ADOPTION OF COMPUTER-BASED ASSISTIVE TECHNOLOGY FOR PERSONS WITH DISABILITIES IN KENYA

BY

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OCTOBER, 2012

DECLARATION

I declare that this project is my original work and to the best of my knowledge has never been presented for an award of degree or other certificate to any University or examining Body.

Signature_____ Date_____ \ \\ _____ V2-

Mbugua Winfred Wairimu

D61/63106/2010

This project has been submitted for examination with my approval as the university supervisor

S i g n a t u r ^ ^ r - ^ " Date....w l ^ .....

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DEDICATION

-phis project is dedicated to all the persons with disabilities and their caregivers, disability bodies ^d other stakeholders that strive to ensure an inclusive society.

ABSTRACT

This study explores the many socio-cultural, technical, economic, and environmental factors that influence the adoption and usage of computer-based assistive technologies by persons with disabilities. As using an assistive technology may make one's disability obvious to others, choices made about technology usage are multifaceted social negotiations involving issues of identity, normalcy, and nature of disability.

The key approach used in this research is the Technology Acceptance Model (TAM). This model is extended to include Technological and Environmental contexts to include other factors that influence adoption of assistive technology. The study found out that perceived ease of use, perceived usefulness, environmental and organizational contexts influenced attitudes towards adoption of assistive technologies. It also established that attitudes were not linked with the intention to use since persons with disabilities would use the technologies if they were available and at affordable prices. The study recommended that similar studies be conducted without perceptions and involve the actual computer-based assistive technology use since these were not assessed.

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List of Abbreviations & Acronyms

Ats	-	Assistive Technologies
jCTs	-	Information and Communication Technologies
JAWS	-	Job Access with Speech
KNBS	-	Kenya National Bureau of Statistics
MDGS	-	Millennium Development Goals
OCR	-	Optical Character Recognition
pWDs	-	Persons with Disabilities
TDD	-	Telecommunications Device for the Deaf
TTS	-	Text-to-Speech
TTY	-	Text Telephone
UNCRPD	-	United Nations Convention on the Rights of Persons with Disabilities
VI	-	Visually Impaired

CHAPTER OINE

INTRODUCTION

1,1 Background of the Study

For many persons with disabilities, many aspects of daily life can be inaccessible and computer-based assistive technologies are one way to offer reasonable accommodations. On the other hand, any benefits of an assistive technology (AT) can only transpire if the technology is adopted and used. Unfortunately, studies have shown that, in general, at least a third of all assistive technologies are abandoned after acquisition (Phillips & Zhao, 1993: Martin & McCormack, 1999: Riemer-Reiss & Wacker, 2000). Attitudes toward adoption may be unenthusiastically perceived by people who are either unfamiliar or familiar but uncomfortable with the technology.

The Assistive Technology Act (1998) of the United States of America, defines an assistive technology device as "any item, piece of equipment, or product system, whether acquired commercially, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of individuals with disabilities*'. The same Act defines Assistive technology services as "any services that directly assist an individual with a disability in the selection, acquisition, or use of an assistive technology device". These services include evaluations, repair, maintenance, funding, and adaptation of devices, training, and technical assistance. Others define such technologies as applications either hardware or software that are exclusively designed and developed to assist individuals with disabilities in overcoming barriers Forgrave (2002) & Rose (2001).

These technologies can be categorized as either high tech or low tech. Johnston & Watson (2007) state that, high-tech devices are more complicated and cost more. They also require training or guidance from the user, such as adaptive equipment, voice recognition software, or word prediction software. In contrast, low-tech is low-priced equipment, as it costs less than high-tech, it is simply designed, and requires limited training. Examples of low-tech devices include but are not limited to talking watches, pencil grips, highlighting marker tape, eyeglasses, and ear plugs to reduce distraction Johnston et al., (2007).

Assistive technologies provide persons with disabilities independence to perform tasks that they were previously unable to complete, or had difficulties in accomplishing, by providing enhancements to the technology required to realize such tasks. LaPlante (1992), states that, assistive technology devices provide alternative ways of performing actions, tasks, and activities while Ashton (2002) states that such technologies can help people with disabilities maximize potential and the ability to achieve individualized educational objectives.

Cornman et al., (2005) reported that surveys may underestimate assistive device use if they restrict questions about such use to people who have already reported that they have difficulty with daily activities and. thereby, exclude respondents who report device use but no difficulty. People may, for example, use a device but report no difficulty because the device is so successful so tamiliar to them that they do not think of their underlying impairment when responding to surv cy questions.

In an effort to address the issues and challenges around the provision of ICT-related services to persons with disabilities (PWDs), the Communication Commission of Kenya (CC'K) facilitated a multi-stakeholder workshop on "E-accessibility for Persons with Disabilities" on 10th and 11th May 2012. Furthermore, during the Workshop, the Commission officially launched the Kenya Disability Web Portal an initiative of the Commission in Partnership with the United Disabled Persons of Kenya (UDPK), the National Council for Persons with Disabilities (NCPWD) and other stakeholders.

1.1.1 Attitudes Towards and Adoption of Assistive Technology

According to Bagozzi. Davis & Warshaw (1992), attitudes towards usage and intentions to use assistive technologies may be ill-formed or lacking in conviction or else may occur only after preliminary strivings to learn to use the technology evolve. Thus, actual usage may not be a direct or immediate consequence of such attitudes and intentions. Some of the assistive technology devices are viewed as a prerequisite for the well-being and independence but at the same time, these devices give rise to negative feelings because of the restrictions implied by their use Pettersson et al., (2007). Also, cultural views and stigmas vary across different disabilities ind are likely to influence the attitudes of an individual with a disability (McDermott, 1993; Cory. 2005).

People with congenital disabilities tend to welcome assistive technology more than those with squired disabilities for they more readily perceive the enhancement to their abilities. Those with cquired disabilities tend to see assistive technology tools as reminders of what they can no °nger do on their own Scherer & Galvin (1996). Because new technologies such as personal

computers are complex and an element of uncertainty exists in the minds of decision makers with respect to the successful adoption of them, people form attitudes and intentions toward trying to learn to use the new technology prior to initiating efforts directed at using. As Dawe (2006) notes, earlier assistive technologies adoption studies lump together users with different disabilities, ranging from mobility impairments to sensory disabilities to cognitive disabilities. Adoption involves a joint group effort among the persons with disabilities who arc the users, the caregivers who maybe the parents or next of kin's or guardians, the society, the assistive technology specialists and the developers of assistive devices. The various barriers which influence the adoption of assistive technologies include and are not limited to: levels of disability, gender, socio-economic status, employment status, age. educational levels, geographic location, ethnicity, culture, health beliefs, social status, family ties and current health.

Courtney (2006), states that privacy can be a barrier for older adults' adoption, however their perception of their need for the technology may override their own privacy concerns. Privacy concerns, as a barrier to technology adoption, can be influenced by both individual-level and community-level factors. Users also have limited understanding of the role that assistive technologies can play in supporting self-management Wanless (2006). Too often people with acquired disabilities arc prematurely pushed into using assistive devices that they then readily discard Scherer & Galvin (1996).

