely to be the adopters of IT. However, trialability had negative impact on *adoption* which implied that the head teachers who believed that IT can not be tried module by module or can not be tried in small scales were highly likely to adopt IT when compared to those head teachers who believed that IT could be tried module by module or could be tried in small scale. This relationship between trialability and adoption was somewhat surprising because it would be expected that the adopters of IT to be those who believe that IT can be tried module by module or can be tried in small scales. Thus, it was recommended that it would be profitable to repeat this study with a different sample of head teachers from other districts to verify the results.

Utilization: *Utilization* was positively influenced by adoption, which indicated that the head teachers who were adopters of IT were the ones who were more likely to utilize IT.

User satisfaction: Utilization had positive impact on *User Satisfaction*; with the head teachers who were utilizing IT were being the ones who were more likely to have higher user satisfaction. On the other hand, compatibility had negative influence on *User Satisfaction;* with the head teachers who thought that IT was not compatible with their previous experiences or those who thought that IT was not compatible with aspects of their work or those who thought that IT did not fit into their work style being the ones who were more likely to have higher user satisfaction during IT implementation when compared to the head teachers who thought otherwise. Thus, it appeared that the head teachers who expected very little from IT were the ones who were getting more satisfaction perhaps after discovering what IT had to offer.

User performance: Head teacher's age, user satisfaction and utilization had positive impacts on *User Performance*; with high user performance being associated with the older head teachers, the head teachers with high user satisfaction and those with high utilization of IT. Like in the user satisfaction model, compatibility had negative effects in this model indicating that the head teachers who expected little

from IT had not only higher use satisfaction but also higher user performance after IT implementation.

In summary, in this study it was found that *Initiation* was influenced by computer related anxiety and IT relative advantage while *Adoption* was influenced by IT initiation and IT trialability. In addition, it was found that *Utilization* was influenced by adoption while *User Satisfaction* was influenced by IT utilization and IT compatibility. Furthermore, *User Performance* was influenced by IT utilization, user satisfaction, IT compatibility and age of the head teacher.

5.2 Recommendations

The study reveals that the factors that influence different phases of IT adoption are as shown in Table 14 above. Those interested in IT in schools should thus ensure that the head teachers, being the main decision influencers in schools do appreciate the relative advantage of IT over what they are otherwise accustomed to, for the first level of IT implementation to be realized. Training is thus important to head teachers first so that they can have the first feel, and also to appreciate the trialability and compatibility aspect. They should be encouraged to utilize the available IT in their schools, so as to experience higher user satisfaction. Schools to be targeted first for IT implementation should be those schools that have head teachers who are relatively older, and experienced, as they are more likely to appreciate the technology.

5.3 Recommendations for Future Research

This study was conducted in Nakuru Municipality, where 25 schools participated. It is recommended that a similar study be conducted covering a larger area, and with a higher population and sample to test the findings in this study, so that the results can be generalized. It is suggested that several districts be included.

From the variance explained (results in presented in Chapter 4 Table 12), it was clear that there are other factors that influence initiation (55%), adoption (40%) and user satisfaction (33%). Further research to find which these other factors are is highly recommended.

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Appendix 1: Questionnaire A

Instructions



Principals' Questionnaire 'A'

a. Please only complete this questionnaire if the school has **at least one or more computers** used for administration purposes and/or for teaching and learning.

b. Please answer all the questions as fully as possible and to the best of your knowledge. All the information collected will be treated as confidential and will be only for the purpose of this study.

c. Where the particular question is not applicable to the school, please mark 'N/A' (not applicable) and proceed to the next question.

d. Thanks for your cooperation and support.

1. When did your school acquire its first computer? ☐☐/☐☐ /☐☐
(dd /mm / yy)

2. Tick which of the following technology items the school has available for teaching and learning purposes.

- ☐ TV(s)
- ☐ Computer(s)
- ☐ Video Machine(s)
- ☐ Overhead Projector(s)
- ☐ Slide Projector(s) Projector(s) linked to a computer
- ☐ Tape recorder(s)/CD player(s)
- ☐ Other. Specify _____

3. Please give total number of the computers available in your school
(Please write in numbers)

☐

4. Of the computers recorded in 3, how many are used mainly or solely for teaching and learning? *(Please write in numbers)*

Total number of computers used mainly for teaching/learning

☐

5. In the table below indicate the software that the school uses and the frequency of use.

	Available (Yes/No)	*Frequency of Use*		
		Not at all	*Infrequently*	*Frequently*
a) Word Processing (Student Writing Centre,MS Word etc.)	☐	☐	☐	☐
b) Spread Sheets (Excel)	☐	☐	☐	☐
c) Presentation Software (Print Shop, PowerPoint)	☐	☐	☐	☐
d) Drawing Software (Kid CAD, Corel Draw)	☐	☐	☐	☐
e) Internet Browsers (Netscape, Explorer)	☐	☐	☐	☐
f) Programming Languages (Logo, Pascal, C++)	☐	☐	☐	☐
g) School Administration/Finance	☐	☐	☐	☐
h) Database (MS Access)	☐	☐	☐	☐
i) Web Publishing (FrontPage)	☐	☐	☐	☐
j) Information Resources (CD-ROM encyclopaedias)	☐	☐	☐	☐
k) Others (specify)	☐	☐	☐	☐

6. At the time of considering the adoption of the technology, please describe to what extent the factors in the following statements affected the decisions in your school.

