

**FACTORS INFLUENCING EFFECTIVE MANAGEMENT OF
ELECTRONIC WASTE: A CASE OF CYBER CAFES IN NAIROBI
CENTRAL BUSINESS DISTRICT, KENYA**

BY

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the Award of the Degree of Master of Arts in Project Planning and Management of
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DECLARATION

This research project report is my original work and has not been presented for academic purposes in any university.

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L50/63974/2010

This research project report has been submitted for examination with my approval as the university’s supervisor.

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DEDICATION

This research project is dedicated to my parents Mr.Sospeter N.Mwathi and Mrs. Rosemary W. Mwathi for their prayers and support.

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LIST OF ABBREVIATIONS AND ACRONYMS

CBD	Central Business District
CFSK	Computer for Schools Kenya
CPU	Central Processing Unit
EEE	Electric and electronic equipment
EOL	End of Life
ICT	Information Communication Technology
NEMA	National Environmental and Management Authority
RFID	Radio Frequency Identification
SPSS	Statistical Package for Social Sciences
UNEP	United Nations Environmental Programme

ABSTRACT

This study sought to examine the factors influencing effective management of electronic waste with particular focus on cyber cafes in Nairobi Central Business District. The study sought to increase understanding, enlighten and create public awareness about the problem of e waste. It further provided an emphasis on use of environmentally sound management of hazardous waste as stipulated in the Basel convention. Through the study, it is expected that proper understanding of e waste management could be a source of employment opportunities for the youth. The purpose of this study therefore was to examine factors contributing to effective management of e waste. The study sought to accomplish the objectives of ; determining the extent to which the availability of financial resources, public awareness influences effective management of electronic waste by cyber cafes in Nairobi CBD, assessing the extent to which existing regulatory framework influences effective management of e waste by cybercafés in Nairobi's Central Business District and establishing the extent to which availability of relevant technology influences effective management of electronic waste by cyber cafes in Nairobi CBD. The study used a descriptive survey design to accomplish its objectives. The target population of the study was the licensed cyber café shops operating within Nairobi CBD as demarcated by Uhuru Highway, Haile Selassie Avenue, Moi Avenue and University Way. The study used random sampling to identify 168 cyber cafes to participate in the study. The study used primary data sources which were obtained using questionnaires and secondary sources through review of relevant literature. The qualitative data generated was analyzed by the use of content data analysis and quantitative data was analyzed using descriptive statistics including percentages, frequencies, means and standard deviation. The response rate for this study was 76.8%. On period of operation, a third has operated their cybercafés for a period of 5-6 years. A proportion of 26.36% have been in operation for 3-4 years, while 22.48% have operated the cybercafés for over 6 years. With regard to the management of electronic and electric waste and the results of data analysis, Kenya has inadequate financial resources to manage electronic waste. In addition to these, the public are not well versed with such waste. Technology and technical skills of dealing with e waste such as recovering valuable items from computer systems and presence of refurbishing systems in Kenya are unavailable. The result of these is resale of obsolete or almost end of life electronic and electrical appliances as one of the ways to deal with e-waste. The study recommended that, the government through legislation should come up with laws that specify handling of e-waste in Kenya. In addition, it also recommended special bins, fixed or mobile, to be put in place so that, end-of life appliances can be safely disposed and to make it easier to manage the waste unlike when mixed with daily household garbage. Further study can be done to investigate the role of government on managing e-waste in Kenya. In addition, another study can be undertaken to analyse effectiveness of policies controlling importation and donation of second-hand electrical and electronic appliances.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

There has been an increasing pace in the production of electrical and electronic equipment within the manufacturing activities. This has led to an increase of waste in electric and electronic equipment. Davis & Heart (2008) define e-waste as obsolete, end-of-life or discarded appliances that use electricity. On the other hand, Peralta & Fontanos (2005) define e-waste as electronic products that no longer satisfy the needs of the initial purchaser.

With the unrelenting pace of technology changing every moment, it is not strange to see electronic products become out-dated within a short time and disposed away as rubbish (Communication Commission of Kenya,2008). This growth coupled with urbanization and growing demand for consumer goods has increased both the consumption of electrical and electronic equipment (EEE) and consequently the production of waste in electric and electronic equipment (WEEE). This can be a source of hazardous waste that poses risk to the environment and to sustainable economic growth.

While electronic component like a personal computer may contain valuable materials such as gold, Heart (2008), notes that they may also contain toxic substances such as lead, mercury, arsenic, cadmium, and selenium and hexavalent chromium. The trend towards pervasive computing therefore means that more and more everyday commodities will contain microprocessors with the borderline between classic electrical equipment such as refrigerators and electronic equipment becoming blurred.

Today, more than 98 per cent of all programmable microprocessors are embedded in commodities that are usually not perceived as computers (Cairns,2005). Even more relevant from an environmental point of view, many commodities that until recently were considered “nonelectric” are now being equipped with microprocessors for extended functionality, or with radiofrequency identification (RFID) transponders for contactless identification. Given these trends in ICT diffusion and application, it is likely that the dissipation of valuable and toxic

materials due to the distribution and disposal of electronics will continue, unless effective countermeasures are taken. The ecological, economic and social consequences resulting from poor handling and management of e-waste include air pollution, especially when e-waste is burnt since most of them are non-biodegradable equipment (Buenker, 2007). The toxicity and radioactive nature of e-waste is dangerous to the humans since they are found in water, soil and animal products. Furthermore, they block the water runoff channels, thus increasing the amount of waste. In economic terms; substantial public spending on health care goes up when the hard chemicals affect people's health through lead poisoning and cancerous mercury. Ozone depletion has also been cited as a result of poor disposal of e-waste, and can lead to unpredictable weather conditions through prolonged droughts and floods.

The current global production of E-waste is estimated to be 20-25 million tons per year, with most e-waste being produced in Europe, the United States and Australia. China, Eastern Europe and Latin America will become major e-waste producers in the next ten years (Robinson, 2009). E-waste is one of the fastest growing waste streams in the world. The increasing market penetration in developing countries, replacement market in developed and high obsolescence rate, make e-waste as one of the fastest growing waste streams (Arora, 2008). The rapid increase in the volume and types of solid waste and hazardous waste generation as result of economic growth, urbanization and industrialization represents a growing problem to both national and local governments in their efforts to ensure the effective and sustainable management of waste. Notwithstanding the considerable efforts made by many governments, international and national organization and agencies in tackling waste-related problems, international reports indicate that there are still major gaps to be filled in this area (UNEP, 2007).

African countries still lag behind when it comes to enacting legislation to deal with electronic waste. This is despite well documented evidence showing that African countries have been the recipients of electronic waste illegally exported from various affluent nations. It has been observed that informal collection, dismantling and recycling of e-waste is beginning to take shape in several countries such as Nigeria, Ghana and Kenya. However, the absence of infrastructure, appropriate collection and recycling services for electronic waste is still a major

challenge in addition to scarcity of data on amounts of waste electrical and electronic equipment generated (Ban, 2005; Nnorom&Osibanjo, 2008).

The uniqueness of e-waste problem in Kenya is that e-waste is relatively new and its quantities are rapidly growing as technology becomes more common. Like other developing countries, Kenya has not yet developed a legal framework and thus, has not established environmentally safe waste management levels to keep in pace with technological change. According to CCK, (2010), Kenya has a broad regulation in EMCA for environmental protection that is not specific to e waste. In view of escalating e waste in Kenya, Serگون (2010) notes that the country is trapped in a scenario where there is a need to promote e government by promoting access to ICT, developing infrastructure to foster development in line with vision 2030 and increased E waste that poses a challenge to environmental sustainability and human health.

The Nairobi Central Business District which is the focus of this study is centre for electronic products and wastes. The CBD is the centre of Nairobi which is the 4th largest city in Africa. It is a designated commercial area and a preferred choice of many as far as businesses are concerned. Due to strong affinity for commercial activities, many ICT related businesses among the most popular being supermarkets are located in this area. It is also the region within which consumers of electronic materials and equipments are likely to visits for their needs. It will thus be expected that as demand for electronic products and services increases, many will visit the Nairobi central business to have their needs met. This consequently increases the operations of acquisition of new electronic products and disposal of electronic waste in firms dealing with such materials. As an area of focus to this study, the cyber cafes within Nairobi Business District are expected to provide adequate information on factors affecting effective electronic waste management.

1.2 Statement of the Problem

Concerns have been raised over increasing pace of e – wastes in Kenya (Robinson, 2009). This can be partly associated to technological revolution that has increased demand of electronic goods. In light of this, Cairns, (2005) notes that there is an urgent need for government and other stakeholders from the private sector to streamline management of e waste especially in the wake of increased turnover of electronic equipment in the country. He further notes that if not carefully

managed, it will be a threat to environment and human health. In Kenya, Communication Commission of Kenya, (2010) indicates that escalating increase in e waste has left the country in double sided decision. While the government seeks to promote access to ICT and development of ICT infrastructure as a strategy towards the achievement of vision 2030, Jerson (2010) notes that the disposal of e waste is costly to the environment and nations have to think how to address them.

Various authors have provided an indication that effective e- waste management is a multifaceted issue and thus affected by several factors. Njiriani (2010) identified government policies, privatization and business liberation as contributing factors in e- waste management. Luther, (2009) identified the requirement of e waste management in a paper on environmental policy analysis. She underscored the issue that devices such as personal computers, central processing units (CPUs), laptop computers , printers , computer mice and keyboards have potential to exceed toxicity and hence the need to classify them as hazardous waste. According to UNEP (2007), Nairobi is particularly faced with several challenges of e waste disposal. As the report notes, Kenya continues to be recipient to electronic imports among which are computers from developed countries. These computers are likely to end up in cyber cafes, offices and well as personal desktops in people's homes. The influx of such electronic wastes happens without proper structures to manage them.

While it is apparent that e waste is a matter of great concern for government, environmentalist, researchers as well as citizens in any particular country, there is scanty evidence that indicates attempts to address the issue of waste management in a context specific manner. Drawing from the review of studies, management of e- waste has in most cases been done to bring out general outlook of the issues under examination. Such general outlook of issues is likely to bring the broad picture of e waste management mainly from country or continent perspective; moreover, studies on e-waste management hardly bring out sector specific issues. This would indicate that a gap remains to be addressed as far as examining the issue of e waste management is concerned. It is therefore on basis of this background that this study sought to examine the factors influencing effective management of e-waste in Nairobi's Central Business District with a focus on Cyber cafes in Nairobi's Central Business District.