Carlson et al., (2001) state that persons with disabilities sometimes have difficulty with tasks, leading to others making decisions for them. The caregivers and the society in general assume ^ Persons with disabilities always require assistance regardless of using assistive devices. This

would lead to abandonment of such technologies since the users are dependent on others. Scaddcn (1996) recommends assistive technology specialists to guide users and caregivers in learning about the tools that are available and facilitate the selection process in a collaborative manner. Approximately one-third of all assistive devices are abandoned (Scherer 1996; Scherer Si Galvin 1996). Users and caregivers often have high expectations on assistive technology devices and can be disappointed when those expectations are not fully met. There are also financial reasons that would lead to attitudes since the assistive technologies are expensive in terms of acquisition, training and rehabilitation of both users and caregivers.

Many assistive technologies designed do not put into consideration persons with disabilities. This may be due to the fact that designers are either uninformed about the precise needs and abilities or they are unaware of the required protocols to assess whether or not their designs are really inclusive. Demirbilck & Demirkan (2004) suggest that the mixing of two approaches; design by users and design for users give better results with higher success rates.

h is therefore important to involve persons with disabilities in the design of assistive technologies since they are the ultimate end users. This will ensure successful adoption of such technologies in the long run. Some of the assistive devices are difficult to use due to poor design the manual instructions are not easy to understand. This is also as a result of lack of user ,rnolvement during the design process. Scherer & Galvin (1996) recommends developers to e,oploo,s w»th a clear purpose in mind and this purpose be conveyed and reflect the needs of USer, ^e tools should be durable, meet user's aesthetic preferences and are easy to use, while rcmainine highly customizable.

1.1.2 Computer-Based Assistive Technology

Assistive technology computer programs are built-in with distinctive features designed to assist specific functions for example address reading, writing, and numeracy challenges (Edyburn, 2000, 2003). Word-prediction software can be installed on computers that run word-processing software. Speech synthesis (text-to-speech or read-back) software such as JAWS is instrumental in improving spelling in some students with special learning needs (Sitko et al., 2005). OCR software combined with a screen reader reduces frustration in decoding and allow for more complete comprehension of text (Lundberg, 1995; Montali & Lewandowski, 1996).

The inclusion of technology in the lives of both persons without disabilities and persons with disabilities can be both a basis of tremendous dissatisfaction and great gratification to its users. If implemented effectively, technology can be an enriching element to improve the mobility, communication and intellectual areas in the lives of persons with disabilities. Braille could be

seen as one of the first assistive technologies, and computers have enabled it to be a much more varied and useful tool. Audio, too, has much to offer those young learners who are blind, and researchers at the University of Iceland have produced a review of the efficacy of audio vs. Braille for a range of everyday tasks (Shimomura, Hvannbcrg & Ilafsteinsson 2010).

^I S Disability in Kenya

According to the Kenya's Persons with Disabilities Act (2003), disability can be defined as any **Physical,** sensory, mental or other impairment, including any visual, hearing, learning or physical ^capability, which impacts adversely on social, economic or environmental participation.

The Kenya National Bureau of Statistics (KNBS) census of 2009 approximates Persons with Disabilities to be 1.3 Million. For the first time persons with disabilities were included in the National Census and disability issues are still a relatively new area of discussion in Kenya.

There are several policies and legislative approaches that promote the development and adoption of assistive technologies in Kenya. These include and are not limited to; The Constitution of Kenya (2010), Persons with disabilities Act (2003), The United Nations on the Rights of Persons with Disabilities (UNCRPD) of (2006). and the Millennium Development Goals (MDGs). These legal frameworks ensure universal design of mainstream technologies. With these legal frameworks in place, the government of Kenya has seen many persons with disabilities get employment in higher positions e.g. County Commissioners, Governors and also senior management positions at the work place, Constitution (2010), Persons with Disabilities Act (2003). The Performance Contract consists of the disability mainstreaming indicator to ensure employers' reserve 5% of employment to persons with disabilities who are qualified and provide reasonable accommodation to facilitate their working environment and also ensure any employee who acquires a disability is provided the appropriate assistive technology.

Aghan (2007) emphasized that although Kenyan journalists occasionally report about disability, they have hardly any training on how to do it in a humanizing and non-stigmatizing manner. More recently the former president Daniel Toroitich arap Moi regarding the nomination of Dr Samuel Kipng'etich Tororei as a commissioner of the National Land Commission was quoted as having said that the Kalenjin were short-changed since Dr Tororei is blind therefore negative tudes towards persons with disabilities still lingers (Daily Nation of 13th August page 11).

1.2 Statement of the problem

Assistive technology devices are viewed as a prerequisite for the well-being and independence but at the same time, these devices give rise to negative feelings because of the restrictions implied by their use. Although these technologies are available, continuous acccss to such provisions may not be readily available and may incur great costs Pettersson et al., (2007). Studies of assistive technology attitudes and how they affect adoption arc complex and challenging. However, earlier studies focused only on whether a technology is adopted or rejected. This emphasize of either adoption or rejection overlooks the actual critical process involved in technology adoption (Rogers, 2003) and in so doing limits the detection of potential interventions to prevent any rejection. Recent case studies have found that associated stigmas can indirectly influence how people relate to a person with a learning disability therefore the decision to use text -to-speech software in public is enclosed by the complex social management of their disability (Cory, 2005; McDermott, 1993).

Dawe (2005) and Wchmeyer (1995) explored more in order to understand assistive technology adoption and usage within their specific areas of interest. Consequently, this understanding made it possible for them to design technologies to better meet their users' needs as well as allowing the researchers to explore more targeted interventions for promoting assistive technology usage.

Assistive technologies therefore face challenges such as funding; widespread lack of awareness the needs of users with disabilities; difficulties in using thus increasing the rate of abandonment. Adjustments made to existing technology to accommodate persons with disabilities incur extra costs. It is important to involve the users into design and encourage elopers to introduce mainstream products and services which are usable by persons with disabilities.

Kenya may not be ready to embrace assistive technology due to the negative attitudes as mentioned above, (Aghan, 2007). (Mugambi, 2012) research on challenges shows that the census of 2009 did not capture the ICT needs of persons with disabilities thus we cannot be able to justify how many were computer literate by the time. Further he noted that apart from being expensive, there is low or lack of awareness on the available assistive technologies. For example Murugami and Mazrui (2012) from Kenyatta University noted that websites designed in Kenya are incompatible with assistive technology products due to lack of guidelines for the design of accessible web sites.

Also persons with visual disabilities can only access banking services through help from other people since ATM keys are not Brailed Wegoki el al., (2012). Understandably, persons with disabilities require assistive technology to assist them in going about their daily activities independently and with dignity even in Kenya. Hence, this paper sets out to answer the research questions, what are the attitudes towards assistive technologies in Kenya and how do these attitudes affect their adoption?

13 Research Objectives

a. **To** establish the factors influencing attitudes towards adoption of assistive technologies in Kenya.

b. To determine the impact of these attitudes on the adoption of assistive technologies.

c- To determine caregivers perspective on assistive technologies in Kenya.

j,4 Value of the study

Developers and assistive technology specialists will be able to make informed decisions on the development of assistive technology. Information System researchers will explore further to increase their understanding of the adoption of assistive technologies for people who use services, and to address the ways in which people are being barred from using such technologies.

This study will enhance awareness in families where a person with disability lives and as a result ensure inclusion in all tasks carried out at home. At the workplace, the employers will be aware of the type of assistive technologies to purchase when recruiting a person with disability or when an employee acquires a disability by providing reasonable accommodation. The policy makers and other stakeholders will ensure that provisions are made in all legal frameworks to ensure disability mainstreaming in social, political and economic aspects.