	Not at all	*Low*	*Moderate*	*High*
a) It was important that we should take advantage of technological developments by adopting them early	☐	☐	☐	☐
b) There was pressure from the public, parents and students that we should modernize and upgrade our technology	☐	☐	☐	☐
c) There was pressure from teachers that we should modernize and upgrade our technology	☐	☐	☐	☐
d) Ministry of Education had initiated the interest in new technologies and we were keen that the school should seriously consider them further	☐	☐	☐	☐
e) Other. Specify_____	☐	☐	☐	☐

7. To what extent do you believe that information technology would:

	Not at all	*Low*	*Moderate*	*High*
a) reduce the number of people necessary to perform tasks	☐	☐	☐	☐
b) reduce the cost of school operation	☐	☐	☐	☐
c) allow me to handle a greater volume of work	☐	☐	☐	☐
d) improve administration and management	☐	☐	☐	☐
e) improve results	☐	☐	☐	☐
f) enhance teaching and learning	☐	☐	☐	☐
g) make new information available to me and school	☐	☐	☐	☐
h) provide more up-to-date information	☐	☐	☐	☐
i) make it easier to get the information that I need	☐	☐	☐	☐
j) save me time in looking for information	☐	☐	☐	☐
k) create more jobs than it would eliminate	☐	☐	☐	☐
l) fit into my work style	☐	☐	☐	☐
m) compatible with all aspects of my work	☐	☐	☐	☐
n) compatible with my previous experiences	☐	☐	☐	☐
o) be very difficult to understand	☐	☐	☐	☐
p) be very difficult to use	☐	☐	☐	☐
q) be able to be tried out in smaller version	☐	☐	☐	☐
r) be able to be implemented module by module	☐	☐	☐	☐
s) other. Specify_____	☐	☐	☐	☐

8. Please tick every source of information listed below that you used to get the information regarding the system

☐ Formal contacts (e.g. workshop, seminar, technical meeting, etc)
☐ Informal contacts (e.g. friends)
☐ Written material (e.g. bronchure, magazine, newspaper, journal, etc)
☐ Don't know

9. To what extent do you believe that you are a person who:

	Not at all	*Low*	*Moderate*	*High*
a) conforms	☐	☐	☐	☐
b) will always think of something when stuck	☐	☐	☐	☐

	Not at all	*Low*	*Moderate*	*High*
c) enjoys detailed work	☐	☐	☐	☐
d) is prudent when dealing with authority	☐	☐	☐	☐
e) never seeks to bend the law	☐	☐	☐	☐
f) like bosses and work partners who are consistent	☐	☐	☐	☐
g) likes to vary set routines at a moment's notice	☐	☐	☐	☐
h) prefers changes to occur gradually	☐	☐	☐	☐
i) copes with several new ideas at the same time	☐	☐	☐	☐
j) can stand out in disagreement against group	☐	☐	☐	☐
k) proliferates ideas	☐	☐	☐	☐
l) prefers to work on one problem at a time	☐	☐	☐	☐
m) often risks doing things differently	☐	☐	☐	☐
n) imposes strict order on matters within my own control	☐	☐	☐	☐
o) fits readily into the system	☐	☐	☐	☐
p) is predictable	☐	☐	☐	☐
q) feel apprehensive about using a computer	☐	☐	☐	☐
r) if given a chance to use a computer, I am afraid I might damage it in some way	☐	☐	☐	☐
s) have avoided computers because they are unfamiliar to me	☐	☐	☐	☐
t) hesitate to use computers for fear of making mistakes that I cannot correct	☐	☐	☐	☐
u) do not understand computer terminology	☐	☐	☐	☐
v) other. Specify_____	☐	☐	☐	☐

10. Does the school offer a subject that focuses on computer studies?

☐Yes ☐ No

If yes, please complete the rest of Questions 13 to 16. If no, please proceed directly to question 17

11. Tick for which grades this is offered.

☐Form 1 ☐ Form 2 ☐ Form 3 ☐ Form 4

12. Tick which of the following computer skills are taught to the learners at the school.

	Form 1 and 2	*Form 3 and 4*
a) Basic Principles of computers	☐	☐
b) Word processing	☐	☐
c) Spreadsheets	☐	☐
d) Presentation graphics	☐	☐
e) File management	☐	☐
f) Using the Internet (e-mail, world-wide web)	☐	☐
g) Database	☐	☐
h) Information Skills (research on CD-ROMS, Internet)	☐	☐
i) Web Design)	☐	☐
j) Desktop Publishing	☐	☐
k) Programming skills	☐	☐
l)System analysis and Design	☐	☐
m)Ethics (acceptable use, hacking)	☐	☐
n) Others (specify)	☐	☐

13. To what extent is ICT used in the curriculum areas?

Include usage:

- *by teachers in researching and preparing lessons*
- *by teachers and students within the lesson itself; and*
- *by students for homework, research and revision*

