FOREIGN ELECTRONIC DONATIONS AND ENVIRONMENTAL SUSTAINABILTY IN KENYA

BY

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DECLARATION

I declare that this is my original work and has not been presented for the award of a degree in any other university.

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DEDICATION

This work is dedicated to my parents Phillips and Hellen Ogolla , siblings Rogers and Jude

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ABBREVIATIONS AND ACRONYMS

Cop: Conference of parties

EEE: Electric and Electrical Equipment

E: Electronic

ICT: Information, Communication and Technology.

MoIC: Ministry of Information and Communication

NGO: Non- Governmental Organization

NEMA: National Environmental Management Authority

UNEP: United Nations Environmental Program

WEEE: Waste Electrical and Electronic Equipment

OPERATIONAL DEFINITION OF TERMS

Basel Convention: a type of convection that recommends that signatories ensure that the generation of hazardous waste and other waste within a country are reduced to a minimum considering social, technological and economic aspects.

E-waste: a term encompassing various forms of electrical and electronic equipment that are old, end-of-life electronic appliances that have ceased to be of any value to their owners

Recycling: is the process of reconditioning used materials (waste) into new products.

Refurbishers: person who renovates or process e-waste but does not include telecommunications carriers, telecommunications manufacturer, or commercial mobile service providers.

Sustainable development: development that meets the needs of the present without compromising the environment for the future generations.

Environmental Sustainability/sustainable environmental development: maintenance of the factors and practices that contribute to the quality of environment on a long-term basis.

Environmental degradation: the depletion of environmental natural resources such as water, air, wildlife which presents a challenge to environmental sustainability.

ABSTRACT

A dominant and current assumption is that, if Africa is to develop, it should incorporate ICT strategies such as e-commerce, e-governance, e-health, e-education, e-gender, e-agriculture, e-commerce as part of its development strategies. Accordingly, ICT has become an essential global resource in Kenyan development. However, Kenya is experiencing digital gap in terms of affordably, accessibility and usage. As such, computers have been donated from global North to South to fill this gap. These donations though beneficial, they have unintended and anticipated consequences that are unknown to donor organizations in the North. The study explores whether these donations can contribute to sustainable development in Kenya. The study examines the nexus between communication and state building. The research also demonstrates how e-waste is a challenge to sustainable development. The study adopted modernisation theory to explain how ICT donation was one of the strategies for nation building. The research design was based on exploratory research using both qualitative and quantitative method. Non-probabilistic sampling using purposive sampling technique was used to collect data. Both primary data and secondary data were collected; the latter was collected through interviews and questionnaire. Data analysis was done by employing the thematic analytical technique. The premises in this study were analysed, and it was observed that communication is a significant resource in nation building in Kenya. However, low penetration of information, communication and technology presents socio-economic and political developmental challenges. Despite Kenya being a signatory to both Basel and Bamako Convention, she is yet to domesticate the policy. Although, there is established e-waste guideline, the standard of e-waste control is still wanting and the trend of domestication has been slow. As such the research concludes that ICT donations bridge the digital divide, but the presence of e-waste will prolong achievement of sustainable development. Accordingly, the question of sustainability should be part of development strategies which involve the application of ICT.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the study

Development aid is one of the issues on the global stage. Riddell (2007:17) define foreign aid as all resources consisting of physical goods and technical know-how, financial grants or loans transferred by donor to recipients. It is provided in form of project aid, humanitarian aid consisting of food aid, technical assistance and programme aid. The marshal plan manifests the first instance of development. It was named after George Marshal who on 5th June 1947, proposed his solution to war torn Europe. The proposal was enacted into law in 1948 as the European Recovery Program (ERP). The marshal plan was geared towards nation building and reconstruction of war-torn countries (Thorbecke, 2005). In his inaugural speech in 1947, United State President Truman described the new independent states as underdeveloped and needed to imitate the path of industrialised countries to develop. Accordingly, the Marshall Plan having succeeded in reconstructing Europe, set an agenda for international development (Ohlin, 1966, 25).

In the context of post-colonial states, foreign aid was used to respond to developmental challenges facing the newly independent states. Notably, one of the areas that received attention as a way of spurring development was the infusion of communication as part and parcel of development strategies. Accordingly, United Nation Educational, Scientific Cultural Organisation (UNESCO) considered that Information, Communication and Technology (ICT) would be a significant developmental resource and called for formulation of comprehensive national communication policy for these states (UNESCO, 1998). During the United Nations Millennium Summit in 2000, ICT was mentioned as part of strategy for achieving the Sustainable Development Goal (SDG).

Whereas the infusion of communication in development planning and execution was considered a significant issues, information, communication and technology (ICT) made it more significant. In his analysis, Toffler articulates the significance of ICT as a stage in developmente. He describes three types of societies based on the concept of waves. The first wave is the agricultural revolution. During this period, people gradually moved from hunting and gathering to herding and agriculture (as cited in Beers, 1986, 22). The second wave according to Toffler (1980, 38) was brought by industrialisation. The society was based on mass production, mass consumption, mass entertainment and mass media.

In the third wave, Toffler had predicted that the future would be shaped by the new information technology. He presumed that the new change was as a result of human kind sudden new abilities to manipulate information using modern information technology. Hence, new civilisation will be created through advanced use of telecommunication which will cause a great impact globally (Alvin &Toffler, 1995). For Castel (1999), ICT is equivalent to electricity in the industrial age. The information age envisaged by Toffler can be attested to the proliferation of knowledge, ideas and advanced technology not only in developed world but also in developing world.

The 1980s development in computing and the emergence of the internet revolutionized communication for development. Information, communication and technology are new technologies such as computers, mobile phone and the internet (Langmia, 2005). Scott and Batchelor (2005, pg.11) posits that the term ICT also include more traditional communication media such as radio and television. The authors further state that digital convergence is gradually bringing devices to the market that include the traditional media phones with radio, media centres with computing capabilities and television which will increasingly blur the distinction between old and new.

Digital revolution has revolutionised communication for development by creating more ways to communication. By bringing together global media, telecommunication and information technology, digital communication forms convergence. This creates room for many technologies to co-exist and none will replace the other. This is because no technology can meet the requirements of the market. The convergence creates an electronic superhighway as voices, video and data, interactive communication technologies and multimedia (Gerald, 2003).

People can communicate from different multimedia tools such as YouTube, podcast among other multimedia tools offering wide variety of choices. In turn, people can keep in constant communication and access to information at any given time and place regardless of distance (Gerald, 2003). Advances in information and communication has also contributed to a wave of change across the globe forcing human kind to selectively form new relation and different kinds of organisations that facilitate the use of new technologies (Ernest, 2004).

Information, communication and technology revolution was seen and still being seen as a critical development asset. Thus, focus has been on promoting ICT as a way of enhancing development. Scholars such as Hansen and Tarp (2002) states that aid contributes to national development. In a country where growth is driven by capital accumulation, aid has a positive effect in increasing the aggregate savings and investment. Scholars have also studied the effect of aid on regime type in recipient country. According to Goldsmith (2001) during the cold war period, donors threatened to condition aid on adoption of democratic reforms. He makes a conclusion that aid conditionality may further the adoption of democratic reforms in recipient country. Dunning (2004) posit that aid is allocated primarily of geopolitical grounds and not as a result of rational humanitarian planning. While these studies have focused on aid

and nation growth, this study looks at ICT as component of foreign aid and how it can be used a tool for development in Kenya.

UNESCO recognise the importance of communication policies in support of development and national communication for development policies in Africa. Kenya's ICT sector has been undergoing a series of policy reform geared towards liberation and privatisation of the sector in essence to make ICT's accessible, affordable and competitive. The amended Kenya Communication Act 1998 (KCA 1998) provides the framework for regulating ICT sector. (Waema, 2005). In June 2001, The Poverty Reduction Strategy paper (PRSP) identified ICT as one of the eight strategic sector priorities that the government of Kenya should address to assist in poverty reduction and spur economic growth (Bowman, 2010). It then followed that in 2006, the government adopted the National Information and Communication Technology (ICT) that spelt out the path to be taken by the State to effectively implement the E-government strategy (Wamoto, 2015). In addition, Public engagement in the use of ICT was reinforced by the enactment of the 2010 constitution that required citizen participation and access to public information. (Opiyo et al, 2017).

Whereas ,ICT revolution has promised to spur development Kenya is experiencing digital gap to be filled through ICT donation. During the Geneva plan of action, Digital solidarity Fund (DSF) a funding mechanism was conceived primarily directed towards technology transfer in developing countries (Fong, 2009). In 1996, World Bank launched its information program to help finance small scale projects designed to implement ICT's as part of broader development efforts. A year later (2007) the Chinese personal computer manufacturers such as Lenovo and Dell technology also announced their plans to design a market low-cost personal computer for use by the rural population (China PC, 2007).

Another project is the MIT Media lab OLPC (One laptop per child) which have introduced the $100 laptop for advancing computer technology in developing. However, these technologies is inferior to western standards hence can be produced and sold cheaply (Allen, 2005). James (2003) argue that the digital gap can be bridged through donation of old computers from developed to developing countries. According to Herat (2007) from 1992-2005 the average lifespan of a computer dropped from 4 and half years to two years. This however raises the question of e-waste and its implication on environment and human health.

According to Wanjiku (2009) short lifespan for most electronic products less than two years for computers are a major drive of growing e-waste problem. E-waste is regarded as those imported or donated second-hand electrical appliances that are obsolete and no longer meets the need of the original user. These electrical appliances include ICT equipment such as computers. The e-waste concept came to light back in the 1970's and 1980's following environmental degradation that resulted from hazardous waste imported to developing countries (Shinkuma and Huong, 2012). The e-waste issue was again raised at conference of parties (COP) 6 in 2002, as an emerging global environmental problem and one of the fastest growing waste streams (Hotta, 2008)

A research conducted in 2014 by the United Nations Environmental Program (UNEP) titled "solving the e-waste problem" showed that Kenya generates 44,000 tonnes of e-waste annually (Daily Newspaper, Monday, January 22, 2018). Asiimwe and Ake (2012) led a research on the conceived role of the East Africa governments in combating negative impacts of e-waste. The research showed that the East Africa Community government considers e-waste as an emerging problem. According to Ramesh (2002) the problem continues to flourish due to adoption and use of ICT for development in bridging the digital gap. This

informed the core interest of this study that sought to explore whether foreign donated computers to Kenya can contribute to sustainable development.

1.2 Statement of the Problem

States in Africa and Kenya recognises that infusion of ICT in development strategies is imperative to spurring development. Accordingly, the government of Kenya's poverty reduction strategy paper for the period 2001-2003, the government recognises that information, communication and technology are engines of development. The Kenyan government also recognises that the remedy to ignorance, diseases and poverty is exposure to knowledge and that if Kenya has to develop economically, socially and even politically, it must enhance its communication capacity in investing in ICT infrastructure as one of the components of development. As such, Kenyan government continue to expand its resources ensuring effective development and integration of ICT in development sector. Despite this, Kenya is still lagging behind in access to communication resources especially ICT resources compared to the other African countries. This had been manifested in the digital divide.

To close the digital gap, various international and national computer donation programs have been launched to specifically provide computers to educational, non-governmental organisations (NGO) and government institutions. The majority of these programmes rely on refurbished second-hand computers with a shorter life span and low-cost computers. Programmes such as the UK based computer aid, the Belgium founded Close the gap, and the US based World computer exchange and the Canadian based computer for schools provide access to computers to, Kenya, Ethiopia, Namibia, Tanzania, Uganda, Zimbabwe, Sierra Leone, Nigeria, Ghana and Mozambique.

In South Africa, computer aid has contributed in poverty reduction and achieve socio-economic development in rural settings through policy and practices that promote digital

inclusion and digital literacy. Information, communication and technology has enhanced the opportunity for the poor to access markets, healthcare facilities, education institution, and elimination of gender inequality. In Kenya, Jamii Thabiti program funded by the UK government through Coffey international donates computers to National Police Service. However, the lifespan of these computers are short as most of them have been used in the countries of origin resulting to massive e-waste. Accordingly, whereas e-donations are meant to bridge the digital gap they seemingly result into the problem of e-waste. Thereby raising question on the nexus between e-donations and sustainable development.

1.3 Research Questions

1. To what extend has ICT influenced development in Kenya since independence?
2. What is the implication of digital divide on sustainable development in Kenya?
3. What is the implication of e-waste on sustainable development?

1.4 Research Objectives

1. To explore, the extend of ICT influence on development in Kenya.
2. To explore the effects of digital divide on sustainable development in Kenya.
3. To explore the implication of e-waste on sustainable development.

1.5 Research Premises

1. Communication is considered a significant developmental resource in Kenya.
2. Low penetration of ICT presents socio-economic and political developmental challenge in Kenya.
3. Presence of e-waste scenario in Kenya could prolong the achievement of sustainable development.

1.6 Justification and significance.

An understanding on nexus between communication and sustainable development is central in policy designing and interventions in the areas of development. One characteristic of Kenya ICT environment is that the largest percentage of ICT initiatives are donor funded. Today, Kenya lacks well developed capacities to screen foreign technologies and is unable to formulate adequate technology related policies or plans. The policy framework for technology imports is relatively liberal. Furthermore, there is no control on capital goods, imports on licensing. Unlike many import substituting countries, Kenya has never had legislation for regulating the transfer of technology. Thus, some donations are made without prior consultation or carrying out a need analysis by the recipient organisation. The comprehensive understanding of the concept digital gap and development contributed by this research is expected to help in the formulation of strategies and policies to bridge the digital gap. This is through incorporating sustainable solutions that respond to local needs.

This work seeks to infuse debates on digital divide into international development discourse. Accordingly, the study brings in the concept of electronic waste as an impediment to sustainable development. In terms of the contribution to research development, this study is significant since the e-waste is an emerging body of knowledge. The concept of e-waste has

been discussed within Information and Technology, Business, and environmental planning but this work links it with sustainable development. While Basiye (2008) explored the role of Extended Producer Responsibility (EPR) electronic waste management in Kenya, Asiimwe (2010) focused on the e-waste management in East Africa. By examining e-waste, the study aimed to provide insight for research in international relations and raise question on environment within international development. Considering that ICT is one of the critical pillars of development according to UNESCO and environment as one of the three pillars of sustainable development.

1.7 Scope and limitation of the study

The study sought to explore whether foreign electronic donations from the perspective of sustainable development in Kenya. The initiative of computer donation to Kenya schools has been criticised as a scheme that favours donations from developed countries. The study, however took a retrospective analysis from 1970's onwards since this period saw the emergence of debate on foreign aid in Africa and UNESCO debate on global information flow.

This retrospect was important as it highlighted the need for sustainable development as a tool for global development. In addition, e-waste is perceived and managed differently among different countries. In most developed countries, there is legislation on the control and use of hazardous chemicals in those products and the management of e-waste after disposal. Therefore, the political interplay between global development and environmental management contextualizes policy recommendation in a manner relevant to both policy makers and scholars.

The study focused on donated computers from USA, Britain and Ireland as a component of global development and e-waste governance. The issue of electronic waste falls under

international relations that traverse geographical location. The research was limited to computers (desktop). The target population was computer aid organisations, learning institutions, NGO's, government institution, government officials, dumpsite recyclers and policy makers.

There were three main limitations, the first is the insecurity because of street boys who are part of gang members who have been reported fighting over control of the dumpsite and the pollution. To overcome this, the researcher had to hire a guide and dress appropriately. Secondly, it was difficult getting cooperation from NEMA because most of the officers were out for field work. Lastly, there was the delay in returning the questionnaires on time. Some of the correspondents returned the questionnaires without responding because they were denied permission to release information.

1.8 Literature Review and Theoretical Framework.

1.8.1 Review of Relevant Literature

The issue at hand falls within the wider subject of international development and how ICT can contribute to bring about the desired development within developing country. It focuses more narrowly on communication as a developmental asset and how it has been considered as one way of bridging this gap.

1.8.1.1 Communication in development

Scholars have written on the link between communication and development. Pioneer researchers in the field of development communication included; Lerner, Klapper and Schramm. These pioneers in the field of development and communication focus more on mass communication. Their understanding of development communication referred to technology-based communications network that create a conducive environment for

development. Lerner (1958) acknowledged mass media as a pillar of democratic political development. His idea was further developed by Klapper who researched on the impacts of mass media on the society. Shcramm (1964) notes the importance of communication in national development. He identifies twelve areas on how mass media can influence development. These studies shaped the application of communication in development in Kenya.

Research on the effect of media merged in the 1920 and 1930's. Pye (1965) points out that communication technology is powerful in breaking down traditional values. During the war years, the mass media were regarded as powerful and manipulative forces which could change opinions in a short period of time. Examples of studies undertaken with this frame of reference in mind include campaigns encouraging social bonding during world war one (Melkote, 1991, p.67). According to Defleur and Ball-Rokeach (1989, pp. 161-162), the mass media were used as a tool for propaganda, with carefully designed messages intended to mobilise sentiments of loyalty for authority, hatred, fear of the enemy, to maintain morale and to channel energy into nation building. According to katz and Lazarsfield (1955) people do not randomly attend to media but rather focus on specific messages. In their study of the 1940 U.S presidential election, they suggested that people often seek out political content that reinforces their beliefs avoiding content that was meant to change their opinions. This insight led the researchers to conclude that the power of media to change attitude is limited (Lazarfeldetal. 1948).These studies helps the present research on understanding how communication was used to promote political agenda.

Paul Lazersfelds study on how newspaper and radio coverage of the 1940 US presidential elections in Erie County, Ohio, disapproved the magic bullet theory. The assumption within this theory was that the media had a powerful manipulative effect on individuals and society

and should be used to disseminate information aimed at changing individual's behaviour (Shannon &weaver, 1949 in Baran &Davis, 2006). The study was based on face to face interview with 1000 Erie County Ohio's voters. It was reported by interviewees that they learned more from interpersonal communication than from mass media. The study argued that media did not influence the public rather there was a two-step flow of communication (Williams, 1989, pp.235-237). The two-step flow of information theory made the audience active reflectors and disseminates of information and not merely passive recipients of messages as suggested in the magic bullet theory (Kobie marie Burger, 1997). Though these studies do not directly reflect Africa's situation, they anchor the goals of the current investigation.

Paulo Freires (1984) attack on the culture of silence. He observed this culture among the illiterate peasants in Brazil. He states that the environment should be the main focus to learning. Therefore, sending messages to a passive receiver formed a population deficient in reasoning and limited in capacity to bring social change. Freires (ibid) simply implied that development should be an instrument for the grassroots to influence social change in their communities. These studies brought in culture as a variable which was useful in present study in assessing how culture influence technology adoption.

A study also conducted among a rural community in Bendel state, Nigeria, explored the preferred form of communication between traditional forms and mass media. Rogers observed the popularity of traditional channels of communication over the use of mass media (Roger 1977 in Moemeka, 2000). Accordingly, Katz et al. (1955) posited that interpersonal communication was potentially far more influential than mediated kind. Tabbs and Moss (1983, p.349) recommended that the importance of information determines the choice of communication media. Urgent messages are sent through mass media because it spreads

faster over a wide area. Servaes (1995, p.44) observed that interpersonal and mass media can be used complementary as they have a direct effect on social behaviour. These studies gave a useful basis for this research to understand social change in communication.

In Kenya, Shcramm (1964) conducted research on the uses of new media in development. He focused on educational radio programs in cultivating the knowledge and behaviour that would lead to development path of western capitalist democracies. He stated that students would be gathered to listen to prepared course content to which would respond to them. The programs targeted key education sectors that the country believed would improve their concerns. He noted that for use of media to be effective there is a need of creating a conducive environment for development. His study shows how the new media such radio was used in development process in Kenya which is at the core of the present study. The 19th century, forms of communication were limited. Newspapers, magazines, radio and television dominated the media. In the 21st century, forms of communications have exploded to offer variety of choice. Shcramm study on influence of new technology in development provided useful basis for this study in surveying historical development of ICT in Kenya.

1.8.1.2 Relevance of ICT in development

Scholars have raised the question on linkage between ICT's and human development dimensions of governance, culture, education, agriculture and health. Majority of population in developing countries dwell in rural areas and depend agriculture for their livelihood. Although literature exist on the use of agricultural systems, much is not mentioned on its relation to ICT's. Hence, it is crucial for this study to examine examples in existing studies the link between ICT's and agriculture in developing countries.

Women farmers are often excluded from mainstream of agriculture training, research and development partly because of their limited literacy level. UNDP (2002) gives an example on

how information and technology have been used in alleviating poverty among women farmers in India. By using computerised network to process and disseminate information, these women are exposed to information ranging from how to access and use new technologies, or agricultural commodity to information concerning farming methods and agronomic practices. In addition, they are informed on recommended crops for seasons as well as information on organised meetings and workshops. The impact of this project however, is yet to be assessed.

Munyua (2002) study analyses the key problems, faced by women in agricultural sector in Africa. The authors assert that lack of consistent and comprehensive information is the main obstacle to agricultural development. The way local information is packaged makes it difficult for stakeholders to access and use. The author therefore advise that traditional and modern ICT's could be used simultaneously to speed up the dissemination of information. This is conflicting to Kole's (2000) study in which she found that African's women organisation repackaged information from internet and redistributed it orally using traditional print media, radio and television. These authors gave basis which this study was underpinned as it partly looked at participation of women in digital revolution.