CHAPTER TWO

LITERATURE REVIEW

2.1 Assistive Technologies

Assistive technology are hardware and software products such as screen readers and voice recognition products that provide essential accessibility to computers for those with significant vision, hearing, learning and physical impairments. The following are some few examples of the types of assistive technologies that provide reasonable accommodations for various types of disabilities:

Text-to-speech (TTS) applications, such as JAWS, BookWise (Elkind. Cohen, & Murray, 1993) and Kurzweil 3000 (Laga. Steere, & Cavaiuolo, 2006) arc screen readers that read aloud everything on computer screens, including text, pull-down menus, icons, dialog boxes, and web pages. Studies by Elkind et al., (1996) found out that adults using the TTS system reading performance improved but this were dependent on the user's severity of the disability. However, studies investigating the use of TTS for teenagers with severe reading disabilities. Farmer. Klein, and Bryson (1992) found no significant improvements with use of the system.

braille embossers transfer computer generated text into embossed Braille output. Braille tonslation programs convert text scanned-in or generated via standard word processing Programs into Braille, which can be printed on the embosser. Refreshable Braille displays vide tactile output of information represented on the computer screen, Microsoft (2012).

Color Overlays according to Evans (2001) work by changing the background color of text from white to another color, which causes readers with visual stress to report less difficulty with sustaining reading and fewer incidences of headaches and eye strain. Further studies show that use of overlays improves reading rate and accuracy Jeanes ct al., (1997). Also the optimal color for an overlay differs across from person to person, requiring the need to carefully sclcct an appropriate color per person (Jeanes et al., 1997; Smith & Wilkins. 2007).

Optical character recognition (OCR) system allows users to scan printed documents, convert them into digital text and also serve as tools for correcting translation errors. However, the scanning proccss can be time-consuming since this is typically done one page at a time (Laga et al., 2006), and OCR is highly sensitive to the resolution and background color of the text being recognized (Bigham. Kaminsky. Ladner, Danielsson, & Hempton, 2006).

Electronic Dictionaries often recommended for people with learning disabilities are specialized, portable devices that allow users to look up unfamiliar words on demand (Raskind & Iliggins, 1998). Studies suggest that the use of dictionaries may improve reading comprehension among students with learning disabilities and are also included in some TTS systems like Kurzweil 3000 thereby obscuring the actual effect of the dictionary' alone Lange et al.. (2006).

TextWindows is a piece of cardboard with a small window cut-out to limit the amount of text scen al a time Pepper & Lovcgrove (1999). The window size can range to show only one or two wo rds at a time to one line of text or more. This approach is believed to help decrease ln terference level from the immediate words and therefore improving the reading speed and

accuracy. Pepper & Lovegrove (1999) suggest that single-word displays may be a viable accommodation, but it should be noted that they do not assess reading comprehension.

Text Telephones (TTYs) are the telephones that people with hearing impairments use to communicate with others on the telephone. TTY/TDD conversion modems are connected between computers and telephones to allow an individual to type a message on a computer and send it to a TTY/TDD telephone or other Baudot equipped device Microsoft (2012).

Alternative input devices allow individuals to control their computers through means other than a standard keyboard or pointing device. Examples include: Alternative keyboards, Electronic pointing devices. Light signaler alerts monitor computer sounds and alert the computer user with light signals. This is useful when a computer user cannot hear computer sounds or is not directly in front of the computer screen. As an example, a light can flash alerting the user when a new e-mail message has arrived or a computer command has completed Microsoft (2012).

2.2 Assistive Technology Adoption

Studies on attitudes assistive technologies and their adoption among persons with disabilities are limited in scope and are very few. This study therefore seeks to provide a background on the technology adoption process and the factors that promote or hinder adoption. To explain the **factors** that promote or hinder the acceptance of a technology, several models have been proposed, such as the Theory of Reasoned Action (TRA) (Fishbein & Aj/.en, 1975), Technology Acceptance Model Davis (1989), Diffusion of Innovations Theory Rogers (1995) and the Unified Theory- of Acceptance and Use of Technology Venkatesh et. al., (2003)

Rogers (2003) innovation-decision process describes the steps an individual goes through in deciding whether to adopt an innovation. This process begins from the knowledge stage where a person becomes acquainted with the technology. Later, the person moves into the Persuasion Stage which is beyond simple awareness of the technology. At the Decision Stage, a person makes the choice to cither reject or adopt the technology. At the Implementation Stage, integration of the innovation into regular use occurs. For example, in an assistive technology study by Dawe (2006), parents repurposed a memo-recording device as a communication aid lor a non-verbal teenager with autism. Confirmation is the final stage where the person is committed to using the technology to its fullest.

Rogers (2003), states that technologies should exhibit a relative advantage over other options for them to be adopted. An adopted technology should be compatible with the users' life and practices. Trialability is a factor for promoting the adoptability of technology by giving the opportunity for a potential user to experience using the innovation itself. For a person to adopt a technology, seeing, hearing about, or otherwise knowing that other persons are using that technology significantly encourages adoption. Further suggestions from Norman et. al., (2002), when deciding to adopt an innovation, the inherent difficulty of using the technology is a major concern.

with these promotions, studies show insights into the factors that hinder the adoption of assistive technologies. Parette (2000) states that, parents often are worried that assistive devices ! tifcir children do not overcome their disability or they make them look too different or even orc ha"dicapped. Dcmiris et al., (2005); Rahimpour et al., (2008) recommend that there is a

need for tailored training in the adoption of assistive technologies. Whilst some persons with disabilities lack interest in assistive technologies, others are simply uninformed of the benefits and opportunities that such technologies can offer. Down & Stead (2006) state that there is low awareness of how assistive technologies can support independent living. According to. Magnusson et al., (2004), a barrier to the use of ICT services by older people, namely, the challenges surrounding training older people to use IT, problems are seen to relate to the effects of ageing on information retrieval which affects learning.

2.3 Theories of Technology Adoption

The technology acceptance model (TAM) was first developed by Davis (1989), based on the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975) in psychology research. TAM consists of two independent constructs; perceived usefulness and perceived ease of use to determine an individual's intention to make use of a system. Perceived usefulness is viewed as being directly impacted by perceived ease of use.

In TAM2 Vcnkatesh & Davis (2000), suggest that users will make an adoption decision based on ?he outcome of their evaluation of the difficulty of using the technology (Perceived liase of Use), their belief that using the technology will increase their job performance (Perceived Usefulness), ^dthe influence from people that are important to them (Subjective Norm).

[cr]al studies have incorporated TAM as a model such as e-Govcrnment and Technology ^^tance: The Case of the Implementation of Section 508 Guidelines for Websites since most [Crnment] websites are inaccessible to some or all persons with disabilities. The webmaster

surv ey revealed that agency perceptions of the accessibility of these websites often did not match the actual levels of accessibility on the sites (Jaeger 2006, 2008).

In Diffusion of Innovations theory, individuals are seen as possessing different degrees of willingness to adopt innovations and thus it is generally observed that the portion of the population adopting an innovation is approximately normally distributed over time. These categories include; innovators, early adopters, early majority, late majority, laggards (Rogers, 1995). Cory (2005) used this model to study assistive technology adoption among people with learning disabilities. He discovered that individuals with learning disabilities tend to avoid disclosing their disability and engage in tactics to hide their disability from others. Consequently, they are perhaps unlikely to be seen using an assistive technology or talking with other users with the same disability about such technologies. Thus, diffusion could be greatly constrained by this restricted amount of communication.