1.3 Purpose of the Study

The purpose of this study was to examine the factors influencing effective management of e waste in Nairobi's central business district.

1.4 Objectives of the Study

- i. To establish the extent to which availability of financial resources influences effective management of electronic waste by cyber cafes in Nairobi CBD.
- ii. To determine the extent to which public awareness influences effective management of electronic waste by cyber cafes in Nairobi CBD.
- iii. To assess the extent to which existing regulatory framework influences effective management of e waste by cybercafés in Nairobi's Central Business District.
- iv. To establish the extent to which availability of relevant technology influences effective management of electronic waste by cyber cafes in Nairobi CBD.

1.5 Research questions

The study sought to answer the following research questions

- i. To what extent does availability of financial resources influence effective management of electronic waste by cyber cafes in Nairobi CBD?
- ii. To what extent does public awareness influence effective management of electronic waste by cyber cafes in Nairobi CBD?
- iii. To what extent does existing regulatory framework influence effective management of e waste by cybercafés in Nairobi's CBD?
- iv. To what extent does availability of relevant technology influence effective management of electronic waste by cyber cafes in Nairobi CBD?

1.6 Significance of the study

Issues of environmental conservation and sustainability have taken centre stage all over the world in the recent past. The findings of this study will increase understanding, enlighten and create public awareness about the problem of e-waste.

The study emphasized on use of environmentally sound management of hazardous waste as stipulated in the Basel Convention. A proper understanding on e-waste management could provide the much needed employment opportunities for the unemployed youth. For instance in China, e-waste recycling is carried out by an informal sector comprising mostly the youth.

1.7 Delimitation of the Study

This study set out to analyse the factors influencing effective management of electronic waste by cyber cafes in Nairobi Central Business District. It was expected that the researcher will easily reach out the target population owing to high concentration of cyber cafes in Nairobi central business district. The study was limited to four variables that is, availability of financial resources, public awareness, existing regulatory framework and relevant technology. The study was carried out in the licensed cyber cafes operating in Nairobi CBD.

1.8 Limitations of the Study

The time available to carry out the study was limited and hence this limited the scope that could be covered. The funds available were also limited given that the researcher was self-sponsored. These shortcomings were addressed through proper planning of both finances and most importantly time. The researcher came up with a schedule of activities that was strictly followed.

1.9 Assumptions of the Study

It was assumed that the managers or proprietors of the licensed cyber cafes operating at Nairobi CBD were available for the research and that, they possessed relevant knowledge that helped the researcher to make accurate conclusion.

1.10 Definition of Significant Terms Used in the Study

Electronic Waste: Electronic products that have reached their end of life and are no longer useful to their owner.

Waste management: The administrative and operational activities that are used in handling, packaging, treatment, conditioning, reducing, recycling, reusing, storage and disposal of waste.

Financial Resources: Amount of funds required to facilitate effective electronic waste management.

Public Awareness: State or condition of having knowledge and consciousness about the subject matter by members of public.

Regulatory Framework: Legal and institutional structures and instruments required for effective electronic waste management.

Relevant technology: Technical know-how, equipment and infrastructure needed for effective electronic waste management.

1.11 Organization of the study

This research project encompasses five chapters:

Chapter one contains the background of the study, the statement of the problem, the purpose of the study, objectives of the study, research questions. It also contains the significance of the study, delimitation of the study, limitations of the study, assumption of the study and definition of significant terms. Chapter two contains review of related literature as well as the conceptual framework. Chapter three is on the research methodology. It contains various subtopics which include research design, target population, sample selection and sample size, research instruments, methods of data collection, validity and reliability of the instrument.

Chapter four discusses the data and findings of this study presented in tables. Chapter five deals with summary of findings, discussions, recommendations and likely areas of further research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews literature related to electronic waste and electronic waste management. It contains the following sub topics: concept of e-waste management current status of e-waste management in Kenya and the factors influencing effective management of electronic waste.

2.2 Concept of E-Waste Management

E-waste management is the management of activities associated with generation, storage, collection, transfer, transport, processing and disposal of e-waste which should be environmentally compatible adopting principles of economy, energy, aesthetics, and conservation. It encompasses the general functions of management like planning, organizing, forecasting, directing, controlling and staffing in ensuring all the various parts of the undertakings function accurately and efficiently (Kiogora, 1995).

The e-waste concept came to light as far back as in 1970s and 1980s following environmental degradation that resulted from hazardous waste imported to developing countries (Shinkuma & Huong, 2009). In reaction to hazardous waste importation, the Basel Convention on the control of trans boundary movements of hazardous wastes and their disposal was instituted in 1992 to control the situation. Since then many countries have become members of the convention. Although the Basel Convention does not regulate second hand items and some e-waste scrap, it has played a role in banning exportation of obsolete products and engineering waste solutions. For example its theme in 2006 was: creating innovative solutions for the environmentally sound management of electronic waste (Buenker, 2007).

E-waste phenomenon continues to flourish due to rapid adoption and use of ICTs which has contributed to increase in e-waste stream. E-waste is said to be one of the fastest growing waste streams (Cairns, 2005); growing at a rate of 3–5% per annum i.e., approximately three times faster than an ordinary municipal solid waste (Davis & Heart, 2008). Increase in e-waste stream

has attracted the attention of many governments, individuals and researchers due to its impact on the environment and human health. According to Schluep, et al., (2008), ICTs are expensive to acquire and maintain. Difficulty in acquiring ICT materials such as hardware and software in developing regions has led to consumption of second hand products and software piracy.

Besides affordability factors, Nnorom & Odjango (2008) suggest that e-waste is internally generated or imported illegally as used goods in an attempt to bridge the so-called digital divide. Economically, urbanization and the growing demand for consumer goods in different regions of the world have increased the demand and supply of electronic products (Babu et al., 2007). This will lead to increased volume of e-waste. Robinson (2009) observes that computers, mobile telephones and television sets will contribute 9.8 million tons in e-waste stream by 2015. These figures indicate that there will be a rise of 4.2 million in e-waste stream from 2010 to 2015 resulting from only computers, mobile telephones and television sets.

A study by Greenpeace in 2008 estimated that, 25% and 20% of the e-waste is recycled safely in Europe and USA. It also shows that China and India which have the biggest population in the world have large informal recycling sectors. For example 99% of India's e-waste goes to informal recycling sectors. This indicates that biggest portion of e-waste generated worldwide is not properly recycled.

It is clear that some of the discarded electronic gadgets contain highly toxic materials (Liu, 2009). Toxic materials can cause devastating health problems, for example cancer. In addition, e-waste pollutes the environment. Therefore poorly disposed ICT products such as computer hardware pose health threats to society. As the number of ICT users grows, e-waste will increasingly become an environmental/health hazard. Apart from the direct problems, this will also discredit ICT as a tool for development especially in poor regions. In relation to the above background, drastic measures are required to prevent e-waste from escalation.

2.3 Current Status of E-Waste Management in Kenya

The e-waste problem in Kenya was brought to the spotlight in September 2006, during the eighth Conference of Parties (COP 8) to the Basel convention on Trans-boundary waste management that was held in Nairobi. Before that, it was not considered urgent due to the assumed relatively low consumption of electrical and electronic equipment (EEE) and the general trend by households to store EEE, reuse it or dump it along with the mass solid waste.

There is a variety of EEE found in the country ranging from computers, cellular phones, televisions sets, refrigerators, and entertainment electronics amongst others. On the status of e-waste in Kenya, UNEP's Executive Director Achim Steiner (2007) stated that there is likelihood of emergence of e-waste being dumped in Kenya. He pointed out that the dumping is carried out under the guise of donations.

The telecommunication sector is one of the fastest growing sectors in the country; it has witnessed continued growth due to the introduction of wireless systems for providing fixed telephones services and heavy investment in the mobile sub sector. The mobile telephony has been a preferred option over the fixed landline by majority of the people due to the ease of acquiring the mobile phone as compared to the installation of the fixed landline and the widespread coverage including the rural and remote areas and the better services provided.

There are many other services provided by the mobile service providers that have attracted the large numbers in subscription, which include the M-Pesa money transfer services and the credit transfer services. The number of mobile subscribers grew from 6.4 million in 2005/ 06 to 9.3 million in 2006/ 07; this represents a 43% increase in the subscriber base (CCK, 2007).

This growth has in effect increased tele-accessibility in the country by about 28%. The growth in the mobile subsector in effect means that there has been an increase in the number of mobile phones purchased. The mobile market segment had an annual turnover of KSh 58 billion in the period 2006/07, against the previous year's KSh 45 billion (CCK, 2007). There has been an influx of second hand computers, mobile phones and accessories from Europe and Asia. The development in the ICT sector at large depends on second hand/reconditioned EEE that is imported into the country.

There is no data or statistics on the availability of various EEE in the country. The data available for televisions sets is contradictory with one source estimating that in the year 2004 only 17% of Kenyans owned a television set (Omosa and McCormick, 2004), while the other states that in 2005 32% of Kenyans owned a television set (Environmental Protection Research Institute 2009).

Currently on the market, there is an influx of cheaper television sets from Asia both second hand and new sets. Now more and more people can afford to purchase these products, and the contentious issue is the end of life disposal of these EEE as they have a short life span, especially the second hand television sets. The amount of pollutants in the television sets is much higher than in other EEE such as the washing machines and refrigerators. TVs contain hazardous and toxic components such as lead and phosphorescent (Barba- Gutierrez *et al* 2007).

2.4 Factors Influencing Effective Management of Electronic Waste

Factors influencing effective management of electronic waste under discussion have been highlighted here below. They include;

2.4.1 Availability of Financial Resources and Management of Electronic Waste

The electronics industry has played a critical role in science and technology in developing devices that have become so essential to our modern way of life. However, it represents an area where the opportunities to operate in a sustainable way have not been properly realized. Much electrical and electronic equipment (EEE) is typically characterized by a number of factors including improved performance and reduced cost in each new generation of products that generally encourage unsustainable behaviour. Hicks et al (2005), explain that, EEE for instance mobile phones are often treated like fashion items replaced long before their design lifetime has expired.

