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E-Waste Management and Awareness Levels of Safaricom's Collection Program in Harambee Sub-Location, Nairobi County, Kenya.

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Abstract

The purpose of this study was to assess the E-waste management awareness levels of Safaricom's E-waste Collection Program in Harambee sub-Location, Nairobi County, Kenya. There has been an exponential growth in E-waste largely attributed to the widespread use of electronic appliances. There has also been a fall in the prices of electronic goods, rendering these goods accessible. However, health and environment authorities world over have raised a red flag over the dangerous dumping of E-waste. Advancement in technology can therefore be looked upon as a curse or a blessing since developed nations have in the past been found seeking to illegally sell their industrial waste to unsuspecting Third World countries. Safaricom Limited has been selected in this study as a case study since the company has tried to lead the way in E-waste management. The overall objective of this research was to assess the awareness levels of Safaricom E-waste Collection Pprogram in Harambee sub-Location, Nairobi County, Kenya. The theory that was found relevant to form a framework for the study is the Rational Choice Theory. This study adopted a descriptive survey method. Mixed methods; qualitative and quantitative, were employed in data collection. The study was carried out among residents of Harambee sub-Location, Harambee Ward which is in Makadara Constituency, in Nairobi County. The estimated population for the sub-Location according to the last demographic national census in 2013 was 22,100 people. It is from this general population that the target population was drawn. This research employed cluster sampling, simple random sampling and purposive sampling. The study employed triangulation in data collection. A questionnaire and interview guides were administered to the respondents. Later, quantitative data was analyzed using Statistical Package for Social Science (SPSS) computer software version 22. The data was presented in form of tables, pie charts, and bar graphs. The study found that the majority of the respondents were aware of health hazards of E-waste. On the other hand, the respondents were not aware of the environmental health hazards caused by E-waste or the existing National and County Government guidelines on E-waste. Further, Safaricom's E-waste Collection Program was unknown to the majority of respondents. The study concluded that there was a need for Safaricom to aggressively sensitize the community on its E-waste Collection Program, proper E-waste disposal methods, as well as the environmental hazards of E-waste. The National Environment Management Authority (NEMA) on the other hand needs to engage the community more with E-waste campaigns on policies and regulations. The study recommended awareness on Safaricom's E-waste Collection Program. Further, the study recommended that NEMA puts in place solid policies on E-waste, and creates awareness on the same with the public.

Key words | *E-waste, environmental hazards, collection program, awareness, disposal methods*

Introduction

This chapter presents the study background, statement of the problem, the study objectives, research questions, and significance of the study, justification of the study, the study setting, conceptual framework, theoretical framework, operational definitions of terms, and the study structure.

1.1 Study Background

The Organisation for Economic Co-operation and Development (OECD) defines E-waste as, 'Any appliance using electric power supply that has reached its end of life.' Another widely accepted definition is from the European Commission Directive 2002/96/EC which defines it as 'Electrical or electronic equipment which is waste.' E-waste contains a variety of materials such as gold, copper, reusable components such as transistors, toxic materials such as mercury, lead, cadmium as well as Cancer causing Polychlorinated Biphenyls (PCB's) (Chris et al., 2006). According to UNEP (2009), there has been an exponential growth in E-waste, which has been largely attributed to the use of electronic and electrical appliances. There has also been a fall in the prices of electronics, rendering these goods more available. Another reason would be the technological advancements and discoveries made which bring on board a varied sample of electronics and electricals. The movement of E-waste from developed to developing nations has elevated the globalisation of E-waste making it a global issue that every country has to deal with. Developing countries are most hit, as their financial capacity limits them from effectively managing E-waste, which is an expensive affair as it caters in proper recycling and laying out of effective regulatory frameworks. E-waste is categorised into three types: household appliances (50%), information and communication technology equipment (30%) and consumer electronics (20%).

Globally, between 1994 and 2003, about 500 million personal computers containing close to 718, 000 tons of lead, 1363 tons of cadmium and 287 tons of mercury, reached their end-of-life (Smith, Sonnenfeld and Pellow, 2006). They further state that the amount of E-waste generated is projected to grow by 10% per year. Widmera, Oswald-Krapf, Schnellmannc, Boni and Khetriwal (2005) argue that E-waste recycling is a lucrative business in developed and developing countries because the recycling process churns out metals such as gold, silver, copper, which can be brought back into the market and resold to make good profit. They argue that the dilemma around this discourse is that most countries are still struggling to maintain a balance between the recycling business and ensuring that the environment is well taken care of. Switzerland was the first country in the world to implement an industry-wide clear system for recycling and collection of E-waste. Economically, Switzerland is doing well for itself, having one of the highest per capita in the world as well as being one of the most technologically advanced countries. According to a World Bank 2004 report, there is one personal computer for every two people in Switzerland. Over 99% of the population has refrigerators and over 96% have TVs (Euromonitor, 2003.) Switzerland ranks among the top countries when it comes to environment protection and its citizens are informed on why and how to care for the environment. The law in Switzerland strictly reinforces, 'The polluter pays' principle. Several systems have been put in place for the separation and collection of different kinds of waste such as glass, paper, plastic bottles and aluminium, which facilitates recycling. Switzerland has two organisations, namely SWICO and S.E.N.S, which are producer organisations that ensure 'brown' and 'white' goods are efficiently managed.

According to Oteng (2012), a major characteristic of the E-waste scenario in Ghana is that the rate at which electronic gadgets become obsolete is unknown. The data management practices are not up to date, and most of the gadgets come into the country when already obsolete. Authorities in Ghana lack the capacity and regulation for proper E-waste management. A few privately owned companies such as Pure Earth and Green Advocacy Ghana, set up an E-waste recycling facility in Agbogbloshie, to help cut down on the mass poisoning the residents were experiencing. Awareness on the dangers of burning E-waste continues to be preached in the town through posters and individual conversations. Ghana is a signatory of the Basel Convention, which holds that prior notice should be given to any country when importing hazardous materials.

Kenya generates 17,000 tons of E-waste annually, 150 tons being from mobile phones (UNEP Press Release, 2010). Rao (2011) says that there were more than 500 million mobile phone users in Africa in 2011. Kenya is among top five countries in Africa with a booming phone market. Other countries are Nigeria, Egypt, South Africa, and Ghana. Kenya has seen a rise in the numbers, owing to the availability of cheap phones and as the Communication Commission of

Kenya (CCK) reports, mobile phone subscription was 33.6 million users. Kenya continues to follow an upward trend in technology usage, with new gadgets making their way into the market every day. This automatically qualifies Kenya as a country that has to find a way to deal with the global issue of E-waste management. According to a CCK quarterly report for January 2008, the number of mobile phones in the country was reported as 10.8 million users in September 2007. A year later, the number had grown to 14.5 million users in September 2008 (CA Quarterly Report January 2009). In December 2014, the number of mobile phone users rose to 33.6 million. It is projected that with a population of around 42 million, approximately 3 out of 4 people own a cell phone.