There are other scholars who believe that cultural beliefs are a hinderance to the adoption of ICT's in developing countries. For instance, Janczewski (1992) looked at the potential technical, economic and cultural problems in implementing IT in West Africa and possible solutions to remedy the situations. The study found out that for ICTs to work effectively in Africa, humidity, temperature and sterility are necessary. The author also listed telecommunication and maintenance issues and, power supply as the main infrastructural problem. Although Janczewski appears to discuss socio-cultural issues in general, he failed to highlight environmental issues which is at the core of this study.

In another study Ryckeghem (1995) provides a framework for understanding ways in which culture influence IT and how IT influences culture with culture being used a diagnostic instrument. The author notes that generally Africans would prefer to consult friends and colleagues for information than search for it in the library or resource centres. As such, information and technology would not increase the productivity of some workers. He concludes that, understanding of work practices and organisational structure, and attitude of the workers where IT has been introduced is being introduced is crucial for effective application.

This line of thought is like that of Hasan and Dista (1999) comparative study on relationship between culture and the adoption of IT in West Africa and the Middle East. The researchers focused on Ghana as a country in west Africa and noted that, the country was receptive to ICT development. The study established that each country ought to have IT policy that acknowledges its culture and ensure that the adoption of IT does not destroy the cultural heritage. Though these researches do not directly mention Kenya, they anchor the goals of the current investigation.

The necessity of technology in Sub Saharan Africa (SSA) raises question on human right concerns. Basing her arguments on the Declaration of human rights, Myers (1998) argues that any introduction of ICT should incorporate right to development of personality in economic, social and culture. Given that a small percentage of SSA have access to advanced ICT's, certain sectors of the population are being deprived of their human rights. This is because SSA lacks the monetary funding's and proper education and tools to implement change. She concludes that computers can assist African citizens realise their basic rights by disseminating information on relevant issues and enhancing their knowledge capability.

Scholars have also raised concerns on how ICT can help in the process of governance given that bad governance has accelerated poverty in developing countries. Ningo (1999) states that good governance is a prerequisite for ICT to solve underlying problems and that governance should be content driven and not technology driven. He concludes that If ICT is properly utilised, it can assist in achieving good governance. Khasiani (2000) assumes that women lack access to ICT reflects the disparity in women and men access to development resources. In her study on women in governance with a focus on the role of ICTs in Kakamega and Makueni county in Kenya, she provides evidence on how community-based centres plays a key role in information development. The study concludes that Kenya women depend on traditional sources of information and lack control over the most effective sources.

Since the democratisation in most African countries, ICT could support the participation of women in governance. Opoku-Mensah (2000) presents examples from Zimbabwe, Ghana, Tanzania and Uganda on how ICT has been used to promote women's participation in electoral participation and political process in Africa. From her findings, in Uganda women have used the internet to assert themselves to political debates. While in Zimbabwe, women have devised their own channels of communication to support their efforts, defend their rights and diffuse their own form of representation. While these studies are informative, they assist in understanding how within governance women apply ICT for political development.

Studies on the relationship between ICT and poverty had highlighted issues of social inclusion and exclusion. Wresh (1996) states that the poor are excluded from much of the worlds information and no one is offering solution to the problem. According to Braga (1998) ICT has and will continue to create economic inequality between developed and developing countries. This view is consistent with Brown (2001) and Chawdhury (2000) who state that there is still scientism as to whether ICT can reduce poverty in developing countries.

Nevertheless, scholars such as Barlow's (1998) believe that ICT can enable developing countries leap frog stages of development. He states that Africa should stages of industrialisation and leap directly into digital era. This conclusion is shared by Hudson (2001) who says that leapfrogging is possible using wireless and satellite technologies. These observations help assess the challenge in digital divide in development.

Access to information and knowledge are considered key enabler in poverty reduction. According to Heeks (1999) the poor need knowledge to access and assess and apply existing information. This may be met by more informal information system than by formal based information technology-based system. The poor will only benefit from ICTs that they can control both the technology and its related know how. O'Farrell (2001) adds that before one can advocate for ICT development among rural and urban poor, they must understand the existing information system. As Lefebvre and Lefebvre (1996) concludes that realisation of full benefits of ICT requires understanding of IT application, their potential and reaction to change.

Deliberates steps has been taken to make sure rural communities have access to ICT's. For instance, a number of studies has proposed telecentres as a method of access to ICT's and as a solution to access difficulties in rural areas and in poor regions (Butcher, 1998). Telecentres address the lack of ICT's throughout Africa and assist in providing universal access to both telephony and other forms of ICTs (Benjamin, 2000). However, little attention has been paid on guidelines to ICT utilisation. For telecentres to benefit the communities and realise rural development focus should be on the people, organisation and the process than the technology themselves (Anderson (1999).

The global community have been debating about digital divide and the role of ICT in fostering sustainable development. In this respect Camacho (2001) asserts that digital divide

is as a result of other social gaps and the gap will continue to grow unless if the technologies are not correctly utilised. Markers et al. (2001) have provided clarity on whether priority should be given to provision of expensive technologies over the need to address the urgent basic need of the poor by development agencies and developing countries. The authors conclude that measure of success should be aimed towards achieving the sustainable development goals and not diffusion of technology or bridging the digital gap. Information communication and technology have potential of increasing information flow and empowering poor people.

1.8.1.3 E-waste: A challenge to sustainable development

Digital revolution offers unprecedented opportunities for sustainable development. At the same time, they contribute to the growth of a global consumption of electronic and electronic equipment resulting to growing amount of electronic waste.

There is limited information on the quantities of transboundary movement of e-waste between and within countries. Schwarzner et al, (2005) estimates global e-waste flows without quantifying country to country flows of e-waste and their formation of networks. A study by Terazono (2004) provided a wider perspective of material flows between Japan and China with definition of recyclable resources under Japan's fundamental law. According to Basiye (2008) there exists a knowledge gap on the flows of e-waste generated in the country and the e-waste imported into Kenya. Kenya ICT action (KICTAnet.) conducted a study on electronic waste in Kenya between December 2007 and April 2008.The study revealed that estimated amount of e-waste generated from only computers, monitors and printers is about 3000 tonnes (Waema et al., 2008). This study focus on the flow of e-waste through donation.

Most researchers have investigated global e-waste disposal, while some researchers have focused directly on toxic submissions associated with the recycling process. For instance, a

report by Basel Action Network (BAN) an environmental NGO showed informal e-waste recycling in Asia, Guiyu region and the cities of Karachi, Pakistan and New Delhi in India as environmental hazard. The report criticises the U.S for exporting e-waste under the disguise of recycling and states that this process is harmful to the poor and vulnerable people in Asian countries. Another report by Silicon Valley Toxins Coalition (SVTC) titled the "digital dump" exposed the issue of e-waste importation in Africa notably Nigeria and how it affected the environment and human health.

Other scholars have stated the problem of inappropriate recycling of e-waste. Leung et al. (2004) reviewed the potential environmental and health risk of toxic substances such as persistent organic pollutants (PoP's) and heavy metals contained in electrical and electronic products. On his part, Sakai (2004) writes that hazardous polybrominated diphenyl ethers (PBD's) are likely to be emitted into the environment during recycling of used home appliances if there is no appropriate control system. These emissions are harmful to the environment and living organisms. For instance, Inanc (2004) investigated on potential pollution caused by E-waste in landfills and dumps in Asia. He established that after extraction of precious metals, the remaining materials are discarded, and the remnants created significant potential health and environmental risks. While these studies have highlighted the health risk and environmental impact of informal recycling, this study looks at how these impacts affect sustainable development.

In Kenya pilot study to find the link between environmental pollution and public health was conducted by United Nations Environmental Programme (UNEP) at Dandora dump site areas in Nairobi. Medical evaluation conducted on 300 children showed that 50% had respiratory problem and 30% had blood abnormalities a sign of heavy metal poisoning. This study relied

on the findings of the above study to explore whether stipulated guidelines and policies has comprehensively highlighted how to mitigate e-waste.

Research has also been done on the responsibility of producers on collection and recycling of end of life products. For instance, Basiye (2008) examined the role of EPR in electronic waste management in Kenya. The study focused on challenges surrounding the end of life management of mobile phones. The study established that competition from repairers undermine effective and efficient take back scheme for End of Life phones. Although the study focused on mobile phone, the principle of ERP also applies to computer which is the focus of this study.

Asiimwe et al., (2012) researched on the role of East Africa Community governments in e-waste management focusing on awareness of the e-waste. Their researched found that policies on how to handle, control, generate, transport and disposal of waste that pose danger to public health and the environment is quite adequate. Moreover, there is high level of environment awareness among government officials and the public was quite high. The researched concluded that Kenyans performance on sensitizing her citizens on e-waste menace is minimal. The researcher's emphasis that the role of the government should make citizens aware of how to dispose of obsolete electronics. Although the study focused on EAC, little attention was given to role of other policy makers such as Kenya Revenue Authority. This study aimed at shedding light on the role of KRA in e-waste governance.

The Kenya government in collaboration with UNEP held a national e-waste conference and exhibition on 28th May 2014. The main aim of the conference is to bring the on the spotlight the mounting e-waste problem and identify the key drivers and find solutions to the problem. The conference discussed the following issues; first, factors that promote e-waste generation. Secondly, e-waste implication on human health and the environment and lastly, how e-waste

can be regulated (UNEP News Centre, 2014). Although the conference highlighted the causes of e-waste accumulation, it did not mention foreign donation of computers as a strategy to bridge the digital gap. This study therefore, build on the conference discussion by going further to explore effect of e-waste (component of ICT which is a developmental resource) on sustainable development.

In a nut shell, most of the studies focused on ICT as a development asset. Information, communication and technology falls within the broader context of international development. As such theoretical debated in foreign with focus to technology transfer was used as explanatory variable to explain the nexus between communication and nation building.

1.8.2 Theoretical Framework

ICT donations fall within the broader context of communication for development in Africa. As such, the study used modernisation theory of development as its analytical unit. Although post-modernist theory describes the period that follows modernity, an era of globalisation, it is inadequate to explain the nexus between ICT donation and sustainable development. The inception of modernisation theory has been historically attributed to three fundamental events after the second world war. First, the rise of United States as a super power. Secondly, the spread of communist movement by the former Soviet Union not only to Eastern Europe but also to China and Korea. Lastly, the integration of the European colonial empire in Asia, Africa, and Latin America giving rise to proliferation of newly independent states which were categorised as the third world countries. (Alvin So, 2010;17). These emerging states were in search for a development path which would enable them leap frog the stages of development.

The major assumptions of modernisation theory of development principally are; First development occurs in stages. Rostow distinguished five stages of social changes which are traditional society, preconditions for take-off, take-off, the drive to maturity and the age of

high massive consumptions (So, 2010). According to Levy (1967, p.207) modernisation produces tendencies toward convergence among societies. For instance, development patterns are in such a way that the more highly developed societies become, the more they resemble one another.

Secondly, modernisation is based on American or European perspective which shows one model of development. Equally, development is an irreversible process that once third world countries experience it, they will not be able to resist the motivation toward development (Tipps, 1976;14). Thirdly, according to Hermassis (1978), modernisation is a transformative process. For a society to transition to modernity, its traditional structures and values must be abolished and replaced by a set of modern values. Fourthly, development is a progressive process which is inevitable but desirable. Lastly, though development takes time to complete, its transformative impact will be felt through time. It is an eminent process due to its systematic and transformative nature which brings transformation into the social system. (Huntington, 1976).

Servaes (2008) work outline the main trends on communication processes in modernisation models in 1950's to present participatory models. Communication was seen as a social system that could transform individuals and society from traditional to modernity. Much emphasis was placed on infusion of money and technology from the developed nations to developing nations. However, persistence and growth of poverty in the world indicated that the dominant model to development was not working (White 2008).

Scholarly works of Wilkins (ed.) (2000); Melkote & Steveas (2001); WorldBank (2007) and McPhail (2008) found out that participatory forms of communication are far more effective for development than modernisation model. It introduces the view that development experts

must allow the people to define their needs and initiatives. In their concluding remark, people must carry out the development of the nation.

From development studies perspective Ansu-Kyeremeh (as cited in White, 2008) has highlighted a centripetal model of development versus centrifugal model. He posits that development ought to respond to the initiatives of the people at the grassroots, in the interior of the nation. The goal for development should be rejection of modernisation model for development as well as importation not only of the technology from the West but also the cultural lifestyle of the West. Resisting of western culture according to Masrui and Okigbo (2008) is unrealistic and unwise. These authors argue that cultural harmony and good intercultural communication is necessary foundation for the social, economic and political development of Africa.

Criticism of the theory regards tradition has been regarded as an obstacle for development. According to Redfield (1965), developing countries do not have homogenous set of traditional values, their system are highly heterogenous. Another aspect of criticism here is that traditional and modern values are not necessarily always mutually exclusive. For example, China despite advances in economic development operate on traditional values and this also seems to be the case with situation in Japan (Cherill, 2016). Japan economic growth has been credited to the use of Confucianism. This is a cultural trait which celebrated the transfer of one's family loyalty to the country, especially in industries and organisations.

Pradip Thomas (2008) analysis of poverty state that modernisation model failed because of the increase of concentration of economic and technological power in an elite class and the declining access of the lower class to the resource development. He suggests that the poor should be given capacity which supposedly enables them to have access to technical knowledge to improve their capacity. The works of Moemeka (1997, 1998, and 2000) and

Fanira (2008) presented African perspectives on communication for development. Their studies emphasised on a form of communication that emphasis on community solidarity over individualistic interests.

One feature of the modernisation perspective is the analytical perspective. In the context of this study, the theory explains how ICT donation was one of the strategies for nation building. However, it fails to address the issue of environment with international development, yet this is one of the areas which has received substantial assistance from donor countries of Europe, North America, China and Japan. While the global market for ICT continues to grow, so does the increasing concern with the closing of the digital gap. According to (Srinivasan, 2001) the moment a new and innovation technology comes to market there is a divide. As such, developing countries finds it more costly to replace their old machines and software (Wade, 2002). To this effect, aid organisations are attempting to bridge the gap through donations of second-hand computers. These donated computers have short life span which raises question on e-waste. James (2003) states that the danger of exporting old computers to developing countries is that the later will become dumps for electronic waste. In this regard the issue of environment within international development is questioned. This work is therefore a critic of strands of modernisation theory of development.

1.9 Research Methodology and Design

The main aim of conducting this research was to explore ICT donations and sustainable development in Kenya. In order, to achieve the set objectives, the study adopted an exploratory research design using an investigative approach to explore multiple sources of information. This was relevant because Kenya has been receiving donated computers through Aid organisations. Thus, the researcher sought to understand the implication of these

donations on sustainable development in Kenya. Additionally, exploratory design increased the researcher's familiarity with the e-waste issue in Kenya.

1.9.1 Research location

The study was carried out in Nairobi (see appendix 6), although foreign electronic donations and sustainable development which falls under international relations is a broader issue that traverse geographical boundaries.

1.9.2 Sampling Design

The study sample size was fifty key informants; however, the researcher was able to interview thirty-nine key informants distributed as follows; four policy makers, ten IT specialists, two academicians, two foreign service officers, two researchers, two NGO programme officers, one medical personnel, two scavengers, one formal recycler and one dumpsite dwellers. This is because some respondents were not available for interviews while others simply were not willing. The study used purposive method as a sampling technique. Purposive sampling allows the researcher sorely on his/her judgment to select units that are representative of the population (Orodho, 2009). The respondents were chosen based on the office or position they held or were holding at the time and referral by informants to other people to participate in the study.

1.9.2 Data Collection Procedure

The study adopted both secondary and primary sources of data. These sources were permanently available and open for public criticism. This contributed to their high validity. The most frequently consulted secondary source of data was the library. For this study, the researcher relied on books and journals to search for materials on communication in development, e-waste issue and relevance of ICT in Kenya. Internet sources were used to

search for materials on organisations dealing with computer donations and on relevance of ICT in development. Reports and government documents were gathered on e-waste and ICT policies in Kenya. This information was sought from government Library (Ministry of foreign affairs), Kenyatta University and Catholic University of Eastern Africa. The researcher reviewed documents to provide the background of the issue, present evidence and backup arguments and statements. A major disadvantage of using secondary sources was that they were likely to be biased through the process of interpretation. However, the researcher used primary data to complement this void. Primary sources were divided into two: written and oral sources. Written primary sources used in this study consisted of policies and legislation and declarations. Oral sources used were interviews and questionnaires.

1.9.3 Research Instruments.

This study used interview guide to gather the information required. This is because interviews were likely to produce detailed, in-depth information (Arksey &Kangh, 1999). Interviews were conducted with key informants knowledgeable on issues related to e-waste governance. The key informants included government officers, NGO's, policy makers and scholars. Their knowledge provided the needed information to understand the issue under investigation. The type of interview used in this research was a semi-structured interview. The last instrument used is in this study was questionnaires. Questionnaires allowed measurement for a viewpoint. The study used questionnaires to quantify the number of functioning computers and non-functioning computers donated to institutions.

1.9.4 Data Analysis

The raw data collected was broken up into parts then placed into similar groups. These groups were used as a guide in organizing the writing process. Data was then analysed using

thematic analytical technique. An IT specialist (see appendix on oral interviews) assisted in interpreting unfamiliar terms.

It involved careful searching across a set of data to find repeated patterns of meanings and responses that fit into themes which had been prepared early. Thematic analysis was appropriate for this study because it allowed the researcher to interpret the topic from various aspects (Boyatzis, 1998). Accordingly, it had significant potential to generate unanticipated insights which open up new perspectives on the subject under study.

1.9.5 Data Management and Ethical Considerations

The research considered ethics in its data collection exercise. Before conducting the research, the researcher obtained research permit from NACOSTI to carry out research. The interviewees were chosen on voluntary consent.

CHAPTER TWO

2.0 COMMUNICATION AND STATE BUILDING IN POST-INDEPENDENCE KENYA

2.1 Introduction

This chapter presents a historical underpinning on the evolution path of ICT and development since independence. The relevance of this chapter is that it would help us lay background for the need of information and communication and technology in areas of development. The chapter also looked at policy dimension that guides the role of ICT in development.

2.2 Communication as a tool for development in Kenya

2.2.1 Historical review

The evolution path of information, communication and technology in Kenya can be traced back to the pre-colonial period with print media being the first entrant in the 1890's, followed by broadcast media (radio and television) in the late 1920's and 1950's respectively. The earliest church publication was a quarterly paper titled *Taveta Chronicle* published by Rev. Robert Stegal of the missionary society in 1895 (Abuoga and Mutere, 1988). Other publication such as the *kikuyu News* (1908-1967) an English monthly was published by the church of a Scotland Mission in Kikuyu. The British East Africa Company published the *Uganda mail* and *leader* in 1899 (Ochilo, 1993).

The Asians were also involved into the business of ownership of some sections of the media. The first national paper, *African standard* sprung up in 1902 as a monthly paper in Mombasa under the ownership of an Asian trader Alibhai Mulla Jeevanjee. The paper reflected racial divide and class situation that they faced as members of a racial minority as well as members of a class (Ochilo, 1993).

The paper was later sold to two businessmen; Anderson and Mayer who renamed it *the East African Standard. These* new owners were keen to promote colonial interests in East Africa (Ochieng, 1992). The reason for selling, according to Patel (1997) was that William Henry, the paper editor, took an anti-colonialism stand against the establishment. Other less important newspapers linked to the East Africa standard included; *Baraza* (1939), *Mombasa times, the Tanganyika standard* established in 1930 (Mbuthia, 1995).

Generally, the colonial press excluded Africans and was mainly used to promote settler's ideas and interest in the country (Ochilo, 1993). However, from the mid 1920's, more print media papers emerged from the Africans focusing on independence agenda. Among the pioneer tittles were; *Tangazo* published by Harry Thuku in 1921, Jomo Kenyatta's *Muigwitharia* (1928), Oginga odinga's *Nyanza times* and, Paul Ngei's *Uhuru wa Mwafrika*. Gradually, as agitation for self-rule and independence by the African elite grew, so did indigenous Africa publications. These publications provided a voice for colonised African peoples in Kenya (Iraki 2010, 143).

However, most of the publications were short lived. The breakout of the MauMau war and the declaration of Emergency in 1952 gave the colonial government a reason to ban all indigenous publication (Makali, 2004). In 1960, after the state of emergency was lifted and the ban withdrawn, his highness the Aga Khan founded the Nation media group. The basic objective was to produce newspapers edited by Africans containing news of particular interest to Africans, expressing Africans perspective for an African audience.

After Independence, similar patterns of media ownership and development continued as they were under colonial rule (Ochilo, 1993;21). Opiyo (2010) observes that the Kenyatta and Moi governments ensured strict control and influence over the development of media in Kenya. The factors that shaped the development of media during Kenyatta era (1963-1978) was

largely driven by the ideology of order, the push for development, political contention and ideological issues surrounding media ownership. Kenyatta government preferred a co-opted media that would contribute to national building and development (Mbeke, 2008).