*Tick **one** box on each line.*

	Substantial	*Some*	*Few*	*None*
a) Mathematics	☐	☐	☐	☐
b) Sciences	☐	☐	☐	☐
c) Languages/Humanities	☐	☐	☐	☐
d) Computer Studies	☐	☐	☐	☐
e) Others (specify)	☐	☐	☐	☐

14. To what extent do the following statements describe your situation:

	Not at all	*Low*	*Moderate*	*High*
1.Hardware Adequacy				
a) There computer hardware is adequate for school administration needs	☐	☐	☐	☐
b) The computer hardware is adequate for teaching and learning needs	☐	☐	☐	☐
c) The present computer hardware an be expanded	☐	☐	☐	☐
2. Software Adequacy				
a) There software is adequate for school administration needs	☐	☐	☐	☐

	Not at all	*Low*	*Moderate*	*High*
b) The software is adequate for teaching and learning needs	☐	☐	☐	☐
c) The software can be modified, corrected and improved	☐	☐	☐	☐
3.Information content				
a) The system precisely provides the school administrative needs	☐	☐	☐	☐
b) The information content meets teaching/learning needs	☐	☐	☐	☐
c) The system provides reports that meet school needs	☐	☐	☐	☐
d)the system provides sufficient information	☐	☐	☐	☐
4. Information Accuracy				
a) The system is accurate	☐	☐	☐	☐
b) The data is correctly/safely stored	☐	☐	☐	☐
5.Information Format				
a) The outputs (e.g. reports) are presented in a useful format	☐	☐	☐	☐
b) The information presented is clear	☐	☐	☐	☐
6. Ease of Use				
a) The system is user friendly	☐	☐	☐	☐
b) The system is easy to learn	☐	☐	☐	☐
7. Timeliness				
a) I get the needed information in time	☐	☐	☐	☐
b) The system provides up-to-date information	☐	☐	☐	☐
8.Vendor Support				
a) There is help available from vendors in case of hardware malfunction	☐	☐	☐	☐
b) There is help available from vendors in case of software errors	☐	☐	☐	☐
c) The help is provided as soon as requested	☐	☐	☐	☐
9. Training and Education				
a) The quality of training has been excellent	☐	☐	☐	☐
b) There is easy access to training and education facilities to help in utilizing the system	☐	☐	☐	☐
c) There is sufficient training for specific software packages	☐	☐	☐	☐
d) Teachers are trained to integrate IT in teaching	☐	☐	☐	☐

15. What was the total school budget for year 2004-2005

Ksh._____

16. How much (in Kshs) did your school spend on ICT in the 2004-2005 financial year (including expenditure on network infrastructure, computers, peripherals, software & content, training, ICT-related telecoms services, ISPs, technical support)?

Ksh._____

17. Tick which of the following statements best describe the way most teachers at the school feel about the use of computers in education.

	Substantial	*Some*	*Little/ None*	*Neutral*
a) Teachers feel computer skills will provide learners with greater job opportunities	☐	☐	☐	☐
b) Teachers feel that there is little value in using computers for learning	☐	☐	☐	☐
c) Teachers feel that other needs should be given greater priority in the school	☐	☐	☐	☐
d) Teachers strongly support the use of computers in education as they see computers as important in helping learners to think and work independently	☐	☐	☐	☐
e) Teachers are concerned that any new technology will increase the work level of teachers	☐	☐	☐	☐
f) Teachers are worried that computers will require them to do further training	☐	☐	☐	☐
g) Teachers feel that computers can be of use in preparing lessons and administrative tasks	☐	☐	☐	☐
h) Teachers see computers as an important source of information to access resources not available to them in the school	☐	☐	☐	☐
i) Teachers believe that computers can be used to allow learners and teachers to interact with other schools through e-mail or joint projects	☐	☐	☐	☐
j) Other. Specify_____	☐	☐	☐	☐

18. Tick the items below that the school believes should be prioritized regarding computer utilization at the school.

	Substantial	*Some*	*Little/None*	*Not applicable*
a) Use of computers in school management and administration	☐	☐	☐	☐
b) Computer use for staff professional development	☐	☐	☐	☐
c) Computer use for lesson preparation	☐	☐	☐	☐
d) Use of computers as a teaching and learning tool in all subjects	☐	☐	☐	☐
e) To teach computer skills	☐	☐	☐	☐
f) To expose students to the potential benefits of computers in every day life	☐	☐	☐	☐
g) Other. Specify_____	☐	☐	☐	☐

The following includes some questions about your background, including your school, level of education and experience.

1. Gender ☐ Male ☐ Female

2. Age ☐ Below 30yrs ☐ 30 -40 years
☐ 41 – 45 years ☐ Above 46 years

3. Highest qualification received
☐ High School
☐ Diploma
☐ University Undergraduate Degree
☐ Postgraduate degree
☐ Other (Please specify): .....

4. Training in computers ☐ Informal
☐ Formal. Then how long was the training in weeks?

5. Name of School : .....

6. Position .....

7. Work experience as a manager/headteacher in this school: _____years

8. Number of workers: ☐ less than 10 ☐ 11 – 30 ☐ 31 - 50
Please write a total of teachers and support staff ☐ 51 – 100 ☐ more than 100

9. Number of students: _____

THANK YOU for your thought, time, and effort in answering these questions.