The mobile phone industry is known to be one of the fastest growing sub-sectors in the telecommunication industry. Technological advancements have rendered mobile phones not only as tools of communication, since also have gadgets and applications that enable phones to be used as cameras, calculators, diaries, financial accounts, as well as recording devices. According to NEMA (2012), once the mobile phones reach their end-of-life, they produce various wastes which consist of metals, plastics, and glass. More often than not, this E-waste is eventually discarded together with other forms of waste, in dust and garbage bins. This presents the problem of safe discarding and disposal of mobile phone waste.

NEMA guidelines acknowledge that lack of clear disposal guidelines has resulted in massive stock being held by the consumer. In the case of phones, consumers will want to withhold them for various reasons; either due to lack of awareness of any collection points for obsolete phones, or for sentimental value. Others will want an incentive in exchange for their old phones. If the above reasons are not motivating enough, most consumers will continue to accumulate old phones or some will dispose them haphazardly, oblivious to the deadly impact to the environment as well as humanity caused by arbitrary disposal.

According to NEMA guidelines (2012), some of the metals and acids can cause blockage of water runoff channels. Economically an impact would be felt, as there would be a colossal amount of money spent on health care, since the casualties of the E-waste effects would have to be treated. This would call for huge investments in costly technological remedies. Further, the dangerous fumes released into the air cause ozone depletion, erratic weather systems and droughts, which all then require extra finances to sort out; money which could be used for other projects.

1.2 Statement of the Problem

With technology advancement, mobile phones have become easily available especially to consumers in developing countries. Within a short time, a consumer, and especially youth who have a craving for the latest smart phones, will haphazardly discard the old phone to get 'the latest trend'. As soon as one acquires a new phone, the old phone is forgotten and dumped in a bin. Careless disposal of mobile phones can cause harm to human life and the environment. Safaricom Ltd, a mobile phone service provider in Kenya launched the Safaricom E-waste Collection program, with 45 retail centers which act as E-waste collection centers. Despite this big number of collection centers in Kenya, there is a very low response from the public, judging from the E-waste collected from the retail centers. Nairobi County is serviced by 26 retail centers, giving Nairobi the lead compared to other counties. However, the response to the returning of obsolete phones remains low.

There is lack of awareness on the dangers of improper disposal of mobile phones, otherwise, the centers would be overwhelmed with the number of people bringing phones that have reached the end of their lives. There is lack of awareness by the general public about Safaricom's E-waste Collection program, as many people only know Safaricom centers as places where they get their phone issues handled. There has also been evident laxity by the Government of Kenya and the Ministry of Environment and Regional Development, in regards to laying down clear legislation on E-waste.

1.3 Objectives of the Study

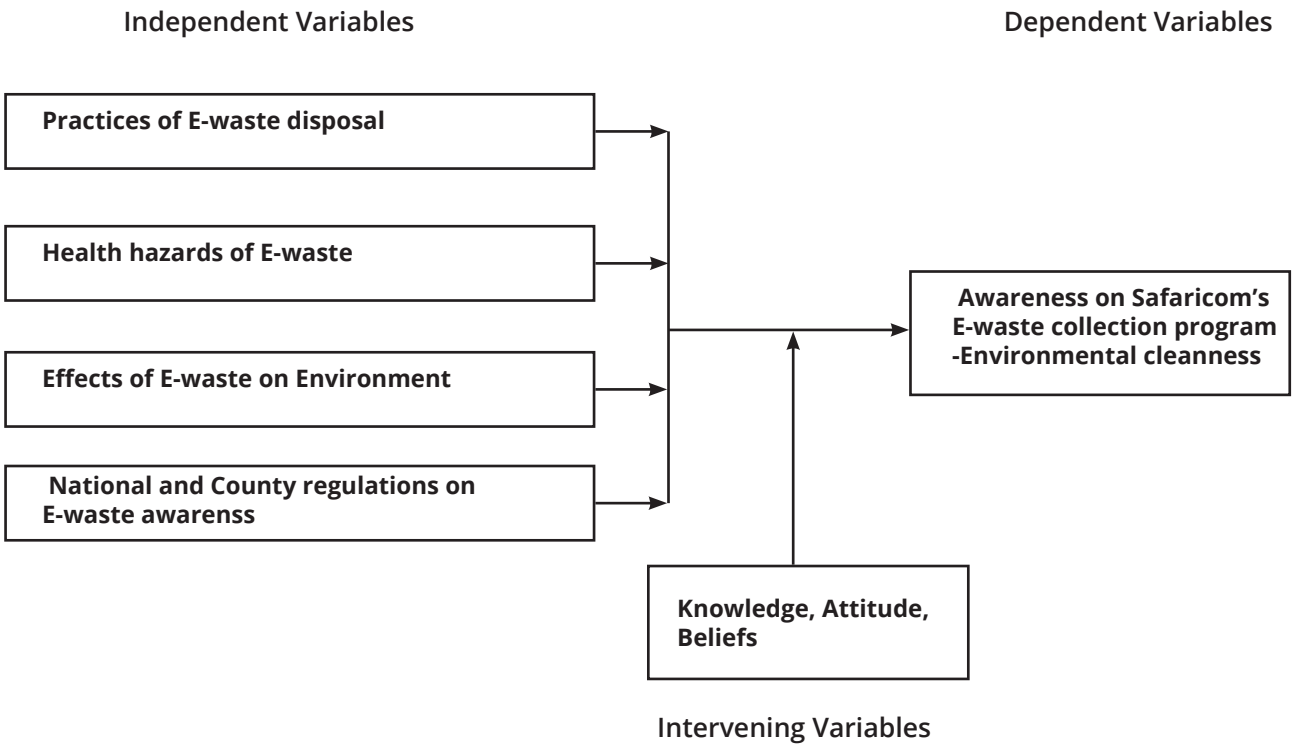
The following were the specific objectives that guided this study:

1.3.1 Specific Research Objectives

1. To examine the health hazards of E-waste amongst residents in Harambee sub- Location in Harambee Ward.
2. To establish the effects of E-waste matter on the environment in Harambee sub- Location in Harambee Ward.

3. To evaluate existing national and county government policies and regulations on E-waste disposal in Harambee sub-Location in Harambee Ward.
4. To establish practices for disposal of E-waste in Harambee sub-Location in Harambee Ward.