Since independence, *the Standard*, *Taifa Leo*, and *the Daily Nation* have been the most influential and stable newspapers. The Kenyatta government had no newspaper to inform, educate or entertain the people but rather it had the Voice of Kenya (VOK) radio and television. It was until, the Moi era that *Kenya Times* newspaper (1983) was established in a bid to counter the influence of established newspaper mentioned above. The paper became the political mouth piece of the government (Iraki, 2010). After Mwai Kibaki won the presidency on National Rainbow Alliance (Narc) ticket, the *Kenya times* ceased to be the government paper.

Both the Kenyatta and Moi governments expected the media to promote the government's position at all times (Abuoga and Mutere). The government used the Kenya Broadcasting Corporation (KBC) act to control broadcasting in Kenya. The act stipulated that no other broadcaster would be licensed without the approval of KBC. According to Opiyo (2010) private media were required to select information, especially from regional news and, from the government owned Kenya News Agency (KNA). The state-owned KBC was often dominated by the ruling party Kenya Africa National Union (KANU) (Kibara 2003, 287). According to Heath (1997), the government had direct influence over the agenda and by extension its role within Kenyan society. It remained the sole broadcasting service from the time of independence in 1963 to 1989 when a second private broadcaster, Kenya television Network (KTN) came into the scene in April 1990.It was launched by the Kenya Times Trust, which had been established in 1987 by KANU and Robert Maxwell.

The reintroduction of multiparty politics in 1991 ushered a new dawn for media and communication sector. The dramatic changes occurring in the Soviet Union and Eastern Europe were a major influence on the Kenyan situation (Throup and Hornsby, 1998; 2). Section 2A was removed from the Kenyan constitution in 1991 paving way for political pluralism. Wanyeki and Lukilo (2000; 1) affirms that the political transformation was accompanied by calls to liberate the airwaves in African. Governments that had previously restricted broadcasting as the preserve of the state were gradually forced due to internal and external pressure. According to Throup and Hornsby (1998; 2), Moi faced internal pressure from radical Kenyan elites and political pressure for reforms. While, the external pressure originated from western donor nations that were keen to see the growth of democratic culture in the country.

Liberalisation of the Kenya's telecommunication sector was a key component of the emerging ICT industry. It led to proliferation of new technologies in Kenya, particularly computer and internet. The history and the development and spread of computers in Africa can be traced back to the 1960's when Ethiopia first introduced computer (Adam, 2004). In Kenya, the first mainframe computers were installed mainly in government agencies that began to computerise their records. Aduda and Ohaga (2004) affirm that internet first became available in Kenya in 1993 and full access was established in 1995. Equally, the African Regional computing Centre introduced the first full internet service in Kenya. This paved way for privately owned internet providers. Mobile phones were introduced in 1992 but only became widely available and affordable after establishment of the Communication Commission of Kenya (CCK) now Communication Authority of Kenya (Mwaniki, 2017, pg. 687)

Throughout out the 1990's, Moi government tended to view efforts to import computers, hardware and software into the country with extreme suspicion. Earlier on, in the 1970's the government imposed punitive fiscal measures on the importation of computers. This measure was influenced by the anxiety that computers might cause a loss of state secrets or a threat to national security (Bowman, 2010). Internally, however, Moi viewed computer technology as an alternative source for the powerful opposition to assert itself (Aduda and Ohaga, 2004). In addition, President Moi went on record stating that he believed computers would leave many Kenyans jobless. The head of public service commission in 1993 went so far to warn the government against the use of internet (Bowman, 2010). The role of communication under one party system and state control of various channels of communication interfered with the role of communication for development.

2.2.2 Use of Communication for Social Change

Communication played a critical role in the promotion of health messages. Mass media especially radio informed people on where and what health services are available. It also informed listeners about where free medical camps and immunisation campaigns were being carried out (Waema and Okinda, 2011). Advocacy for family planning also received substantial media coverage. Family planning education and motivation falls within the wider context of communication because family planning is usually a national goal. As such it is relevant to think in term of nationwide mass communication in addition to individual personal communication. The use of contraceptives is part of family planning project. It can only be successful if the population are made aware of the need for family planning and provided all the information about its principles and practices (UNESCO, 1969).

Family planning programs and contraceptive use are important to national development UNESCO (1973). World Health Organisation (2012) states that use of contraceptives slows

down a country's population rate. Hence, when population growth rate of a country is reduced the economic development is spurred and enabling the government to incest and grow the economy and subsequently reduce poverty, hunger and insecurity. Contraceptives also reduces infant mortality rate which is sometimes caused by closely spaced and ill-timed pregnancies among women due to improper family planning information.

In the early 1970's Kenya was among the first countries in sub-Saharan countries to adopt family planning with comprehensive communication program that reached all communities. The government adopted a population policy in 1967 and later launched national family planning program. The program emphasized on the reduction of family size and spaced children to lower the population growth rate (Republic of Kenya, 2012). Between 1960-1990's the average number of births per woman dropped from about 8 in the late 1970's to about 5 per woman in the mid 1990's. The use of radio and other mass media widely in increasing information about family planning is believed to have attributed to significant decrease in birth rate (Westoff et.al, 1995).

Westoff and Rodriquez (1995) acknowledge that the family programme in Kenya has for a long time used mass media to advocate for family planning practices. In their analysis of Kenya Demographic and Health of 1989, they discuss the contraceptives behaviour and reproductive preferences of mass media messages that try to inform and motivate people on methods and advantage of regulatory fertility. The study established that contraceptives prevalence rate was high among women who recalled or seeing family planning messages in three media (radio, television and print) compared to those who did not recall any family planning messages in the media (Jato et al., 1999). In the past according to Ryerson (2011), television and radio programmes on family planning in Kenya were very popular that they increased the use of contraceptives. In addition, the social norms also encouraged small families through the media (Crichton, 2008).

Women heard about the importance of family planning on the radio and went to health centres to consult about the best method for them (Waema and Okinda, 2011). Rosemary (O.I, June 12, 2015) mentioned that she visited a health centre right after listening to a radio program on the importance of using family planning methods. She is now on family programme and still listens to family planning programs for new developments. Another correspondent Mary Njeri (O.I, June 12, 2015) recalls a song that was frequently played on radio called Mumbi /family planning. The song told of a story of a family dispute between husband and wife in a traditional kikuyu setting. The argument in the marriage is that the wife has had enough with giving birth to more children. They already have eight children, but the husband still wants more children. The husband is arrogant and rude and does not accept the woman's argument.

Through radio and print media, others came to learn the importance of washing hands to prevent communicable diseases, good hygiene and nutritional practices. The division of Health education established in 1957, produced educational materials like booklets, folders, handouts, taped messages, films and mounted photographs for free distribution to targeted audiences. Most of these materials were in English and some translated into Kiswahili. However, due to low literacy rate of the population, radio campaigns were perceived as the most effective channel to convey health messages (Division of Health, 1987).

Public health campaign to promote good hygiene practices through mass media was backed up by demonstrations and group meetings to raise awareness and generate interest among stakeholders. For example, WASH (water, sanitation and hygiene) campaign prompted local radio stations to produce and broadcast programmes and advertisement which promotes the use of good sanitation and hygiene practices. The aim is to address local attitudes and cultural barriers to using latrines and use of soap for handwashing and increasing awareness of the negative impacts of open defecating (Jenkins, 1999). According to correspondents, from the

health programs, they learned about various diseases preventions especially the oral faecal route. Other respondents revealed that during the group meeting, health workers carried out defecation mapping exercise. One of the correspondents said;

> before learning the health risk linked to open defecation, I used to defecate in the nearby bushes or swamps (Ochidho, O.I, June 14, 2015).

Sanitation and hygiene programmes assume that when people are impacted with knowledge on how waterborne diseases are transmitted, they will change their unhygienic practices and adopt better practices. Wilberforce (O.I, June 15, 2015) revealed that they were taught how to make homemade handwashing soap but since he cannot afford soap, his family uses ash to wash after visiting latrine and tender leaves to wipe behind. Mukisa (O.I, June 15, 2015) also mentioned that she used to boil water for drinking and sleeping under treated mosquito net after attending teachings organised by the health workers. But, after a while she got tired because boiling water became expensive.

Communication was also significant tool in promotion of education. Emile and John (1980) observed that the education radio broadcast boosted education especially in Europe which had inadequate trained teachers and also had insufficient teaching and learning resources. Radio broadcast had potential of improving the quality of education by reaching many pupils using a single radio programme. Owing to its potentiality, attracted the attention of international agencies such as UNESCO who offered to fund it in Africa (Sidney, 1974).

The first radio broadcast to schools in Kenya began in the year 1960 through the Ministry of education. It a was strategy for improving the standard of education to increase access to education and extend educational opportunities beyond the school through distance learning. In 1966, the Kenyan government received experts from Canada to assist in preparing radio broadcasts over the Voice of Kenya (now KBC). According to Sydney (1974) the radio

lesson targeted primary and secondary students and teacher training colleges. Schools were provided by teachers guides and course pamphlets for lesson preparation.

According to Kenya Institute of Education (1999) research report series No. 65, in 1976 the educational broadcasting in kenya was upgraded into Education Media service (EMS). It was later absorbed into the Kenya Institute of Education which aired the programmes through KBC. This was a national strategy of improving the status of education and to wider access to education, improve teacher qualification and extend education opportunities beyond the school through distance learning and teaching so that large number of people both young and old in urban as well as rural and especially the nomadic and disadvantaged groups could take part in the program.

Some radio programmes impacted knowledge and skills for saving money (Obot et al. 2010). Baraza (O.I, June 16, 2015) narrated how after listening to a radio program that taught on money, he joined a mwalimu SACCO and started saving money. Similarly, there were radio programmes for school student taking business studies covering topics they study in school. However, according to Kenya Institute of Education (2011) research report no. 98, training of production and technical staff made the programme very expensive and the government could not manage to continue financing the programme. In 1995, the radio broadcast was discontinued due to the high costs of production and transmission faced by the government. Radio broadcast to school was restarted in 2003 following the introduction of free primary education.

International agencies such as world bank (1983) and governments have advocated strengthening of national agricultural support system as a strategy for increasing agricultural production (Bindish and Evenson, 1997). Approaches such as integrated Rural development

Program, Training and Visit (T and V) extension approach, and farmer filed schools (FFS) have been used to empower farmers and deliver extension services in Africa (Davis, 2008).

The Kenyan government adopted the training and (visit T and V) system of agricultural extension service management in 1982 with support from World bank as a supplement to the old system which had been implemented before independence. One notable success of this system was in the dissemination of hybrid maize technology in the late 1960's and early 1970's. The system spread rapidly by 1985 it covered some 30 districts despite having been started on a plot basis in only two districts (Banor et al. 1984).

An important and salient feature of T and V extension system is a regular of visits by frontline extension workers to contact farmers These are officers who carry out mandates on behalf of the department or agricultural institute and are in regular contact with the farming community. In addition, these officers are assigned to a specific area in order to take care of the needs of various group within the identified areas. The role of extension officers served as a link for the department of institution and enables service provider to evaluate its impact, refocus on its goals and aims in order to ensure full beneficial of the programmes (Banor et al. 1984).

Radio and several channels such as extension officers, newspaper, Television have been used to disseminate agricultural information. According to Nabubugu (2001), radio is the powerful and effective channel to project the information and knowledge related to agriculture. In some cases, radio has been used to advise populations and to encourage discussion and extension support for new measures (Hornick 1988; pg. 71). The effectiveness of radio can further be enhanced if radio stations are localised and geared to programming that meets the specific interest and needs of their special audiences (Gomez, 1970; pg.71).

Majority of farmer focused radio program aims to educate and inform farmers. For example, programmes such as *Makala ya Wimbi* and *Mali Shambani* produced at KBC studios focus on sharing information about new or modern technologies to assist farmers improve yield. Onditi (O.I, June 20, 2015) states that programmes are developed according to farmers calendar by production teams and the experts. For instance, at the beginning of the year, the team schedule topics that would be useful for farmers such as land preparation and farms input to prepare the farmers for the planting season. Farmers would be advised how to achieve higher yields, chose the appropriate fertilers and how to test for soil fertility.

Other programs such as *farmers voice* focus on giving voice to farmers by enabling them hold forums to raise and discuss their concerns. Farm forum idea involved organisational group of farmers who met in their homes to listen to radio broadcast discuss their challenges and take joint action to address them. Farmers are experts since they have been in the business for a long period. Hence, they cannot be ignored (Onyancha, O.I, June 20, 2015).

Kenya's approach to agricultural and rural development is enshrined in its modernisation of agriculture plan which calls for a shift from traditional agriculture to a technologically based to ensure food security (Nakabugu, 1999). In most cases, the radio farm programs focus is oriented towards promoting food security and inviting expert to advise and educate farmers on different subject matter.

Agricultural extension experts interviewed stated that agriculture programs provided relevant information to farmers especially when they were well researched and invited experts from agricultural sector. He said:

> Agriculture programs on radio are important because they help bridge the agriculture information gap which faces small scale farmers. The programmes enable us to reach many farmers in a very short time. The farmers are able to get

> teaching and guidance directly from agricultural experts at the comfort of their homes at no cost for extension services or consultancy Marvin Njeru (O.I, June 21, 2015)

Miriti (O.I, June 21, 2015) acknowledges that the experts invited as speakers in the programs are clear and knowledgeable about the subjects they discussed and as such the programme offered learning about new farming techniques. Information from the experts in the agriculture program has been useful to the implementation of learned knowledge by small scale farmers. As one of the farmers said:

> I have gained knowledge on poultry rearing, rabbit keeping and farming as an enterprise. The program gave me new ideas about bee keeping and that has motivated me not only to start farming but also start honey production (Mwangi, O.I, June 22, 2015)

Mzee Ngala (O.I, June, 22, 2015) state that the radio programs are useful in encouraging farmers to diversify their crops to avoid overreliance on one type of crop such as maize which often results to food shortage. But, more importantly the programmes have assisted him in improving his dairy feeds. His cows now produce more milk since he changed the quality of feeds. He also started horticulture farming after listening *ukulima biashara* (agricultural business) a farm programme on KBC.

Radio was a popular media used in the areas for communication for development. This is in the view of its accessibility, its low literacy level and does not face distribution challenged like newspapers. However, the emergence of ICT and its widespread application is believed to revolutionise communication in development. This raises question how relevant ICT in development is.

2.3 Relevance of ICT in Kenya

The digital revolution has led to the use of ICT's thus completely transforming its approach towards global development. Nicol (2003) observes that ICT is becoming an increasingly powerful tool for enhanced participation of its stakeholders in the global market, promoting governance, improving the delivery of basic services, enhancing local development initiatives and strengthening economic capacity. Based on this knowledge, the study sought to explore the relevance of ICT to Kenya's development. This is discussed in the sections below.

2.3.1 Electronic governance

One of the areas where the relevance of ICT is felt in Kenya is that of electronic governance. This is the application of ICT for delivering government services. According to Misuraca (2007), the use of ICT enhances government's ability to foster development by supporting broad public-sector reforms and good governance both within government administration as well as in their interaction with citizens and the private sector. Kitaw (2006, p.55) observed that governments in Africa must be willing and committed to induce transformational patterns towards being more citizen-centred.

The government of Kenya introduced the concept of huduma centre in 2013. Huduma Kenya is a programme initiated by the government of Kenya aimed at transforming public service delivery of public citizen access to various public services and information under one roof through integrated technology platform (Marwa, 2013). One advantage of huduma centre is that it provides efficient government services closer to the consumer. Thus, allowing citizens to participate in the evaluation and monitoring of government agencies given that all government agencies operate under performance contract. Further, these agencies have a service charter showing how long someone should wait for a particular service and the cost for such services. Additional, the programme provides platforms such as the call centres

where customers can give feedback concerning service delivery. However, the program is facing challenged in terms of infrastructure development in remote parts of the country, thus forcing citizens to travel over a long distance to seek services in available centres (Opiyo, 2015).

Online e-citizen was launched in 2014 by the information communication and technology authority of Kenya. It provides citizen centric information and assist citizens complete their transactions from government agency regardless of their geographical location. E-citizen offers similar services offered through the huduma programs. The portal has not only made it easier for Kenyans to access services but also for foreign nationals can apply for a Kenyan visa online. The portal works by allowing both internal and local persons create an online account that enables them to access various services from government agencies (Opiyo et al.,2015. pg.450).

In the same year (2014), the Kenyan government launched yet another online system which is part of Integrated Financial Management Systems (IFMS) under the national treasurer. The e-procurement system is an online system for submitting and evaluating government related procurement applications. It was established to reduce corruption in government tendering and hasten procurement process. The in- built price referencing for all tender ensures that bids above a certain amount cannot be submitted, hence reducing the risk of consultants over quoting and overcharging the government (matinde, 2014). According to Abdalla et al., 2015), although the system has been successful, it has faced challenges such as mismanagement of public fund, limiting its mandate to enhance transparency and governance.

Electronic tax filing was introduced in 2007, by Kenya Revue Authority through an online system called KRA online. Wasao (2014) describes electronic tax system as an online

platform whereby the taxpayer is able to access through internet all the services offered by KRA. In 2013, a new online system called itax which was implemented by India firm Tata. Through this system, a taxpayer is able to file tax returns, make payments and, apply for and receives tax refunds. According to Mandola (2013), taxpayers are promised of faster process, lower cost and increased efficiency. It is in this regard that several tax authorities have adopted an electronic approach.

The 2013 election saw the establishment of 'Uchaguzi' an online platform where citizens could report on items linked to the vote, including announcing of the results and issues encountered with staffing and polling stations. In 2007 elections reports were submitted through SMS, with uchaguzi platform reports is virtually transmitted through any electronic such as twitter and facebook. During the elections twitter hash tag showed how political empowerment can be galvanized by social media. These hash tags linked the media to audiences and played an essential role in linking news to the audience as well as political news making (Marchant, 2013)

2.3.2 Electronic health

A significant amount of GDP in African nations is spent on delivering health care through inefficient systems, costly and lacks transparency. World Health Organisation (WHO) report in 2010 revealed that 20 to 40 % of all health spending is wasted due to inefficiency. Since, the first World Telecommunication Development Conference (WTDC) in 1994, improving access to healthcare services in developing countries through ICT has received particular attention. According to World Bank (2004), ICT's has the potential to transform the delivery of health services across Africa in a manner that not only increases efficiency but also improves accountability.

Application of e-health serves as a vehicle for the transformation of health conditions in Africa. Eng (2004) defines e-health as the use of ICT tools such as computers, mobile phones, satellite and digital platform to enable, support and improve health care services to patients and the population at large. E-health supplements traditional delivery of services and channels of communications thus enabling healthcare organizations to meet the needs of its patients. Nazi Kim (2003) posited that investment in ICT has the potential to reform health system, extend services to rural areas and reduce waste and redundancy, empower patients to make informed decisions, streamline organizational processes and transactions, and improve quality, value and patient satisfaction.

2.3.3 M-Health

The term M- health was coined by Prof. Robert Isteparian who described it as the use of emerging mobile communication and network technology to provide healthcare (Folaranmi, 2013). Adoption of M health in Kenya aim at providing healthcare for all and affordable access to medical care givers.

Various M -health initiatives have been launched by the Kenyan government. One of these is Jamii Smart, initially known as Integrated Mobile Maternal, Newborn and Child health Information Platform (KimMNCHIp), launched in 2011, in kilifi and Busia (Mbembe, 2011). Jamii Smart was tailored for pregnant women in Kenya and offered medical care for them and their babies before, during and after their pregnancy (CHMI, 2014).

The project was implemented in two phrases, the first being a clinical phrase and the other was community level. The M health solution was to use information technology at the dispensary, clinic to relay automated hard copy of mother and child clinic card

into the system. In addition, it listed the services likely to be offered for the various challenges. Mobile health also assisted community health workers post data from the field and share information via messaging services to mothers. This application benefited 9,000 pregnant and lactating mothers in a test period of 3 years (Mbembe, 2011).

Afya Kenya is another initiative developed by Rosemary Mwitah, for nomadic communities in kenya such as the Turkana, Pokot, Samburu and Maasai. The program also targeted maternal, child and emergency healthcare to remote areas. The M-health solution consisted of telephone nursing whereby professional nurses trained community health workers and offered medical advice. They also gave reminders on prenatal and antenatal clinic visits, simple diagnosis and counselling. These services were relayed via SMS services or voice calls. This initiative benefited 2,500 mothers and more than 7,000 children under the age of 5 years (Mwitah, 2013). This initiative bridged the gap between medical care in rural and urban areas.

The M-health initiatives in Kenya, however face numerous challenges. First and foremost, lack of awareness about the initiative is a major challenge. The people are simply unaware of the available M-health services and how they can access them for their benefits. Secondly, lack of electricity or any form of power source to charge in remote areas poses a challenge and greatly affect their ability to adopt M-health services (Mbembe, 2011). Lastly, there are areas that experience poor or no network coverage which hinders the access or sending of data (Oteri, 2015).