With products increasingly having short lifestyles, using hazardous materials and processes and generating waste both during manufacture and at the end of life, manufacturers of EEE have becoming an increasingly popular and easy target for environmental groups who have embarrassingly highlighted the deficiencies of many large international electronics companies.

A case study of Mexico by Davis (2007) showed that one among the factors that affect proper disposal of electronic waste management is weak municipal finances, capacity and coverage. According to Davis, the delivery of municipal services in solid and electronic waste management is frequently affected by poor finances and lack of proper incentives framework to ensure that generators pay for the actual cost of disposal. The development of stable cost-recovery mechanism has also been affected by limited managerial capacity that prevents sustained interest by private or autonomous entities in the provision of services.

In most developing countries-Kenya included, the most known possible way of managing electronic waste is through recycling mostly done in the informal sector. However, Stephenson, 2006 observes that in execution of such task, there is not enough value in most e-waste to cover the costs of managing it in a responsible way and thus financial incentives are required.

Given that one of the challenges of managing electronic waste is lack of public awareness on safe disposal of end of life appliances, sources indicate that, there is need to enlighten the public on the effects of these products (Stephenson, 2006). In addition to this Singh and Ramadhan (2010) suggests that, specific landfills and bins should be adopted to handle only electronic waste to keep distinct normal household garbage and electronic components from government agencies, education institutes, companies and ICT centers. However, the adoption of these measures lies on the hands of municipal kitty to finance such facilities. Considering the economy of developing countries, such a task might face neglect due to limited financial resources.

In developed countries, electronic and electrical waste processing usually first involves massive human resources in dismantling the equipment into various parts manually, but increasingly by use of automated shredding machine. A typical example by Hicks et al., (2005) is the NADIN electronic waste processing plant situated in Novi Iskar. The advantages of this process are the human's ability to recognize and save working and repairable parts, including chips, transistors, RAM. However, in developing economies, managing electronic waste in such a manner becomes costly due to the human resources cost and costs of obtaining relevant technology.

There are neither earmarked funds, nor investments that can be used to finance improvements in e-waste recycling and e-waste management; this is coupled by lack of appropriate infrastructure for recycling as most of the recycling activities are conducted by the repairers and refurbishes in

unregulated premises (Wexler, 2012). The lack of resources needed in planning, strategizing and management of e-waste has led to the problem not being regulated and properly addressed. Thus for the poor economies in this case, it becomes a challenge in maintaining green environment free from unattended electronic appliances that are hazardous to living organisms.

2.4.2 Public Awareness and Management of Electronic Waste

Electrical and solid waste is one of the most immediate, serious and visible environmental problems confronting municipal authorities in developing countries like Kenya (Robinson, 2009). Most of the municipal waste materials collected are dumped on open wasteland or low-lying areas even near creeks and other ecological sensitive regions in a more or less uncontrolled manner. Such inadequate e-waste disposal causes serious environmental problems that affect health of humans and animals and cause serious economic and other welfare losses.

This kind of disposal, however, does not meet the norms of disposal specified in the municipal solid waste rules (Rao, 1991) due to improper management and lack of public awareness, a major part of cities in developing countries is largely polluted and creates health sufferings of general people.

Stephenson (2006) explains that, few people are aware of recycling options for their old personal computers and televisions sets. Because of the apparent value of used electronic products, some give their used equipment to friends or family members before eventually storing these units in their garages or basements. In another perspective, consumers perceive their waste as a resource that can generate income, thus the unwillingness of consumers to give out their end of life goods for free. This perception is further enhanced by the value attached to products by the consumers; there is a tendency to store end of life electric and electronic equipment's especially mobile phones at home even if these products are obsolete as opposed to disposing them. The consumers' reluctance to pay for recycling and disposal services reinforces the notion that nothing goes to waste and that garbage is money.

In a study carried in Bangladesh by Sarker et al., (2012) to examine the public awareness about impact of electronic and solid waste disposal and its management system, one hundred people were selected through simple random sampling technique. Data were collected through

structured and semi-structured questionnaire and interview methods. The questionnaire containing 45 questions was developed to obtain the relevant information during the period from August to September 2011.

The data established that, 89% of the total respondents have more or less idea about waste. However, more than half of respondents (53%) do not have idea about hazards of electronic wastes such as health problem, aesthetic problem, lead and radioactive effects. 47% has no idea about how these wastes are causing problem or polluting the environment. Nevertheless, majority (87%) of respondents agreed that, their individual participation was very crucial to maintain the disposal system in a safe and appropriate manner whereas 13% did not have any headache regarding associated problems of electronic and solid waste.

In Kenya, it is estimated that 17,500 tonnes of e-waste in the form of refrigerators, old computers, televisions, mobile phones and other electronic equipment are produced (Humanipo, 2013). Due to improper disposal of the electrical and electronic waste, dangers of non-communicable diseases such as cancer are on rise with significant contribution to environmental degradation (UNEP, 2007).

The People Daily of 24th July 2013 highlighted that, all citizens are generators of electronic waste and at some point there is need to dispose them off. In addition, the paper highlighted that there is no proper awareness on electronic waste disposal in Kenya. It is only in June 2013 according to Humanipo (2013) that Safaricom, Kenya's leading mobile operator, promised to launch an E-waste Disposal awareness campaign aiming to educate the public on the practice of disposing electronic and electric equipment.

The literature available indicates that, members of the public are aware that electrical components become obsolete but they have no idea on the proper way to dispose the electronic waste. Due to the hazardous nature of the e-waste, therefore, it should be segregated at source because only few people know the dangers of improper e-waste disposal.

2.4.3 Regulatory Framework and Management of Electronic Waste

The fundamental principle for development of E-waste regulations is based on the conceptual life cycle of electrical and electronic equipment (EEE). The major feature in any policy/ law / regulation is the definition of WEEE / E-waste and the sections/ blocks in the life cycle which need to be regulated.

Ramachandra et.al, (2004) note that management of E-waste in industries should begin at the point of generation. This can be achieved through waste minimization techniques and sustainable product design. In industries, waste minimization involves adopting inventory management; volume reduction and recovery, production process modification and re-use.

The Kenyan government, in realization of the need to protect and conserve the environment and the need to safeguard the public health has enacted several laws to regulate and protect the same. There is no specific legislation that deals with e-waste in Kenya (Bwalya and Zulu, 2012). However, various legislations can be read to impact on e-waste. The overall objective of these legislations is to reduce the generation and environmental impact of all forms of waste and to ensure that the health of the people and the quality of environmental resources are no longer significantly affected.

Waste management in Kenya is under the auspices of the Local Authorities as mandated under the Local Government Act (CAP 265) and Public Health Act (CAP 242). These pieces of legislation make the local authorities responsible for the provision and management of municipal waste.

The Public Health Act (Cap 242) of the Laws of Kenya defines nuisance as to include, any accumulation or deposits of refuse, offal, manure or other matter whatsoever which is offensive or which is injurious or dangerous to health. Section 118 (i) (h) further defines nuisance to include, any accumulation of stones, timber or other material if such in the opinion of the medical officer of health is likely to harbour rats or other vermin.

This Act does not give guidelines on how solid waste management should be carried. There are no recommended ways of storage, collection, transportation, processing and disposal of waste.

The Act only stipulates penalties for those who fail to comply with the notice given by the medical officer of health to remove the nuisance (Government of Kenya, 2010).

The main shortcoming with these statutes is the fact that they are silent on sound environmental management of waste. However enactment of the Environmental Management and Coordination Act (EMCA 1999) provides a conduit to address the waste management scenario in Kenya as there are provisions on the manner in which waste should be handled. The provisions by EMCA regarding handling and disposal of wastes state that: “no person shall discharge or dispose of any wastes in a manner that would cause pollution, to the environment or ill health to any person; no person shall transport wastes except to a licensed wastes disposal site established and in accordance with a valid license issued under the Act (EMCA 1999).

This act mandates the National Environmental Management Authority (NEMA) to develop regulations on waste management including hazardous waste management. The authority has gazetted regulations for the management of hazardous waste. These regulations prescribe the procedure and the criteria for the classification of toxic and hazardous materials with their toxicity and the hazard they present to the human health and environment; labelling, packaging and processing of chemicals and materials; control of imports and exports of toxic and hazardous chemicals and materials permitted to be imported or exported; transportation, distribution, handling of chemicals and materials, storage and monitoring of their residue on human health and environment.

In line with the mandate, NEMA developed waste management regulation in 2006. Part IV of this regulation deals with hazardous waste in totality, i.e. the hazardous waste specifications, requirement for Environmental Impact Assessment (EIA), handling, storing and transporting, export permit and its validity, transit of hazardous was and insurance amongst other issues. However, the waste management regulations of 2006 are not explicit when addressing e-waste; the components of e-waste are covered under various facets of the regulation such as hazardous waste management and chemical waste management. The lack of explicit and detailed mention on e-waste has created loopholes in the regulation as the e-waste handlers and actors do not comply with the regulation requirements on waste handling, as they state that the regulation does not cover e-waste.

In a cause to fight against hazardous waste, Kenya is a signatory to numerous multilateral environmental agreements which include; Basel convention on the control of Trans boundary movements of hazardous wastes and their disposal; Bamako convention on the Ban of the imports into Africa and the control of trans-boundary movement of hazardous wastes into Africa; Nairobi convention which provides a mechanism for regional (East Africa) cooperation, coordination and collaborative actions on solving pollution problems of the coastal and marine environment; Stockholm convention on Persistent Organic Pollutants (POPs) and; Rotterdam convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade.

Lack of national environmental laws or guidelines for e-waste increases susceptibility of such nations being points of exporting refurbished electronics. According to Third World Network (1999) a significant amount is likely sent to countries that have few if any protections for workers or countries with regulations that are not enforced thus the need to enact stringent laws in fight of lethal impacts of electronic waste.

2.4.4 Technology and Management of Electronic Waste

Africa is very susceptible to e-waste dumping because there is often a desperate hunger to catch up with the rest of the world in terms of technology (Osibanjo, 2007). This susceptibility has opened floodgates of second hand products and donations. There is high level of importation of e-waste as second hand devices, this importation is uncoordinated and most of the zero rated products such as computers can be imported without being changed at the point of entries as it does not generate any revenue to the government.