Unified Theory of Acceptance and Use of Technology (UTAUT) aims to explain user intentions to use an Information System and subsequent usage behavior. The theory holds that four key constructs (performance expectancy, effort expectancy, social influence, and facilitating conditions) are direct determinants of usage intention and behavior Vcnkatesh et. al., (2003).

UTAU T has been used by Keller (2004), in the implementation of v irtual learning environments, fhe model of was chosen due to its high explanatory value and to provide a model exploring Actors of technology acceptance.

Recording to Zhang and Nunamaker (2003), e-learning eliminates the barriers of space and time. Learning can be accomplished whenever a student chooses, and has a potential to reach a global audience, including persons with disabilities, pan-time, and non-traditional students.

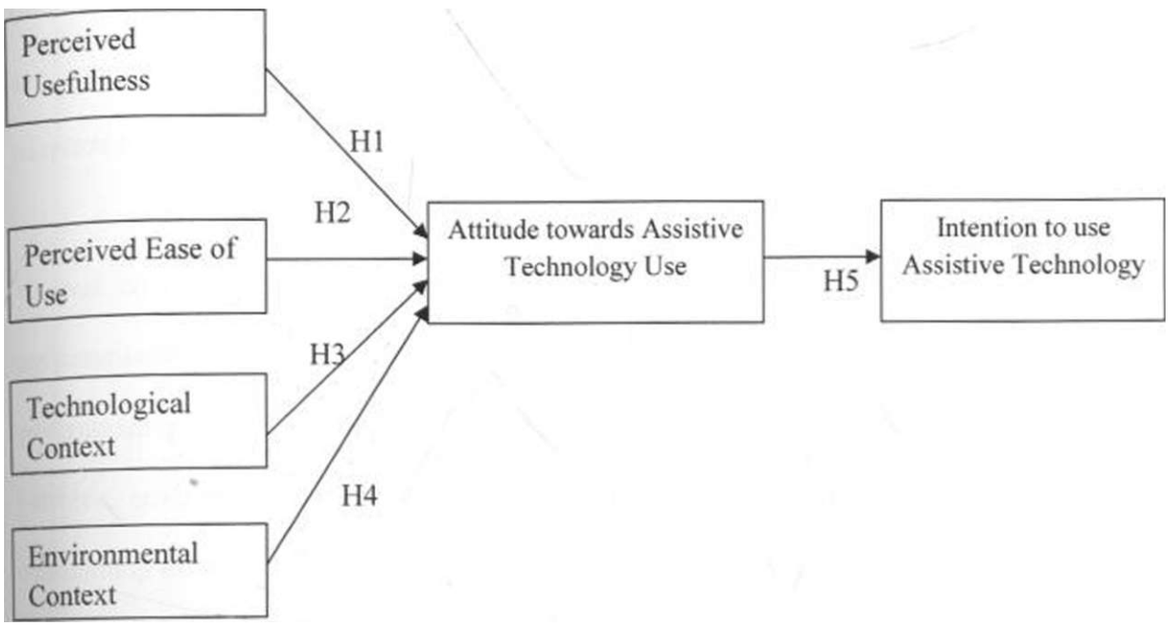
2.4 Summary of Literature

In summary, studies have shown assistive technologies for various disability categories exist, and models explaining attitudes towards and their adoption. The Diffusion innovation model Rogers (2003) shows the steps an individual goes through prior to adopting technology. Parette (2000) highlights the stigma caused by disability thus an individual develops an attitude towards an assistive technology and consequently this influences adoption. Down & Stead (2006) noted the lack of awareness of the technologies and the hindrance towards adoption. Several models on assistive technology adoption have been sited; website accessibility (Jaeger 2006, 2008) using TAM (Davis, 1989); Virtual Learning Keller (2004) using UTAUT Vcnkatesh et. al., (2003) and Cory (2005) used diffusion of innovations theory Rogers (2003) to study individuals' adoption of assistive technologies.

Conceptual framework

The TAM model will be used in this study since it posits that perceived ease of use and Perceived usefulness predicts attitude toward use of a technology. Consequently, attitude toward predicts the behavioral intention to use and intention predicts the actual use of that Oology (Davis 1989).

Figure 1: **Conceptual framework on attitudes towards assistive technology**



Adopted from Davis et. al., (1989)

Davis (1989) described the TAM variables as follows:

Perceived usefulness refers to the degree to which the user believes that using the technology will improve his or her work performance. Perceived ease of use refers to the degree to which a person believes that using a particular system would be free from effort. Attitude towards using determines the behavioral intention to use that technology. Behavioral intention to use is Ascribed as the user's attitude and the perceived usefulness influence of the individual's behavioral intention to use the system.

The technological context describes the set of technologies available lor innovation adoption by an organization (DiPietro et ah 1990). Relative advantage (Rogers. 1983) or perceived benefits (Iacovou, Benbasat, & Dexter. 1995), complexity, compatibility (Tornatzky & Klein, 1982), cost and communicability (Premkumar et al. 1994) have been found to be key determinants of adoption innovations.

Various environmental variables such as external support (Premkumar & Roberts. 1999), environmental uncertainly (Grover & Goslar, 1993), information intensity (Thong, 1999), government pressure (Kuan & Chau, 2001); will be examined to analyze the relationship between environmental variables and innovation adoption. Attewell (1992) noted that, overcoming the lack of knowledge of the innovation would lead to greater likelihood of adopting the innovation. Therefore knowledge about assistive technology will have a positive impact on the adoption decision.

2.6 Hypotheses

Based on the TAM framework and the description offered above, the following hypotheses were developed for this study:

H1: *Perceived ease of use* has no effect on *attitude towards using.*

H2: *Perceived usefulness* has no effect on *attitude towards using.*

H3: *Technological context* has no effect on *attitude towards using*

H4: *Environmental context* has no effect on *attitude towards using*

H5: *altitude towards using* has no effect on *Intention to use*

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H5. *attitude towards using* has no effect on *Intention to use*

CHAPTER THREE

RESEARCH METHODOLOGY

3J Research design

In this study, a descriptive research method was conducted since it involved collecting quantitative information. This method was appropriate as it involved collecting data in order to test hypotheses anc* was usec*t0 describe attitudes towards adoption of assistive technologies.

3.2 Population

This study focused on the users and caregivers of assistive technologies since the findings were to reflect a true representation of the attitudes towards assistive technologies and how such attitudes affect adoption of such technologies. The diagram below shows that the major impairments are physical and visual and therefore this study will concentrate on the two.

Disability	**Male**	**Female**	**Total**
Visual	153,783	177.811	**331,594**
Hearing	89,840	97,978	**187,818**
Speech	86,783	75.020	**161,803**
Physical	198,071	215,627	**413,698**
Mental	75,139	60.954	**136,093**
Others	44,073	55,233	**99306**
Total	**647,689**	**682,623**	**1330,312**

SoUrce: National Population Census 2009 (Kenya National Bureau of Statistics)

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3.3 Sampling

The basic idea of sampling is that by selecting some of the elements in the population, we may draw conclusions about the entire population. Population is the total collection of elements about which we wish to make some inferences (Cooper and Schindlcr. 2008). The sampling frame will concentrate on the Association of the Physically Disabled in Kenya (APDK) which has approximately 2000 members and the Kenya Society for the Blind with approximately 1500 members. Each member has a caregiver who visits the National Council for Persons with Disabilities office and records shows over 500 per week.