Appendix 2: Questionnaire B

Instructions



Principals' Questionnaire 'B'

a. Please only complete this questionnaire if the school has **no computers** used for administration purposes and/or for teaching and learning.

b. **Please answer all the questions as fully as possible and to the best of your knowledge. All the information collected will be treated as confidential and will be only for the purpose of this study**

c. Where the particular question is not applicable to the school, please mark 'N/A' **(not applicable) and proceed to the next question.**

d. Thanks for your cooperation and support.

1. Indicate below whether the school has the following resources.

*Check **one** box in each line.*

Resource	*Yes*	*No*
a) Electricity	☐	☐
b) Telephone line(s)	☐	☐

2. Tick which of the following technology items the school has available for teaching and learning purposes.

- ☐ TV(s)
- ☐ Video Machine(s)
- ☐ Overhead Projector(s)
- ☐ Slide Projector(s) Projector(s) linked to a computer
- ☐ Tape recorder(s)/CD player(s)
- ☐ Other. Specify _____

3. What conditions prevent the school from acquiring computer facilities.

	Substantial	*Some*	*Little/None*	*Not at all*
a) Limited classrooms that are suitable for computers	☐	☐	☐	☐
b) No electricity	☐	☐	☐	☐
c) No phone line	☐	☐	☐	☐
d) Poor security on school premises	☐	☐	☐	☐
e) Vandalism of equipment and facilities	☐	☐	☐	☐

f) Lack of available staff trained to use computer equipment and software.....	☐	☐	☐	☐
g) Other. Specify_____	☐	☐	☐	☐

4. Tick which of the following statements best describe the way most teachers at the school feel about the use of computers in education.

	Substantial	*Some*	*Little/ None*	*Neutral*
a) Teachers strongly support the use of computers in education as they see computers as important in helping learners to think and work independently	☐	☐	☐	☐
b) Teachers feel that there is little value in using computers for learning.....	☐	☐	☐	☐
c) Teachers feel that other needs should be given greater priority in the school.....	☐	☐	☐	☐
d) Teachers feel computer skills will provide learners with greater job opportunities.....	☐	☐	☐	☐
e) Teachers are concerned that any new technology will increase the work level of teachers.....	☐	☐	☐	☐
f) Teachers are worried that computers will require them to do further training	☐	☐	☐	☐
g) Teachers feel that computers can be of use in preparing lessons and administrative tasks	☐	☐	☐	☐
h) Teachers see computers as an important source of information to access resources not available to them in the school	☐	☐	☐	☐
i) Teachers believe that computers can be used to allow learners and teachers to interact with other schools through e-mail or joint projects	☐	☐	☐	☐
j) Other. Specify_____	☐	☐	☐	☐

5. If the school were to start using computers, why would it do so?

	Substantial	*Some*	*Little /None*
a) To prepare students for the future	☐	☐	☐
b) To attract students to the school.....	☐	☐	☐
c) To improve student learning	☐	☐	☐
d) To keep the curriculum and methods up-to-date.....	☐	☐	☐
e) To facilitate new forms of learning	☐	☐	☐
f) To offer the surrounding community access to computers for adult.....	☐	☐	☐
g) Other. Specify_____	☐	☐	☐

6. Indicate the important conditions and resources which must be in place before the school is able to start using computer.

	Not at all	*Low*	*Moderate*	*High*
a) No specific conditions must be in place before the school is able to start using computers.....	☐	☐	☐	☐

	Not at all	*Low*	*Moderate*	*High*
b) The school must have a suitable room for computers	☐	☐	☐	☐
c) School must have access to electricity and have a phone line	☐	☐	☐	☐
d) At least one teacher must have sufficient training to run and manage the computers	☐	☐	☐	☐
e) All teachers must have some training in the use of computers	☐	☐	☐	☐
f) The school must be able to raise sufficient funding to maintain the computers	☐	☐	☐	☐
g) Parents must be informed about the use of computers and support their use in the schools	☐	☐	☐	☐
h) Other problems in the school must first be resolved (e.g. absenteeism, classrooms in poor conditions)	☐	☐	☐	☐
j) Other. Specify _____	☐	☐	☐	☐

7. If the school introduced computers which grades would receive priority?

☐Form 1 ☐Form 2 ☐Form 3

☐Form 4

8. If the school introduced computers, for what purposes would they be used?

	Substantial	*Some*	*Little/None*
a) Use of computers in school management and administration	☐	☐	☐
b) Computer use for staff professional development	☐	☐	☐
c) Computer use for lesson preparation	☐	☐	☐
d) Use of computers as a teaching and learning tool in all subjects	☐	☐	☐
e) To teach computer skills	☐	☐	☐
f) To expose students to the potential benefits of computers in every day life	☐	☐	☐
g) Other. Specify_____	☐	☐	☐

9. To what extent do you believe that introduction of information technology would:

	Not at all	*Low*	*Moderate*	*High*
a) reduce the number of people necessary to perform tasks	☐	☐	☐	☐
b) reduce the cost of school operation	☐	☐	☐	☐
c) allow me to handle a greater volume of work	☐	☐	☐	☐
d) increase the effectiveness of my school	☐	☐	☐	☐