As the use of electrical and electronic components including television sets, mobile phones, computers and generally ICT equipment expands in all countries, their many benefits are linked by new challenges at their end-of-life referred to E-waste. Researchers such as Li et al., (2007) explain that, ICT equipment contains many metals, plastics and other substances, some of which are hazardous and others valuable resources equipment.

E-waste is a problem, which can potentially cause environmental damage if not dealt with in an appropriate way. However, the massive resource impact of electrical and electronic equipment (EEE) is widely overlooked (UNEP 2009). According to UNEP, summarizing the lack of closing the loop for electronic and electrical devices leads not only to significant environmental problems but also to systematic depletion of the resource base in secondary materials.

Within relevant existing literature on environmental problems, the terms technique and technology have been often used synonymously. However, Darby and Obama (2005) explains these terms are not synonymous within the e-waste discussion as technique refers to methods of creating new tools, establishing products of tools and the capacity for constructing such artefacts while technology refers to the know-how.

In the management of electronic waste, integrated waste policy and management which addresses environmental impacts along the whole life-cycle of products have to be considered. The known technological measures to handle e-waste include the 3R principle, i.e. reduce, reuse and recycle. Recycling reduces electronic waste taken to final disposal, improves energy efficiency and decreases consumption of natural resources. However, to achieve this relevant technology, sustainable innovation is required.

Sustainable innovation aims at a successful generation and commercialization of innovative technologies for achieving sustainable development and sustainable consumption and production patterns. Hence, sustainable technology innovation is an important driver for economic growth and productivity. It helps to reduce poverty and aides in minimizing negative environmental and health impacts. It is a critical dimension for developing countries and transitional economies. Without sustainable innovation these developing countries such as Kenya will remain disadvantaged and unable to make a shift to clean and resource efficient technologies and sustainable economic growth.

Technology transfer and capacity building are also critical tools to implement innovation in emerging economies. However, according to UNEP (2009) simply copying innovative technologies from post industrialized to industrializing economies does not necessarily generate the most sustainable solutions. Thus, capacity building and the fostering, coordinating and strengthening of existing regional capacities are essential for enabling industrializing countries to

stimulate local development of sustainable technologies and innovation and to allow them to experience progress and sustainable livelihoods.

Currently, the available data on e-waste arising is poor and insufficient and estimation techniques are required for extension of known data to regional-global coverage. However, especially in developing countries, the barriers for innovative and sustainable e-waste recycling technologies can be difficult to overcome. Consequently, recycling technologies have to be identified for a range of framework conditions and e-waste products.

With the recycling technology, markets for the recycled electronic appliances need to be created. The creation of markets can be regarded as the basis of technology transfer. The main drivers for the creation of recycling and recycling technologies markets are economic and regulatory factors. However, the market potential of e-waste recycling technologies and the framework conditions vary between countries and regions (WIPO, 2007).

Specifically, the most promising technologies for e-waste recycling need to be identified and fostered through relevant instruments. Particularly in many developing countries tools and instruments are required that promote the finance of collection and transfer of technology innovation in the field of e-waste recycling. This would save costs, energy and natural resources and could help countries to be less dependent on raw materials prices.

In Kenya, there is lack of relevant technology that can be used in the management of e-waste; this applies mostly to recycling technologies. The technological gap between the developed and developing countries compounded with the high price of acquiring this technology has led to the emergency of backyard recyclers who resort to usage of rudimentary techniques that pose a major threat to the environment and to their health.

2.5 Theoretical Framework

The study was based on Ajzen's theory of planned behaviour (1988). The theory of planned behaviour is the successor to the theory of reasoned action of Ajzen and Fishbein (1975, 1980). The succession was as a result of the discovery that behaviour appeared not to be 100%

voluntary and under control, which resulted in the addition of perceived behaviour control. With this addition, the theory was called the theory of planned behaviour.

According to the theory of planned action, behaviour is guided by three kinds of considerations. Behavioural beliefs that is beliefs about the likely consequences of the behaviour, normative beliefs. Belief about the normative expectations of others, and control beliefs about the factors that may facilitate or impede performance of behaviour.

Ajzens considerations are crucial in circumstances/ projects/ programmes when changing behaviour of people. In their respective aggregates, behavioural beliefs produce favourable or unfavourable attitude towards the behaviour. Normative beliefs result in perceived social pressure or subjective norm, and control beliefs give rise to perceived behavioural control. In combination, attitude towards the behaviour control lead to formation of behavioural intention. In general, the more favourable the attitude and subjective norm, the greater the perceived control, the stronger should be the person's intention to control the behaviour in question. The theory of planned action explains why merely proving information do not work. Increasing knowledge alone does not help behaviour very much. Campaigns that aim at attitudes, perceived norms and control in making the change have good and better results. Similarly in management programmes focus on explanation of importance is not likely to succeed but a combination of knowledge and attitudes.

Azjen's theory is suitable in explaining the behaviour behind the management of electronic waste. Like any other programme that needs management, managers of firms dealing with electronic waste management as well as the government have the duty to examine the effectiveness of their management strategies as far as effective management of electronic waste is concerned. The theory explains why some management styles may fail while others may not fail. Despite its application in management of electronic waste management, the theory has been faulted for basing its argument on cognitive processing and level of behaviour change. Critiques of the theory argue that some behaviour may be largely influenced by emotions.

2.6 Conceptual Framework

This is a schematic diagram illustrating the relationship between the dependent variable and the independent variables and other moderating variables. According to Kothari (2004), a conceptual framework provides the ideological position of a researcher as far as the study variables are concerned.

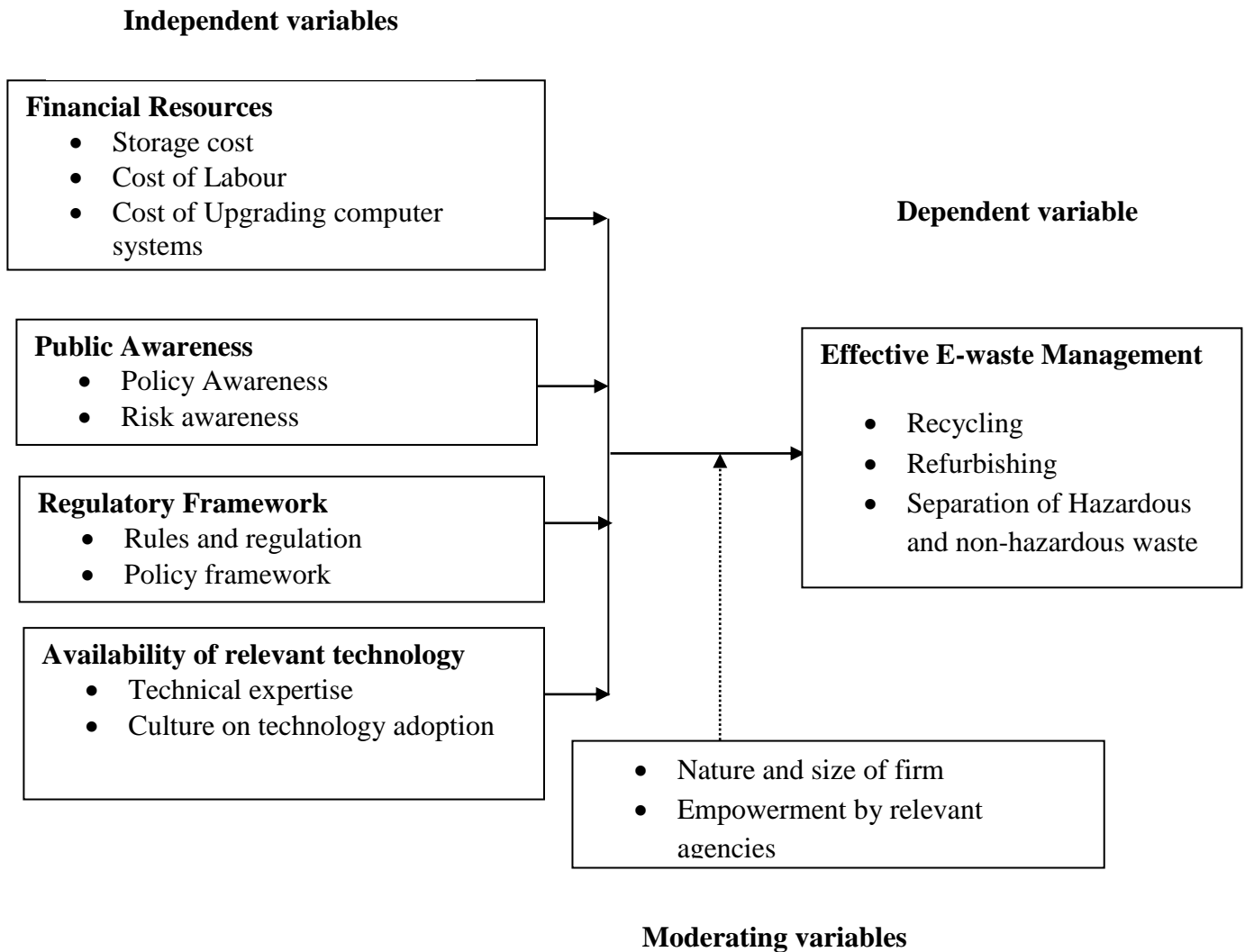


Figure 2.1: Conceptual framework

As illustrated in figure 2.1, the independent variables are availability of financial resources, public awareness, existing regulatory framework and relevant technology. The dependent

variable is effective management of electronic waste and the moderating variables are empowerment by relevant agencies. Availability of financial resources is very important in promoting effective management of electronic waste. As part of the process of electronic waste management, one may require some extra storage space to store used equipment before they are refurbished or recycled. Refurbishment of used equipment requires some skills, expertise and equipment which create the need to have adequate funds to facilitate the process. Recycling equipment and incinerators are also expensive to purchase and require adequate funds to acquire them.