1.4 Conceptual Framework



1.5 Theoretical Framework

The advancement in technology globally has brought with it an array of products and services and in that stride, things are done easier and faster and generally the quality of life has improved; the consequent challenges notwithstanding. It follows that this advancement has eased the availability and access to electronics and electricals, particularly to consumers in developing countries. The developed countries, in turn, have slyly rode on the platform of technology advancements, (Abramovitz 1989 cited in Sirmai 2005) to flood developing countries with electronics and electricals. Some of these have a short life spans, which eventually causes an increase in the E-wasteE-waste stream.

1.5.1Theory

The Choice Theory or Rational Action Theory by George C. Homans, is what this research uses. According to Heath (1976), individuals are motivated by the wants or goals that express their 'preferences'. He further adds that individuals act within specific constraints and on the basis of information they have, about the conditions under which they are acting. This theory holds that individuals must anticipate the outcomes of alternative courses of action and calculate that which pleases them. Rational individuals choose the alternative that is likely to give them the greatest satisfaction. Homans (1961) argues that human behavior is not random, but determined. Decisions are mainly tied to rewards and punishments that individuals encounter. Consequently, individuals will tend to embrace that which leads them to reward and shun anything that leads them towards punishment. According to this theory, it is evident that whichever action one undertakes after their phone has come to the end of life, is not random, it is always thought out. The rewards and punishment are thought out, and a decision made on how to dispose of the electronic gadgets. Heath says that individuals act on the basis of information they have, this shows that with consistency in creating awareness on the Safaricom E-Waste Collection program, and further,

the hazards associated with polluting the environment, people will make decisions that will not harm the environment. In addition, for fear of the punishment associated with improper disposal of mobile phone waste, people will be careful to properly dispose of their E-waste.

1.6. Review of Empiric11al Literature

1.6.1 E-waste effects on the Health of Individuals

Kristen, Goldizen, Sly, Brune, Neira, Berg, and Norman (2013) conducted research amongst a population in Guiyu, South East China, where people were exposed to potentially hazardous substances through inappropriate and unsafe management practices related to disposal and recycling of E-waste. Guiyu is the largest E-waste recycling center in the world. The researchers recorded plausible findings, of a population that had been greatly affected by E-waste. They discovered that exposure routes can vary depending on the substance and the recycling process. They also identified a number of ways through which the exposure to hazards occurred, such as inhalation, ingestion, and dermal contact, especially when they were at work. For those not working, it was likely that they had come into contact with either contaminated soil, water, dust, air, or food sources, including meat. Children, fetuses, pregnant women, elderly people, people with disabilities, workers in the informal E-waste recycling sector, and other vulnerable populations, and therefore faced additional exposure risks (Wong et al, 2007). Children were a particularly sensitive group because of additional routes of exposure (breastfeeding and placental exposures), high-risk behaviour (hand-to-mouth activities in early years and high risk-taking behaviour in adolescence), and their changing physiology (high intakes of air, water, and food, and low rates of toxin elimination). The children of E-waste recycling workers also faced take-home contamination from their parents' clothes and skin, and from direct high-level exposure if recycling was taking place in their homes. The city's residents exhibit substantial digestive, neurological, respiratory, and bone problems. For example, 80 percent of Guiyu's children experience respiratory ailments, and are especially at risk of lead poisoning. Pregnancy outcomes in the areas exposed to E-waste revealed that there were cases of still births, miscarriages, premature births and reduced birth weights. Also, it was noted that physical growth indicators for children living in Guiyu were relatively lower, compared to children in the neighbouring town of Liangying, which did not have E-waste recycling.

The researchers recommended that there was a need for the international community to urgently come together and prioritize discussions around adverse health effects of E-waste. Informal E-waste recycling has long been accepted as a source of dangerous environmental pollution, but the health risks it poses to exposed populations are only beginning to be recognized. Simultaneously, the international health community, academia, policy experts, and non-governmental organisations, in conjunction with national governments, should create policy solutions, educational programs, and interventions to reduce E-waste exposure and its adverse health effects. Osibanjo (2015) shares a gender report of women and children, vulnerable groups that are actively involved in E-waste scavenging and crude recycling activities especially in Ghana and Nigeria. He says that a study on the informal E-waste management sector found that the E-waste refurbishing, collection, and recycling centers were dominated by adult men and child male workers. There are hardly any women working in the refurbishing and repair operations. However, women make up a large share of waste pickers as well as sellers of drinking water to male workers at the recycling centers. Women and girls are estimated to make up around 30% of the workforce. E-waste specifically affects women's morbidity/mortality, and fertility, as well as the health of any children. Of the 14 general types of hazardous chemicals commonly found in E-waste, more than half affect women's general reproductive and endocrine functions. Women exposed to environmental toxins such as heavy metals, flame retardants, PCBs, and phthalates may suffer from anemia, fetal toxicity, hormonal effects, menstrual cycle irregularities, endometriosis, auto-immune disorders, and cancers of the reproductive system. E-waste work may also be tied to fertility problems. Lead and mercury exposure within the first trimester of pregnancy may affect fetal development, resulting in potential neuro-behavioural development problems, low birth weight, or spontaneous abortion and birth defects. Songa and Lubanga (2015) revisit health risks associated with Kenya's E-waste recycling. They note that as much as Kenya is not a well-established E-waste recycling center, the amounts of contaminants that could have been averted from leaking into the environment and endangering human health . Proper recycling could have reduced or removed some of the contaminants.

The United Nations Environmental Program commissioned a pilot study of the Dandora Municipal Waste dumping site in Nairobi, Kenya in 2014. Environmental samples (soil and water) were analyzed to determine the content and concentrations of various pollutants (heavy metals, polychlorinated biphenyls and pesticides) that are known to affect human health. Soil samples from the dumpsite were compared to samples taken from another site - Waithaka, which is a peri-urban residential area on the outskirts of Nairobi. A medical camp was then set up adjacent to the dumpsite, at the St. John's informal school. The study showed that 328 children and adolescents were examined and treated for various elements; 40 were referred for further laboratory tests, which entailed blood and urine sampling to assess the impact of exposure to environmental pollutants from the dumpsite on human health. The findings for the study revealed that 50% of these children had respiratory, gastrointestinal, and dermatological problems, while 30% had blood abnormalities signaling heavy metal poisoning from the dumpsite. Blood investigations confirmed that 50% of the children had low haemoglobin levels. The study recommended the adoption of sustainable management of E-waste which could in-turn combat poverty and generate green jobs through proper recycling, collection, and processing of E-waste. Further, this would safeguard the environment and human health from the hazards posed by rising levels of E-waste.