	Not at all	*Low*	*Moderate*	*High*
e) make new information available to me and school	☐	☐	☐	☐
f) provide more up-to-date information	☐	☐	☐	☐
g) make it easier to get the information that I need	☐	☐	☐	☐
h) save me time in looking for information	☐	☐	☐	☐
i) create more jobs than it would eliminate.....	☐	☐	☐	☐
j) enhance teaching and learning	☐	☐	☐	☐
k) improve results	☐	☐	☐	☐
l) fit into my work style	☐	☐	☐	☐
m) compatible with all aspects of my work	☐	☐	☐	☐
n) compatible with my previous experiences.....	☐	☐	☐	☐
o) be very difficult to understand.....	☐	☐	☐	☐
p) be very difficult to use	☐	☐	☐	☐
q) be able to be tried out in smaller version.....	☐	☐	☐	☐
r) be able to be implemented module by module	☐	☐	☐	☐
s) other. Specify_____	☐	☐	☐	☐

10. To what extent do you believe that you are a person who:

	Not at all	*Low*	*Moderate*	*High*
a) conforms	☐	☐	☐	☐
b) will always think of something when stuck ..	☐	☐	☐	☐
c) enjoys detailed work	☐	☐	☐	☐
d) is prudent when dealing with authority.....	☐	☐	☐	☐
e) never seeks to bend the law	☐	☐	☐	☐
f) like bosses and work partners who are consistent.....	☐	☐	☐	☐
g) likes to vary set routines at a moment's notice	☐	☐	☐	☐
h) prefers changes to occur gradually.....	☐	☐	☐	☐
i) copes with several new ideas at the same time	☐	☐	☐	☐
j) can stand out in disagreement against group	☐	☐	☐	☐
k) proliferates ideas	☐	☐	☐	☐
l) prefers to work on one problem at a time	☐	☐	☐	☐

	Not at all	*Low*	*Moderate*	*High*
m) often risks doing things differently.....	☐	☐	☐	☐
n) imposes strict order on matters within my own control	☐	☐	☐	☐
o) fits readily into the system.....	☐	☐	☐	☐
p) is predictable.....	☐	☐	☐	☐
q) feel apprehensive about using a computer.....	☐	☐	☐	☐
r) if given a chance to use a computer, I am afraid I might damage it in some way.....	☐	☐	☐	☐
s) have avoided computers because they are unfamiliar to me.....	☐	☐	☐	☐
t) would hesitate to use computers for fear of making mistakes that I cannot correct	☐	☐	☐	☐
u) do not understand computer terminology	☐	☐	☐	☐
s) other. Specify_____	☐	☐	☐	☐

11. What was the total school budget for year 2004 – 2005?
Ksh. _____

12. Indicate below whether members of the school community have access to computers outside of the school.

Groups	*Management(e.g. Principal, Deputy Principal, HOD)*	*Administration (e.g. Secretary, Bursar)*	*Teachers*	*Learners*
a) Access at home.....	☐	☐	☐	☐
b) Access at another school.....	☐	☐	☐	☐
c) Access at a community resource (community centre, internet café)	☐	☐	☐	☐
d) Other. Specify_____	☐	☐	☐	☐
e)No access	☐	☐	☐	☐

13. Indicate below any aspect of computers in education that you feel has not been covered in the questionnaire and/or the school believes should be elaborated upon.

_____

_____

_____

_____

_____

_____

_____

The following includes some questions about your background, including your school, level of education and experience.

1. Gender ☐ Male ☐ Female

2. Age ☐ Below 30yrs ☐ 30 -40 years
☐ 41 – 45 years ☐ Above 46 years

3. Highest qualification received
☐ High School
☐ Diploma
☐ University Undergraduate Degree
☐ Postgraduate degree
☐ Other (Please specify): .....

4. Training in computers ☐ None
☐ Informal
☐ Formal. Then how long was the training in weeks?

5. Name of School : .....

6. Position .....

7. Work experience as a manager/headteacher in this school: _____years

8. Number of workers: ☐ less than 10 ☐ 11 - 30 ☐ 31 - 50
Please write a total of teachers and support staff ☐ 51 – 100 ☐ more than 100

9. Number of students: _____

THANK YOU for your thought, time, and effort in answering these questions.

Appendix 3: Letter Inviting School Participation

Egerton University
P. O. Box 15337
Nakuru
February, 2006.

Mr,/Mrs./Ms .....

.....Secondary School

Nakuru.

Re: RESEARCH PROJECT

I am a student at Egerton University pursuing a master course. I am currently carrying out a research on 'Factors Influencing IT Implementation in Schools'.

Your school has been selected to participate in the study, and request you to assist in the collection of required data, mainly by way of filling in a questionnaire.

I take this chance to assure you that the information collected will be treated as highly confidential, and only for the purpose of this study.

Thank you for your cooperation and support.