Public awareness contributes to effective management of electronic waste. It can be measured by assessing the level of knowledge of the risks posed by the hazardous components of electronic waste to the users and the environment, the conscious efforts of separating the waste at source and the disposal of waste at the designated dumping sites as opposed to open haphazard dumping. Recycling as a process of effective electronic waste management requires specialized equipment. Developing countries may lack the technological capacity and equipment to carry it out. However, this technology can be found in developed countries which recycle electronic waste. Moderating variables are nature and size of firm as well as relevant agencies on e-waste disposal.

2.7 Summary

The literature review section has provided both theoretical and empirical perspectives of the study. Under the theoretical perspective, the concept of e waste management has been discussed with major highlight on definition, historical review of e waste management, trends in e waste management efforts, as well as recent and global statistics on e- waste management that justifies a need for drastic measures on management of e-waste.

Under the empirical perspective, various studies have provided a critical look of the study constructs in relation to their influence on effective management of e-waste, both from global and local scenarios. Among the constructs examined include inadequate financial resources. Under this, items identified under global perspective include; poor finances as well as lack of proper incentive framework that matches the cost of disposal to payment to those who generate e-waste. E-waste management in Kenya has been carried out mainly through recycling,

indicating that there is little value in such waste to recover the cost of managing it in a responsible way.

Under public awareness, studies indicate dumping of e waste as an environmental problem due to lack of regulation and little awareness about recycling. In Kenya, there is an indication that while people are aware that electronic components become obsolete, they have little or no idea to dispose them. The construct on regulatory framework indicates that there are no specific regulations to deal with e-waste management in Kenya. Technology is said to be rapidly increasing and thus contributing to upsurge of electronic wastes. While existing literature has highlighted e-waste management technology that could be used, it underscores the need for concern in the current situation indicating that the available data on e-waste management is poor and estimation techniques are required for extension of known data to regional, global and local coverage.

2.8 Research Gap

The study sought to examine the factors influencing the management of electronic waste. A review of existing literature established gaps that the present study sought to fill. Though the concept of electronic waste management is not new, it has hardly been given attention especially with regard to how electronic waste is managed. The phenomenon of electronic waste has been painted as one that continues to flourish due to adoption of ICT and related technology. Various scholars (Carns 2005; Schuluep 2008; Nnoram & Adjango (2008) acknowledge the problem e-waste management and underscore the need to establish the determining factors of the process of effective e waste management. According to Omosa (2004), there is no data or statistics of various electronic waste despite the increased availability of electronic waste material. It was therefore based on this gaps that this study sought to examine the factors influencing effective management of electronic waste management, with focus on cyber cafes in Nairobi central business district.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter provides discussion on the methodology used by the researcher in examining the factors affecting effective management of E-waste in Nairobi Central Business district. The chapter has been sectioned into; research design, target population, sample and sampling procedures, research instruments, data collection and analysis.

3.2 Research Design

The study adopted a descriptive survey design. According to Orodho, (2009), a descriptive research design seeks to explain things as they are in their natural phenomenon. The design was suitable in this study as it sought to examine the e-waste management practices in Nairobi's cyber cafes and the factors affecting them. The design facilitated collection of data through a standardized questionnaire. Thus it was suitable in describing the characteristics of large population where no other method can undertake.

3.3 Target Population

Target population is defined as all the members of a real or hypothetical set of people, events or objects to which a researcher wishes to generalize the results of the research study (Mugenda, 2003). The target population for this study was managers of cybercafés within Nairobi's central business district. The CBD has 560 registered cyber cafes operating within the central business district according to City Council of Nairobi's licensing department.

3.4 Sampling Design and Sample Size

Sampling entails the procedure of selecting suitable study elements to participate in the study. Mugenda (2010) and Kothari (2010) recommend a sample size of at least 10% of accessible population in a social science study. These authors further recommend that considerations should be made to ensure that adequate representation of the population proportions as well as ethical

considerations. This study used a sample size of 30% the total population of licensed cybercafés in Nairobi's central business district for sample size. This made a sample size of 168. The cyber cafes were selected randomly until the desired sample size is attained.

3.5 Data Collection Instruments

The study used secondary and primary data as sources of information. Secondary data was mainly gathered through systematic identification, location and analysis of documents containing information on e-waste management and factors affecting e-waste management. According to Kothari (2004), secondary data sources are available, saves time and are cheaper to obtain compared to primary sources of data. The limitations of secondary data is that it may not exactly fit the in the intended purpose of the study. In gathering of primary data, questionnaire was used. Given the population of focus, questionnaire was the most suitable. According to Chandran, (2004), questionnaires provide a high degree of data standardization and adoption of generalized information amongst any population. They are useful in a descriptive study where there is need to quickly and easily get information from people in a non-threatening way. They provide flexibility at the creation phase in deciding how questions are administered. Questionnaires provide an even stimulus potentially to a large number of people and provide the investigation with an easy accumulation of data. The researcher therefore formulated questionnaire for the managers of the licensed cyber cafes.

3.6 Pilot Study

Before the actual data collection process, a pilot study was conducted on cybercafés outside Nairobi central business district. The researcher chose 20 cybercafés from which to conduct the pilot study. The purpose of the pilot study was to enable the researcher to ascertain validity and reliability of the instrument and familiarize himself with the questionnaire content and the administration process.

3.6.1 Validity

Validity is defined as the accuracy and meaningfulness of inferences, which are based on the research results (Mugenda, 2010). In other words, validity is the degree to which results obtained from the analysis of the data actually represents the phenomena under study. Validity, according

to Shampock, (2004) is the degree to which a test measures what it purports to measure. All assessments of validity are subjective opinions based on the judgment of the researcher (Calmorin, 2007). An expert's judgment was used to validate the research instrument during the pilot study.

3.6.2 Reliability

Mugenda and Mugenda (2010) define reliability as a measure of the degree to which a research instrument yields consistent results or data after repeated trial. The pilot study enabled the researcher to assess the clarity of the research instruments so that those items found to be inadequate or vague were modified to improve the quality of the research instrument thus increasing its reliability. The split-half technique was used to test the reliability of the instrument.

The split half reliability artificially divides test into two halves and correlates the individual scores on the two halves. The Researcher administered the test to a group and later divided the items into two halves using odd and even numbers. Scores for each for each individual on the two halves were obtained and coefficient correlation calculated. To transform the split half correlation into an appropriate score reliability estimate for the entire test, the Spearman–Brown Prophecy Formula was employed;

$$r_{xx} = \frac{2r_{\frac{11}{22}}}{1 + r_{\frac{11}{22}}}$$

Where,

r_{xx} = estimated score reliability of the entire test

$r_{\frac{11}{22}}$ = Pearson r correlation between two halves

According to David, (2004) a minimum correlation coefficient of 0.65 is recommended as indicating that an instrument is reliable, and thus a correlation coefficient range between 0.60 – 0.80 is considered reliable. A reliability coefficient of 0.80 was obtained and deemed adequate in judging the research instrument reliable.

3.7 Data Collection Procedure

The researcher obtained letter of introduction from the university. He then proceeded to the cybercafés and issued the questionnaire to managers or administrative representatives for each of the cyber café. A time span of thirty minutes was allowed for the respondents to fill in the questionnaire and return to the researcher. Those who were unable to fill the questionnaire were allocated more time so that the researcher picked the questionnaire the following day.

3.8 Data Analysis Technique

Quantitative approach was used to analyze data. Under this approach, responses were reduced into quantifiable elements and descriptive statistics generated out of them. Data was then coded and entered into Statistical Package for Social Sciences (SPSS) program for analysis. Data was presented in table and interpretations made based on research objectives. A correlation analysis was further undertaken to determine the relationship between variables under examination. The results of the correlation were judged based on the correlation coefficient obtained and described based the following range.

-1	Perfect negative relationship between the variables
-0.10	Almost no relationship
0	No relationship between the variables
0.02-0.09	Very weak relationship
0.10-0.29	Weak relationship
0.30-0.49	Moderately weak relationship
0.50	Moderate relationships
0.50-0.60	Moderately strong relationship
0.70-0.89	Strong relationship
0.98-0.98	Very strong relationship
0.99	Almost perfect relationship
+1	Perfect positive relationship between the variables

3.9 Ethical Considerations

Prior to embarking on the study, the researcher sought written permission from the concerned authorities. The questionnaire was approved by the supervisor before being used in the research. The participants were informed of the purpose of study and assured of confidentiality. No names were required on the questionnaire and participation was voluntary.

3.10 Operationalization of variables

The following is a table showing the operational definition of both dependent and independent variables.

Objective	Variable	Indicators	Measurement scale	Data collection methods	Data analysis
1. To establish the extent which availability of financial resources influence effective management of electronic waste	Independent	<ul style="list-style-type: none"> • Purchase of new ICT equipment and electronics instead of second hand • Refurbishing used equipment as opposed to disposing it • Acquisition of storage space for used equipment as opposed to disposing it • Acquisition of designated dumping sites • Purchase of recycling equipment 	Ordinal	Questionnaire	Descriptive
2. To determine the extent which public awareness influence effective management of electronic waste	Independent	<ul style="list-style-type: none"> • Knowledge of inherent risks • Separation of waste at source • Disposal of waste at designated dumping sites • Willingness to pay for collection of discarded equipments 	Ordinal	Questionnaire	Descriptive
3. To determine extent which regulatory framework affect effective management of e waste	Independent	<ul style="list-style-type: none"> • Policies on e waste management • Frequent supervision by government officials • Extent to which penalties are reinforced 	Ordinal	Questionnaire	Descriptive
4. To establish the extent which availability of relevant technology influences effective management of electronic waste	Independent	<ul style="list-style-type: none"> • Technological capacity to recycle e-waste • Setting up recycling plant 	Ordinal	Questionnaire	Descriptive
5. Effective Management of Electronic waste	Dependent	<ul style="list-style-type: none"> • System upgrading • Reuse and recovery of valuable materials • Refurbishment • Disposal procedures used 	Ordinal	Questionnaire	Descriptive

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATIONS

4.1 Introduction

This chapter presents results and findings of the factors influencing effective management of electronic wastes in Kenya. The study objectives were to establish the extent to which availability of financial resources influences effective management of electronic waste in Kenya, how the public awareness influences effective management of electronic waste, how the existing regulatory framework influences effective management of e waste by cybercafés and how the availability of relevant technology influences effective management of electronic waste. Cybercafés managers within the Nairobi CBD were the respondents of this study.