According to Bartlett, Kotrlik. & Higgins (2001) table a sample size of 1500 is 110 and 2000 is 112 for continuous data. In this study stratified random sampling method will be used. This population comprises of users and non-users of assistive technologies thus the sample shall comprise of two strata i.e. users and caregivers. Therefore, sample size for the users will be 112 for each association and caregivers.

3.4 Data collection

This study relied on primary data collection through use structured questionnaires. Two sets of questionnaires were designed for each stratum. Each participant was asked to fill out the questionnaire indicating his or her agreement or disagreement with each statement on a 5-point 1-ikert-type scale with the end points being "strongly disagree" and "strongly agree*'. Scale items spearing on the survey were adapted from scales measuring variables in Davis et al. (1989).

questionnaires were divided into seven sections. Section A focused on the demographic data

^ respondents, Section B concentrated on Perceived Ease of Use, Section C Perceived

Usefulness, Section D Attitudes towards using assistive technologies. Section H Intention to use assistive technologies, Section F Technological context and Section G Environmental context.

3.5 Data Analysis

Data analysis usually involves reducing accumulated data to a manageable size, developing summaries, looking for patterns, and applying statistical techniques (Cooper & Schindler, 2003). Statistical Package for Social Science (SPSS) was used to aid in analyzing all the data collected through the questionnaire. The data collected was analyzed using both descriptive analysis and inferential analysis. In descriptive analysis, there were two measures, one is the central tendency which includes mean, median and mode; the other was dispersion that consists of range, standard deviation and variance (Sekaran. 2003).

The computations were done using SPSS. Multiple regression models incorporating several independent variables were applied to analyze the relationships of the variables. The applicable formula used was;

$$y = a + b_i X_i + b_2 X_2 + \ldots\ldots\ldots\ldots b_n x_n$$

b i is the slope of the plane along the x i axis and b 2 is the slope of the plane along the x 2 axis etc. and [tk]a" is the intercept of the regression equation..

For objective one, regression analysis was conducted to identify the factors that influence persons with disabilities attitude towards assistive technology adoption For objective two, regression analysis was also conducted to explore the impact of those attitudes with the intention to use the assistive technology. For the research hypothesis, multiple regression analysis was used to analyze the relationship between perceived usefulness, perceived ease of use, technological context and environmental context and attitude towards assistive technology adoption.

CHAPTER FOUR

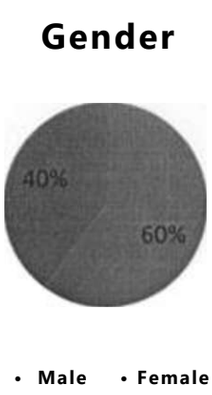
DATA ANALYSIS, RESULTS AND DISCUSSION

The results of the study were presented according to the data analysis procedures outlined in the previous chapter. The collected data was analyzed in line with the objectives. The analysis results were presented in charts and tables. Simple and multiple regression analyses were performed to test the hypotheses of the study.

4.1 Response Rates

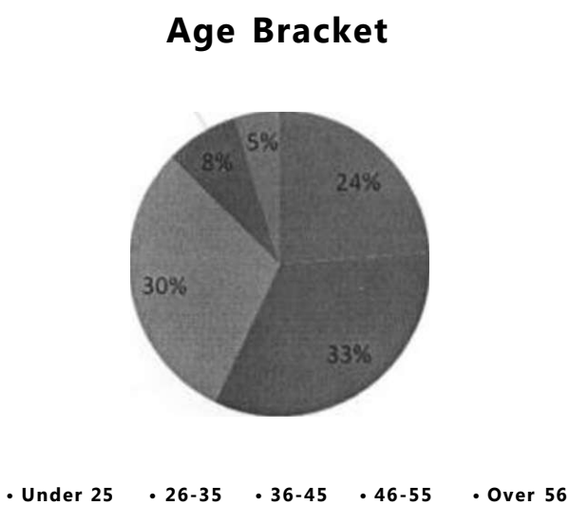
A total of 63 valid questionnaires were collected and analyzed for the users' computer-based assistive technology adoption part of the study. Demographic data were collected regarding respondents' gender, education, age. and familiarity with assistive technology.

Figure 2: Respondents Gender Analysis



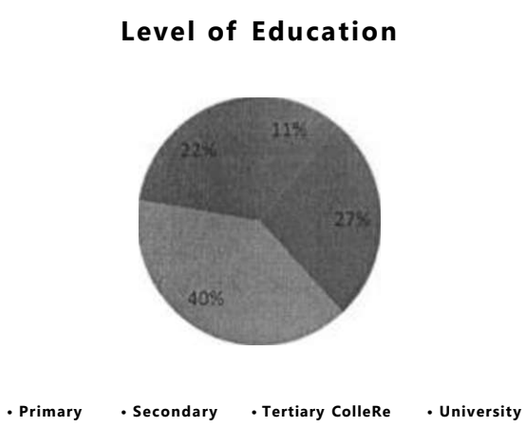
questionnaire was administered to persons with visual impairments and physical impairments. [a]bove pie chart indicates that most respondents were male with 60% against female at 40%.

figure 3: Respondents Age Bracket Analysis



From the above chart, majority of the respondents were between the ages of 26-45 years with 33% ranging between 26-35 years and 30% between 36-45 years.

Figure 4: Users Level of Education Analysis



From the above chart majority of the respondents' level of education is from tertiary college with 40%.

Figure 3: Respondents Age Bracket Analysis

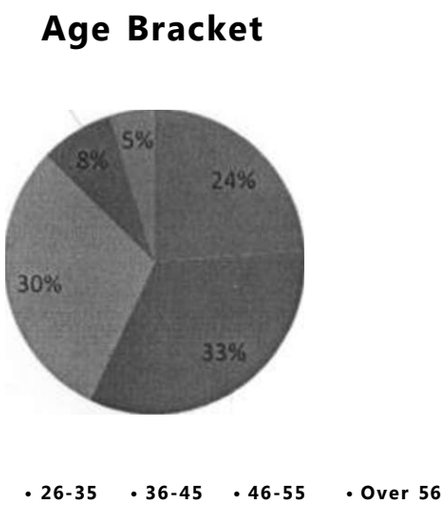


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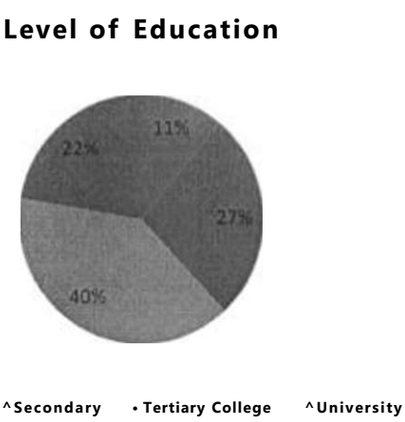
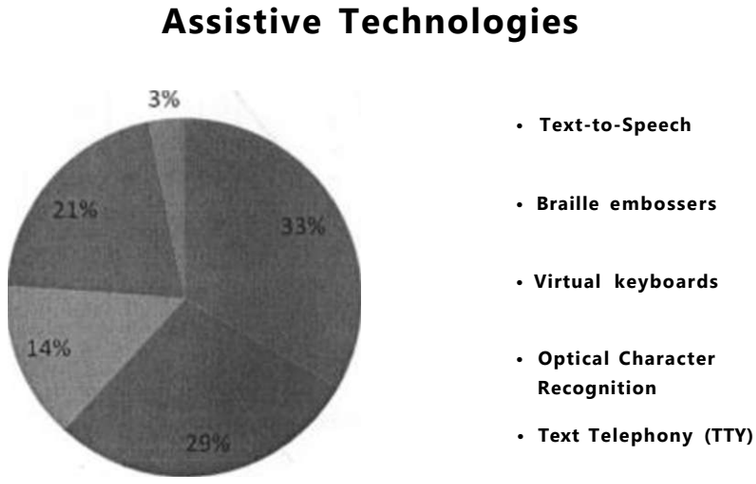
Figure 4: Users Level of Education Analysis



from the above chart majority of the respondents' level of education is from tertiary college with **40%.**

Figure 5: Type of Assistive Technology used



The results as indicated above show that majority of assistive technologies are for persons with visual impairments, with 33% for text-to-speech software. 29% Braille embossers, 21% Optical character recognition 21%. This shows that majority of assistive technologies available arc for the visually impaired.