1.6.2 E-waste Effects on the Environment

Cherutich (2007) observes that the European Union passed the Waste Electrical and Electronic Equipment Directive (WEEE), and every member country was to effect it as law in their respective countries. The European Directive banned electronics and electricals which contain substances such as lead, cadmium, and polybrominated biphenyls, among others. The directive also set various annual targets for collection, reuse, and recycling of E-waste. Gupta (2012) says that informal waste recycling is carried out by poor and marginalized social groups who end up scavenging on waste to survive. Gupta says that it is this application of inefficient methods that increases the risk of environmental hazards. He notes that samples collected from and around recycling facilities in India at Seelampur, Jafrabad, Shastri Park, Mayapuri, Burari, and adjoining areas of Delhi, show that lead, cadmium and acids were being released into the environment. Gupta lists a number of metals that are harmful to the environment. Cathode Ray Tubes, which are processed by the breaking and removing of the copper yoke then dumped, contain lead and barium, which leak into the ground water, releasing toxic phosphor. Another source of E-waste that is prevalent is printed circuit boards, which are processed by de-soldering and removing chips. They contain brominated dioxins, beryllium, mercury, and cadmium, which are emitted in the air. Wires are another source of EE-waste, processed by open burning so as to recover the copper. They contain hydrocarbons, which are discharged into water, air and soil. Gupta also mentions plastics from computers as hazards and they are processed by shredding and low temperature melting. These are hazards which emit brominated dioxins, heavy metals, and hydrocarbons in the air. To counter the EE-waste menace, Gupta says that some recycling companies have come up in India, in the last few years. Such companies are like the Attero Recycling Plant, Ash Recyclers in Bangalore, and the E-waste Agency in Bangalore. These companies ensure safe extraction and proper recycling. Gupta however notes that as much as this is the case, the companies only manage to capture 3%, as the rest goes to informal recycling yards. This is because the informal sector buys the rest of the EE-waste at a higher price than formal recycling companies. Sitaramaia and Kumari (2014) say that atmospheric pollution due to burning and dismantling activities seem to be the main cause of occupational and secondary exposure. The emission of the gases may cause ozone layer depletion, as the fumes and gases can be toxic. Informal sector EE-waste activities are a crucial cause of environment-to-food-chain contamination, because animals easily feed on plants that have grown on polluted soil. Adesokan, Adie and Obasanjo (2016) conducted an assessment to determine the soil pollution by toxic metals near E-waste recycling operations in Ogunpa area in Ibadan, Nigeria. The study assessed soil contamination with lead (Pb), copper (Cu), chromium (Cr), nickel (Ni) and cadmium (Cd) arising from crude EE-waste recycling. The findings were that all the soils sampled from that area were highly concentrated with lead and copper. The recommendation was that soils from that area require urgent clean up, especially for the mentioned metals, so as to safeguard human life and the environment in Ogunpa.

Kaloki (2014) conducted a research where he assessed existing EE-waste management systems in institutions of learning in Ruiru sub-County, Kiambu County. Among the findings, Kaloki established that institutions of learning were among the largest producers of EE-waste, such as computers, typewriters, printers, television sets, radios, desk phones, and still cameras, among others. However, none of the institutions sampled had an EE-waste management policy or a defined method of

EE-waste management. 40% of them disposed of waste without prior separation, 40% stored it, and 18% gave it to scrap dealers. The level of awareness on the effects of EE-waste on the environment was very low, at 25%. Kaloki observes that the free laptop program is likely to compound the EE-waste stream in primary schools if proper mechanisms of mitigating this are not going to be put in place. The study recommended that EE-waste specific policies be developed to govern EE-waste from the production, importation, collection, transport, recycling, and disposal stages.

1.6.3 Existing National and County Government Regulations on E-waste

Kumar and Singh (2014) observe that developed and developing countries are facing the heat of EE-waste and have come up with measures for controlling, dealing, and combating the menace. They look at the EE-waste legislation in Japan, a leading electronics manufacturer. They observe that they have limited regulations aimed at EE-waste. In 1998, Japan enacted the Specified Home Appliance Recycling Law (SHARL). In 2001, the Law was later amended to ensure the proper treatment of home appliances. Japan highly advocates for incineration and continued use based on cost comparison to material recycling. Under this law, manufacturers are free to charge the consumer for EE-waste management costs. Khetriwal, Kraeuchi, and Schwaninger (2005) present Switzerland as the first country to implement an industry-wide organized system for the collection and recycling of EE-waste. Switzerland ranks among the top countries in the world regarding environment protection. Khetriwal et al., say that the Swiss law on waste management stresses on the 'Polluter pays principle,' which has greatly encouraged the reduction, reuse, and recycling of waste. Switzerland has systems that are well recognized and acknowledged by citizens. Their responsibility lies in segregation and collection of different kinds of waste such as glass, paper, plastic bottles, and aluminum, among others, to facilitate better recycling. The two organisations, SWICO and SENS, are primarily managed by Producer Responsibility Organisations (PRO's). The Ordinance on the Return, the Taking back and the Disposal of Electrical and Electronic Appliances (ORDEA) legislation came into force in 1998, where retailers, manufacturers, and importers are required to take back, at no charge, the appliances that they bring into the country. The consumers on the other hand, are obliged to return the EE-waste appliances and are not supposed to dispose them off via household trash or the bulky items collections. On 31st January 1990, Switzerland's membership to the Basel Convention, was ratified. The convention was established in 1989 and it prevents rich countries from dumping hazardous waste in poorer countries.

Asiimwe (2014) conducted a study to investigate the conceived roles and actions of governments in the East Africa Community towards control of EE-waste. He gave a case of Uganda, where he stated that the first legislation was passed in June 2009 and implemented later, in January 2010. The aim of the policy was to protect the environment and to encourage manufacturers to do the work from Uganda. Asiimwe says that at the moment, there is no policy on recycling E-waste. The country relies on generic solid waste management policies that were drawn in the 1990's. On environmental agreements, Uganda is a signatory of the Rotterdam, the Basel, the Stockholm Conventions, the London Guidelines for the Exchange of Information on Chemicals in International Trade of 1987, the World Charter for Nature of 1982, the Montreal Protocol; on substances that deplete the ozone layer of 1987, the Strategic Approach to International Chemicals Management (SAICM); a policy framework that promotes chemical safety around the world, all which play a significant role in environmental campaigns. Closer home, Asiimwe's research on legislation in Kenya revealed that Kenya lacks a regulatory framework, according to authors Mureithi and Waema (2008). Just like their neighbouring country Uganda, Kenya adopts the National Environment Management Authority (NEMA) laws which are solely for solid waste management. These laws help in controlling generation, handling, transportation, storage, or disposal of waste that threatens public health, the environment, or natural resources. As a step towards fighting hazardous waste, Kenya is a signatory to numerous agreements. Kenya is a signatory to the Basel Convention, which deals with the transboundary movement of hazardous goods into Africa, and the ban on hazardous imports into Africa. Bamako Conversion is another agreement that deals with the importation of hazardous goods into Africa. Kenya became a signatory of the Nairobi Convention in 2010, to provide for regional cooperation and coordination on solving pollution problems of the coastal and marine environment. Kenya is also a signatory to the Stockholm Convention dealing with Persistent Organic Pollutants.