4.2 Response Rate

The response rate of respondents who participated in the study is as presented in Table 4.1

Table 4.1: Response Rate

Response	Frequency	Percent
Responded	129	76.8
Did not Respond	39	23.2
Total	168	100.0

This study targeted cybercafés operating within the Nairobi CBD. Random sampling method was used to identify 168 cyber cafes to participate in the study. In these cybercafés, managers were the respondents who answered the research instrument. Out of the 168 respondents sampled to participate in the study, 129 respondents responded to the research instrument while 39 respondents did not respond. This formed a response rate of 76.8%, which was adequate to draw an inference, since it was above 50% according to the recommendation of Mugenda (2009).

4.3 Background Information

Background information for the respondents in this study tackles the period of operating the cybercafés and the academic qualifications.

4.3.1 Period of Operation

The period of operation of respondents who participated in the study is as shown in Table 4.2.

Table 4.2: Period of Operation

Period of Operation (Years)	Frequency	Percent
0-2	23	17.83
3-4	34	26.36
5-6	43	33.33
Over 6	29	22.48
Total	129	100.0

Among the 129 respondents who responded to the research instrument, majority of them equivalent to 33.3% have operated their cybercafés for a period of 5-6 years. A proportion of 26.36% have been in operation for 3-4 years, while 22.48% have operated the cybercafés for over 6 years. Those who stated period of operation to be 0-2 years represented by 17.83%. From the statistics, over 50% have been operating cybercafés for more than 5 years. This shows that, the respondents are aware of the e-waste generated by their businesses.

4.3.2 Academic Level

The academic level of respondents who participated in the study is as shown in Table 4.3.

Table 4.3: Academic Level

Academic Level	Frequency	Percent
College Certificate	31	24.03
Diploma	47	36.43
University Degree	43	33.33
Masters	8	6.21
Total	129	100.0

Academic qualifications for the respondents shown that, majority of the Cybercafé managers have diploma as their highest academic qualification. A third hold university degree, 24.03% have college certificate while 6.21% have masters. The academic qualification reveals that, the respondents are knowledgeable enough to understand the phenomena under investigation.

4.4 Factors Influencing Effective Management of Electronic Wastes in Kenya

The factors influencing effective management of electronic wastes in Kenya under study included; availability of financial resources, public awareness, existing regulatory framework and availability of relevant technology.

4.4.1 Availability of Financial Resources on Effective Management of E- Waste

The effect of availability of financial resources on effective management of e-waste is cross-tabulated in Table 4.4.

Table 4.4: Effect of Availability of Financial Resources on Effective Management of E-Waste

Statement	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree		Total	
	F	%	F	%	F	%	F	%	F	%	F	%
We have adequate resource to upgrade our computer systems	0	0.0%	0	0.0%	17	13.2%	83	64.4%	29	22.4%	129	100%
We have adequate resource to refurbish used machines for reuse	0	0.0%	7	5.4%	21	16.3%	36	27.9%	65	50.4%	129	100.0%
We have employed enough workers to dismantle used machine for recovery of valuable items	0	0.0%	2	1.6%	13	10.1%	67	51.9%	47	36.4%	129	100.0%
We have no well-established e waste disposal mechanisms	46	35.7%	60	46.5%	23	17.8%	0	0.0%	0	0.0%	129	100.0%
The government provides incentives to facilitate	0	0.0%	0	0.0%	0	0.0%	88	68.2%	41	31.8%	129	100.0%

management of e waste													
The cost of e waste management is more than financial resources we gain out of it	32	24.8%	63	48.8%	21	16.3%	11	8.5%	2	1.6%	129	100.0%	
It is hard to access funds for e waste management	41	31.8%	55	42.6%	24	18.6%	7	5.4%	2	1.6%	129	100.0%	

One of the objectives of this study was to establish the extent to which availability of financial resources influences effective management of electronic waste by cyber cafes in Nairobi CBD. The analysis of the responses provided in regard to this objective indicates that, financial resource is a problem to the management of electrical and electronic waste in Kenya. In a question eliciting responses from the respondents in the quest that there is adequate resource to upgrade their computer systems, no respondent had concurring opinion. Only 13.2% were neutral while the 86.8% disagreed and strongly disagreed.

A proportion of 5.4% agreed that they have adequate resource to refurbish used machines for reuse. Respondents equivalent to 16.3% were neutral over the statement while the majority of the respondents disagreed and strongly disagreed by 27.9% and 50.4% respectively. Only 1.6% agreed that that they have employed staff to dismantle used machines and recover valuable items. Proportion of 10.1% were neutral over the statement while 51.9% and 36.4% disagreed and strongly disagreed that they have employed workers to dismantle and recover valuable items.

Managers for cybercafés within the Nairobi CBD indicated unavailability of well-established e waste disposal mechanisms in Kenya. This was inferred from 35.7% and 46.5% who strongly agreed and agreed that there are no well-established e-waste disposal mechanisms. Similarly majority of the respondents disagreed and strongly disagreed with a proportion of 68.2% and 31.8% that the government provides incentives to facilitate management of e waste.

The assertion that the cost of e waste management is more than financial resources gained out of it received a positive response from the respondents where, 48.8% agreed, and 24.8% strongly agreed. A proportion of 16.3% were neutral over the assertion while 10% held disagreeing and

strongly disagreeing opinion. Similar trend was exhibited in the response to the assertion that it is hard to access funds for e waste management.

4.4.2 Influence of Awareness on Effective Management of E Waste

The influence of awareness on effective management of e-waste is cross-tabulated in Table 4.5.

Table 4.5: Influence of Awareness on Effective Management of E Waste

Statement	Strongly Agree				Neutral				Strongly Disagree				Total	
	F		%		F		%		F		%		F	%
	F	%	F	%	F	%	F	%	F	%	F	%	F	%
I am aware of existing policies regarding e waste disposal	0	0.0%	13	10.1%	26	20.2%	41	31.8%	49	38%	129	100.0%		
Government agencies regularly undertake sensitization programs on e-waste management	0	0.0%	0	0.0%	12	9.3%	61	47.3%	56	43.4%	129	100.0%		
We are well aware of how we should undertake e waste management	0	0.0%	9	7.0%	35	27.1%	63	48.8%	22	17.1%	129	100.0%		
There is a well-established e waste collection system for cybercafés within Central business district	0	0.0%	0	0.0%	3	2.3%	84	65.1%	42	32.6%	129	100.0%		
We occasionally receive technical support from the government on e-waste management	0	0.0%	0	0.0%	0	0.0%	89	69.0%	40	31.0%	129	100.0%		
I have attended workshops on e-waste management	0	0.0%	0	0.0%	8	6.2%	77	59.7%	44	34.1%	129	100.0%		
It is hard to access funds for e-waste management	41	31.8%	55	42.6%	24	18.6%	7	5.4%	2	1.6%	129	100.0%		

Respondent’s awareness on the management of electronic and electrical waste was gauged using several assertions that aimed at evaluating how members of the public are aware of e-waste. The assertion that respondents were aware of existing policies regarding e waste disposal received mixed reactions with majority contrasting the statement. Of the responses, 38% strongly

disagreed, 31.8% disagreed, and 20.2% were neutral while the minority represented by 10.1% agreed that they are aware of existing policies regarding e waste management.

Among the respondents of this study, none of the respondents agreed with the statement that government agencies regularly undertake sensitization programs on e-waste management. A proportion of 9.3% were neutral over the statement while the majority comprising of over 90% disagreed and strongly disagreed by 47.3% and 43.4%.

A smaller proportion of 7% acknowledged being well aware of how they should undertake e-waste management. The majority comprising of 65.9% were against the assertion while 27% held a neutral opinion. Similarly majority of the respondents held that there is no well-established e waste collection system for cybercafés within Central business district. This claim is supported by the majority response that held disagreeing and strongly disagreeing opinion, as shown by 65.1% and 32.6%. A small proportion equivalent to 2.3% was neutral.

In another statement seeking to know government involvement in supporting e-waste management, all the respondents were contrary to the statement that they occasionally receive technical support from the government on e-waste management. This was responded to by 69.0% of those who disagreed and 31% who strongly agreed. In a similar trend, 6.2% of the respondents were neutral of whether they have attended workshops on e-waste management. More than 90% have never attended such workshops.

Vast majority of respondents supported the assertion that, it is hard to access funds for e waste management. This is inferred from the statistical representation that indicates 42.6% agreed while 31.8% strongly agreed on the assertion. Neutral opinion was represented by 18.6% while 7% disagreed and strongly disagreed on the statement.

4.4.3 Influence of Existing Regulatory Framework on Effective Management of E Waste

The influence of existing regulatory framework on effective management of e-waste is cross-tabulated in Table 4.6.

Table 4.6: Influence of Existing Regulatory Framework on Effective Management of E Waste

Statement	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree		Total	
	F	%	F	%	F	%	F	%	F	%	F	%
There are legal provisions governing e waste management in Kenya	3	2.3%	8	6.2%	52	40.3%	37	28.7%	29	22.5%	129	100.0%
We have central point within which we can take e waste	0	0.0%	0	0.0%	4	3.1%	77	59.7%	48	37.2%	129	100.0%
There are no rules and regulations governing how computer systems are purchased	34	26.4%	53	41.1%	25	19.4%	11	8.5%	6	4.7%	129	100.0%
We are well familiar with government agencies dealing with e waste management	0	0.0%	0	0.0%	11	8.5%	78	60.5%	40	31.0%	129	100.0%
We are familiar with primary, storage, collection and recycling of e waste in Kenya	0	0.0%	0	0.0%	2	1.6%	83	64.3%	44	34.1%	129	100.0%
We are aware of our duty in dealing with hazardous and non-hazardous waste	0	0.0%	0	0.0%	6	4.7%	73	56.6%	50	38.8%	129	100.0%
We are familiar with various classification of e waste as described in the regulatory framework	0	0.0%	0	0.0%	3	2.3%	77	59.7%	49	38.0%	129	100.0%

While looking to establish the influence of existing regulatory framework on effective e-waste management, respondents were required to rate their level of agreeing, based on the statement posed to them. The result shows that, majority are neutral of the presence of legal provisions governing e waste management in Kenya. This response was represented by 40.3%. Total response of 8.5% supported the statement that there are legal provisions governing e waste management in Kenya. The rest tallying to 51.2% were contrary to the statement.