4.2 Description of Individual Measurement Items

The user's computer-based assistive technology adoption section comprises five constructs (perceived usefulness, perceived ease of use, attitude towards assistive technology adoption, intention to adopt assistive technology, Technological context and environmental context) with a total of 20 items. All items were measured on a five-point Likert type scales ranging from "Strongly Disagree", "Disagree", "Neutral", "Agree", and "Strongly Agree". Table 1 summarizes the means and standard deviations of each item.

Table 1: Users Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
PEOU	63	2.3	1.5	3.8	2.905	1.0534	1.110
PU	63	1.0	4.0	5.0	4.615	.3587	.129
ATTITUDES	63	1.0	4.0	5.0	4.497	.4277	.183
TECHNOLOGICAL	63	1.5	2.5	4.0	3.202	.5641	.318
INTENTION TO USE	63	1.5	3.5	5.0	4.087	.4881	.238
ENVIRONMENTAL	63	1.7	1.0	2.7	1.885	.6561	.430
Valid N(listvvise)	63						

1 = strongly disagree. 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree.

4.3 Perceived Ease of Use (PEOU)

The table below provides the R and R^2 value. The R value is 0.959. which represents the simple correlation and, therefore, indicates a high degree of correlation. The R value indicates how much of the dependent variable, attitude, can be explained by the independent variable, perceived ease of use. In this case, 91.9% can be explained, which is very large.

Table 2: PEOU Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.959*	.920	.919	.1218

a. Predictors: (Constant), PEOU

ANOVA'

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10.434	1	10.434	703.303	.000[b]
	Residual	.905	61	.015		
	Total	11.339	62			

a. Dependent Variable: ATTITUDES
b. Predictors: (Constant), PEOU

The ANOVA table indicates that the regression model predicts the outcome variable significantly well. This indicates the statistical significance of the regression model that was applied. Here. P < 0.0005 which is less than 0.05 and indicates that, overall, the model applied is significantly good enough in predicting the outcome variable.

4.4 Perceived Usefulness (PU)

The R value is 0.896, which represents the simple correlation and, therefore, indicates a high degree of correlation. The R^2 value indicates how much of the dependent variable, attitude, can be explained by the independent variable, perceived usefulness. In this case. 80.4% can be explained, which is very large.

Table 3: Perceived Usefulness Model Summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.896[a]	.804	.800	.1910

a. Predictors: (Constant), PU

ANOVA*

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.114	1	9.114	249.763	.000[b]
	Residual	2.226	61	.036		
	Total	11.339	62			

a. Dependent Variable: ATTITUDES
b. Predictors: (Constant), PU

4.5 Intention to Use

The R value is 0.214, which represents the simple correlation and. therefore, indicates a low degree of correlation. The R^2 value indicates how much of the dependent variable, altitude, cannot be explained by the independent variable, intention to use. In this case, 4.6% can be explained, which is very small.

1

Table 4: Intention to use Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.214[a]	.046	.030	.4212

a. Predictors: (Constant). INTENTION TO USE

ANOVA"

Model		Sum of Squares	df	Mean Square	F	Sig.
11	Regression	.519	1	.519	2.923	.092[b]
	Residual	10.821	61	.177		
	Total	11.339	62			

a. Dependent Variable: ATTITUDES
b. Predictors: (Constant), INTENTION TO USE

4.6 Technological Context

The R value is 0.636, which represents the simple correlation and, therefore, indicates a low degree of correlation. The R^2 value indicates how much of the dependent variable, attitude, cannot be explained by the independent variable, technological context. In this case, 40.5% can be explained, which is adequate.

Table 5: Technological Context Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.636[a]	.405	.395	.3327

a. Predictors: (Constant), TECHNOLOGICAL

ANOVA"

Model		Sum of Squares	df	Mean Square	F	Sig-
1	Regression	4.589	1	4.589	41.464	.000[b]
	Residual	6.751	61	.111		
	Total	11.339	62			

a. Dependent Variable: ATTITUDES

b. Predictors: (Constant), TECHNOLOGICAL

Environmental Context

The R value is 0.767, which represents the simple correlation and, therefore, indicates a low degree of correlation. The R^2 value indicates how much of the dependent variable, attitude, eannot be explained by the independent variable, environmental context. In this case, 58.9% can ** explained, which is adequate.

Table 6: Environmental context Model Summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	*J6T*	.589	.582	.2766

a. Predictors: (Constant), ENVIRONMENTAL

ANOVA"

Model		Sum of Squares	df	Mean Square	F	Sig-
1	Regression	6.674	1	6.674	87.250	.000[b]
	Residual	4.666	61	.076		
	Total	11.339	62			

a. Dependent Variable: ATTITUDES

b. Predictors: (Constant), ENVIRONMENTAL

H1*: Perceived ease of use* has no effect on *altitude towards using.*

The results indicated that persons with disabilities find assistive technology easy to use though the learning curve indicate that majority find the technology difficult especially those with who acquire a disability as adults. Majority of the respondents understand the objectives of using the technology. Therefore perceived ease of use has an effect on attitude towards using assistive technology.

H2: *Perceived usefulness* has no effect on *attitude towards using.*

results show that perceived usefulness has an effect on attitude towards using assistive [c]nnology. Many users were in agreement that not only assistive technologies increase their Activity at work, home and school but also improve their independence significantly.

H3: *Technological context* has no effect on *attitude towards using*

The regression analysis shows that majority of users agreed that adopting assistive technology will offer better quality life to persons with disabilities though integrating such technology was found to be difficult. The results also indicated that assistive technology was prohibitively expensive and majority cannot afford.

H4: *Environmental context* has no effect on *attitude towards using*

The results indicate that majority are not aware of assistive technologies apart from those who are educated and exposed to the mainstream society. Also many felt that the government has little support for assistive technologies. The overall readiness for the country was neutral among the respondents.

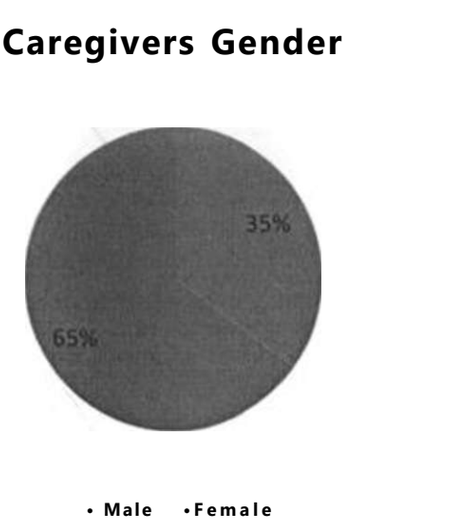
H5: *attitude towards using* has no effect on *Intention to use*

According to the results, the intention to use construct indicated that there was little relationship with the attitudes towards using assistive technology. Persons with disabilities would show intention to use the technologies if they were available and were able to afford.