2.3.3.1Telemedicine

Telemedicine is the provision of health care across a geographic separation by the use of telecommunication and computers (Goldberg, 1996). The types of telecommunication is divided into two namely; real-time or pre-recorded telemedicine. In the case of real-time the information is sent and received almost instantly by the recipient while in the case of pre-recorded telemedicine; information is captured and send later for subsequent reply (Antony et al., 2005). Examples of pre-recorded telemedicine includes; tele-electrography, tele-radiology and tele-obstetrics (Mea, 2006) while real time telemedicine includes; teleconsultation, teledermatology and telepathony (Wooton, Craig and Patteron, 2006).

In a study conducted by Qin et al. (2013) on the reliability of telemedicine system in rural Kenya revealed that, patients living in rural Kenya fail to receive medical services due to high transportation costs to where doctors are based. As such, African air rescue (AAR) and Safaricom collaborated in 2012 to launch telemedicine services in Kenya (www.telecompaper.com).Telemedicine in the radiotherapy department has also been implemented at the Agah Khan University Hospital. The specialist situated at the main hospital in parklands provides second opinion on radiology images done in outreach branches. In addition, telesurgery has also been successfully performed at the same institution (www.eastafricaaidproject.org). Although telemedicine projects have been tested in Kenya, still clinical telemedicine aimed at profiting the rural people had not been sustainable (Wootton, 2001).

2.3.3.2 Electronic Medical Record (EMR)

The need for EMR in Kenya has been necessitated by data complexity, increase in patients served and the desire to have efficient health information systems (Ministry of health, 2010). EMR is a computerised system where physicians record essential

information such as patient's medical history, demographics, and consultation notes, lists of problems, allergies and vaccines (Luwick DA et al. 2009).

Application of the EMR system is increasingly being adopted in Kenya to improve medical record management and the quality of patient care. In 2001, the Mosoriot medical Record system (MMRS) was developed by Moi University of medicine (Eldoret) in collaboration with Indiana University of medicine. It was installed in primary health care centre, serving 60, 000 patients and runs Microsoft access on two networked computers. However, the development and implementation of these systems had not been properly conducted. Consequently, creating multiple EMR system with varying objectives and functioning without the ability to share patient's information with other systems and the government. Following this realisation of challenges, *Standard and Guideline for EMR systems* in Kenya was developed to guide the development of EMR systems, for successful use and implementation of the system (Ministry of Health, 2010).

2.3.4 Mobile Banking

Mobile banking and other electronic banking methods is provision of affordable financial services to unbanked people through mobile phones (Must &Ludewig, 2010).The m- banking provide financial services such as person to person money transfer, micro payments, loans and savings using mobile phones and long distance remittance (Donne &Tellez, 2008).Although, the traditional banks have been offering those services, their services have been inaccessible for the poor people in urban and rural setting. In addition, transactional costs and minimum balance required by the traditional bank is high compared to their income level (Maurer, 2008).This has excluded many people from the formal financial sector.

One popular mobile money transfer application in Kenya is m-pesa. It was launched in March 2007 by Safaricom, one of the largest Kenyan's mobile telephone network (Vaughan, 2007). Its main objective as a money transfer method was to provide affordable banking services for the unbanked (Hughes & Lonie,2003). Its use was limited to depositing and withdrawing money as well as transferring money and purchasing airtime (Safaricom, 2009).

Although, m-pesa has provided accessibility and safety of money transfers, some users were discouraged from storing large amount of money in m-pesa. This is because, it was not designed as a savings mechanisms and money stored accumulated no interest(Jack and Suri, 2011).Further, recurring cash floats shortages raised concern among the users making it difficult to access money. The authors observed that m-pesa influenced saving behaviour amongst its users and as such, mobile operators can partner with financial service providers to mobilise appropriate savings products. (Morawczynski and Pickens, 2009).

Based on the above findings, two more services were launched by m-pesa in 2010 to provide banking products. The first one is m-kesho, launched by Safaricom in partnership with Equity bank. M-kesho extends the services of m-pesa by linking it to a dual bank account in equity bank (Mas, 2010). It also allows Equity account holder to transfer money, deposit and withdraw from mpesa agents and ATMs. Further, customers are able to save, obtain loans and assurance from bank using their mobile phone (Safaricom, 2010). The second service introduced is the m-shwari, a paper banking service offered through m-pesa in partnership with the Commercial Bank of Africa. Just like, m-kesho, m-shwari also offers m-pesa subscribers opportunity to save, earn interest on savings and borrow money through their mobile phones (Safaricom, 2010).

Electronic mobile banking offers convenience through easy home access, 24-hour service, worldwide access, time savings and wide variety of services available (Gerrard and Cunningham, 2003). Despite being convenient, mobile money comes with various challenges safety being one of them. Security and safety of mobile payment transaction is one of the primary concerns for users. The use of the pin and secret code for m-pesa transaction enhances the security and privacy issues (Aker and Mbiti, 2010)

2.3.5 Electronic Education

Education in most societies is fundamental in the process of achieving sustainable development (UNESCO, 2003). The African Union specifically recognizes, in its second Decade of Education for Africa (2006-2015) plan of action that the future development of Africa will be greatly influenced by the quality of education to its citizens. According to the UNESCO Institute of Statistics (2006), Africa needs a 68 % teacher increase to meet the sustainable goals enshrined in the provision of universal primary education and also to cater for the increasing growth of school-age population.

This problem is aggravated by inadequate qualification of the teaching force. According to UNESCO (2003) -EFA report 2006, one of the alternatives of increasing the number of teachers is to reform teacher training by shortening the length of time spent on pre-service training. This raises the following question: Is it possible for ICT to improve the quality of education in Africa? If so, how? Haddad (2002); Carlos and Gadio, (2007) state that ICT has potential to improve the pre-service teacher training by providing access to more and better educational resources, offering multimedia and stimulation of good teaching practice, and catalysis. The new technologies can also enable distance learning and individual training opportunities. It also overcomes teacher

isolation, breaking down the classroom walls and connecting them to colleagues, mentors, curriculum experts and the global teacher community.

Apart from providing training opportunities, the use of internet as a training media exposes teachers to pedagogical practices equivalent to what they may do with their student using technology. Teachers begin to learn skills and develop new knowledge on- line through interaction with instructors, mentors, experts moulding the possible learning experience of their students after training (Styler 2000 in Carlson & Gachio 2002, p.122).

In addition, UNESCO (2002), points out that ICT poses challenges to traditional method of learning and teaching. Using ICT in teaching and learning creates change in the education and training for both educator and learner. This is because, traditional forms of education and learning have changed to incorporate new approaches to teaching such as from teacher centred to student centred interactive knowledge environments. Moreover, World Bank (2003) underscored that ICT has the potential to increase the availability of quality educational materials through interactivity and global reach by sharing knowledge, materials, and database quickly and cheaply regardless of geographic distance.

There has been a significant growth in the application of e-learning in Kenyan Universities. As stipulated in Kenyan vision 2030 (2007), Kenyan universities are compelled by the government to implement e-learning and blended learning as an alternative delivery system. For, instance, at the University of Nairobi, introduction of e-learning began in 2004 with a well-tested e-learning platform called Wedusoft. Kenyatta University launched e-learning to students in June 2005 by adopting the blackboards software (Mutabari, 2009). Given that little was known about the e-

learning software, in 2009, the management consulted experts from United Kingdom to install Moodle platform. The experts also trained a number IT personnel on how to operate ODel-KU and 250 lecturers on how to upload their course unit material on the platform (Daily Newspaper, 2011). As at 2012 about of the trained lecturers were using the Moodle platform to deliver on-line teaching. However, the application of e-learning in Kenya universities is still as the infant stage. Most universities are using e-learning blended mode and have lagged behind in full use of e-learning (Tarus, 2011).

Implementation of e-learning has however, undergone a number of challenges. One of the challenges hindering the implementation id inadequate infrastructure facilities such as computers, network and internet connectivity, and computer labs to support the high numbers of students. financing is also another major challenge. According to Kashorda and Waema (2014) ICT and e learning related projects rely on donor funding. Lastly, lack of motivation among teaching staff hinders implementation of e-learning. This is because most of them view conversion of their course to e-content as extra work with no additional pay.

There has been initiative by the government to provide computers to school to promote digital literacy. During president Uhuru Kenyatta's campaign on 2nd March, 2013, he promised that if he wins election, he would provide every child with a personal laptop (The star, 2013).the project would help Kenya leapfrog traditional industrial revolution and be a catalyst for growth and prosperity (Ministry of ICT, 2013).In Jan 2014, the laptop tender was won by Indian Olive technology. However, issues of corruption in acquisition of the tender arose hence slowing down implementation of the laptop project (The star, January 27, 2013).

2.3.6 Electronic Commerce

ICT has the potential of revolutionising how global economics and business are conducted. UNCTAD Report (2005) defines e-commerce as the use of electronic means and technologies specifically designed for the purpose of receiving or placing orders to conduct commerce. Deliveries of products or service may occur outside of the internet.

One of the advantages of e-commerce according to a report by Humphrey et al, (2003) is the ability to assist developing economies profit more from trade. Unlike the requirement necessary to run a business from a physical building, - commerce does not require storage, space or insurance, the only requirement is a well-designed web to reach customers. Additionally, e-commerce allows for higher profit margins as the cost of running a business is less.

Another advantage, according to Maumbe and Okello (2013), is that e-commerce allows the diversification of existing products and the possibility to develop new ones. Lawrence (2002) states that the internet provides open global networks and access to it is relatively cheap. Internet commerce offers products in developing countries obtain better information on global markets and provide direct access to new customers. It opens up a new range of possibilities for enriching interactions with customers.

2.3.7 Electronic Agriculture

Agriculture is an important sector in Africa and the majority of the rural population depend on it (Stiener, Bruinsma &Neuman, 2007). According to Maumbe (2010), the need to effectively deploy ICT in the agricultural sector in order to reduce poverty, increase food security and improve people's livelihood and attain agricultural development cannot be under estimated. However, Tripps, (2001) argues that the

contribution of agriculture to rural development depend on the generation and delivery of new agricultural technologies.

ICT is also a powerful tool for economic and agricultural development aimed at eradication of poverty (World Bank, 2003).Kipanje (2006) states that ICT play crucial role in facilitating communication and access to information for agriculture. Its application in agriculture lies in meeting the farmer's needs for market information (Meeira, Rao &Jhamtai, 2004). However, according to Maumbe (2010), if modern ICT are not adequately build into the agricultural supply chains, there is a probability of stagnation in dissemination, utilization and application of new scientific agricultural information for development processes. The same author also states that ICT can be used to monitor and evaluate farm production inventories and support the production, processing, distribution, and marketing services for agricultural good until they reach final consumer.

Agriculture plays an important role in Kenya economic growth and development. According to Muriithi, Bett and Ogaleh (2007), small holder agriculture forms the bulk of agriculture producers in Kenya. As such, providing information and knowledge to these small holder farmers is crucial to poverty alleviation. Several platforms such as m-farm, icow have impacted Kenya agriculture.

Mobile farm (M-farm) is a mobile application, launched in October 2010 by a small Kenyan start-up company as an m-service targeted at small holder farmers in Kenya. The platform provides wholesale market in Kenya and farmers can also access information by sending a SMS to a short code to access a searchable data base. Further, m- farm helps small holders farmers in collectively selling their produce to large buyers

through contacts and connect buyers and sellers through an internet and mobile phone enable platform (Eggleston et al, 2002).

Like m-farm, icow was developed in 2010 by green dreams tech limited to fill the information gap faced by small scale dairy farmers in Kenya, especially in the rural areas (Mfonobong, 2011). Most farmers in Kenya rely on a limited number of middle men or traders to receive price information due to high cost of searching for information elsewhere (Eggleston et al, 2002). This application keeps farmers informed of important animal breeding and feeding method through technology. The farmers register his cows free of charge and receive regular text message on their mobile phones about the breeding, feeding schedule and, updated market rates on cattle price (Baldauf, 2010).

The government has also initiated programs to provide information to farmers across the country. One of these initiatives is the Kenya agriculture Information Network (KAINET) initiated in April 2006 in response to pressure from national and international community to promote exchange of information and access among stakeholders in the agriculture sector. Kilimo Salama is another agriculture initiative set up in 2008 to assist small scale farmers deal with weather risks such as floods and drought that threatens their livelihood. Kilimo Salama is one of the largest insurance program in Africa and the first to reach small-scale farmers using mobile phone technology (UAP, 2012). The initiative also assists farmers to insure their total anticipated harvest value by paying the full premium amount (Macharia, 2013).

2.3.1 Policy Dimensions

In 1970's and 1980's the concept of communication policy was introduced to promote the development of communication in Africa. Governments and institutions were to formulate

policies to guarantee consistency and avoid conflicts in the actions of numerous public and private individuals. African countries were already familiar with policy making. Most countries already had policies in various sectors such as economic policy, education policy, health policy, environmental policy among others (UNESCO, 1996). Communication policy was to be perceived as a further contribution to national development through combining activities around issues that cut across a number of sectors. According to Peter (1980) communication policies set of rules and principles emanating from political and social ideologies that guide the behaviour of communication systems.

National information and communication policy therefore enunciates principles, values and norms that are relevant to communication at government level, to civil society and private sector, within the context of the development goals of a nation. An approach that considers information and communication as a tool for development, planning would provide a basis for integrating information and communication interventions within national development strategies (Hancock, 1981).

The Yaoundé declaration in July 1980 demonstrated Africa's commitment towards adopting communication policies in achieving development goals in Africa. In this declaration, each leader was required to formulate and implement a national communication policy. As African leaders made attempts to formulate national policy they anticipated change such as; better and high quality agricultural production, growth in industrial yield, increased literacy levels, improved health care services and facilities, political stability and integrity in leadership (UNESCO, 1981).

Advent of the new technologies called for major reforms in the telecommunication sector to guide the role of ICT in development. The government of Kenya established the Kenya posts and Telecommunications Corporation (KP&TC) in 1977. Before, telecommunication (ICT) services in Kenya were managed as part of a regional network under the collapse of the East

African Community. The enactment of Kenya Communication Act (1998) split KP & TC into three legal entities, namely Telkom Kenya Limited (TELKOM), postal Corporation of Kenya (POSTA) and the Communications Commission of Kenya (CCK). The national Communication secretariat was also formed under the Act to serve as the policy advisory arm of the government and matters pertaining to the info-communication sector (Bowman, 2010, pg.95).

2.4 Conclusion

The chapter set out to lay background for the need of ICT donation in development. The study established that aid was a strategy for development at independence. During colonial period, media was a major instrument of political and social change, but no distinct relevant to the local people. After independence, print media played a critical in promotion of democracy and providing forum for collective discussion. Radio was popularly used to disseminate messages of hygiene and sanitation, campaigns of family planning, disease prevention and agricultural development projects. For instance, UNICEF continue to use media to promote immunization compaigns and among children, nutrition and hygiene in Kenya.

The overarching conclusion in this chapter is that communication would be a significant resource for state building and that ICT would be important especially in digital era. It emerged that there has been attempts to draft a national communication policy tracing back to 1980.It was until, 2006 that the government of Kenya finally adopted a national ICT policy. The government of Kenya continue to develop ICT programs for development, however these efforts seems to be threatened by the digital divide. The next chapter looks at how digital divide is manifested and possible way to bridge the gap.

CHAPTER THREE

3.0 MANIFESTATION OF DIGITAL DIVIDE IN KENYA

3.1 Introduction

In the previous chapter, we examined the nexus between communication and development. The study established that communication and especially ICT is considered a significant resource in nation building in this digital era. Communication and technology has created the digital super highway of global network of computers that would provide a very high-speed access to information in all forms through telephone or wireless connection. Superhighway offers a new way of improving the delivery of public services and permits citizens to have easy access to government information. To this effect, National ICT Policy and Poverty Reduction Strategy Paper (2001-2003) are some of the policy dimensions articulated by the State to guide the role of ICT in development. Although, the relevance of ICT in Kenya has been felt in development sectors, it is inadequately accessible across borders thus failing to make meaningful impact. Kenya strives to overcome the digital divide as part of its strategic goal of vision 2030. However, efforts to bridge the gap raises questions on environmental stability.

3.2 Manifestation of digital divide

There are different interpretations of the concept digital because of the multi-dimensional phenomenon encompassing the gap. According to Ngathie (2003, p.1) digital divide is manifested in the limited access to ICT facilities and resources. Only those who can afford the new technologies can benefit from these resources. Castels (2002, p.28) defines digital divide as inequality of access to the internet. Jan Van Dijik (2006, p.178) defines it as the gap between those who do not have access to computers and the internet. Wilson (2006, p.300) perceives digital divide as an equality in access, distribution and use of information and

communication technologies between two or more populations. Haround Ba (2001) observes that:

> Access is providing to those who have no computers or telephone and lack of access to networked technology will result in a substantial segment of society having neither the skills nor the means to participate in the progressively more knowledge-based U.S economy. (Haround Ba, 2001)

The above quotation implies that addressing the digital divide is merely narrowing the digital gaps by making these new technologies accessible to the people within and between countries. According to Warschauer (2002), defining digital divide in terms of access is problematic because lack of access causes social exclusion and those excluded have fewer opportunities to access and use computer and internet.

The digital divide represents geographic, demographic and socio-economic dimensions. White et al. (2011, p. 2008) defines it as unequal access to new technologies and the inequality in the ability to benefit from ICT both between and within countries. Wijewardera (2002, p. 2) view digital divide as the disparities across different socio-economic and geographic strata in obtaining access to new technologies. It also refers to abilities of certain communities to take advantage of new opportunities presented by new technologies which many others are benefiting from (Disraeli, 2001, p.1). OECD (2001) summarises the situation as:

> The gap between individuals, households, business and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technology (ICT's) and their use of internet for a wide variety of activities, the digital divide reflects various differences among and within countries. (OECD, 2001, p.5)

More broadly, digital divide is used to describe communication gap between those who already have access to ICT and skills to process information digitally and those who do not

have access or skills to use the same technologies within a geographic setting, society or community (Massimo et al., 2013).To this end, digital divide refers to a dimension of social economic inequality between groups of persons, according to categories of persons, in a given population in their access to use or knowledge of ICT (Chinn & Fairlie, 2004).Digital divide reflects a dimension of social inequality that is measured by relative level of access to ICT products and services and the benefits they bring between different segments of the population.

Norris (2001, p.131) has categorised the digital divide into three constituent elements; the global divide between advanced countries, the social divide between information rich and information poor within advanced industrial countries and the democratic divide between those within the online community who do and do not use resources to engage, mobilize and participate in public life. According to Keniston (2004, pp. 13-19) the first one is the divide existing between nations, individuals who are rich, educated and powerful and those who are not. The second category of divide is the linguistic and cultural, which separates those who speak English or another West European language from those who do not. The third category is the growing digital gap between the rich and the nations and lastly the emergence of a new elite group who are benefiting from the information and technology industry.

This section has highlighted digital divide as a crucial global issue. Although, access and usage of ICT is increasing in developing countries, the information haves are increasing their accessibility and usage at such an exponential rate. This raises question on how digital divide is manifested.

3.2.1 Affordability and Access to Digital Infrastructure

One way that digital divide manifest itself is through availability, accessibility and affordability of digital infrastructure. Access to physical infrastructure in telecommunications

is critical to ICT development. Infrastructure consist of the availability of good communication systems, road, water, hospitals and learning institutions. Development of digital infrastructure is corelated to the economic capability of a country. Thus, countries that are economically powerful have better investment in infrastructure. In an analysis of the global divide, countries with efficient infrastructure have the capability to invest in the ICT development (Pardesi, 2007). Kenya has limited access to digital technologies due to lack of infrastructure ranging from irregular supply of electricity to limited availability of ICT facilities. The electricity supply is characterised by frequent outages that hamper the use of the digital technology (Mutula, 2008).

The various forms of telephone access include public phones, mobile phones, fixed lines phones and internet protocol telephony using the internet (Stork, 2011). Telecommunication network in Kenya is being extended and modernised but still experience low supply of telephone lines per 100 people compared to the average global penetration of 13 lines per 100 inhabitants. (Ganitsky, 2003). Demand for telephone service is high and the waiting time for services averages 4.5 years and the period to attain high level of teledensity is still relatively low. Until a country has passed the threshold of 1 telephone line per 100 people, it is difficult to estimate how long it takes to reach higher levels (CCK, 2011).