Within the Nairobi CBD, there is no central point within which generators of e-waste can take. This is shown by none response on those expressing agreeing and strongly disagreeing opinion on the assertion. Small proportion of 3.1% holds neutral opinion of the existence of central point to take e-waste. The rest of the respondents tallying to 96.9% expressed contrary opinion on the presence of central point for e waste disposal. More than 65% of the respondents held that, there are no rules and regulations governing how computer systems are purchased in Kenya. Those expressed neutral opinion were represented by 19.4% while 8.5% disagreed and 4.7% strongly disagreed.

The assertion that the respondents were well familiar with government agencies dealing with e waste management received no response agreeing to it. Small proportion of 1.6% were neutral while the majority of more than 95% shown that they are not familiar with government agencies dealing with e waste management. Similar trend was exhibited in a bid to determine whether the public is aware of their duty in dealing with hazardous and non-hazardous waste. In this case, no one expressed concurring opinion over the statement. In addition, only 4.7% were neutral while 65.3% disagreed with the assertion.

None of the respondents acknowledged by agreeing or strongly agreeing that the public is familiar with various classification of e waste as described in the regulatory framework. The majority of the respondents disagreed with the assertion while only 2.3% expressed a neutral opinion.

4.4.4 Influence of Technology on Effective Management of E Waste

The influence of technology on effective management of e-waste is cross-tabulated in Table 4.7.

Table 4.7: Influence of Technology on Effective Management of E Waste

Statement	Strongly Agree				Neutral				Strongly Disagree				Total	
	Agree		Agree		Neutral		Disagree		Disagree		Disagree		Total	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%
We have computer refurbishing systems in our cyber	3	2.3%	16	12.4%	36	27.9%	44	34.1%	30	23.3%	129	100.0%		
We have the culture of upgrading the technology we are using on the existing systems	0	0.0%	13	10.1%	41	31.8%	53	41.1%	22	17.1%	129	100.0%		
We have the technical knowhow to recover valuable components from our computer systems	7	5.4%	19	14.7%	33	25.6%	47	36.4%	23	17.8%	129	100.0%		
We have enough technical expertise on disposal of e waste	0	0.0%	0	0.0%	11	8.5%	79	61.2%	39	30.2%	129	100.0%		
The cost of technology deters us from effective management of e waste	24	18.6%	63	48.8%	28	21.7%	9	7.0%	5	3.9%	129	100.0%		
We do not consider e waste as a major issue in our cybercafé	23	17.8%	54	41.9%	32	24.8%	19	14.7%	1	0.8%	129	100.0%		
Demand for electronic wastes leads to resale as the only way to deal with old products	17	13.2%	44	34.1%	46	35.7%	8	6.2%	14	10.9%	129	100.0%		

The quest of whether technology has any influence on effective management of e-waste was tested using several assertions. The respondents were required to express their level of agreeing and disagreeing based on 5-point Likert scale. From the data analysis results, most of the respondents represented by 34.1% and 23.3% disagreed and strongly disagreed that they have computer refurbishing systems in their cyber. A segment of 14.7% concurred with the assertion while 27.9% held a neutral opinion.

The assertion that, there is a culture of upgrading the technology cyber use on the existing systems was majorly responded to by 58.2% of those disagreeing and strongly disagreeing, while 31.8% of the respondents were neutral over the assertion. The minority were 10.1% who agreed with the assertion. Very few people have the technique to recover valuable items from computer systems. Such a comment is inferred from the total respondents who agreed with the assertion as shown by 20.1%. More than half of the respondents tallying to 54.2% have no such knowhow, while 25.6% were neutral whether they possess such skills to recover valuable items from computer systems.

On whether there is enough technical expertise on disposal of e waste, none of the respondents agreed with the assertion. Most of them, equivalent to 91.4% held contrary opinion to the assertion as 8.5% expressed neutral opinion. On the other hand, public perception of e waste was responded differently on the claim that most cybercafés do not consider e waste as a major issue. Majority agreed to this assertion with 41.9% and 17.8% strongly agreed. Respondents expressing neutral opinion were 24.8% while 15.5% held contrary opinion to rate disagree and strongly disagree.

Demand for electronic wastes leads to resale as the only way to deal with old products. This is one among the ways that most members of the public adopt to deal with e-waste. Such an inference is drawn from the data analysis results that reveal the majority, 47.3% agreeing with the assertion, 35.7% expressing neutral opinion while 17.1% expressing contrary opinion to the statement.

4.4.5: Effective Management of E-Waste

The various measures on effective management of e-waste areas cross-tabulated in Table 4.8.

Table 4.8: Effective Management of E-Waste

Statement	1-Very high		2- High		3- Average		4-Poor		5-Very Poor		Total	
	F	%	F	%	F	%	F	%	F	%	F	%
Upgrading of systems in instead of repurchasing new ones	31	24.0%	45	34.9%	28	21.7%	16	12.4%	9	7.0%	129	100.0%
Refurbishing of old machines	13	10.1%	24	18.6%	49	38.0%	31	24.0%	12	9.3%	129	100.0%
Donating machines to non-profits organizations	0	0.0%	11	8.5%	37	28.7%	52	40.3%	29	22.5%	129	100.0%
Separation of hazardous and non-hazardous waste	0	0.0%	0	0.0%	14	10.9%	78	60.5%	37	28.7%	129	100.0%
Dumping of waste at designated dumping sites	28	21.7%	31	24.0%	43	33.3%	13	10.1%	14	10.9%	129	100.0%
Recycling and reuse of electronic products	2	1.6%	6	4.7%	18	14.0%	74	57.4%	29	22.5%	129	100.0%

Respondents view on the effective measures of managing e-waste in relation to their areas of operation was measured using Likert scale ranging from very high to very poor. One of the measures was upgrading of systems instead of repurchasing new ones. Among the total respondents, more than 50% comprising of 24% and 34.9% rated such a measure very high and high. A proportion of 21.7% practice such mechanism to an average while 12.4% and 7% they don't practise such a measure for they rated it as poor and very poor.

Majority of the responds are average over the aspect of refurbishing old machines. This is represented by a proportion of 38%. Those rating such a mechanism very high were 10.1% while 18.6% rated it high. Poor rating was given by 24% of the respondents as 9.3% expressed very poor rating in relation to refurbishing old computers.

Very small segment of the respondents' equivalent to 8.5% acknowledged donating machines to non-profits organization by rating the measure as high. The majority group represented by 40.3% and 22% do not consider such a measure, as they expressed poor and very poor rating.

This measure was however used to determine how cybercafés manage e-waste, meaning, they may be using until they dispose to garbage collection or use and donate while useful life is likely to end. On the aspect of separating hazardous and non-hazardous waste, none of the respondents practice this. However, 10.9% averagely practice such a measure based on their rating. The majority, represented by more than 85% were contrary to the e-waste management practice as they expressed a rating of poor and very poor.

When it comes to dumping of waste at designated dumping sites, 45.7% rated this management mechanism very high. A third rated it averagely while 10.1% and 10.9% rated it poor and very poor. This e-waste management measures appear to scoop the most rating from respondents. However, the assertion might have been viewed by respondents from the general view of ordinary waste as opposed to e-waste only, hence generating such a positive response.

The technology of recycling and reuse of electronic products is practiced by very few respondents based on the rating on this statement where 1.6% rated the measure very high while 4.7% rated it high. A proportion of 14% rated it average while the majority represented by 57.4% rated it poor and 22.5% very poor.

4.5 Correlation Analysis

In analysing factors influencing effective management of electronic waste, correlation analysis was undertaken to determine the relation and the interaction of the independent variables on the dependent variable. Thus, study variables, Effect of; finances, awareness, regulatory framework and technology were correlated with E-waste management. The results of correlation analysis were judged based on the strength of relationship between the correlated variables and whether or not the correlation coefficient was negative or positive. Interpretations were made based on the following scale.

Table 4.9: Correlation Analysis

		Correlations				
		Effect of Finances	Effect of Awareness	Effect of Rules and Regulations	Effect of Technology	E-Waste Management
Effect of Finances	Pearson Correlation	1				
	Sig. (2-tailed)					
Effect of Awareness	N	129				
	Pearson Correlation	.836**	1			
Effect of Rules and Regulations	Sig. (2-tailed)	.000				
	N	129	129			
Effect of Technology	Pearson Correlation	.947**	.844**	1		
	Sig. (2-tailed)	.000	.000			
E-Waste Management	N	129	129	129		
	Pearson Correlation	.800**	.795**	.818**	1	
E-Waste Management	Sig. (2-tailed)	.000	.000	.000		
	N	129	129	129	129	
E-Waste Management	Pearson Correlation	.923**	.889**	.918**	.787**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
E-Waste Management	N	129	129	129	129	129

** . Correlation is significant at the 0.01 level (2-tailed).

All the factors discussed to affect e-waste management indicate positive and significant relationships. From the correlations table, there is a very strong positive relationship between effect of finances and e-waste management. The correlation is shown by the coefficient value of .923 with *P* values of 0.00. Since the *P* (0.00) is less than 0.01 for two tailed correlation, the relationship is significant. Therefore, it is interpreted that, with availability of finances, e-waste management is effective; else the e-waste management is ineffective.

Similar trend is exhibited in the relationship between level of awareness and e-waste management. The results indicate that there is a positive and very strong relationship between level of awareness and e-waste management, with correlation coefficient of 0.889 at *P* value

0.00, which is less than 0.01. Hence the relationship is significant. Therefore, when members of the public are aware on the e-waste management, the e-waste management is effective.

Regulatory framework as discussed in the study acts as the scale for monitoring e-waste management practices and brings into attention the role of the authority or government to the public. Correlation analysis indicates that, there is a positive and very strong relationship between effect of regulatory framework and effective e –waste management, as shown by coefficient of 0.918. This relationship is significant since *P* value 0.00 is less than 0.01. Thus when the regulatory framework is active, E-waste management is also effective. Otherwise, the negative is true.