Florence Thuku
Researcher

Appendix 4: Multiple Regression Modeling

Using multiple linear regression technique, the relationship between predictor variables (e.g. human and technological factors, also called independent or explanatory variables $x_1, x_2, \ldots, x_p$) and output variable (that is either *Initiation, Adoption, Utilization, User Satisfaction* or *User Performance*, also called outcome or dependent variable y) were modeled by fitting a linear equation to observed data. In other words, every value of the independent variable x was associated with a value of the dependent variable y. It should be noted that five separate multiple regression analyses were carried out in this study, a model each for initiation phase, adoption phase and evaluation phase, and two models for the implementation phase (i.e. utilization and user satisfaction).

The population regression line for p explanatory variables $x_1, x_2, \ldots, x_p$ was defined as

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \ldots + \beta_p x_{ip} + \varepsilon_i \qquad \text{[Equation A1]}$$

Where

y_i is the IT-implementation phase indicator (i.e. either *Initiation, Adoption, Utilization, User Satisfaction* or *User Performance*) score for head teacher i (for i=1, 2, ... 25 head teachers),

β_0 is the population average IT-implementation phase indicator (i.e. either *Initiation, Adoption, Utilization, User Satisfaction* or *User Performance*) score for all the head teachers in the population adjusted for explanatory variables $x_1, x_2, \ldots, x_p$,

$\beta_1, \beta_2, \ldots, \beta_p$ are the regression coefficients associated with explanatory variables $x_1, x_2, \ldots, x_p$,

$x_1, x_2, \ldots x_p$ are several explanatory (input) variables describing head teacher characteristics (i.e. Age, gender, education level, computer related anxiety and attitudes toward change), technological factors (e.g. relative advantage, compatibility and complexity) and IT-implementation levels, and

ε_i is the deviation of the IT-implementation phase indicator (i.e. either *Initiation, Adoption, Utilization, User Satisfaction* or *User Performance*) score from the population average score β_0 for head teacher i.

The ε_i term is also known as the residual for head teacher and the values of this parameter were of not interest in this study and therefore they were not presented.

Appendix 5: Reliability Analyses and Item Responses

Table A1: Reliability Analysis: Computer Related Anxiety Scale

PERSON17 Feel apprehensive about using a computer
PERSON18 If given a chance to use a computer, I am afraid I might damage it in some way.
PERSON19 I have avoided computers because they are unfamiliar to me
PERSON20 I hesitate to use computers for fear of making mistakes that I cannot correct
PERSON21 I do not understand computer terminology.

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
PERSON17	6.7391	10.9289	.1843	.8198
PERSON18	6.9130	7.3557	.6627	.6470
PERSON19	7.2609	8.3834	.7890	.6186
PERSON20	7.2174	9.6324	.5609	.6987
PERSON21	6.8261	8.8775	.5020	.7136

Reliability Coefficient, Alpha = .7516

Table A2: Reliability Analysis: Attitude towards Change Scale

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
PERSON01	47.2000	42.4842	.5667	.7937
PERSON02	46.7000	44.8526	.5035	.7996
PERSON03	46.4500	47.7342	.4050	.8075
PERSON04	47.0500	41.2079	.6610	.7859
PERSON05	47.3000	43.5895	.4009	.8083
PERSON06	46.6000	46.3579	.6582	.7985
PERSON07	47.5000	47.3158	.2320	.8176
PERSON08	47.2000	43.6421	.4737	.8011
PERSON09	47.1000	46.7263	.4542	.8042
PERSON10	46.9000	48.5158	.2021	.8169
PERSON11	47.0500	45.2079	.6050	.7962
PERSON12	47.1000	48.0947	.1398	.8259
PERSON13	47.3500	46.6605	.3418	.8096
PERSON14	47.1000	44.3053	.5900	.7947
PERSON15	47.0000	44.2105	.5603	.7959
PERSON16	47.4000	46.7789	.2419	.8183

Reliability Coefficient, Alpha = .8149

Table A3: Reliability Analysis: Relative Advantage Scale

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
BELIEF01	23.1304	9.4822	.1741	.7504
BELIEF03	22.7826	8.9960	.2952	.7228
BELIEF04	22.9130	8.1739	.5065	.6747
BELIEF05	23.3913	9.5217	.2370	.7298
BELIEF06	22.9565	8.5889	.4701	.6840
BELIEF07	22.8696	8.4822	.5510	.6692
BELIEF08	22.9565	8.1344	.6853	.6440
BELIEF09	22.8261	8.7866	.5392	.6754

Reliability Coefficient, Alpha = .7231

Table A4: Reliability Analysis: Compatibility Scale

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
BELIEF12	5.2500	2.9783	.6741	.8564
BELIEF13	5.2083	2.3460	.7988	.7413
BELIEF14	5.7917	2.7808	.7408	.7974

Reliability Coefficient, Alpha = .8593

Table A5: Reliability Analysis: Initiation Scale

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
CFACTO02	5.3125	2.8958	.6745	.2878
CFACTO03	5.3750	3.1833	.6290	.3717
CFACTO04	5.3125	4.0958	.2084	.9196

Reliability Coefficient, Alpha = .6639

Table A6: Item Responses: ITCURR, ITSKILL and ITTASK Scales

a) For ITCURR (use of IT in curriculum areas)