Communication infrastructure is made of complex mesh of interconnected networks designed to carry different types of communication traffic. In Kenya, integration of networks is less developed and are divided into fixed and mobile networks. The fixed line copper-based connections were means of connecting customers to telephone network and have always had low penetration levels. The rapid growth in mobile network infrastructure has greatly expanded access to telecommunication. Networks that were initially concentrated in urban areas and cities increasingly began pushing into rural areas. By 2009, ninety percent of Africa's urban population and forty eight percent of the rural population live within reach of

mobile network. Coverage numbers continue to increase although sign the rate of increase is slowing down as networks expand into remote rural areas (Williams et al. 2011)

Dial up connection was the dominant way used for internet access. However, dial up connection was slow in connection, high effects of noise and congestion in the telephone line making internet access unreliable. As such Kenya strived to look for alternative ways of internet access. One such access technology is the use of broadband technology (Kenya Data Network, 2009). To promote broadband connectivity and stimulate demand for it, the government has adopted national ICT policy as well as universal access policy (G.O.K, 2004). The Kenya government has so far licensed three broadband backbone providers with at least seventy-eight internet service providers (ISP's) providing connectivity to end users (CCK, 2004). The world bank (2011) reports highlight most prominent ISP such as Access Kenya, Wananchi online, UUNET, Jamii Telcom (JTL), Kenya Data Networks (KDN). They provide a host of services over fiber optic cables, satellite technology including internet protocol services, infrastructure services as well as collaborated services.

There has been mass adoption of broadband in many developing countries including Kenya while the uptake of broadband has been low and below expectations causing the broadband access to widen considerably (Firth and Kelly, 2001). The low uptake can be attributed to lack of suitable copper wireless infrastructure that has not only limited access to broadband internet but increased the role of wireless network infrastructure in providing such access. Broadband generates higher volume traffic than voice services do. As the number of subscribers, particularly broadband internet users increase traffic levels on the networks grow. Furthermore, a greater proportion of this traffic is international because much of the content that is accessed over the internet is stored other than the one in which the user is located. This is particularly true for Africa which currently hosts very little internet content.

The capacity of international networks has therefore been a key constrain on the development of affordable broadband services in Kenya.

Kenya rely on satellite communication for regional and international connectivity which is a more expensive mode of communication as compared to underground fibre optics cables. The voice networks have relied on satellites because of the inadequacy of submarine fiber optic network information and the relatively low bandwidth requirements of international voice traffic. On fibre optic network, electrical impulses from data communication is transmitted as light pulses from one point to another through an optical fibre. The data transmited is through digital information generated by telephone systems, cable television and computer systems. Unlike copper cabling, optical transmission has a very low signal loss, thus transmitting data over much greater distances. Another advantage is that, it is not subjected to electromagnetic and radio interference frequency because it uses light not electricity. Moreover, optical cable can transmit a much lighter amount of data that copper wire thus proving more bandwidth per connection (Sharma et al. 2013).

There has been development of submarine fiber optic cable to ensure that all coastal countries have access to the intercontinental network. As of 2010, twelve undersea cables were operational and five more were being deployed. In 2009, Seacom and the East African marine systems (TEAM) landed at the Kenyan coast (William et al. 2011). Landlocked countries have no submarine fiber optic cable in place, giving them opportunity to choose the submarine cable they want to connect to at high cost of international bandwidth. Submarine cables was expected to boost internet connections and largely reduce the cost of telecommunication data transmission in the region. However, practical obstacles such as unreliable domestic networks and mobile network still operating on 3G which operate on low bandwidth restrain demand for high bandwidth internet services (World bank, 2010).

Despite, the fact that Kenya was among the first countries to get internet connection in East Africa, the mass use of technology remained limited due to underinvestment in the telecommunication sector (Musakali & Mutula, 2007). Investment in ICT including telecommunication infrastructure and their derived services provide a significant benefit to the economy (Sridhar, 2009). According to James (2007) information, technology and communication has the potential to improve a country's productivity and co efficiency, and more importantly improve the lives of its citizen. It has been noted that since 2000, Kenyan economy grew at an average of 3.7 percent. The use of different ICT had led to an increase in people's income due to efficiency and cost savings in commercial transaction(Heeks, 2011). Falch and Anyimadu (2003) believe that countries without an adequate telecommunication infrastructure and without local expertise in ICT will find it difficult to remain competitive in the world economy. On an extensive level, the existence of any kind of infrastructure in a society determines the availability of crucial products that are needed to enhance growth and development of any society (Pardesi, 2007).

The other issue associated with access to digital infrastructure is its availability at affordable price. Most people have limited access to digital technologies due to high costs of ICT facilities. Countries that have high internet penetration also have low access charges for using service. Given that African countries have lower incomes, internet charges are high. Internet access charge is composed of two elements namely; usage charges for the telephone network and the internet service providers access charge. In the case of Africa, local usage tariffs are sometimes high and no service available is experienced nationally in several countries. Users are required to call abroad to be connected, pay high international tariffs. As such majority of rural dwellers are cut off communication (William et al. 2011).

The growth and broadband services in Africa is limited by the high price of band width. For instance, the monthly cost of dial up internet access in SSA is approximately US$50 per

month compared with US$12 per month in South Asia (World bank, 2007). The average cost of a low volume internet account in Africa is about US$65 per month for the lowest priced services. Dymond et al. (2002) posit the proportion of income that the poor can afford to allocate to telecommunication service vary between 0.5 % and 20%of their income. Hence, the poor households are incapable of fully paying for ICT services.

This subsection looked at the affordability, availability and access to digital infrastructure. Information, technology and communication that effectively support digital technology are lacking. If available, they are not accessible because they are not affordable.

3.2.2 Accessibility and Usage of ICT technology and Internet

Access and usage of computer is another way of how digital divide manifest itself. Access to ICT technology can be viewed as availability, affordability to ICT products and services and the skills to use ICT effectively. Despite the removal of taxes levies on computers, promotion of e-learning in institutions of higher learning, and the launch of e-government strategy in 2004, personal computer (PC)ownership in Kenya is still low. Although the estimate number of computer ownership rose from 0.03 PC per 100 people in 1990 to 1.37 PC per 100 people in 2005 (ITU, 2015). Considering that lower incomes of most Kenya population, it is unrealistic to expect widespread ownership of personal computers. Accordingly, a large number of potential users are unable to afford a PC and internet services providers (ISP) access charges (ITU,2001).

Although Kenya is ranked highly in Africa in term of absolute number of internet users, its internet penetration is still low compared to other African countries. According to the International Telecommunication (2012), Kenya accounts for 3.2% of internet users in Africa. According to Communication Authority of Kenya, the number of internet users stood at 22 million in 2014 which is still low (CAK, 2014).

According to Mutula (2002), digital gap is experienced more in rural developed areas compared to urban dwellers who have access to internet services. For instance, in Kenya, though internet facilities are fairly distributed in the country, there is remarkable concentration in urban centres with institutions far remote from cities experiencing difficulties in internet connectivity. A study conducted in Kenya to find out the household's perspective on the development outcomes of internet usage and mobile penetration showed that internet access and usage was limited and restricted to urban areas while mobile phones are distributed across the country (Ndungu & Waema, 2011). These authors further state that rural internet access and usage is more driven by mobile phones compared to urban areas. An estimated 47 percent of rural internet access is through mobile phone compared to 39 percent of urban internet.

Although internet penetration has slightly increased, there are still some constrains that limits its accessibility. Poverty is one of the crucial factors that affect the digital divide of countries. According to Okwemba (www.ipsnews.net) and Buruchara (www.tespok.co.ke), 50% of Kenya's population live below the poverty line, the cost of internet access is relatively high due to the cost of telephone call rates. This problem is compounded by lack of electricity and low literacy level. As noted by Mutula (2002), the poor power supply on which internet services are predicated in the rural areas of Kenya, makes the use of internet less cost effective. According to Levy (2010) digitisation is not important the poor when compared to the basic needs of food, shelter and clothing. It is therefore logical that a large a population is not able to access the internet services due to increasing level of poverty.

Unavailability of computers with their high cost as well as the cost of internet are the main barriers ICT usage. There are other key demographic attributes such as gender, literacy level, disabilities, language discussed below that contribute to digital divide.

3.2.2.1 Gender

There is a significant gap between genders in terms of accessing and using internet. The gender divide may exist because of differences between men and women in socio-economic status excluding people from using technology (Bimber, 2000). Men are more likely to access and use the internet than women. Studies that have purposed to address internet usage specifically, have showed that the percentage of women using the internet lags the percentage of men using the internet in developing countries. Globally, the percentage of women using the internet is 12% lower than the proportion of men. While the gender gap in internet has narrowed in most part of the world since 2013, Africa had widened. The percentage of women using internet in Africa is 25% lower than that of men (ITU, 2017, pg.3).

In Kenya, 21 percent of men and 11 percent of women had used the internet in August 2008 and in 2001, estimates stood at 70 percent and 30 percent respectively. The difference was attributed to the opinion that information technology (IT) was a technical subject suitable for men (Kariuki and Sininji, 2001). Similarly, Cooper and Weaver (2003) states that women have been concerned about the societal stereotyping that encourages usage of the internet by men and equally discouraging it's use by women. This has resulted into fewer women web developers and programmers leading to lack of content relevant to women in terms of needs and interests. According to United Nations (2012) survey, content linked to new technologies are largely male centric. In Global Media Monitoring Report (2010), only 12 % of global media focus specifically on women and that 46% of these news stories supports gender stereotypes while 6% challenge them. It is therefore questionable whether women in developing countries will be interested to search for information online if the content is inaccessible and irrelevant for their needs.

While internet connection is a barrier for both genders, women are more affected than men because of cultural obstacles. Public internet access facilities such as cyber café is easy way to access information but they seem impractical for women who cannot leave home for religious and cultural reasons. Others simply feel intimidated due to low technological skills and the belief that they are socially unwelcome. Furthermore, these access points are often not open for women and the use of such facilities by women and their interaction with men in some cultures is unacceptable (Melhelm et al., 2009, pg. 22).

In addition, women living in rural areas do not have access to digital information and skills needed to utilize ICT efficiently. This could be because of language barriers due to lower literacy level which impede them to learn english that is used by the internet (Cooper and Weaver, 2003). According to Melhelm et al. (2009), only a third of internet users globally speak english meaning the rest whom are non-english are excluded from accessing information online.

Gender income gap also significantly impact the affordability of ICTs for women because they cannot afford charges of internet services (Cooper and Weaver, 2003). In Kenya 81.4% of men compared to 49.9% of women are actively working or studying. While 29.9% of the Kenyan men belong to the top 25% income group of the country, women represent only 6% (Hilbert, 2011). This clearly demonstrate that women have less income level which influence availability and affordability of internet and ICT access.

3.2.2.2 Literacy Gap, Content and disability Related Skills

Digital revolution raises question on the relationship between digital divide and literacy. A survey done by Kenya National Bureau of Statistics (KNBS) on adult literacy in Kenya (2006) shows that national literacy rates 61.5% and numeracy rate is 64.5% with male literacy rate at 64.2% and females 58.9%. Nairobi had the highest literacy at 81.1% while

North Eastern had 8.1% (KNBS, 2006). This can be attributed to dependency on technology by urban dwellers, availability and access to ICT facilities compared to rural folk (Allen, 2003)

As governments and institutions continues to convert contents of information resource into electronic databases, digital literacy skills become essential for people to be able to access and use information (Bruce, 2002). Ojedokun (2001; 26) observe that information literacy as a critical component of higher education and should be integrated into the academic programme. Information literacy in institution of higher learning is so important due to the need to satisfy a great demand for professionals equipped with its skills, competencies and comprehensive coverage (Dangani and Mohammed, 2009; 15).

Digital skills show significant differences in performance between different ages and education (Hargittai, 2002). The quality of education a person has or acquire or aspire greatly influence the gap in utilization of internet and other electronic resources. According to synovate (2009) the level of education and internet usage are directly co related. The study concludes that at least three in every ten Kenyans may never use the internet given their literacy level and attitude. Foulger (2002) state that the internet is the domain of the literate. A person who is not able to read nor write cannot have a reason to use computer or internet. The better educated are statistically more likely to have and connected to internet. Only 6.6% of people with elementary school education or less use internet. This is in line with the claim that most Africans access the internet through work or public and less through private household level because of income constraints and cost of access (Fleetwood, 2001).

There is a link between digital skills, accessibility and age (Jung, 2005). Friedman (2001) found that internet connection among younger demographic is substantially higher than that of elderly population in both developed and developing countries. Similarly, Enock and

Solker (2006) found that there is still a significant gap between the youngest and the oldest university students. Borus and Rue (2000) state that digital gap is a generational phenomenon and it will diminish in time as younger computer literate replace older non-users. However, ICT is constantly evolving, and advanced ICT's may cause new digital divide between young and older generation.

The language of internet content can become a principal obstacle to the use of information. For instance, English language and computer skills are some of the factors limiting effective use of internet. In 1998 about 85% of the text on the internet was in English language (Nunberg, 2000) and in another estimate in 2003, 70% of the world's web were in English (UN Chronicle, 2003). Since many people in SSA do not speak or understand English, they are excluded from the use of the internet. This makes it difficult for them to exploit content in the internet or access and share information. In Kenya, rural dwellers are continuously prevented from benefiting from ICT due to the mentioned factors and low provision of appropriate content both in terms of subject matter and language (Kinuthia, 2009). Although, internet content has been translated into some African language such as Kiswahili, there is still no content development in respect of the majority of the more than 800 languages spoken in Africa.

The use of ICT may be seen as source of potential barriers for people with disability due to insufficient skills and financial resources. Although computer technology has allowed them to function independently, they continue to experience a variety of barriers to computer use (Burgstahler, 2003). Waddell and Urban (2011) highlighted inaccessible websites and software compatibility with adaptive devices and voice automated systems inaccessible to telephone. Persons with mobility impairment may have difficulties typing using a standard keyboard and surfing through the electronic media. Due to lack of fine motor skills, they may

find it, difficult for them to press multiple keys simultaneously. Consequently, they are not able to access web content that requires mouse movement (Deng, 2005).

Although internet access does not require hearing ability, people who are deaf still face internet usage difficulties. Some internet sites require them to use audio output that does not provide text captioning. With the growing number of online distance education, online learners with hearing impairment may not able participate in audio or video conferencing sessions without aid from sign language interpreters (Burgstahler, 2002). Visually impaired students rely on screen readers and braille software to access information which are only accessible through electronic text. A such they cannot access the images showed within contents (Foly and Reagan, 2005). Partially impaired learners find it difficult to navigate and comprehend websites that have inconsistent pages because they can only see the computer screen to certain extent at a time (Burgstahler, 2002). Equally, students with learning disabilities find it difficult to navigate through clustered websites. Hence, finding crucial information is often not easy for them since they cannot just look over information (Bush, 2005).

3.3 Bridging the digital divide and the question of Environmental sustainability

Given that digital divide has been highlighted as a significant global issue, there have been strategies and initiatives to bridge the digital gap. One of the ways is through donations of ICT technology. Information, communication and technology falls within the broader context of foreign aid as a strategy for development.

3.3.1 Computer Aid

Donation of computers is one of the ways of bridging the digital divide as understood within the framework of technology transfer for development. During the first decade of development UN emphasised on technology transfer from the North to South (Roger, 1968). Technology transfer has been defined as the process whereby technology is moved from one geographical location to another with an aim of application towards development (Barquin (1981). This transfer can take place from one national boundary or from one country to another. According to another definition technology transfer is viewed as the acquisition, development and usage of technologic knowledge by other country other than that which the knowledge originated (Derakhshani, 1983, 20). This shows that technology not only involves transfer of technology but also transfer of knowledge through training and education.

Governments are responsible for formulating policies on technology acquisition, transfer and diffusion (Fisher,1992). The government of Kenya first attempt at policy formulation on technology transfer was contained in sessional paper NO.10 of 1965, when import substitute as a strategy of individual development was formulated to facilitate technology transfer to Kenya (Republic of Kenya, 1965). Equally, when ICT was identified as a key ingredient in development, the government took initiative to formulate national ICT policy, which stipulated procedures for acquisition of computer hardware and software.

The discourse on computer aid as a way of bridging the digital gap was initiated at a series of world summit on information society summits. In retrospective, the turn of millennium, saw escalating insecurity and internal conflicts in developing states towards the end of the 20th century led to humanitarian crisis. The states were unable to provide adequate basic services for their citizens. International community once again recognised that poverty and inequality should be a goal for aid as these are the triggers of conflict, unrest and crimes (Addison et al. 2015). Most donors, aid agencies and NGOs refocused on poverty reduction as a

development goal (Folke &Nielsen, 2006). The new aid also emphasis on the International Development Targets (IDT's) and the Millennium Development Goal (MDG). In September 2000, all member states at the UN millennium summit pledged to reduce world poverty by signing up to MDG (Mosley, 2001).The goals include halving extreme poverty, achieving universal primary education both for girls and boys, reducing infant and maternal mortality and ensuring environmental sustainability. The focus of these goals is centred on poverty reduction. Accordingly, ICT was mapped as a tool to achieving the sustainable goals.

In 2001, the U.N General Assembly adopted resolution 56/183 approving the holding of world summit on the information society (WSIS).The summit was held in two chapters in Geneva, December 2003 and Tunisia, November 2005 to deliberate techniques to bridge the digital divide (Marc Raboy, 2004). At the summits, the bridging of the communication gap was presented as a vital opportunity not to be ignored by South (WSIS, 2005; para. 5 & WSIS, 2002; para. 2). As earlier mentioned ICT's was described as pre-requisites for development. The rationality was that no nation wished to be debarred from the information society (IS) as an "outcast" (ITA, 2003, p. 2). Suggestions and recommendations were made on how to fill the gap. It emerged from the summits that ICT donation would be significant in bridging this gap.

The international organizations are important agents of technology transfer and have played a prominent role in the introduction of ICT in Kenya. Half of the computers acquired in the early 1980's was aid donated (Mayuri, 1995). According to UNESCO (2013), donated computers that have exceeded their lifespan may be redeployed for others to use or offered to needy students in other schools, to government organisations or to charities. Equally, used computers still in good conditions present huge opportunity to help reduce poverty in developing countries, despite their limitation in some applications software (UNESCO,

2004). Accordingly, computers are sent to developing countries through non-governmental organisations. Kenya just like any other developing countries has high hunger for second hand computers due to low prices as compared to a new computer (Basiye, 2008).

Table 3.1: Presents No. of Computer Donated to Kenya (2011-204) by Camara International.

Kenya				
Year	**2011**	**2012**	**2013**	**2014**
Computers send	820	1266	**1790**	**2490**
No. of Schools	**65**	**102**	**120**	**170**

Source: Camara Education: Annual Reports, 2011-2014, pg.17,20,14, 18.

In Kenya there was a significant increase in imported second hand computers after the government introduced zero rated duty in 2006. A study by Ethics international in 2007 revealed that the number of second-hand computers doubled following the removal of the VAT in the country. According to Ikechukwu (2003) most of the zero-rated products such as computers can be imported without being charged at the point of entries as it does not generate any revenue to the government.

The increase in the computer penetration can also be attributed to the fast-growing ICT advancements which demands for computer use and access. Generally donated computers are refurbished and old products making them affordable for the people. Government programmes and policies such as E-governance, provision of computers to education institutions and the removal of import taxes on new or old computers also play a key role in increasing access to computers (Human Development Report, 2005, p.22).

According to Manyua (1995) the number of computers introduced through international organisation assisted projects have icreased. In most cases the computers are either donated for a specific project or the recipient organisation may request for the technology. Camara is an international charity operating in Ireland, the Uk, and the USA. Due to high cost of brand new computers, the organization collects used computers from individuals, institutions and businesses disposing off computers. Between 2005- 2014 a total of 121,914 redundant computers were collected of which 61,634 were refurbished for reuse and send to Kenya, Ethiopia, Zambia, Tanzania and Lesotho. These second-hand computers are shipped in bulk in 20 or 40 foot containers to partners in developing countries. A 40-foot container holds 1000 machines (Julien, O.I, April 9, 2015)

To increase access to computers in developing countries, the organisation refurbishes computers, monitors and laptops donated by organisations and individuals across the UK and provides to schools, NGOs and Institutions in Kenya (Mairu, O.I, April 13, 2015). He further mentioned that Computers for Schools in Kenya, Kenyatta University, Kenya Union of the Blind and Kenya National Library Service as some of their partners in Kenya. Computer Aid International which is the largest donor of computers to developing countries has donated over 75,000 computers since its inception to Kenya and South Africa (Computer Aid International, 2006, p.4).

Table 3.2: Present a table of computers that were received and those that are functioning and non-functioning (see appendix for list of the government, learning institutions and NGO's)

Year	2015		
	Received Computers	**Working computers**	**Not working**
Government institutions	179	156	23
Learning Institutions	928	603	325
NGO's	198	130	68

Source: http://camara.org/about-us/monitoring-and-evaluation/

From the table above, learning schools recorded the highest number of computer failure. Odedra (1995) observed extensive underutilisation of computers and failure of major computer-based projects in the country. The author explains that the country accepts equipment which may not be appropriate or of the highest quality and which may rule out any attempt to standardise uses of equipment as a way of reducing the rage of spare parts needed. She further states that this distortion is already creating serious problems in the country where the limited foreign exchange reserves reduce ability to import required parts. Accordingly, the appropriateness of technology usually depends on the condition under which the technology is transferred from developed to developing countries and the influence that will be exercised by both parties on the whole transaction.