The Ministry of Information, Communication, and Technology has also instituted the ICT policy, which requires electronic dealers to commit to minimizing the effects of their infrastructure on the environment, if their licenses are to be renewed. The National Waste Management Strategy (2014), states that waste management facilities are in poor shape

in all the 47 counties. In putting together a Waste Management Strategy for Kenya. Kenya Vision 2030 set up flagship projects in five cities namely Nakuru, Mombasa, Kisumu, Eldoret and Thika. It was observed that the waste challenges were similar in all counties. The observations gathered from the five cities led to strategies that were replicated in other counties, which ensured efficient and sustainable waste management systems were put in place, even as the country developed into a new industrialised State in 2030.

1.6.4. Practices for E-waste Disposal

E-waste collection methods can be classified by the used models and by the persons or organisations responsible for organizing and/or financing the operations. The following models are available for collection (Chancerel, 2010). First is the Drop-off program, with permanent collection centers or retailers, containers on the streets, or temporary collection events. Second method is the Pick-up program, where the EE-waste is collected at either homes or offices. Third is the Distance collection, where the user sends the EE-waste by post to the collector. Mobile Muster is the official recycling program of the Australian Mobile Phone industry. It is a free, non-profit program that accepts all manner of mobile phones, as well as their chargers and accessories. The organisation is managed by the Australian Mobile Telecommunications Association (AMTA) on behalf of its members such as the handset manufacturers, network carriers and service providers. According to Mobile Muster (2013), Australia had over 30 million mobile phones as at mid-2012, with more than 23 million mobile phones hidden away in drawers and cupboards at workplaces or at home. Mobile Muster's study revealed that 77% of Australians chose to keep or give away their old mobile phones, while 3% threw them out. Mobile Muster encourages recycling, arguing that it would bring forth greenhouse gas benefits which equivalent to planting 111,000 trees. Australia has over 4,000 free public drop-off points, which include mobile dealers and local councils. In 2012-2013 alone, Mobile Muster reported having collected 87 tons of mobile phone components, 1 million handsets and batteries, and 38,479 kg of accessories, which represented a collection rate of 53% of available mobile phones. In 15 years, this program saw 1,014 tons of mobile phone components collected and recycled, including 7,791 million batteries and handsets and more than 518, 000 kg of accessories (Mobile Muster, 2013).

Rwanda, voted the cleanest city in Africa, is yet to implement a clear institutional framework on EE-waste management. The Ministry of Youth and ICT in collaboration with the Ministry of Trade and Industry there, have carried out preliminary EE-waste awareness initiatives among government institutions. However, they agree that there is a need to extend awareness to the private sector and communities to improve their knowledge on EE-waste handling and disposal. Between November 2014 and January 2015, a survey was carried out to know the status of EE-waste in Rwanda. The survey revealed that for the period ranging from 2010 to 2014, import of ICT equipment increased by 5 times. The survey also revealed that Rwanda has an EE-waste annual generation potential of 9,417 tons of which 7,677 tons (81.52%) will be contributed by individuals, 1,143 tons (12.14%) by public institutions, and 597 tons (6.34%) by private institutions. The lack of an EE-waste management framework and capacity to handle E-waste in Rwanda, has resulted in institutions and individuals storing, or in some cases, disposing of it with other types of waste. The solid waste contractors collect waste from different places to allocated landfills without any distinct segregation of E-waste. In some instances, valuable components of EE-waste are recovered, and non-valuable components which are in most cases toxic for the environment, are left mixed with other types of waste, causing health and environment hazards. Rwanda does not have a treatment facility for EE-waste. The lack of an efficient collection, recycle, and reuse system is one of the problems for EE-waste management in Kenya. According to Otieno and Omwenga (2015), firms such as Nokia, Practical Action, WEEE Center and Computer for Schools, have attempted to manage EE-waste through recycling and refurbishment programs. However, most of the WEEE has been found to be managed by the informal sector, also known as the Jua Kali sector in Kenya. In 2008, Nokia launched a 'take-back' system in Kenya, where consumers would be given a small incentive for returning mobile phones and accessories that had come to their 'end-of-life'. Consumers would drop off the obsolete phones at Nokia centers and Nokia would take these back to the various manufacturers. In 2014, Microsoft took over the mobile telephony operations of Nokia, bringing a slow death to the take back system. Safaricom Limited is a communications company in Kenya which provides voice, data, and financial products and services, to its individuals, businesse, and corporate clients. The CAK Statistics Report of Quarter 3, 2016 shows that Safaricom is currently the leading mobile phone telecommunications company with 20.63 million registered subscribers. Other mobile phone service providers such as Airtel come second at 6.7 million subscribers,

Orange Kenya Limited at 4.8 million, Finserve Africa Limited at 1.6 million and the latest entrant, Sema Africa Limited, at 158 pre-paid subscriptions. In tandem with their commitment to a clean environment, Safaricom launched an E-waste initiative in 2011. The program was in response to the high rate of E-wasteE-waste coming into the country. Safaricom opened retail centers for the public to dispose of their E-wasteE-waste, with a keen interest on mobile phones. A year later, in 2012, Safaricom re-launched the EE-waste recycling program whose objective was to manage the impact of old/unused electronic gadgets from 'cradle to grave.' The initiative is aimed at collecting old electronics (phones, lap tops, and related accessories) and handing them back to a recycler. Specialized boxes were designed for collection, which were then distributed to all of Safaricom's retail centres and offices. They also developed an EE-waste information bulletin that was distributed to customers and other members of the public to raise awareness and urge them to drop their EE-waste into collection boxes for recycling. According to its sustainability report of 2015, Safaricom reported that it had collected 170 tons of EE-waste in 2015. They reported that the dramatic increase of the collection from EE-waste in the previous year was as a result of the successful awareness and collection roadshows held in 2015.