Item	Variable label	Variable statement	Not at all *(code 1)*	Low *(code 2)*	Moderate *(code 3)*	High *(code 4)*	Missing *(code 9)*
13(a)	ICTUSE01	Extent of IT use in Mathematics	2	5	4	3	0
13(b)	ICTUSE02	Extent of IT use in Sciences	1	4	4	5	0
13(c)	ICTUSE03	Extent of IT use in Languages/Humanities	1	3	5	5	0
13(d)	ICTUSE04	Extent of IT use in Computer Studies	10	0	0	4	0

b) For ITSKILL (IT skills taught to learners)

Item	Variable label	Variable statement	Form 1 & 2 *(code 1)*	Form 3 & 4 *(code 2)*	All classes *(code 3)*	None *(code 0)*	Missing *(code 9)*
6(a)	CSKILL01	Basic Principles of computers	5	0	6	2	0
6(b)	CSKILL02	Word processing	4	1	5	3	0
6(c)	CSKILL03	Spreadsheets	4	1	4	4	0
6(d)	CSKILL04	Presentation graphics	5	1	4	3	0
6(e)	CSKILL05	File management	5	3	2	3	0
6(f)	CSKILL06	Using the Internet (e-mail, world-wide web)	3	3	3	4	0
6(g)	CSKILL07	Database	3	2	4	4	0
6(h)	CSKILL08	Information Skills(research on CD-ROMS, Internet)	4	3	1	5	0
6(i)	CSKILL09	Web Design)	1	1	0	8	3
6(j)	CSKILL10	Desktop Publishing	5	2	1	4	0
6(k)	CSKILL11	Programming skills	3	5	0	5	0
6(l)	CSKILL12	System analysis and Design	2	4	0	7	0
6(m)	CSKILL13	Ethics (acceptable use, hacking)	3	4	1	5	0

c) For ITTASK (IT tasks used by employees in the school)

Item	Variable label	Variable statement	Not at all *(code 1)*	A little *(code 2)*	Quite a lot *(code 3)*	A great deal *(code 4)*	Missing *(code 9)*
18(a)	SITEMS01	Use of computers in school management and administration	0	2	8	7	1
18(b)	SITEMS02	Computer use for staff professional development	0	7	7	3	1
18(c)	SITEMS03	Computer use for lesson preparation	1	4	9	2	2

18(d)	SITEMS04	Use of computers as a teaching and learning tool in all subjects	0	3	8	5	2
18(e)	SITEMS05	To teach computer skills	1	0	8	9	0
18(f)	SITEMS06	To expose students to the potential benefits of computers in every day life	0	0	5	12	1

Table A7: Reliability Analyses Results: ITCURR, ITSKILL and ITTASK Scales

a) For IT Use in Curriculum Areas (ITCURR) Scale

Variable label	Item- Total Correlation
ICTUSE01	0.5202
ICTUSE02	0.7502
ICTUSE03	0.6727
ICTUSE04	0.1855
Reliability Coefficients (Alpha) =	0.7015

b) For IT Skills Taught to Learners (ITSKILL) Scale

Variable label	Item- Total Correlation
CSKIL01	0.8558
CSKIL02	0.8686
CSKIL03	0.9529
CSKIL04	0.9476
CSKIL05	0.9530
CSKIL06	0.9491
CSKIL07	0.9287
CSKIL08	0.9305
CSKIL09	0.4226
CSKIL10	0.9219
CSKIL11	0.9677
CSKIL12	0.9127
CSKIL13	0.8874
Reliability Coefficients (Alpha) =	0.9697

c) For IT Tasks Used by Employees in the School (ITTASK) Scale

Variable label	Item- Total Correlation
SITEMS01	0.3444
SITEMS02	0.4217
SITEMS03	0.4121
SITEMS04	0.3427
SITEMS05	0.3077
SITEMS06	0.2997
Reliability Coefficients (Alpha) =	0.7206

Table A9: Reliability Analysis: User Satisfaction Scale

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
SSITU01	68.8000	134.8857	.5035	.8990
SSITU02	68.9333	141.0667	.3118	.9043
SSITU03	67.9333	142.2095	.3120	.9033
SSITU04	68.8667	136.9810	.5148	.8980
SSITU05	69.0000	140.4286	.3846	.9014
SSITU07	68.5333	140.1238	.4439	.8995
SSITU08	68.5333	137.4095	.4869	.8988
SSITU09	68.0667	140.3524	.6574	.8958
SSITU10	68.4000	135.9714	.7306	.8931
SSITU11	68.1333	139.2667	.5248	.8975
SSITU12	67.8000	143.8857	.4895	.8988
SSITU13	67.6667	141.3810	.6845	.8960
SSITU14	67.8000	141.4571	.6532	.8963
SSITU15	67.8667	139.8381	.7639	.8946
SSITU16	68.0000	140.2857	.6416	.8959
SSITU17	67.9333	138.9238	.7106	.8946
SSITU18	68.0000	135.7143	.6660	.8942
SSITU19	68.6000	138.2571	.4461	.9000
SSITU20	68.6667	140.9524	.3928	.9009
SSITU21	68.7333	140.7810	.4722	.8987
SSITU22	68.4667	141.2667	.6661	.8961
SSITU23	68.4667	141.4095	.6564	.8963
SSITU24	68.4667	146.5524	.3129	.9015
SSITU25	69.0000	141.0000	.4253	.8998