It is crucial to utilise information about the local content in the development of ICT solutions (Avgeron, 2001). Huq (1995) state that the large scale donation of computers from industrialised countries often involves technology of the wrong kind and use. Charles (O.I,

April 10, 2015) claim that aid agencies have no knowledge on local factors that influence the success of computer donation projects. This results into outcome that do not meet the developmental goal. In addition, these projects were launched where computer solution that were successfully implemented somewhere else failed to perform. This is because actual reality was never fully comprehended according to local values. Moyo (1996) emphasis that the methods and techniques for component-based development are often in appropriate to development to third world countries because they generally do not take into account of the socio-cultural content of third world nations. Mayanja (2003) emphasises that only people at the grassroots level can tell whether they have the economic and technical resources to allow the technology to function and what technology is useful for what purpose. According to O'Really (1995: 243) it is common that donated computers lie idle and gather dust for years. The issue is that technology has to be appropriate to the local culture.

Short life span exacerbates the disposal of computers. The life of a computer used in the office is approximately 2-3 years while those at home have a typical life of 3-5 years (Kariuki, O.I, April 24, 2016). According to James (2003), the lifespan of a western business computer is only 2-3 years. This is because of the rapid technological business progress and non-upgradeability of most software which causes people to buy new computers every 2-3 years as well as heavy profits of the hardware and software industry.

Computers are usually discarded before they become dysfunctional. Many of donated computers are probably between 5-8 years by the time they are sent to developing countries. This would suggest a longevity way past what the original manufacturer may have built them for (Dennis, O.I, April 29, 2015). A survey carried out in Kenya to assess the e-waste situation in Kenya was supported this view. The survey revealed that 90% of the consumers indicated that they possessed computers for over 5 years after which they discarded them (Shluep et al., 2008).

Computer Aid International which is the largest supplier of refurbished computers suggested that the average life of a refurbished computer was nearly three years. This life span corresponds with that of refurbished Camara computers (Camara report, 2008). According to Herat (2007) from the year 1992 to 2005 the average lifespan of a computer dropped from 4 and half years to two years. Wanjiku (2009) underscored that short life span for most electronic products less than two years are a major drive of growing e-waste problem.

According to Gilbert (O.I, May 8, 2015) used computers are slower than new machines because the RAM is small. The new computers tended to freeze up, blew power supply and had weak processor (Mulwa, O.I, April 24, 2015). This is because most of the donated computers used in Kenya have not gone through the process of adaptation. The technology adoption and diffusion theory posit that for imported technology from advanced social system to perform efficiently, it has to be modified or go through a process of adaptation to fit the new environment (Schnmacher, 1973). According to Mulwa (O.I, 24th April, 2015) adaptation should involve design change that either add new functional capability to the technology to use in its performance of existing function in the new environment it has been introduced.

Most of the donated refurbished computers are always labelled brand-new on the package. Hence, consumers regard refurbished computers as brand new not knowing that refurbished is a word used to mask old products (Ocholla, O. I, May 15, 2015). Refurbishers transform old computers by replacing defective components. Refurbishment simply involves the cleaning and repairing in order to make the refurbished product more attractive at the same time affordable for the populace. According to Mansell (1999) the construction of hardware and software doesn't not give sufficient attention to the local context. The application are developed and designed for markets in developed countries which are transferred to

developing nations with little concern about the need for technical modification or the importance of the local content, was well as skills or training.

Unfortunately, most electronic imports are rarely tested for functionality (Charles, O.I, May 20, 2015).This contradicted statement by Julien (O.I, 9th April, 2015).She stated that before shipping the electronics to recipient country, they conduct quality control test on machines. Most donated computers once broken is difficult to find spare parts and others come already broken or simply don't take up power and this contributes to already piling obsolete computers in the storage (Benedict, O.I, October 6, 2015). Donated equipment might be too old to have spare parts readily available in a case where the software is erased, it might not be possible to replace. Furthermore, due to international regulations, it might be difficult to obtain a software release.

The Kenya bureau of standards manages a programme that aims to minimise the national risk of hazardous goods entering the country. There are many items that need to be checked and priority is given mostly to consumable goods (Kivutha, O.I, August 14, 2015). It is nearly impossible to check functionality of all these items. The duty of a custom officer is to check whether the tax has been paid for that particular good. Checking of the functionality of the electronics equipment lies solely on the importer. Although, there are a times when imports duties are not paid by the importer. In such a case, many of the electronics are left in the warehouse at the port. After a specific period of time, mostly a year, when these electronics are not claimed the Kenya Port Authority are liable for their disposal (Dominique, O.I, September 12, 2015).

On the question of disposal mechanism policy, the respondents mentioned various sources on how to dispose of obsolete computers. Some higher learning institutions have asset disposal policies. When computers become obsolete, they are taken to a collection point at Nakumatt

galleria and others that are still functioning are donated to children orphanage for use (Mueni, O.I, May 14, 2015). While others have internal procedures, which involves advertising and selling to the general public. However, before auctioning they remove some parts that can be reused by the institution (Mulwa, O.I, May 14, 2015).Regarding policy on electronic disposal for primary and secondary school, Kaguthi (O.I, May 27, 2015) responded that most schools do not have a disposal policy, however for most schools, the non-functioning computers are stored in the stores or sent five computers to computer for Kenyan schools in exchange for one computer. Ojwang (O.I, June 5, 2015) confirmed that unused computers are stored in a room in the building or sold to merchants that deals with metals.

Although international aid organisations have provided assistance in the acquisition of technology in education and training, as well as in technical assistance but not in an effective way. Hence, the equipment is often given to organisations with no training or provision of extra recurrent costs. This statement is confirmed by Mairu (O.I, 13th April, 2015) that camara international provide maintenance services to non-functioning computers but at a fee. Education and training are often neglected in projects. In regard to the technical assistance the people who are supposed to be supporting the locals are overworked and usually neglect the transfer of skilled to users (Odedra, 1995).

Akindale (1989) states that there is lack of maintenance of the IT system in most institutions and organisations. Instead of repairing or adapting the systems to reduce cost in the long run, systems are abandoned by reverting to the manual method or to new ones. According to Mazrui (1986) there is generally lack of maintenance culture that ignored maintenance of the existing systems or that see maintenance as the least in their scheme of essentials. This due to technical nature of most of the systems in those organisations because they have not acquired the knowledge of most modern technologies which they now use nor how to repair them. Ojwang (O.I, 9th June, 2015) explains that most of the IT systems maintenance are corrective

requiring minor fixing with little cases of perfective maintenance or adaptation of software to new operating system or language requirement. It is cost effective to make existing software more perfective than to purchase new one.

3.5 Conclusion

The chapter shows that despite Kenyan government taking significant steps towards acquiring competence in ICT growth, still there is certain sector of the population, especially in rural areas could be left behind. They have no access to any form of technology, live below poverty line, do not have electricity and are illiterate. Accordingly, the digital divide presents an incomplete roadmap for using ICT in achieving sustainable development.

Initiatives have been taken by international non-organizations such as Computer aid to bridge the gap through donations of computers. However, Computers donated to Kenya donated was found to contribute to 20% of the stock of second-hand ICT equipment as of 2009 (Ratemo, 2009). As established in this study these donated computers have a short life span raising concerns on disposal method and electronic waste.

CHAPTER FOUR

4.0 THE CHALLENGE OF E-WASTE ON SUSTAINABLE DEVELOPMENT IN KENYA

4.1 Introduction

In previous chapter, the study established that one of the ways to bridge the digital divide is through ICT donations. However, efforts to bridge the digital divide through donations raises questions on sustainable environmental development. Environmental dimension cannot be ignored because it is one of the important aspects of sustainable development. Attention has been focused on how economic development causes environmental degradation on global commons such as population, water, atmosphere and natural resources. However, the implication of the information, communication and technology needs to be considered in the context of transition towards a more digital world and a growing information society. This chapter questions whether the efforts to bridge the digital gap through donations leads to sustainable development. This is doubtful because of the issues about managing the e-waste.

4.2 E-waste

E –waste is considered by the United Nations as a subset of waste electrical and electronic equipment (WEEE). Within EU the term WEEE is widely used to refer to end of life and disposed electrical and electronic equipment. WEEE under EU is divided into ten categories listed as in table 4.2.1.1. Based on this classification, scholars such as Streicher-Port et al. (2005) and Robinson (2009) consider any ICT and telecommunication equipment (category 4) and consumer equipment (Category 4) from this list as e-waste.

Table 4.1 : The ten categories of WEEE under European Union Directive

NO.	Category	Label
1	Large household appliances	Large HH
2	Small house hold appliances	Small HH
3	Information Technology and equipment	ICT
4	Consumer equipment	CE
5	Lightning equipment	Lightning
6	Electrical and electronic tools	E &E tools
7	Toys, and leisure and sport equipment	Toys
8	Medical devices	Medical Equipment
9	Monitoring and Control equipments	M &C
10	Automatic dispenser	Dispensers

Source: EU Directive (Directive 2002/96/EC) of European Parliament and the Council of 27th January 2003, on waste electrical and electronic equipment (WEEE).

Puckett et al. (2002) define e-waste as electronic equipment that is considered hazardous and do not, in functional state serve any purpose to any intending user unless the equipment has been refurbished. Shluep et al. (2012) adds that such equipment is also intended for dismantling, destined for material recovery, recovery of spare parts or final disposal. UNEP summarises the above definitions of e-waste as various forms of electrical and electronic equipment (EEE) that are old and reached end of life and have ceased to be of any value to their owner. (UNEP, 2007). For the purpose of this study, e-waste may also include some second-hand computers which are exported to developing countries as donation after they have reached their end of life and are no longer useful. As such, UNEP's definition of e-waste is the most suitable in the context of this study and will be adopted in this chapter.

4.2.1 Factors contributing to increase in e-waste in Kenya

The rapid increase of e-waste in Kenya is due to several factors. One of these factors is digital revolution in communication industry and its very rapid advancement have resulted in the increase in e-waste volume. Initiatives such as removal of tax on computers and the

launch of e-government strategy (2004) aimed at mainstreaming ICT in Kenya has resulted to high demand for cheap computers. Additionally, the rapid expansion of the telecommunication sector has led to high proliferation of mobile devices (CAK, 2014). A study executed in Kenya under the umbrella of ICT action network revealed that Kenya generated 3,000 tonnes of e-waste only from computers, monitors and printer in 2007.They predicted an increase in e-waste volume as the importation and use of computer increases to satisfy the growing demand (Mureithi & Waema, 2008). A report by UNEP (2010) also estimated that Kenya is responsible for more than 11,400 tonnes of e-waste annually of which 2,500 tonnes are from personal computers.

Despite the increasing demand for and penetration of ICT many are unable to afford new devices. Consequently, demand for cheaper second-hand ICT equipment's coupled with low labor costs for reparation and refurbishment has led to a strong electronic re-use market. A substantial portion of the demand for second hand computers in developing countries is met by donation from charity or aid organisations. For instance, in Kenya, donated computers contributed 20% of the stock of second hand ICT equipment in the country as of 2009 (Ratemo, 2009). This in turn leads to a higher domestic e-waste generation per year due to reduced life span of second hand ICT equipments (Yu et Al., 2010).

These donated computers have short life span. The life span of a computer fell from 4-6 years in 1997 to 2 years in 2005 (Babu et al., 2009,308). With increasing availability of cheap second-hand computers, along with the short life span raises question on e-waste. The decrease in the lifespan of computers imply that the volume of e-waste generated is increasing by 10% annually, making e-waste the fastest growing waste stream and equally toxic (Osibanjo &Nnoma, 2007, p. 493).

Kenya also lacks proper policy and legislative framework on e-waste creating a loophole for

reusable goods and e-waste in European Union (EU) labelled as second-hand goods. This is due to EU law allowing exportation of reusable goods as strategy for managing end of life electronics (Kuper &Hojsik,2008, p. 10). Gattuso (2005) also adds that the rush to burn desktops and other electronics from landfills in the US has resulted to thousands of tonnes of computers to developing nations, Kenya included. The justification is that US computer recycling market is not big enough to handle the large amount of e-waste generated which are increasingly banned from municipal landfills. Green peace in 2008 indicated that between 25 percent and 75 percent of second hand EEE imported arrive in an unusable condition beyond repair (J- Keper, 2008).

According to Schluep et al. (2012) approximately 90 per cent of imports are new products, although having a low life expectancy resembling second hand products. Presumably, these new imports are not or faked branded low-cost Asian imports. In addition, approximately 10 per cent of the imported volume are used and about 70 per cent of used EEE imports arrive in functioning state but life span is often short. Schluep et al (2012) concluded that international illegal import of EEE is not the issue but rather the low quality of some second-hand equipment. These equipments are imported without being tested in the exporting country. Further, absence of any kind of code of conduct followed by importers. He presumes that such equipments are dysfunctional and their imports is contrary to the Basel Convention.

Second hand computers that are functioning are regarded as e-waste because they can no longer serve the needs of the original purchaser. Accordingly, donated computers cannot be separated from the general e-waste stream. Although they are likely not to make up a relatively small portion of the total e-waste flow, their implication on sustainable development is significant. The following subsection focuses on impact of unregulated disposal of obsolete ICT equipments on the environment and human health.

4.3 Implication of E-waste on Environment and Human Health in Kenya

Obsolete computers contain toxic substances such as heavy metals that pose a serious risk to the environment and human health (UNEP, 2015). Based on this knowledge, the study sought to explore implication of discarded ICT on the environment and human health.

4.3.1 Environment

One of the issues regarding e-waste is its impact on the environment. Informal recycling leads to emission of significant levels of heavy metals and persistent pollutant to soil and water systems. A comprehensive review conducted by Sepulveda et al. (2010) in China and India e-waste recycling areas highlighted high level of heavy metals such as lead, polychlorinated dioxins, cadmium in the air, dust, soil and water samples. This is also the same case in Kenya. A study conducted by Njoroge (2007) analyzed soil samples from localities adjacent to Dandora dumpsite and within the dumpsite. The research showed high levels of heavy metals emanating from the site in particular lead, mercury, cadmium, chromium and copper.

Based on the knowledge that e-waste disposal is an issue, the study sought to find out methods of e-waste disposal in Kenya. According to Michael Woznick (O.I, March 4, 2015) there are different methods of e-waste disposal such as open dumping, incineration, salvage and sanitary landfill. The most common method in Kenya in particular is open dumping. The advantage of this method is that it is cheap to maintain and requires no planning. However, it poses a danger to the environment and public health

Responding on the question related to strategies of e-waste management, Michael Woznick (2015) stated that recycling and material recovery and reuse has been adopted by many countries. Informal recycling is mostly practiced in Kenya and is operated by informal sectors. It is characterized by extractions of materials such as copper, aluminum and manually dismantled in a crude manner which poses danger to the environment and public

health. In an interview to find out the route of exposure to the environment, Ngezaire (O.I, 20th April, 2015) states that:

> E-waste contains high toxic ingredients such as lead, mercury, cadmium and flame retardants which omit dioxides on burning. It is a persistent pollutant generated in one place, but they travel long distance because they are transported by air. When it goes into the atmosphere it settles in the rain clouds and rain brings it down, it settles on the vegetables and grass, the cattle eat the grass and humans consume it. The more people consume the vegetables the more they accumulate dioxide. (Ngezaire, 2015)

In another interview, Joan Kimani (O.I, April 29, 2015) underscored that discarded computer parts are known to take indefinite time to degrade naturally in landfills and the leaching from landfills contaminates soil and ground water in the adjoining areas. If these enter sources of drinking water like rivers, they can cause serious health problems in humans, plants and animals alike.

The researcher also sought opinion of father John Paul (O.I, May 4, 2015) a Cambodian Missionary working within Dandora community for seven years. He is of opinion that Nairobi River is the most polluted river because trash from the dumpsite are disposed in it. The river passes at the feet of the dumpsite and most farmers channel the water into their farms. This statement was attested by Waitito (O.I , May 6, 2015) who admitted that water from the river is used for irrigation of vegetables that are later sold within Nairobi. According to respondent C, the more humans consume the vegetables the more they accumulate dioxide. They dissolve poorly in water, thus are stored readily in fatty tissue and may be passed to infants through breast milk.

It is evident that rudimentary recycling techniques couple with the amount of e-waste processed have adverse environmental impacts including danger to the workers. Long range transport of pollution has been observed which suggest a risk of secondary exposure in remote areas. This raises question on ICT and sustainability of the environment

4.3.2 Health

Another issues of e-waste regards its impact on health. The release of toxic chemicals into the environment may pose risks not just to the environment but also to the local residents close to the informal recycling as well as the recyclers themselves. The e-waste recycling in Kenya is largely unregulated and recovery of precious materials such as copper, aluminum is done using simple recycling methods. Of most concern is the manual disassembly of valuable components from wires and cables, followed by the open burning of certain components to separate copper from plastics. There is a high risk of exposure to dioxin and most copper electrical wiring is coated with chlorine containing Polyvingly Chloride (PVC) which forms dioxins (Sepulveda et al., 2010).

Through dumpsite observation and interview with Tyson (O.I, May 6, 2015) the researcher asked the respondent to demonstrate the process of recycling a discarded computer. With the help of an IT expert in the interpretation of his statement, he replied laughing:

> ….it’s not an easy job. It’s a long process and one needs to be careful because electronics are very fragile. Some parts of the electronics can be taken apart using bare hands but other parts as the cathode tube you have to use a hammer. Process of metal recovery from circuit boards is through open burning or smelting it then dipped in hydrochloric solution. After an hour, it will form a sludge, which is drained from the acid. The copper is removed and the acid solution, is normally

> thrown into nearby water or land. The copper is usually packed and sold for reuse in the market. (Tyson, O.I, May 6, 2015).

The process of manual dismantling as described above pose a number of health-related issues such as physical injuries and chronic ailments. A study conducted in China on human scalp hair, examining the extend of heavy metals exposed to workers and residents in e-waste recycling areas, revealed high level of cadmium, copper and lead (see table 3 on effects of these heavy metals on humans) (Wang et al., 2009). The chairman of scavengers Tyson (2015) replied to a question asked about the health issues his members experience. He said that:

> Madam, there are many risks in this job. While dismantling glass objects, small pieces can get into your eyes. As you can see, most of us have bruises, scars of burns and deep cuts. There are workers who dump acid carelessly and many have been burned accidentally. (Tyson, 2015)

From the observations and interviews conducted, it was evident that informal recycling is a danger to the workers. Exposure to toxics substances can occur through broken CRT's, during sorting at the dumpsite or CRT crushing during metal recovery. Tyson (2015) explains that the workers frequently complain of muscle weakness which could be as a result of direct exposure to toxic chemicals, respiratory problems and choking from fumes.

Children are more vulnerable to emissions of metal fumes during uncontrolled burning. Njoroge (2007) conducted a study that investigated heavy metal exposure of 328 children around Dandora dumpsite. Blood analysis indicated that half of the children examined had high level of lead. The researcher spoke to Simba (13 years old) (O.I , May 7, 2015) a scavenger at Dandora dumpsite. He complained of headache, chest pains and frequent coughs

which could be as a result of direct exposure to toxic fumes. A medical doctor at Savannah Health Clinic in Dandora, attested that children are more affected by this human tragedy. Exposure to heavy metals such as lead can cause serious irreversible neurological damage and underdevelopment in children. Most of them suffer from skin infection, respiratory and other organ problems. Due to long exposure to toxic chemicals, someone dies slowly (Nyokabi, O.I, May 7, 2015).

Table 4.2: Overview of Potential Health and Environmental Hazard of E-waste.

Computer Components	Potential Health Hazard	Potential Environmental Hazard
Cathode (CRT)/Monitors	• Silicosis, cut injury, inhalation or direct contact with phosphor containing cadmium and other metals such as lead and mercury	• Release of lead, mercury, barium, toxic phosphor and other heavy metals into water and soil
Printed circuit boards	• Inhalation of tin, lead, dioxin, beryllium, cadmium, mercury	• Air emission of metals and dioxins
Dismantled Printed circuit boards	• Inhalation of tin, lead, dioxin, beryllium, cadmium, mercury and respiratory irritation	• Tin and lead contamination of soil and water • Emission of brominated dioxin, beryllium, mercury and Cadmium
Chips and other related components	• Corrosive injury to eye and skin, inhalation of acid fumes and harmful gases such as chlorine and sulphur dioxide	• Water and soil contamination and air emission of hydrocarbons, heavy metals, halogenated substances and acids
Plastics from computers and peripherals	• Direct contact and inhalation of hydrocarbons, dioxin, and heavy metal	• Emissions of dioxins and heavy metals and hydrocarbons
Wires and cables	• Inhalation of bromated and chlorinated dioxin and polycyclic aromatic hydrocarbons PAH's	• Emissions of brominated and chlorinated dioxin, PAH's
Miscellaneous computer parts and enveloped in rubber	• Inhalation of dioxins and PAH's	• Emission of dioxins,PAH's
Toner Cartridges	• Respiratory irritation, unknown carcinogenic impact of carbon black, cyan, yellow and magenta toners	• Soil and water pollution
Secondary steel, copper and precious metal smelting	• Heat injury, Inhalation of dioxins and heavy metals.	• Emissions of dioxins and heavy metals

Source: Adapted from Puckett et al. (2002*). Exporting harm: the high-tech trashing of Asia*. Basel Action Network, pg. 26.