1.7 Research Design

Research design refers to how a researcher guards against or attempts to eliminate bias and alternative interpretations of results (Punch, 2010). According to Churchill and Lacobucci (2009), research design is the framework or plan of a study used as a guide to collect and analyze data. In order to get all relevant information on level of awareness on the Safaricom E-waste Program in Harambee sub-Location, I employed descriptive survey design since I was measuring attitudes and orientation in the larger population. The research used a mixed methods approach where both qualitative and quantitative data collection methods are used.

1.8 Sample and Sampling Techniques

According to a household survey done by Fin Access Ltd in 2016, the average household size in Kenya is 5 people per household. Hence, there are 4420 households in Harambee sub-Location. The research employed cluster sampling, simple random sampling, and purposive sampling techniques. Simple random sampling was used for the 4420 households in Harambee sub-Location. This research targeted a sample size of 354.

The researcher used cluster sampling for the 10 estates in Harambee sub-Location and simple random sampling to pick 34 houses from each estate, to arrive at 340 respondents. Probability sampling was used because it is easier to keep the sampling error in check than with non-probability sampling. This type of sampling allowed the researcher to employ tests of statistical significance that permit inferences to be made about the sample from which the samples will be selected (Bryman, 2008). Each element had an equal chance of selection independent of any other event in the selection process. The researcher employed non-probability sampling on key informants which included the Head of a Safaricom retail shop in Harambee sub-Location, 7 mobile phone repair dealers out of the 8 in Harambee sub-Location, 6 Garbage Firm Managers of Harambee sub-Location out of the 6 firms paid to collect garbage. The research targeted a sample size of 354.

The sample size was calculated following the adoption of the formula derived from (Yamane, 1967). N is the sample size, N is the population size (4420), E is the acceptable sampling error, *95% confidence level p= 0.5 are assumed.

1.9 Methods and Instruments of Data Collection

The study used interview guides and questionnaires to obtain information from the respondents. These tools were developed in line with the set objectives. Interview guides were administered to the different key informants such as the Safaricom Retail Head, the 6 Garbage Firm Managers and 7 mobile phone repairers. Questionnaires were administered to the residents of Harambee sub-Location.

1.10 Data Analysis Procedures

Descriptive statistics was used to analyze quantitative data while content analysis was used to analyze qualitative data. The researcher used Statistical Package for Social Science (SPSS) computer software version 23 for further analysis of

$$n = \frac{N}{1 + N * (e)^2}$$

quantitative data. Quantitative data result findings were presented in the form of bar graphs, frequency tables, and pie charts. Qualitative data results were presented in narration and verbatim.

1.11 Presentations of Research Findings

1.11.1 Demographic Information

Of the respondents, 5 (1.67%) were below 20 years, 50 (16.7%) were between 21 to 30 years, 75 (25%) were between 31 to 40 years, 150 (50%) were between 41 to 50 years, 20 (6.67%) were between 51 to 60 years. There were no respondents in the 61 and above age bracket. This could be attributed to the fact that people of this age have already retired and left the city. The few that were available to respond thought it was best to have a younger person in the household handling the EE-waste matter since it sounded too technical for them.

Key informants were asked about their gender. All 7 mobile phone repairers from Harambee Shopping Center were male; 4 out of the Garbage Firm Managers interviewed were male; and 2, female. The Safaricom Retail Manager interviewed was male. This agreed with what Osibanjo (2015) says, that EE-waste refurbishing, collection, and recycling businesses were dominated by men.

1.11.2 Health Hazards of E-waste

Table 1 | *below shows types of diseases that can be caused by E-waste.*

Responses	Frequency	Percentage
Heart disease	100	34
Respiratory disease	70	25
Blood abnormality	60	20
Not aware	50	16
Other: hearing problems, skin diseases etc	15	5
Total	**295**	**100**

Source: Researcher, Wanjiku Githaiga (2017)

Table 1 above shows that majority of the respondents; 100, (34%) stated that heart disease is caused by E-waste, followed by respiratory disease at 25%, blood abnormality at 20%, not aware at 16% and hearing problems at 5%. This was the case because most of the respondents (63%) have tertiary levels of education and were thus aware of the health hazards caused by E-waste. The study findings have also been supported by Wong et al., (2007), whose study highlighted the various neurological, digestive, and respiratory conditions that emerged as a result of E-waste.

Literature by Wong et al., (2007) in Guiyu, East China, showed that pregnant women and lactating mothers are at risk of respiratory and heart diseases through inhaling lead fumes from recycling phone factories. Children born in such environments end up dying prematurely or have stunted growth due to lead fume exposure. The study also showed that 16% of the respondents were not aware of any health hazards caused by E-waste. This can be attributed to the low education levels of some of the respondents, which according to Figure 2, stood at 13%.

Key informants to this study were asked whether they were aware of the health hazards caused by improperly discarded mobile phones. From the interviews, 5 mobile repairers and 5 Garbage Firm Managers said they were not aware of the health hazards caused by improperly discarded mobile phones.

One of the respondents asserted that:

> *"As a business man, my main aim is to make profit. The day I will start thinking about the environment, my children will sleep hungry. By using spares from an obsolete phone to refurbish a new one, I make a decent profit from that, which goes into uplifting my life and my childrens'. They need to go to school, eat and live a normal life and they all depend on me. The profit that I make from this enables me to ensure that these children live a comfortable life. As far as I am concerned, I only collect, repair and sell phones. Let the organisations in charge of the environment do their work as well." (Mobile phone repairer, RH).*

Other two respondents were aware of the health hazards caused by improperly discarded mobile phones.
One of the respondents asserted that:

> *"… I am aware of health hazards caused improperly discarded mobile phones. I read widely, and have seen how countries such as China suffer from this menace. Children are born with respiratory complications, while others have stunted growth, to mention but a few. I also read somewhere that lead from mobile phones can cause complications in the blood system" (Garbage Firm Manager, RB).*

One of the mobile phone repairers said:

> *"I am aware of the health implications of improperly discarded mobile phones. I am an environmentalist and conscious about my environment. Once in a while I attend symposiums and seminars organized by Safaricom, NEMA and like-minded partner organisations. E-waste has been a key agenda in most of the meetings, so from this I have heard the various health implications associated with improperly discarded mobile phones. I try as much as possible to sensitize my clients but I realize I can only do so much. The government through NEMA has to take a lead in this. The danger with this whole situation is that we may not see or feel the effects associated with EE-waste for now. The adverse effects build up subtly, each day. I fear for the day we will wake up and find our planet has been completely destroyed and we have no other planet to run to. For now, people are enjoying the profits that come with selling the profitable parts in say, a mobile phone. The business is lucrative because you are making good money from a phone that is already dead. However, it has to come to a point where people love their lives enough to know how to strike a balance between managing EE-waste and making money out of it. I believe until we know and feel the effects, such as individual health deterioration, we will continue to just joke around" (Mobile phone repairer, RJ).*

1.11.2 Environmental Hazards of E-waste

Respondents were asked whether they were aware of the environmental hazards caused by discarded electronic equipment. Out of the 295 respondents, 245 stated that they were aware of the environmental hazards caused by discarded electronic equipment, while 50 were of the contrary opinion. The 245 respondents also mentioned that E-waste results in toxic soils used for planting, increase of toxic rain or river water and clogging of drainage systems.