4.8 Caregivers' Demographic information on respondents

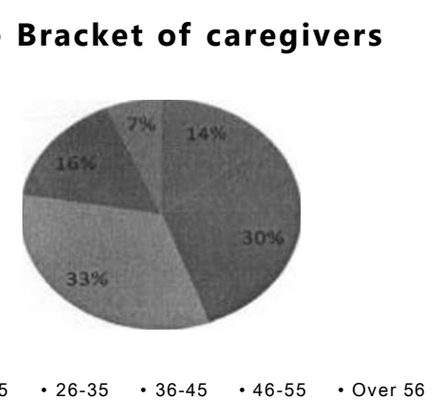
A corresponding total of 63 valid questionnaires were collected and analyzed for the caregivers' computer-based assistive technology adoption part of the study. Demographic data were collected regarding respondents' gender, education, age, and familiarity with assistive technology.

Figure 6: Caregivers gender



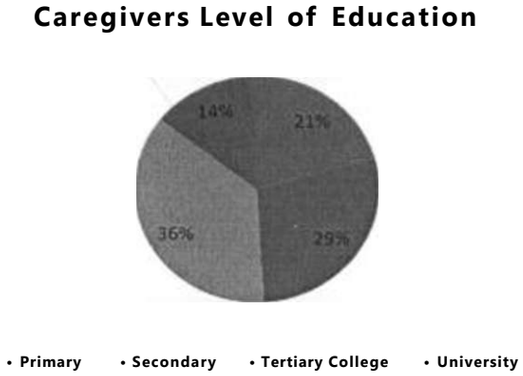
From the above chart, majority of the caregivers are female with 65%.

Figure 7: Caregivers Age Bracket



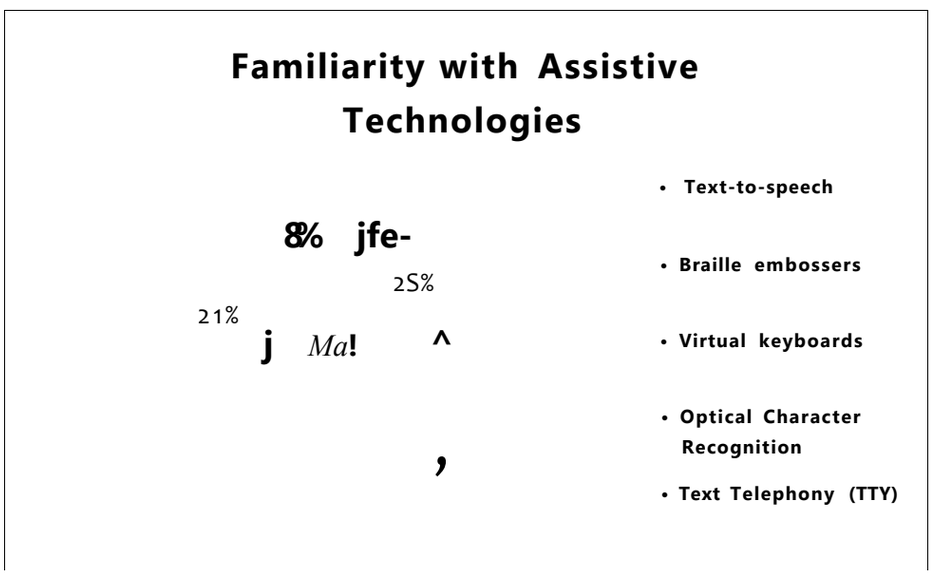
Majority of the caregivers fall under the ages between 26-35 at 30% and 36-45 at 33%.

Figure 8: Caregivers Level of Education



As shown in the chart above many caregivers had gone to tertiary colleges thus a 36% followed by secondary education at 29%.

Figure 9: Familiarity with ATs



The assistive technologies known to majority of caregivers are Braille embossers with 35%, text-**to**-speech software such as Job Acccss with Speech (JAWS) and Non-Visual Desktop Access (NVIM) at 25%.

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4.9 Description of Caregivers' Measurement Items

The user's computer-based assistive technology adoption section comprises assistive technology construct with a total of 10 items. All items were measured on a five-point Likert type scales ranging from "Strongly Disagree", "Disagree", "Neutral", "Agree", and "Strongly Agree".

Table 7: Descriptive Statistics Results for Caregivers'

	N	Minimum	Maximum	Mean	Std. Deviation
AT is a good idea	63	3	5	4.25	.761
Adoption of ATs gives better quality life for PWDs	63	4	5	4.65	.481
Pressure from govt to adopt is low	63	4	5	4.60	.493
ATs compatible with existing technology	63	3	4	3.40	.493
Readiness of Kenya to adopt is low	63	1	4	2.87	1.198
Pressure to adopt by users and disability bodies low	63	3	5	4.02	.635
People are aware ATs can improve lives	63	1	2	1.79	.408
Cost of integrating ATs not expensive	63	1	2	1.79	.408
Government desire to support is high	63	2	3	2.79	.408
Availablity of financial resources is low	63	2	5	3.83	.976
Valid N (listwise)	63				

1 = strongly disagree. 2 = disagree, 3 = neutral, 4 = agree. 5 = strongly agree.

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According to the descriptive results, caregivers* response on assistive technologies adoption was high with a mean of 4.65. They were also in agreement that the government pressure to adopt was low thus a mean of 4.6. Response on assistive technology awareness gave a mean score of 1.79. This indicates that many arc not aware of the assistive technologies. Also the cost of such assistive technologies was high and financial resources were limited.

4.10 Discussions of findings

Earlier studies on IT adoption suggested that top management support plays a crucial role in adoption of innovation in organizations (Orlikowski. 1993; Wesh & White, 1981). Overall readiness was found to have significant positive impact on users' attitude towards assistive technology adoption. Readiness refers to the level of financial and technological resources of the country that are available in order to adopt a new technology. As hypothesized, knowledge about assistive technology was found to have significant positive impact on attitude towards assistive technology adoption. The factors inlluencing attitudes towards adoption indicated that majority of individuals found ATs easy to learn and use though they required a lot of mental effort in the initial stages. Furthermore, both individuals and caregivers perceived that ATs enhanced productivity and improved effectiveness at work, home and school. The results also showed that the cost of software and equipment was prohibitively expensive and majority of PWDs are not able to afford.

This finding coincides with Ettlie's (1990) and Thong's (1999) researches that indicated that decision makers with more knowledge about an innovation are more likely to implement an [a]8gressive technology adoption policy. The results of the study revealed that the relationship

between attitude towards assistive technology adoption and intention to adopt assistive technology was positively significant in both users' and caregivers' level. The results of the study indicated that FWDs intention to use ATs was based on accessibility and affordability. Also stigma and social aspects contributed to abandonment of assistive technology. Findings also show that caregivers believe that use of ATs is a good idea and adoption would enhance PWDs independence and ensure a better quality life. Majority agree that the overall readiness to adopt such technologies is low and the available financial resources are limited.