The table above explains how a poorly disposed computer hardware contains highly toxic materials that can cause divesting health problems and environmental degradation. With the increase of e-waste production and consequent threat of environmental degradation, there is a need for a regulation framework to mitigate the e-waste problem.

4.4 Evolution of Policy Response

The environmental health problems caused by informal recycling of e-waste raises questions on the issues about managing the e-waste. With regard to national context of e-waste management, Kenya is a party to both Basel and Bamako conventions. This raises question on how these conventions are applied in Kenya.

4.4.1 Basel Convention: Background of the Negotiation Process

From the negotiation of the treaty, two opposing viewpoints emerged on various action involved in the formulation. On one hand, the North camp wanted the waste trade across borders to continue being legalized. Subsequently, being generators of waste, they advocated for regulation of the waste rather than a ban. Indeed, with the high-profile documented cases of hazardous waste dumping in developing countries such as koko, Nigeria negotiation on the South Camp was geared towards a global ban (Krueger, 1999). This stand clearly demonstrates global intended interest to protect powerful waste producing firms located within their region.

UNEP tended to agree with the point of regulation rather than a total ban. In defense, they stated that not all states have the technical capacity to dispose their wastes safely. Therefore, there is a need for exportation of these wastes to other countries with better disposal equipments. UNEP, however made it clear that waste should not be exported to developing

countries (Tolba, 2007). The point UNEP was putting across is that developing countries are not able to recycle waste because they do not have equipments to do so. Therefore, they can export their waste to developing countries where there is better equipments for waste disposal. Point to note is that most South states produced less waste compared to North states.

On the other hand, the South states were strongly advocating for an outright global ban of the trade (Kummer, 1992, 535-536). Although, some African governments were earlier involved in waste trade deals, they had realized the harm of accepting these hazard waste shipments. Moreover, African leaders had begun to call for an end to "toxic terrorism" (Rozelia, 1998). Their key interest was not only to preserve the environment but also achieve sustainable economic development.

Additionally, as former Kenyan president Moi on September 6, 1988 stated that;

> "African has rejected all forms of external domination and do not want external domination to come in through the back door in form of "garbage imperialism" (Reuters News Reports, June 24, 1988)

To strengthen South stand on the ban, a series of negotiation processes were held prior to the Basel negotiation. A regional workshop on toxic waste was held in May 1988 in Monrovia. The delegates recommended a ban on the movement of toxic waste in Africa and elaboration on Africa convention on waste trade (Kebe, 1990: pg, 252). Shortly after, at the OAU 48th ordinary session held in Addis Ababa, resolution 1153 was adopted. It condemned those involved in waste importing and declared the practice a crime against Africa and African people.

During 11thSummit of Economic Community of West Africa states (ECOWAS) which was held in Lomé, a resolution was called to stiff penalties upon parties that dump toxic waste. It

further pledged to adopt national legislation that outlawed the acceptance of foreign wastes and agreeing to a monitoring group called "Dump watch" (Rozelia, 1998). Kenya is a party to the Lomé convention and in July 23, 1988, the Permanent Secretary of the ministry of Environment and Natural resources, S. Lesrima announced total ban on hazardous waste shipments in Kenya.

The south was supported by environmental NGOs such as Greenpeace. It has campaigned to end the waste trade in order to force companies in the Europe to pursue clean production methods that would eliminate toxics wastes. Green peace also began publishing quarterly newsletter, waste trade update (renamed toxic trade update in 1992) to create awareness to the public and the governments on waste trade issue around the world (Marbury, 1995).

Hilz and Radka (1991) affirmed that during the final conference of Plenipotentiaries on March 22, 1989, North and South used explicit threat of continuing the status quo to bend their negotiation in their favor. Developed countries especially those from Africa had proposed that trans-boundary movement could take place only if, there was the simultaneous transfer of adequate and environmental sound technology. Unfortunately, this proposal was rejected. To reach an agreement, most of the original positions by African states had to be watered down in the final document (Kummer, 1992). The Basel convention regulated the trade in hazardous waste for disposal, but it did not make it illegal. It rather operated on PIC principle (Birnie &Boyle, 1992).

4.4.2 Implications of Bamako Convention on electronic waste.

Obsolete donated computers are considered electronic waste. Kenya is a signatory to Bamako convention and is in the process of drafting a national policy on e-waste. Accordingly, provisions of the Bamako Convention is used in the management of e-waste. For the purpose

of this study, it is important to understand the implication of Bamako document on electronic waste and how Kenya has domesticated it.

African countries were of the opinion that their concerns were not adequately considered and safeguarded under the Basel convention. Bamako convention on the ban of the import into Africa and control of the trans-boundary movement and management of hazardous wastes in Africa was adopted in 1991(Webster Main, 2002).

Prior to the adoption of the Basel convention, African states had foreseen that Basel would not adequately protect Africa from trans-boundary waste pollution. In June 1998, at the 11th summit, ECOWAS adopted a resolution calling for national legislation banning the importation of hazardous wastes to Africa and establishing a "dump watch" to monitor illegal waste shipments. It was recognized that all striving for economic development and progress in the region would be in vain if due consideration was not given to environmental and human health protection (Kummer, 1999).

Their view was also supported by Non-aligned movement (NAM) who perceived dumping in Africa as taking advantage of the poverty situation in Africa. The European Community (EC) also agreed under the Lome treaty to ban exports to 68 former colonies in Africa, the Caribbean and the Pacific (the ACP). As stated in Lome convention, the ACP states also agreed not to import waste (Mehari Gebre, 1992)

African leaders acknowledged that political corruption has contributed to, much of environmental degradation in Africa. UNEP asserted that owing to issues such as poverty and political instability, African leaders might be tempted to accept money to legitimize and condone what would be environmental injustice. Thus, the passing of resolution 1153 requesting African leaders to reach consensus on a common African position to deal with the inadequacy of the convention was established. This explains the refusal of these states to sign

the Basel convention during 1989 and 1990 (Webster-main, 2002). On 20th July, 1991, the Bamako convention was adopted at the Pan-Africa Conference on Environment and Sustainable Development in Africa (Kylie, 1992).

Dumping of hazardous wastes contains toxic material that are harmful to human health and pollute the environment. In this regard, the effects of dumping hazardous wastes was brought to the attention of delegates attending that conference of Africa Ministries of Health (Huntoon, 1989). After an in-depth study of the issue, the ministers adopted a resolution in which they appealed to members to conduct studies on the existing methods of storage, transport and dumping of hazardous waste generated in their respective countries and further enact national legislation (Handley, 1989). During the 3rd African Ministerial Conference on the environment, the General Secretariat passed the resolution adopted by the 3rd conference of African Ministries of Health. It was then proposed that:

> In the view of the chronic and serious health problems as well as ecological risk caused by the uncontrolled dumping of hazardous waste and toxic chemicals in the environment through industrial, agriculture and household activities; the OAU higher authority should adopt the necessary measures to defend Africa final position on the Basel Convention. (Vallete, 1989)

Scholars such as Webster-main (2002) perceive Bamako convention as a unique document drafted by and for the African region a symbol of pro activity of African states to act regionally in prevention of illegal dumping of toxic waste. To African nations the Convention symbolizes power to act collectively in the post-cold war era. Xie Zhenhua (as quoted in Webster-Main, 2002) argues that given the fact that Africa is plagued by political corruption

and saddled with little or no waste handling technologies, it needed the Bamako convention to compensate for that missing gap.

The ban was also viewed as an expression of bitterness by African leaders as a result of colonial experience. In an article *environmental racism: Smuggling Europe's toxics waste and Dumping them on Africa (2009),* it established that dumping dangerous waste in African's back yards from industrialized nations is a reminder of slave trade horror. The trade has also been labeled by some African leaders as "garbage imperialism". While others see it as neon-colonialist exploitation. Still to others, dumping raises the question of preferring poverty to compromising African dignity. The AU played a vital role during the negotiations of the global convection. Its official position was to emphasize the conviction of African nations that export of hazardous waste to the continent is a morally reprehensible and a criminal act. Thus, it was only natural for African countries to demonstrate opposition towards the recycling loophole in the Basel Convention (Mehari Gebre thesis, 1992).

The Bamako Convection introduced a total ban on the import of hazardous waste from non-parties to Africa. This confirms its intension of protecting human health and the environment thus, a better deal for Africa. The ban fills the gap of pretext exportation for recycling. It is worth noting that export from non-party to party jurisdiction is clearly stated but not from parties to non-party jurisdictions. Several debate rose concerning the total ban on the movement of hazardous waste. Among them is that it is disadvantageous to those nations that lack disposal for the toxic wastes (Sheaver &Russel, 1993).

The focus of Bamako was to address the growing issue of dumping in Africa by developed countries. The convention allows movement of hazardous wastes between African states provided they have disposal facilities. Moreover, it allows exportation of hazardous waste to non-AU members. The chief benefit to the imposition of the total ban is that it decreases the

possibility of generators imposing their responsibilities of disposal on countries without disposal technology (Waugh,2000). This concept has been adopted in Kenya's e-waste regulation 2013 which permits import of e-waste from within Africa.

The Ban also implies that states parties to forgo any illegitimate recycling or reclamation interest they have for environmental security. This creates an impression that Bamako ignores the importance of recycling and reclamation in environmental world order. At the same time, it passes a message that they are incapable of handling recycling and reclamation were it to exist (Webster-Main, 2002). The fact that the convention doesn't recognize recycling and reclamation, creates a loophole for importation of obsolete computers through foreign donations by charity organizations. Question arises whether national e-waste policy is appropriate framework to deal with multifaceted dimensions that include; environmental protection and effect on human health.

4.5 E-waste Policy in Kenya

Waste management in Kenya is under the jurisdiction of the local authorities. The local act (CAP 265) and Public Health Act (CAP 242) recognise local authorities responsible for the management of municipal waste. While the Environmental Management and Coordination Act (EMCA 1999) provides mechanism in addressing waste management issues and ways in which waste should be safely disposed. The act also stipulates institutional framework for environmental management in Kenya (EMCA, 1999). Equally, the act mandates NEMA to develop regulations on waste management including hazardous waste and the principal agency that deals with the implementation of all policies relating to the environment (NEMA, 2008).

In September 2006, the e-waste problem was brought to the spotlight during the eighth conference of parties (COP) (8) to the Basel Convention on trans-boundary waste

management held in Nairobi. Previously, e-waste was not considered immediate problem due to assumed low consumption of ICT and the general trend of consumers to store obsolete electronics, reuse it or dump it along with the municipal solid waste (Basiye, 2008).

As such, NEMA developed the waste management regulations (2006) described in legal notice No.12 of the Kenya Gazette supplement No.69. It deals with all categories of waste including hazardous waste, industrial waste, radioactive waste, and pesticides and biomedical. The regulation implies e-waste by virtue of its toxic composition which is listed as hazardous waste. In the regulation hazardous waste is defined as a substance that is explosive, flammable, oxidative, toxic and corrosive. Administration, activities and operational procedure in handling, treatment, recycling, storage and disposal of waste is stipulated in the regulation. The environment management and coordination regulation (2007) is a subsidiary legislation of EMCA that deals with management of control substances that deplete the ozone (Kenya Gazette, 2006).

The Ministry of Information and communication has been proactive regarding e-waste. The ICT policy promulgated in 2006 identified e-waste as an issue and states that;

> As a prerequisite for grant or renewal of licenses, applicants must demonstrate their readiness to minimize the effects of infrastructure on the environment. This should include provision of appropriate recycling/disposal facilities for waste that contain toxic substances (Waema et al. 2008,664)

The Amendment Bill of Kenya Communication Commission (2008) recognize the dangers of e-waste on human health and the environment if not properly discarded. The CCK is a regulatory body in the communication sector established in February 1999 by the Communication Act of 1998 to ensure proper management of the e-waste (Amy, 2009).

A study conducted between 2007 and 2008 by the Kenya ICT Action Network further highlighted e-waste issue. The study illustrated high imports of second hand ICT in 2007 compared to previous years. The estimated amount of e-waste produced is likely to increase and the use of computers in coming years (Waema et.al, 2008). The director of Computer for Kenya Schools in 2008 claimed that there were many computers in the country and that there was no system in place to handle e-waste in Kenya (Basiye, 2008). Accordingly, NEMA developed-waste management guidelines aimed at regulating e-waste in 2010.The e-waste guideline was introduced after realization that Kenya as country had not anticipated the problem of e-waste. The E-waste from computer is categorized under the guidelines as e-waste from ICT and telecommunications equipment.

According to former Minister for Information and Communication Samuel Poghisio (Daily Business, Wednesday 4, 2010), e-waste is now a matter of profound concern for Kenyan government. Richard kiaka Dimba (O.I, August 11, 2015) warns that Kenya, like Nigeria is headed for a potential devasting surge of harmful electronic waste and the problem is spreading. It is anticipated that in the near future, it will be a crisis because Kenya lacks a policy that directly deals with e-waste (O. I, 11th August 2015). Moreover, Kenya has inadequate infrastructure to handle e-waste. Electronic, industrial and solid waste management situation is not good enough (Benjamin Langwen, O.I, August 14, 2015).

According to Dr. Ndemo Bitange, former Permanent Secretary (PS), Ministry of Information and Communication (Daily Nation, Monday, July 26th, 2010) dumping of second hand computers in the form of donations is worsening the e-waste situation given that there is lack of proper policy and legislative framework. Benjamin (O. I, August 14, 2015) agrees with this statement and argues that computer donations are posing more problems such as accumulation of e-waste and cause environmental degradation in Kenya. In his opinion, it will cost the government much more to curb the situation. These views confirm UNEP (2010)

statement during the Nairobi 7th September 2010 workshop on e-waste and electronic equipment, that there is evidence that Africa is used as a dump site for electronic waste. Former Environmental Minister, the late John Michuki speech during a workshop on e-waste, held in Nairobi, on 7th September 2010, stressed on the importance knowing how much e-waste is produced and the actual impact and how many people are affected with these toxic wastes.

There are several key issues that national e-waste policy should put into consideration. According to Basiye (2008) it is essential that national policy to cooperate Extended Producer Responsibility (EPR). The idea is that the producer of a particular waste stream should have responsibility beyond and also be able to collect and help in recycling and getting rid of the waste. In European countries, EPR strategy worked well but not in Kenya. This is because Kenya has inadequate regulatory framework. Hence, various stakeholders do not take up responsibilities. Although, ICT policy instituted by Ministry of information and Communication (MoIC) in 2006, compel dealers to demonstrate their readiness to minimize their effects of the infrastructure on the environment to be able to get licences (Mureithi, 2008).

Commenting on the same question, Benjamin (2015) add that Environmentally Sound Management (EMS) should be clearly defined by the national policies. According to him, definition of EMS is broadly defined in Basel Convention. As such, countries are left to determine what treatment procedures are applicable in their own context. In this context, ICT donors tend to settle for less stringent standards.

During a national e-waste conference and exhibition held in Nairobi, 28th May 2014, Senior Compliance and enforcement officer at NEMA, Immaculate Simiyu made a presentation on the role of policy makers in e-waste management in Kenya. She stated that there is an urgent

need for e-waste policy. It is an issue of great concern that Kenya does not have any concrete pillar so far to manage e-waste. So far Kenya has no policy on recycling policy touching on electronics. In 2010 NEMA came up with the e-waste regulation in Kenya. The e-waste regulation drafted in 2013 had not been approved by parliament in 2017. Commenting on the difference between the guideline (2010) and drafted guidelines, Emmaculate Simiyu (2014) stated that the latter is more binding. The former serves as a set of recommendations for actors along the e-waste chain while the later builds on guideline stipulated making it more legal (UNEP News Centre, 2015).

NEMA was not able to clarify a number of concerns for this study at the time of the interview. This is because regulation might go for additional changes as some aspects still need clarification. Therefore, some aspects will only be decided upon once the regulation become fully active. This implied that the e-waste guideline is the only active document on e-waste management.

Table 4.6: Summary of E-waste Legislation Progress

Country	Date enacted	Tittle of Legislation	Area of concern
Kenya	1999	Environmental Management and Coordination Act (EMCA) No.8	Provides regulations on hazardous wastes
Kenya	29th September 2006	Waste Management Regulation 2006	Part four of the waste regulation deal with the handling of hazardous waste.
Kenya	2007	City Council of Nairobi (solid waste management)by laws of 2007	Defines responsibilities of hazardous waste producers.
Kenya	2008	Amendement Bill of Kenya Communication (2008)	Proper management of the e-waste
Kenya	2010	E-waste guideline	Handling of e-waste
Kenya	2013 (not yet enacted)	Environmental Management and Coordination (E-waste management regulation (2013) not yet enacted	E-waste management

Source: Asiimwe et al. (2012). E-waste management in East African community. ***Handbook of Research on E-Government in Emerging Economies: Adoption, E-Participation, and Legal Frameworks: Adoption, E-Participation, and Legal Frameworks, 307***

E-waste is growing faster in Africa and more especially in Kenya given that Africa is the last continent to receive digital technology. Kenya not having a national regulation will pose a great challenge in the management of e-waste in the near future.

Regarding issuing of permit on e-waste management, making a presentation at regional workshop on e-waste held in Lagos, Nigeria, 20-23 October 2015, Emmaculate Simiyu stated that NEMA issues permits to recyclers. One of the licence was issued to Computer Schools for Kenya as a collection and refurbishing centre for obsolete computers. The other licence

was insured to East Africa Compliance limited (EARC) a recycling plant in Athi river. It's a public- private partnership initiative between Hawlett Packard (HP), the German development institution DEG and EARC meant to recycle waste in an environmental friendly way. The law also (section 87 (3) requires that any person managing waste at the dumpsite should have a licence. However, from the observation and interview conducted Dandora dumpsite operate without a licence from NEMA even though the dumpsite has been in existence before the establishment of the institution.

Informal recycling poses a threat to formal recycling. This disappointment was expressed by Michael Woznick during an interview. He said;

> Even though we encourage the public to dispose obsolete electronics at our collection centers, there is a section that chose to sell it to individual vendors. Others prefer to stock them at their premises. The frustrating fact is that they are not aware and bother about how the venders will dispose of the electronic, (Michael, O.I, March 4, 2015)

This implies that the public is more concerned of the economic factor rather than the environmental concern. It emerges that due to inadequacy in e-waste policy, producers do not carry out their responsibility in e-waste management. Producers have the responsibility of financing e-waste management, create e-waste awareness, designs products that that environmentally friendly and establish e-waste collection centers.

4.6 Conclusion

The chapter examined whether efforts towards bridging the digital gap through ICT donations really lead to sustainable development given that issues surrounding e-waste management is questionable. It emerged that the presence of e-waste situation could prolong the achievement of sustainable development in Kenya. The study indicates that the health consequences of both direct and indirect exposure to hazardous chemicals from the waste stream can be potentially severe. The crude method of metal extraction is commonly handled with little

regard for the health and safety of the workers or surrounding communities and the environment. Overall, leading to persistent organic contaminants and toxic metals contamination of the environment and adjacent working area. Clearly, it was not possible for this research to conduct a comprehensive study of the full extent of damage caused to human health and environmental impacts arising from informal recycling of e-waste. This is because hazardous e-waste has the ability to spread far distances and remain in the environment for extended periods.

While NEMA have developed a national e-waste management guideline, questions have emerged whether the guideline is a suitable framework to deal with multifaceted dimensions that include; technology transfer, environmental and health hazards. The study reveal that the guideline is operational but not effective since it is not legally binding which leads to weak enforcement. According to the findings in this study, producers do not carry out their responsibility in e-waste due to in adequacy of e-waste policy. This study also shows that there is a problem with all stakeholders working together in attempt to develop e-waste policy in Kenya. Most policy makers still operate in isolation. This chapter concludes that e-waste pose a challenge towards achieving sustainable development in Kenya.

CHAPTER FIVE

5.0: SUMMARY, CONCLUSION AND RECOMMENDATIONS

The central aim of this study was to explore the nexus between ICT donation and sustainable development in Kenya.The study was conceived on an observation by Musili (2008), the Director of CFSK that there were too many computers coming to Kenya in form of donations. There has been a global campaign and strategies for Africa to incorporate ICT in their national development initiatives. But, Kenya is experiencing deficiency in accessing and using ICT resources. Accordingly, donation has been found as one of the ways to bridge this gap. However, most of these donated computers are obsolete, thus raising concerns over implication of e-waste on sustainable development.

5.1 Chapter Summary

Chapter one set out the background of the study, outlining the, research questions, assumptions, objectives, justification of the study, and scope of the study, limitation of the study, literature review, theoretical framework and research methodology of the study. The study used modernisation theory as its analytical tool. Information, communication and technology according to UNESCO is a prerequisite for development. To increase accessibility, availability and affordability of ICT in Kenya, computer aid has been donating second hand computers with short life. This creates a e-waste problem posing danger to human health and environmental degradation when not properly disposed. This raises question on the issue of environment within development aid. As such the study critics the strands in modernisation study.