Reliability Coefficient, Alpha = .9019

Table A10: Item Responses: User Performance Scale

Item 'A'17 'B' 4	Variable label	Variable statement	Substantial *(code 1)*	Some *(code 2)*	Little /None *(code 3)*	Neutral *(code 4)*	Missing Values *(code 9)*
a)	CTFEEL 01	Teachers feel computer skills will provide learners with greater job opportunities	0	1	5	12	0
b)	CTFEEL 02	Teachers feel that there is little value in using computers for learning	1	3	13	1	0
c)	CTFEEL 03	Teachers feel that other needs should be given greater priority in the school	0	8	7	3	0
d)	CTFEEL 04	Teachers strongly support the use of computers in education as they see computers as important in helping learners to think and work independently	0	2	3	13	0

e)	CTFEEL 05	Teachers are concerned that any new technology will increase the work level of teachers	2	5	8	3	0
f)	CTFEEL 06	Teachers are worried that computers will require them to do further training	1	5	11	1	0
g)	CTFEEL 07	Teachers feel that computers can be of use in preparing lessons and administrative tasks	0	3	4	11	0
	CTFEEL 08	Teachers see computers as an important source of information to access resources not available to them in the school	0	1	2	15	0
h	CTFEEL 09	Teachers believe that computers can be used to allow learners and teachers to interact with other schools through e-mail or joint projects	1	0	4	13	0

NB.

Items c), e), were recoded, while a), b), and f) were dropped

Table A11: Reliability Analysis: User Performance Scale

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
CTFEEL03	7.8889	7.0458	.2816	.7479
CTFEEL04	8.7778	6.4183	.5176	.6836
CTFEEL05	7.8333	7.2059	.1449	.8039
CTFEEL07	8.6111	6.0163	.5473	.6722
CTFEEL08	8.9444	6.0556	.8816	.6112
CTFEEL09	8.7778	5.5948	.6894	.6265

Reliability Coefficient, Alpha = .7336

Appendix 6: Regression Analyses SPSS Outputs

Table A12: Initiation Final Regression Model

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.676	.225		11.901	.000
	Relative Advantage	.471	.195	.556	2.413	.031
2	(Constant)	1.557	.533		2.920	.013
	Relative Advantage	.536	.173	.634	3.109	.009
	ANXIETY	.581	.257	.460	2.258	.043
3	(Constant)	1.557	.533		2.920	.013
	Relative Advantage	.536	.173	.634	3.109	.009
	ANXIETY	.581	.257	.460	2.258	.043

a. Dependent Variable: Initiation

Table A13: Adoption Final Regression Model

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.822	.260		-3.158	.005
	Initiation	.470	.114	.661	4.128	.000
2	(Constant)	.714	.499		1.430	.167
	Initiation	.512	.094	.721	5.433	.000
	TRIALABI	-.615	.180	-.452	-3.407	.003
3	(Constant)	.714	.499		1.430	.167
	Initiation	.512	.094	.721	5.433	.000
	TRIALABI	-.615	.180	-.452	-3.407	.003

a. Dependent Variable: Adoption

Table A14: Utilization Final Regression Model

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-5.0E-03	.115		-.043	.966
	Adoption	.845	.117	.839	7.228	.000
2	(Constant)	-5.0E-03	.115		-.043	.966
	Adoption	.845	.117	.839	7.228	.000

a. Dependent Variable: utilisation

Table A15: Satisfaction Final Regression Model

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.042	.185		11.042	.000
	utilisation	1.099	.186	.783	5.909	.000
2	(Constant)	3.654	.701		5.216	.000
	utilisation	.967	.178	.689	5.429	.000
	COMPATIB	-.597	.252	-.301	-2.371	.027
3	(Constant)	3.654	.701		5.216	.000
	utilisation	.967	.178	.689	5.429	.000
	COMPATIB	-.597	.252	-.301	-2.371	.027

a. Dependent Variable: satisfaction

Table A16: Evaluation Final Regression Model

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.190	.214		.888	.384
	satisfaction	1.034	.086	.932	12.022	.000
2	(Constant)	.691	.274		2.516	.020
	satisfaction	.787	.124	.709	6.360	.000
	utilisation	.442	.174	.284	2.548	.019
3	(Constant)	3.7E-02	.265		.141	.890
	satisfaction	.669	.099	.603	6.770	.000
	utilisation	.550	.135	.353	4.069	.001
	Head teacher's age	.335	.084	.223	4.015	.001
4	(Constant)	1.095	.552		1.982	.062
	satisfaction	.585	.099	.528	5.911	.000
	utilisation	.582	.125	.374	4.641	.000
	Head teacher's age	.289	.080	.192	3.605	.002
	COMPATIB	-.282	.132	-.128	-2.135	.046
5	(Constant)	1.095	.552		1.982	.062
	satisfaction	.585	.099	.528	5.911	.000
	utilisation	.582	.125	.374	4.641	.000
	Head teacher's age	.289	.080	.192	3.605	.002
	COMPATIB	-.282	.132	-.128	-2.135	.046

a. Dependent Variable: Evaluation

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