Many researchers in the field of information technology have investigated the relationship between attitude and behavioral intention and have found significant results (Chen & I an. 2004: Vijayasarathy, 2003). Consistent with these studies, the findings of the study indicated that, users* attitude towards assistive technology adoption is an important factor for determining their intention to adopt it. Furthermore, the results suggested that when users' attitude towards assistive technology adoption is positive, their likelihood of using it would be high.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

This study extends Technology Acceptance Model (TAM) within the context of computer-based assistive technology with the inclusion of Environmental and Technological contexts. The study had three research objectives namely; to establish the factors influencing attitudes towards adoption of assistive technologies in Kenya, to determine the impact of these attitudes on the adoption of assistive technologies and to determine caregivers' perspective on assistive technologies in Kenya from which research questions were drawn to be answered by the study. Different questionnaires were used to collect the required information from PWDs and caregivers'. Descriptive statistics and regression were the analysis techniques used.

The results indicated that relative advantage had the strongest impact on users' attitude towards assistive technology adoption followed by complexity, complexity, compatibility and cost. In this study, government support, readiness and knowledge about assistive technologies were identified as environmental determinants of assistive technology adoption. Overall, the findings **of** the study indicated that all of the environmental factors had significant influence on users' attitude towards assistive technology adoption. The results indicated that government support had the strongest impact on users' and caregivers, attitude towards adoption.

5.2 Conclusions

In this study, government support, readiness and knowledge about assistive technologies were identified as environmental determinants in the decision of assistive technology adoption. As hypnotized, knowledge about assistive technology was found to have significant positive impact on attitudes towards assistive technology adoption. Improving the usefulness of assistive technologies would be promising for PWDs attitude towards assistive technology adoption and their intention to adopt decisions. Enhancing the assistive technologies* ease of use is also important. To increase the usability of assistive technologies, developers should design them in a way that docs not confuse or exhaust PWDs. It is therefore suggested that sensitizations of assistive technologies in schools, at the work place and at home would increase the people's assistive technology acceptance level.

5.3 Limitations of the study

The participants responding to the questionnaires assumed that assistive technologies were similar to assistive devices such as crutches or white canes. As a result many questionnaires were irrelevant since the answers were not a reflection on what was being sought. 1'he current study-was limited to users' and caregivers' for consistency purposes. This study is perception-based and actual computer-based assistive technology use was not assessed. Information about ATs in general was provided in the first page of the questionnaires and assumed to be informative enough for the respondents to create a perception about such technologies. More responses came from individuals with visual impairments since they are the majority users of assistive technologies.

5.4 Recommendations

Based on the results of this study, many arc not aware about assistive technologies and thus sensitizations should be done to enhance disability mainstreaming in all aspects of life. The government should also enhance usage of assistive technologies through adequate funding and by also ensuring that such technologies are available and affordable. Future research could explore whether the Kenya's Constitution dispensation on an inclusive society will influence adoption towards assistive technology.

5.5 Suggestions for further study-

Future research, should measure the actual use of assistive technology, to provide a more accurate and valid results for users' and non-users' perceptions about assistive technologies. In addition to the factors identified in this study, there may be some other factors that may have impact on attitude towards assistive technology. Future research might explore different kinds of people attitudes towards assistive technologies and consequently their adoption. More research involving other East Africa countries would provide useful information for comparing cultural differences in assistive technology adoption in persons with disabilities lives.

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APPENDICES

APPENDIX A: QUESTIONNAIRE FOR USERS

SECTION A: GENERAL INFORMATION

1. Gender [ ] Male [ ]Female

2. Age [ ] under 25 years [ ] 26-35 years

   [ ] 36-45 years [ ] 46- 55 years

   [ ] over 56 years

3. Level of Education Primary' [ ] Secondary [ ] Tertiary College [ ]

   University [ ]

4. Computer Experience (years) None [ ] 1 - 3 years [)

   4-6 years [ ]

   10 years or above [ ]

5. What type of Assistive Technology do you use? JAWS [1

   Braille Embossers [ ] Optical Character Recognition [1

   NonVisual Desktop Access (NVDA) [ )

SECTION B: PERCEIVED EASE OF USE (PEOU)

This section seeks to establish the degree to which assistive technology is understood. Please tick one answer accordingly.

Perceived Ease Of Use	STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE
1 find Assistive technology easy to use					
Learning to use assistive technology would be easy for me					
My objective for using the assistive technology is clear and understandable					
Using assistive technology does not require a lot of mental effort					

SECTION C: PERCEIVED USEFULNESS (PU)

This section seeks to establish the degree to which the user believes that using the technology will improve his or her work performance. Please tick one answer accordingly.

Perceived Usefulness	STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE
Assistive technology will be useful in my life					
Using assistive technology will increase my productivity at work, home & school					
Using assistive technology will enhance my effectiveness					
Using assistive technology will improve my independence					

SECTION b: ATTITUDE TOWARDS USING (ATTITUDE)

This section seeks to establish the attitudes that users have towards assistive technologies. Please tick one answer accordingly.

Attitude 1 oward Using	STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE
I like the idea of using assistive technology					
1 have a generally positive attitude toward using assistive technology.					
1 believe it is (would be) a good idea to use assistive technology in my daily activities					

SECTION E: INTENTION TO USE (ITU)

This section seeks to establish the intention to use assistive technologies. Please tick one answer accordingly.

Intention to Use	STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE
I intend to use assistive technology in my daily activities					
1 intend to use assistive technology if 1 get access and can afford					

SECTION F: TECHNOLOGICAL CONTEXT

This scction seeks to establish the technological context on assistive technologies. Please tick one answer accordingly.

Technological context	STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE
Adopting ATs will offer better quality life to PWDs					
Integrating ATs in life of a PWD will not be very difficult					
Compatible with the PWDs daily routine					
Cost for equipment, software will not be prohibitively expensive					

SECTION G: ENVIRONMENTAL CONTEXT

This section seeks to establish the environmental context on assistive technologies. Please tick one answer accordingly.

Technological context	STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE
Majority are aware of the strengths and the limitation of A Ts					
Government support for the use of ATs is high					
The overall of readiness of our country for adopting, implementing, and using of ATs is high					

APPENDIX B: QUESTIONNAIRE FOR CAREGIV ERS

SECTION A: GENERAL INFORMATION

1. Gender [ ] Male [JFcmale
2. Age [ ] under 25 years [ ] 26-35 years
   [ ] 36-45 years [ ) 46- 55 years
   [ ] over 56 years
3. Level of Education Primary [ ] Secondary [ ] Tertiary College [ )
   University [ ]
4. Computer Experience (years) None [ ] 1 - 3 years [ ] 4 - 6 years []
   10 years or above [ ]
5. What type of Assistive Technology do you know? JAWS [ ] Braille Embossers [ )
   Optical Character Recognition [ ] Text Telephones [|

SECTION B: ASSISTIVE **TECHNOLOGY ADOPTION**

This section seeks to establish assistive technologies adoption. Please tick one answer accordingly.

Assistive Technology Adoption	STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE
Adopting assistive technology is (would be) a good idea					
I believe that adopting assistive technology ensure a better quality life to PWDs					
The amount of pressure placed by the government to adopt and use assistive technology is low					
1 believe adopting assistive technology will be compatible existing technologies.					
The overall level of readiness of Kenya for adopting, implementing and using of assistive technology is low					
The amount of pressure placed to adopt and use assistive technology by critical partners e.g. disability bodies and users is low					
People are aware of how assistive technology can improve PWDs lives					
The cxpectcd cost of integrating assistive technology with existing technologies will not be prohibitively expensive					
The government desire to support assistive technology is high					
Availability of financial resources to meet the costs of adoption and implementation of assistive technology low