In Chapter two, the study aimed at examining the nexus between communication and state building in post-independence Kenya. The study showed that there was the idea of the use of

communication for development. Print media was among the first form of communication media to be introduced in Kenya. However, radio was a popular channel for communication of development issues and advocacy. This is in view of its accessibility among the population and has the greatest ability to cut across literacy level. Media was used to promote development programs in such fields as health and nutrition, agriculture and education. The colonial government used media to promote settler's idea and interest in the country. Africans were prohibited from business ownership of any form of media because they feared an uprising. However, from 1920's African publication emerged focusing on independence agenda. After independence, the government exercised full control over print and electronic media and was essentially the governments communication organs.

One of the first and still common widespread use of media for social development is in health and nutrition. Radio has been used in health education and promotion for decades. Radio stations provided information and alert the public on clinic days for polio vaccinations schedules soon after its development. The family planning Association of Kenya produced many booklets, posters, films and videos as well as radio programmes about family planning. The messages communicated on the programmes emphasised monogamy, delayed marriage, small family, equal treatment of male and female children and the problem brought by overpopulation. Media exposed women on family planning methods and contraceptive practises.

To promote hygiene practices, hygiene education programmes focus on increasing people's knowledge on risky hygiene practises assuming that when people know better how water and sanitation diseases are transmitted they will stop unhygienic practices and adopt better practices. These programmes promoted better ways of excrete disposal and hygiene habits. The study showed that safer excreta disposal practices led to a reduction of waterborne diseases such as diarrhoea and better hygiene through handwashing, food protection and

domestic hygiene. To improve on hygiene practices, many programmes issued basic hygiene equipment and material such as soap which helped in proper hand washing. The health educators relied on research on how disease was transmitted, symptoms and prevention of water and sanitation related diseases. However, education does not itself reduce the risk of transmission only action can and that better knowledge does not in many cases lead to behavioural change.

Farmers relied on agricultural information from radio programmes. They would gather to listen to radio broadcast about farming and community development and would discuss what they head. These farm forums encourage rapid diffusion of new technologies to improve farm production. Radio was also used in schools to teach children various subjects especially English language. The emergence of digital revolution spurred up the use ICT in development sectors such as agriculture, education, health, governance and business. The government has included strategies to develop ICT institutions in the country's vision 2030.These initiatives have focused on infrastructure and investment in the ICT sectors. In addition, National ICT policy guides the role of ICT in development. The overarching conclusion in this chapter is that communication would be a significant tool for development and ICT in particular would be essential in digital era.

Chapter three set out to find out whether Kenya has been penetrated enough with information especially ICT so as to realise sustainable development goals. The study found out ICT penetrations still low compared to other African countries thus constrains ICT ability to meet developmental goals. Variables such as education, gender, poverty, governance define utilisation of technology. For instance, high levels of poverty increase digital gap. This is because the population do not have necessary finances to afford computer or internet connection. Digitization is not a priority compared to basic need such as food, shelter and

clothing. It therefore makes sense that a huge portion of the population will not be able to have access to internet nor computer.

Chapter four looked at how e-waste effects the efforts of bridging digital divide through ICT donations given the issues surrounding e-waste management in Kenya. The study established that the e-waste scenario could prolong the achievement of sustainable development. The prevalence of informal recycling exposes humans and the environment to toxics components inherent in decomposing electronic devices is not new. In the study the surrounding area of Dandora dumpsite demonstrate much higher environmental health problems such as diarrhoea, dysentery and upper respiratory infections. Equally, the processing of electronic waste has been shown to present adverse health effects to both e-waste workers and the surrounding area. Thus, e-waste highlights human development issues which compose of sustainable development targets.

It also emerges that communities around Dandora dumpsite are aware of the dangers emanating from the dumpsite. Although the residents have brought these concerns to the attention of the government and sought legal means but not much has been done. Likewise, the donor organisations and the government are aware of these implications. However, they continue to donate computers that are near end of life endangering the lives of people. As such the donor organisations and the government are putting environmental and human rights at risk. In the new Kenya constitution article 42, section 69 and 17 stipulates the right to clean and non-toxic environment. This has also been enshrined in the RIO Earth Summit (UN Convention) in 1992. This raises question on e-waste policy framework and its appropriateness to handle multifaceted dimensions that includes donations and implications of e-waste on the environment and human health.

5.2 Conclusion

The central element in this work is ICT donation that leads to a critical question on its implication on sustainable development in Kenya. It emerges that ICT plays a significant role for development. However, it also emerges that Kenya lacks these resources which leads to digital gap. In order, to meet the developmental prospects of communication, donation has been sought as a way of filling the gap. But these raises question regarding e-waste given most of the donations are obsolete raising question on nexus between ICT donation and sustainable development. Whereas, there have been campaign and strategies to incorporate ICT in development initiatives in Africa (developing countries in general), the question of e-waste implication has not been critically considered. This work has attempted this.

5.3 Recommendations

Based on my findings, the following recommendations are made:

The study has highlighted problems that result to failure in the technology transfer process. Policy deficiency on transfer of technology is one of them. One way to tackle the problem is for aid organizations to articulate technology transfer policies and guidelines for effective transfers. Although, Kenya has regulated the activities of foreign direct investors, however, for a long-term benefit, these policies need to be well defined and integrated within ICT policies. Efforts to focus on stages of the transfer process and regulate them have proven to have limited effect.

Kenya needs to organize and manage aid because without adequate management, aid is likely to be ineffective. Computer aid and Camara education should partner with recycling company such as East Africa Compliance limited in Kenya to create awareness of e-waste Accordingly, the recipient institutions should not store obsolete ICT equipment in houses or stores. This is dangerous because of oxidation from the metals release toxic chemicals. They

should send to registered and licensed centers such as Safaricom and CSFK for safe recycling.

Lastly, future research could explore the issue of human right issues in relation to application of ICT as a developmental asset. As established by the study, the people living around the dumpsite are highly affected by the pollution. According to western countries policy that "the allocation of foreign aid should be linked to political reform and respect for basic Human Rights in recipient countries" (Carey, 2007).

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ORAL INTERVIEWS

NAME	TITLE	INSTITUTION	DATES
Michael Woenick	**Director**	**EARC**	**4th March 2015**
Julien Osogo	**Program officer**	**Camara International**	**9th April 2015**
Frankline Mairu	**Program Officer**	**Computer Aid International Kenya**	**13th April 2015**
Ngesaire Frankline	**Senior Researcher**	**IDRC**	**20th April 2015**
Mr. Kariuki Kilon	**IT specialist**	**Kenyatta University**	**24th April 2015**
Mr. Mulwa John	**IT specialist**	**Kenyatta University**	**24th April 2015**
Mr.Dennis Muli	**IT specialist**	**Ministry of Information, Communications and Technology**	**29th April 2015**
Mrs.Joan Kimani	**IR lecturer**	**USIU**	**29th April 2015**
Waititu Titus	**Farmer**	**Korogocho**	**6th May 2015**
Tyson Kamau	**Scavenger**	**Dandora dumpsite**	**6th May 2015**
Simba Otis	**Scavenger**	**Dandora dumpsite**	**6th May 2015**
Dr.Nyokabi Joan	**Medical doctor**	**Savannah clinic**	**7th May 2015**
Mr.Gilbert Onsoro	**Computer studies Teacher**	**Upper Hill School**	**8th May 2015**
Mrs.Mueni Nduta	**IT specialist**	**Catholic University**	**14th May 2015**
Mrs.Ocholla Adhiambo	**Computer studies Teacher**	**St. Catherine Mountain View**	**15th May 2015**
Mr.Charles Mbote	**IT specialist**	**IDRC**	**20th May 2015**
Mrs.Kaguthi Josephine	**Computer studies Teacher**	**Mountain View Secondary**	**27th May 2015**
Mr.Ojwang Ken	**IT specialist**	**Ministry of Education, Science and Technology**	**5th June 2015**
Mr.Richard Kiaka Dimba	**Researcher**	**Eco Ethics International**	**11th August**
Kivutha Douglas	**An officer**	**Kenya Bureau of Standards**	**14th August 2015**

Benjamin Langwan	**NEMA**	**Compliance and Enforcement Officer**	**14th August 2015**
Gideon Apote	**NEMA**	**Officer**	**22nd August 2015**
Evans Ikua	**Linux Professional Association of Kenya**	**Chairman**	**24th August 2015**
Respondent E	**NEMA**	**Officer**	**25nd August 2015**
Mr.Dominique Okuru	**Custom Duty Officer**	**KRA**	**12th September 2015**
Rose Mary	**citizen**	**citizen**	**12th June, 2015**
Mercy Nyeri	**citizen**	**citizen**	**12th June , 2015**
Ochidho Johnson	**citizen**	**citizen**	**14th June, 2015**
Wilberforce Waititu	**citizen**	**citizen**	**14th June, 2015**
Mukisa Collins	**citizen**	**citizen**	**14th June, 2015**
Baraza Wanyonyi	**educationist**	**educationist**	**16th June, 2015**
Onditi Eric	**farmer**	**farmer**	**20th June, 2015**
Onyancha Shadrack	**farmer**	**farmer**	**20th June, 2015**
Miriti Tom	**farmer**	**farmer**	**21st June, 2015**
Mwangi Waganjo	**farmer**	**farmer**	**21st June, 2015**
Ngala maboza	**farmer**	**farmer**	**21st June, 2015**
Marvin Rotich	**farmer**	**farmer**	**21st June, 2015**

APPEDICES

APPENDIX: 1 QUESTIONAIRE FOR INSTITUTIONS AND NGO'S

NAME OF LEARNING INSTITUTION/NGO'S: Consolata School

DATE: 10th February 2015

1. What do you use Computers for?
   a) Games b)Video c)Image editing d)Sending email e)Web-browsing and applications
   Others (specify) - All the above

2. How many computers do you have? 40

3. How many are not functioning? 38

4. How do you procure your computers? **Possible reason for that particular channel……..**

   a. Charity donations……**specify the donor/s**……..
   b. Second-hand
   c. Brand new
   d. Internet
   e. Relatives, friends
   f. Refurbished
   g. Others (specify)……

5. Do you frequently have internet connectivity? Yes

6. What do you consider important when acquiring a computer?
   a. Memory size
   b. Color
   c. Size
   d. brand
   e. Purpose
   f. Internet access
   g. Others specify……

7. What is the make of the computers? Why that particular brand? .....
   a. Hp /Compaq
   b. Toshiba
   c. IBM
   d. Apple
   e. Sony
   f. Others (specify)…….

8. What state are the computers when you acquire them?

   a. Functioning
   b. Broken
   c. Isolated
   d. Others (specify)……

9. What is the possible lifespan of the computers?
   a. 1-2 years

b. 2-3 years
c. 3-5 years
d. Others (specify)…….

10. What is the discarding state of these computers?
    a. Broken and fixable
    b. Broken and unfixable
    c. Working condition
    d. Other reason specify…….
11. What are your reasons for discarding computers?
    a. To update software
    b. High repair cost
    c. Malfunction during use
    d. outdated
    e. lifespan collapsed
    f. Other reasons (specify)…….
12. How do you dispose the computers?
    a. Advertising and selling to the public (specify sources newspaper, advertising, internet, others……..)
    b. Donation to (Families…,schools**(Consolata Fathers' Children's Home**)……,…… employees… friends……)
    c. Disassembled to reuse some parts
    d. Dropped at garbage collection points
    e. Sold to general merchants that deals in metal parts and plastics
    f. Taken to computer for schools in Kenya(CFSK)
    g. Send to recycling center (**which ones**)……..
    h. Store in their own premises.
13. Would you pay to dispose of obsolete computers? Yes/**No (it has never been necessary)**
14. What do you understand by the term digital divide? And how can that gap be bridged? Digital divide refers to the difference that there exists between those who have access to ICT and those who do not. The gap can be bridge by involving the authorities and the community in creating communal access to ICT.

List of Institutions, Ministries and NGO's

1. Ministry of Foreign Affairs and International trade
2. Ministry of education
3. Ministry of information, communication and technology
4. African Union of the Blind
5. Kenya Union of the Blind
6. International Development Research Centre
7. Kenyatta University
8. Catholic University

9. Technical University
10. UpperHill School
11. Sunshine Secondary School
12. Starehe Boys
13. Kamkunji Boys
14. Strarehe Girls
15. Our lady of Fatima
16. Consolata school
17. Kilimani primary school
18. Olympic primary school
19. Milimani primary school
20. Moutain view primary school

APPENDIX 2: INTERVIEW GUIDELINES FOR EXPERTS ON ENVIRONEMNTAL IMPACT OF E-WASTE

1. What are some of the e-waste disposal methods?
2. What factors contribute to improper disposal?
3. What are some of the strategies of managing e-waste in Kenya?
4. What are the toxic components found in computers?
5. How are the toxic materials exposed to the environment?
6. What are the implication of these exposures?

APPENDIX 3: INTERVIEW GUIDELINES FOR SCAVANGERS, RECYCLERS AND PEOPLE LIVING AROUND THE DUMPSITE.

1. What do u do here at the dumpsite?
2. What are some of the health issues your workers complain of?
3. In case of an accident at the dumpsite, do you get compensated?
4. How do you dismantle a computer?
5. Are you aware of the e-waste policy for recycling e-waste
6. Has the government hind to your plight as residents living at the dumpsite?
7. Are you involved in policy making if e-waste?
8. Is there any training you have participated concerning safe recycling of e-waste?

APPEDIX 4: INTERVIEW FOR GOVERNMENT (NEMA)

1. In your own opinion, how is e-waste situation in Kenya
2. NEMA drafted e-waste guideline in 2010 and a national e-waste policy in 2013, what does these guidelines seek to address?
3. What are the factors that led to the drafting of the e-waste regulations?
4. Have these guidelines assisted in the regulating e-waste flow in Kenya?
5. What challenges is the institution facing in implementation of these guidelines?
6. What are the international e-waste agreement that Kenya is a signatory to?

7. How has these international regulations shaped the drafting of the national policy?
8. What key issues should the national e-waste policy take into consideration?
9. What roles can the citizen play in environmental governance
10. Have NEMA involved the citizen in the formulation of the 2013 e-waste policy?
11. Have u partnered with any other organizations in management of e-waste?
12. So far what has been done to help the communities around the dumpsite?

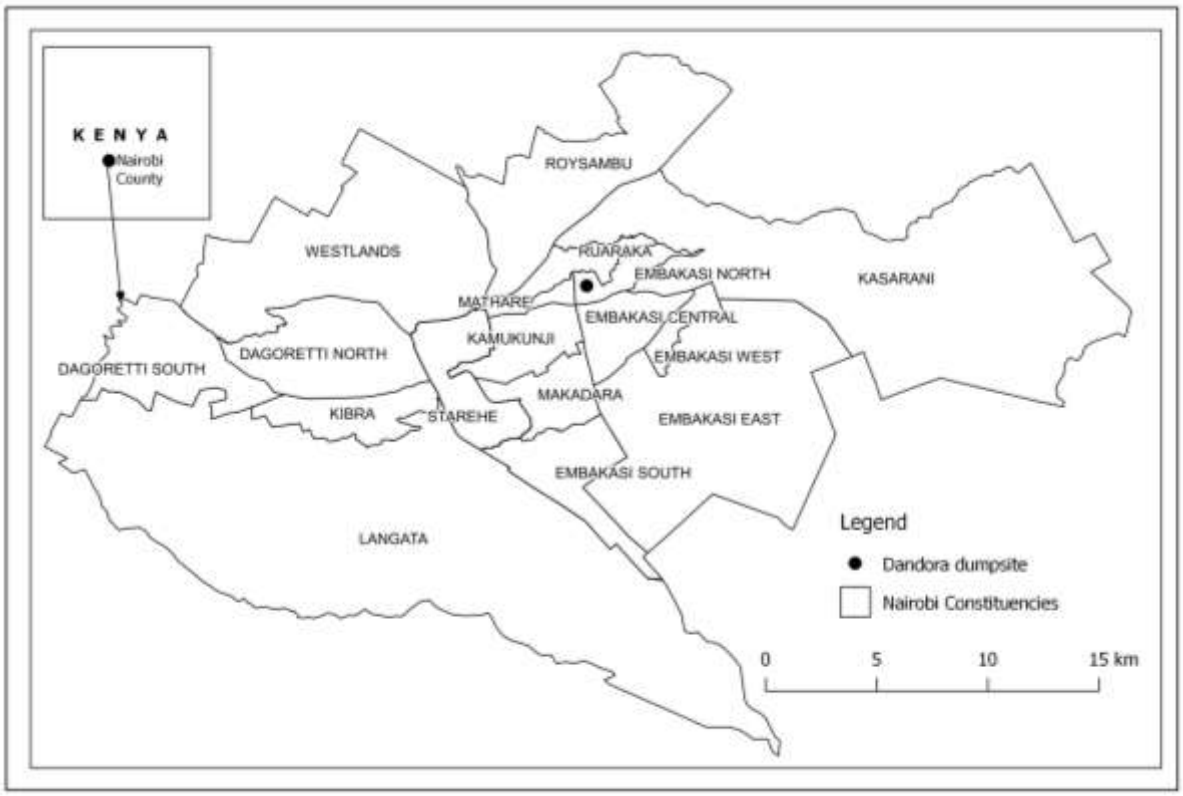
APPEDIX 5: INTERVIEW SCHEDULE: KRA AND KEBS

1. Where are the sources of computers that come into the country?
2. What are the rates or trend of computer are imported?
3. Briefly describe the computer importation?
4. Why does Kenya import donated computers?
5. In your own opinion what are the reasons that prompt foreign countries to donate computer in Kenya?
6. Why are computers not taxed?
7. Are second hand computers labelled brand new? Why?
8. How do you check for end life of these computers?
9. If the computers are found to be broken or not function, what is the procedure taken to handle such a scenario?
10. Can you provide a statistics on the number of donated computers since 2012-2014?

APPENDIX 6: interview FOR USE OF COMMUNICATION IN DEVELOPMENT.

1. What is the of Radio Programme?
2. What is the duration of programme?
3. Date and time of transmission?
4. Programme format (i.e state if it is a magazine, use of interviews, call-in or pre-recorded? etc
5. What issues are covered in the programme?
6. How the topics the feature in the programme selected?
7. How resourceful are the experts invited to the programmes
8. What is the feedback system used in the programme? ie SMS, letters etc
9. How do the presenters respond to issues raised by the audience?
10. How helpful (if at all) did you find what you heard in the programme to your
11. activities? b) If not why?
12. Have you been able to practice what you heard in the programme?
13. Yes No

APPENDIX 7: STUDY MAP



Map of Nairobi County Showing the Location of the Study Site (Dandora dumpsite).

APPENDIX 7: Dismantled cathode ray tubes

Source: Author

APPENDIX 8: Circuit board

Source: Author

APPENDIX 9: Plastic

Source: Author

APPENDIX 10: Wires and Cables

Source: Author

APPENDIX 11: Recycling machine at EARC

Source: Author

APPENDIX 12: Piles of computers and laptop at EARC

Source: Author

APPENDIX 13: Pipe water passing through leachate from the dumpsite

Source: Author

APPENDIX 14: Leachates from the dumpsite

Source: Author

APPENDIX 15: Open dumping

Source: Author

APPENDIX 16: Auctioning of old computers at Kenyatta University

APPENDIX 17: Research Permits

THIS IS TO CERTIFY THAT:
MISS. BERNICE AKINYI OTIENO
of KENYATTA UNIVERSITY, 2216-202
nairobi,has been permitted to conduct
research in *All Counties*

on the topic: *E- DONATIONS AND SUSTAINABLE DEVELOPMENT IN KENYA (2002-2014)*

for the period ending:
30th April,2018

Permit No : NACOSTI/P/15/0778/5729
Date Of Issue : 20th April,2015
Fee Recieved :Ksh. 1000

Applicant's Signature

Director General
National Commission for Science, Technology & Innovation

CONDITIONS

1. You must report to the County Commissioner and the County Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit
2. Government Officers will not be interviewed without prior appointment.
3. No questionnaire will be used unless it has been approved.
4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.
5. You are required to submit at least two(2) hard copies and one(1) soft copy of your final report.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice

REPUBLIC OF KENYA

NACOSTI

National Commission for Science, Technology and Innovation

RESEARCH CLEARANCE PERMIT

Serial No. A 4947

CONDITIONS: see back page

KENYA REVENUE AUTHORITY

Ref: KRA/5/1003/4/23

2nd May, 2015

Bernice Otieno
Kenyatta University
P.O BOX 43844
NAIROBI.

Dear Madam,

RE: REQUEST TO UNDERTAKE RESEARCH

Reference is made to your letter dated 19th May, 2015 on the above subject.

We are pleased to inform you that approval has been granted for you to undertake research on, *"E-Donations and Sustainable Development in Kenya (2002- 2014."* However, this can only be done through administration of questionnaires.

The research you intend to undertake should only be for academic purposes only and any data or information given should be treated with utmost confidentiality.

Kindly share you findings with the Authority on completion of the study.

Yours faithfully,

Elijah M.Nyaribo
For: Deputy Commissioner- HR

Tulipe Ushuru Tujitegemee!

Times Tower Building
Haile Selassie Avenue, P.O. Box 48240-00100 Tel: 310900 Fax: 316872