The findings have been supported by literature from National Environment Management Authority [NEMA] (2007) guidelines, which indicated that E-waste causes blockage of water run-off channels, ozone depletion, and erratic weather systems. E-waste has also been seen to result in increased toxic materials such as lead in soils and in rain water. Such toxic materials can cause heart and respiratory conditions. The study findings also concur with literature from Gupta (2012) who stated that E-waste emits brominated dioxins, heavy metals, and hydrocarbons in the air, resulting in air pollution, later causing respiratory diseases. These toxic gasses are also responsible for global warming.

Key informants were asked whether they knew of any environmental hazards caused by improperly discarded mobile phones. Of the respondents, 6 mobile phone repairers and 5 Garbage Firm Managers were not aware of the environmental hazards caused by improperly discarded mobile phones, only 1 mobile repairer and Garbage Firm Manager were aware of this.

1.11.3 Existing National and County Government Policies

Respondents were asked whether they were aware of the laws governing E-waste management in Kenya. Majority of the respondents 255 (86%) were not aware of any laws governing E-waste management in Kenya while, 40 (14%) were aware. Those who stated that they were aware of the laws governing E-waste in Kenya, indicated that they had information concerning laws governing E-waste due to the nature of their jobs, businesses, or area of expertise.

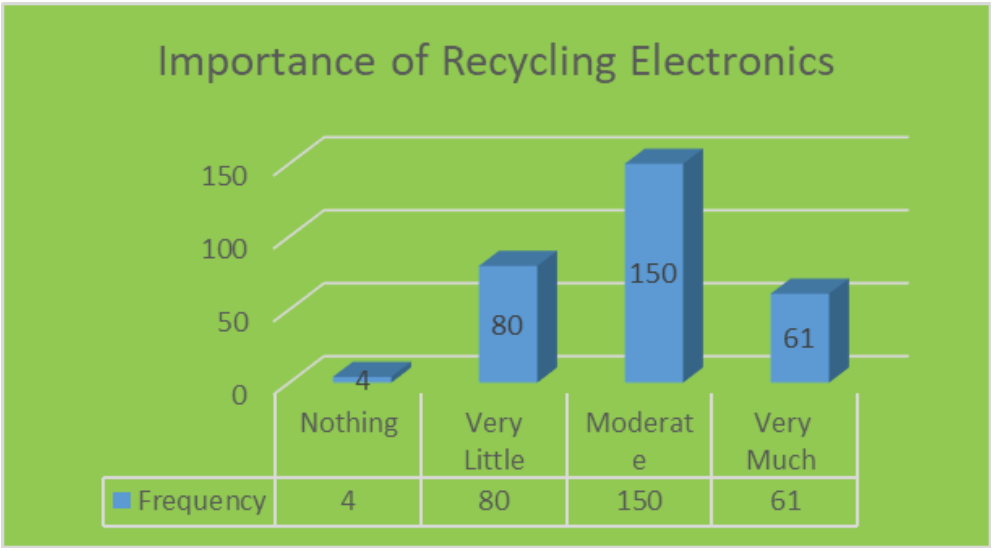
1.11.4 Practices for Disposal of E-waste

The study sought to find out whether respondents had waste collectors in their areas of residence. All respondents, 295 (100%) stated that they have garbage collectors in their estates. This is because residents of Harambee sub-Location have an organized system of waste management through the use of private garbage collectors. Respondents were also asked whether they separate their EE-waste for waste collectors. All respondents 295 (100%) stated that they do not separate their E-waste. Some of the reasons said they had not been asked to, it was not their job while others said that they were not aware that they were supposed to separate EE-waste from other waste.

1.11.4.1 Knowledge on Recycling Electronics

Figure 2 below shows knowledge on the importance of recycling electronics.

***Figure 2** | Knowledge on importance of recycling electronics*



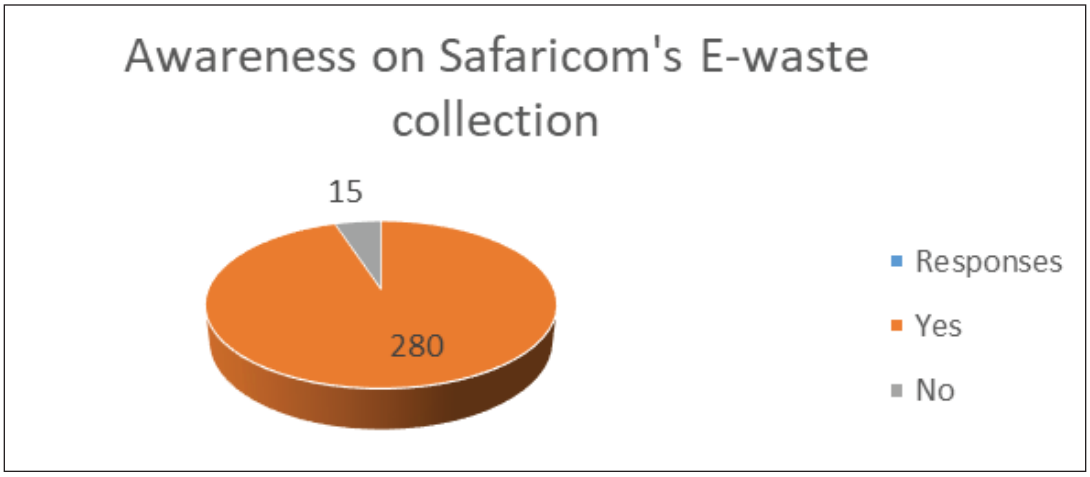
Source: Researcher, Wanjiku Githaiga (2017)

Majority of the respondents 150 (51%) stated that they had moderate information concerning the importance of recycling electronics. This was followed by 80 (27%) who had very little information, 61 (21%) who had a lot of information, and 4 (1%) that were least informed. Majority of the respondents had moderate information. This can be attributed to the tertiary level of education which most respondents had. Those with the least information could be attributed to some respondents having no education or being ignorant.

1.11.4.2 Awareness on Safaricom E-waste Collection Program

Respondents were asked whether they were aware that Safaricom takes back dead mobile. Figure 9 below shows their response.

***Figure 3** | Awareness on Safaricom's E-waste Collection Program*



Source: Researcher, 2017

Figure 3 above shows that out of the 295 respondents, 280 (95%) stated that they were not aware of the Safaricom E-waste Collection Program, while 15 (5%) reported of knowing about the program. Majority of those who stated they did not know about the program argued that they had not seen any advertisement, either print or electronic, about the EE-waste collection program. Respondents who knew about the program stated that they got the information from Safaricom agents and were also intentionally conscious on all matters environment. They also added that they learnt about the Safaricom E-waste Program from attending conferences and trainings organized by Safaricom, at times in partnership with NEMA.

Conclusion

The purpose of the study was to assess awareness levels of the Safaricom E-waste Collection Program in Harambee sub-Location, Nairobi County, Kenya. The study sought to examine the health hazards of E-waste; effects of E-waste matter on the environment; evaluate existing national and county government policies on E-waste disposal; and establish practices for disposal of EE-waste in Harambee sub-Location.

The first objective focused on examining the health hazards of E-waste amongst residents in Harambee Sub- Location. Results of this study indicate that residents of Harambee Sub- Location know that heart disease, respiratory and blood abnormality diseases are caused by E-waste. Majority of the respondents indicated that these diseases are caused by E-waste. The same sentiments were also shared by all key informants. The study also found that majority of the respondents were aware of components in the mobile phone that can be toxic to their health.

The second objective sought to establish the effects of E-waste matter on the environment in Harambee sub-Location. The study found that majority of the respondents were not aware of the environmental health hazards caused by discarded electronics. This was largely due to lack of information on environmental matters, or ignorance. Lack of information on environmental hazards caused by E-waste might have adverse effects on the environment.

The third objective focused on evaluating existing national and county government policies and regulations on E-waste disposal in Harambee sub-Location. Results from the study indicate that majority of the respondents were not aware of any existing guidelines on E-waste disposal. This was due to limited information and to ignorance from the respondents. One of the organisations mentioned that regulation of the disposal of mobile phone waste included the National Environment Management Authority (NEMA). The study finds that the public's knowledge on guidelines governing EE-waste is low, and this might lead to continued destruction of the environment.

The fourth objective sought to establish practices for disposal of EE-waste in Harambee sub-Location. Study findings indicate the majority of respondents prefer to sell their non-functioning mobile phones instead of taking them back to Safaricom. The main reason cited was lack of incentive from the mobile phone company. Majority of the respondents were not aware of the take-back program of non-functioning phones by Safaricom. Due to this, respondents continued to improperly dispose of their malfunctioning phones, which led to negative impacts on health and the environment.

Recommendations

i. There is need to educate the public on negative environmental impacts of E-waste. This will result in an informed public and one which will be more cautious about the disposal of E-waste.
ii. There is need for more sensitization to the public on Safaricom's E-waste Collection Program. This should be done by the mobile phone company on a regular basis. This will result in an eco-friendly way of disposing non-functioning mobile phones. There is also a need for Safaricom to offer incentives for consumers to return malfunctioned phones.
iii. Government and NEMA need to strengthen their guidelines on EE-waste and create policies on the same. This would result in proper regulations on EE-waste and cast a clear path for the public on how to handle E-waste disposal.

References

Alan, Bryman, (2008). Of methods and methodology, Qualitative Research in Organisations and Management: An International Journal, Vol. 3 Issue: 2, pp.159-168

Communication Commission of Kenya, (2008). Communications statistics report, CCK, Nairobi. http://www.cck.go.ke/resc/statistics/Communications_Statistics_Report_2008.pdf

Churchill, G., & Lacobucci, D. (2007). Marketing Research: Methodological Foundations. Ohio: Cengage Learning.

David W, Velis, C., Costas, Cheeseman, and Chris (2006). Role of informal sector recycling in waste management in developing countries, Habitat International, 30, 797-808.

Guidelines for E-waste Management in Kenya, 2007

Gupta Mamta, (2014), Environmental Effects of Growing E Waste, Volume 3 Issue 12, Page 204-206, https://www.ijsr.net/archive/v3i12/U1VCMTQyOTY=.pdf

National Environment Management Authority (2012). E-waste management in Kenya, Annual report.

Osibanjo, O. (2015). Gender and E-waste Management in Africa, in Gender Heroes; From Grassroots to Global Action: a Collection of Stories Featuring Gender Perspectives on

Oteng-Ababio, M. (2012). E-waste Management in Ghana– Issues and Practices, Ghana. University of Ghana, Department of Geography and Resource Development, Legon, Accra, Ghana.

Punch, K. (2010). Developing effective research proposals. 2nd ed. London: Sage Publications Ltd.

Rao, M. 2011. Regional hubs of excellence and innovation. Mobile Africa report (2011). Mobile Monday.www.mobilemonday.net/reports/MobileAfrica_2011.pdf

Rolf Widmera, Heidi Oswald-Krapf, Deepali Sinha-Khetriwal, Max Schnellmannc, Heinz Boni., 2005. Global perspective on E-waste. Technology and Society Lab, Empa, Swiss Federal Laboratories for Materials Testing and Research, Lerchenfeldstr. 5, CH-9014 St. Gallen, Switzerland

Smith, T., Sonnenfeld, D.A., & Naguib Pellow, D. (2006). Challenging the chip: Labor rights and environmental justice in the global electronics industry Philadelphia, PA, Temple University Press.

Wong, C. S., Duzgoren-Aydin, N. S., Aydin, A., & Wong, M. H. (2007). Evidence of excessive releases of metals from primitive E-waste processing in Guiyu, China. Environmental Pollution, 148(1), 62-72.

UNEP, (2007). Environmental Pollution and Impact on Public Health; Implications of the Dandora Municipal Dumping Site in Nairobi, Kenya, Urban Environment Unit.

UNEP, 2009. Recycling—From E-waste to Resources: Sustainable Innovation and Technology Transfer Industrial Sector Studies, United Nations Environment Program.

S.EN.S. Annual Activity Report (2003; 2004) http://www.sens.ch 15th March 2015 2010 Hours

SWICO. Annual Activity Report (2003; 2004) http://swico.ch 15th March 2015 Hours

Swiss E-waste Competence Report 2003; 2004 www.E-waste.ch 15th March 2015 2020 Hours C.C.K, (2012). Counterfeit phones statistics reports, Nairobi, Kenya. http://www.mobilemuster.com.au/media/39176/mobilemuster_annualreport_2013_lr

The 2016 FinAccess Household Survey-FSD Kenya (2016) http://www.fsdkenya.org/wp-content/…/02/The-2016-FinAccess-household-survey-report1.pdf