Similarly, technology as one of the factors deemed affecting e-waste management; the correlation analysis confirmed that, there is positive and very strong relationship between the two variables. The strength is presented by the correlation coefficient of 0.787 at *P* value 0.00 declaring the relationship as significant. In interpretation, absence of proper technological expertise as well as tools leads to poor e-waste management, else ineffective e-waste management.

CHAPTER FIVE
SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSION AND
RECOMMENDATIONS

5.1 Introduction

This chapter provides a summary, conclusion and recommendations to the study based on research findings. The study sought to analyse the factors influencing effective management of electronic waste in Kenya.

5.2 Summary of Findings

The research was guided by four objectives and four research questions. The descriptive survey research method was used and questionnaires were used as the data collection method.

5.2.1 Effect of Availability of Financial Resources on Effective Management of E- Waste

Results of the study with regard to the objective of establishing the influence of finances on effective management of e-waste management show that majority of the respondents do not have adequate resource to upgrade their computer systems. Similarly, 78.3% expressed their opinion that they have inadequate resource to refurbish used machines for reuse. A big proportion indicated that they do not have employee's staff to dismantle used machines and recovering valuable items from them. The availability of financial resources was also gauged on availability of well-established waste disposal mechanism in Kenya. The results indicated that there is no such an avenue.

5.2.2 Influence of Awareness on Effective Management of E-Waste

Majority of the respondents with regard to the influence of awareness on e-waste management indicated that they are not well versed with existing policies regarding e-waste disposal. None of the respondents agreed that the government agencies regularly undertake sensitization programs on e-waste management. A smaller proportion of 7% acknowledged being well aware of how they should undertake effective e-waste management. Majority were not familiar with proper waste management practices like separation of waste at source, disposal of waste at designated

dumping places or the inherent risks associated with hazardous wastes. Similarly majority of the respondents held that there is no well-established e waste collection system for cybercafés within the Central business district.

5.2.3 Influence of Existing Regulatory Framework on Effective Management of E-Waste

The influence of existing regulatory framework was measured using different assertions. The results indicated that most of the respondents are not well versed with the existing regulatory frameworks that deal with e-waste management. In addition, many Kenyans hold that there are no rules and regulations governing how computer systems are purchased in Kenya. This might be inferred from the respondents experience that in the Nairobi CBD, there is no central point within which generators of e-waste can take it. The conclusion on the influence of existing regulatory framework in Kenya was adopted from the response that Kenyans are not well familiar with government agencies dealing with e waste management.

5.2.4 Influence of Technology on Effective Management of E-Waste

Measuring the influence of technology on e-waste management showed that the technologies for computer refurbishing in their cybercafés within the Nairobi CBD are unavailable. More than half of the respondents disagreed that they have a culture of upgrading the technology cyber cafes use on the existing systems. In addition, very few people equivalent to 20.6% have the technique to recover valuable items from computer systems. On the statement seeking to know whether there is enough technical expertise on disposal of e waste, none of the respondents agreed with the assertion. On the other hand, public perception of e waste was responded differently on the claim that most cybercafés do not consider e waste as a major issue. In this case, therefore, demand for electronic wastes leads to resale as the only way to deal with old products since appropriate technology is not available to manage e-waste.

5.2.5 Effective Management of E-Waste

On the effective management of e-waste, upgrading of systems instead of repurchasing new ones was rated high by almost three quarters. On the aspect of refurbishing old machines, majority were average based on their experience of refurbished machines as well as their take if the

technology was to be introduced in Kenya. Very small segment of the respondents' equivalent to 8.5% acknowledged donating machines to non-profits organization by rating the measure as high. Moreover, the technology of recycling and reuse of electronic products is practiced by very few respondents based on the rating on this statement where 1.6% rated the measure very high and 4.7% rated it high.

5.3 Discussion of Findings

The major objective of this study was to determine the factors influencing effective management of e-waste in Kenya. To obtain enough data for inference, specific variables; influence of financial resources, technology, public awareness and regulatory framework were analysed and data discussed.

5.3.1 Availability of Financial Resources on Effective Management of E- Waste

The data on the availability of financial resources to manage electrical and electronic waste reveals that, Kenya has inadequate financial resources to manage electronic waste. This is referred from the data obtained that 86.8% disagreed with the assertion that they have adequate finances to upgrade their computer systems. In addition, more than 80% indicated unavailability of well-established e waste disposal mechanisms in Kenya. These findings are consistent with the literature review that; one among the factors that affect proper disposal of electronic waste management is weak municipal finances, capacity and coverage. According to Davis (2007), the delivery of municipal services in solid and electronic waste management is frequently affected by poor finances and lack of proper incentives framework to ensure that generators pay for the actual cost of disposal. The development of stable cost-recovery mechanism has also been affected by limited managerial capacity that prevents sustained interest by private or autonomous entities in the provision of services.

5.3.2 Influence of Awareness on Effective Management of E Waste

Awareness of the public helps in implementing necessary strategies as far as e-waste management is concerned. The statistical analysis on the objective determining the extent to which the public awareness influences effective management of electronic waste by cyber cafes in Nairobi CBD, shows, within the Nairobi CBD, 65.9% of the public are not well aware of

electronic and electrical waste. In this regard therefore, in an environment where awareness is lacking management of such phenomena might fall out. The representation of the respondents over the awareness objective concurs with Stephenson (2006) literature that explains that, few people are aware of recycling options for their old personal computers and televisions sets. Because of the apparent value of used electronic products, some give their used equipment to friends or family members before eventually storing these units in their garages or basements.

It also agrees with the study of Sarker (2012) that sought to examine the public awareness of e-waste, which concluded that 89% of the total respondents have more or less idea about waste. However, more than half of respondents (53%) do not have idea about hazards of electronic wastes such as health problem, aesthetic problem, lead and radioactive effects. Thus in application, members of the public are aware that electrical components become obsolete but they have no idea on the proper way to dispose the electronic waste. Due to the hazardous nature of the e-waste, therefore, it should be segregated at source because only few people know the dangers of improper e-waste disposal.

5.3.3 Influence of Existing Regulatory Framework on Effective Management of E Waste

With a clear authority from the government enhances public awareness and ethics towards operation of their activities. In this study, most of Kenyans are not aware of any legal system governing e waste management as indicated by 51.2%. In addition according to opinion of the majority, it appears like Kenya has no specific agency that is known to deal with electronic and electrical waste. This is inferred from the study results 95% indicating unavailability of any agency to tackle e-waste. In such a condition therefore, ordinary household garbage end up being mixed with e-waste due to lack of central point to deposit such hazardous components. In addition, laxity of government agencies or absence of any framework to manage e waste, results to the public failing to understand their roles in dealing with e-waste and even failing to understand the ills of such hazardous components to both human and animal health.

Referring to the literature, the law that can be inferred with regard to e-waste is the Public Health Act (Cap 242) of the Laws of Kenya that defines nuisance as to include, any accumulation or deposits of refuse, offal, manure or other matter whatsoever which is offensive or which is injurious or dangerous to health. Section 118 (i) (h) further defines nuisance to include, any

accumulation of stones, timber or other material if such in the opinion of the medical officer of health is likely to harbor rats or other vermin. However, this Act does not give guidelines on how solid waste management should be carried. There are no recommended ways of storage, collection, transportation, processing and disposal of waste (Government of Kenya, 2010). Thus, in such circumstances, lack of national environmental laws or guidelines for e-waste increases susceptibility of such nations being points of exporting refurbished electronics. According to Third World Network (1999) a significant amount is likely sent to countries that have few if any protections for workers or countries with regulations that are not enforced thus the need to enact stringent laws in fight of lethal impacts of electronic waste.

5.3.4 Influence of Technology on Effective Management of E Waste

From the study results, technology and technical skills of dealing with e waste such as recovering valuable items from computer systems and presence of refurbishing systems in Kenya are unavailable. The result of these is resale of obsolete or almost end of life electronic and electrical appliances as one of the ways to deal with e-waste. Such decisions are as a result of unavailable resources as many hold that the cost of technology deters them from effective management of e waste.

Literature on the other hand is consistent with these findings. In the management of electronic waste, integrated waste policy and management which addresses environmental impacts along the whole life-cycle of products have to be considered. The known technological measures to handle e-waste include the 3R principle, i.e. reduce, reuse and recycle. In addition, in Kenya, there is lack of relevant technology that can be used in the management of e-waste; this applies mostly to recycling technologies. The technological gap between the developed and developing countries compounded with the high price of acquiring this technology has led to the emergency of backyard recyclers who resort to usage of rudimentary techniques that pose a major threat to the environment and to their health.

5.3.5: Effective Management of E-Waste

From the e - waste management techniques responded to by the respondents shows that, in Kenya, majority of e-waste generators are not aware of how e-waste should be managed. Over 50% rated the practise of upgrading of systems instead of purchasing new ones high. On

managing e-waste through donation, a very small segment donates to NGOs. The greater proportion uses these electronics until disposal or they give out to relatives when their useful life is finished. In addition, they are not aware of the hazardous content of such appliances. Therefore, the idea of e-waste is neglected and thus there is need to enlighten people on the dangers and safe ways of disposing such obsolete and finished electronic and electrical waste.

These results concur with the study by Sarker et al., (2012), which established that, 89% of the total respondents have more or less idea about waste. However, more than half of respondents (53%) do not have idea about hazards of electronic wastes such as health problem, aesthetic problem, lead and radioactive effects. 47% has no idea about how these wastes are causing problem or polluting the environment.

5.4 Conclusion

With regard to the management of electronic and electric waste and the results of data analysis, Kenya has inadequate financial resources to effectively manage electronic waste. In addition to these, lack of vital information on e-waste has led to a general lack of public awareness on the same. The mode of handling of e-waste by cyber café operators is unsatisfactory and wanting. Majority of them store the junk in their stores or throw it out in waste polythene bags together with other solid waste for collection by the local authorities. Further, the only known government agency in Kenya involved in managing waste is NEMA. However, the policies on how to handle e-waste are not clear and most cyber café managers/operators are not familiar with various classification of hazardous waste as described in the regulatory framework.

Technology and technical skills of dealing with e waste such as recovering valuable items from computer systems and presence of refurbishing systems in Kenya are unavailable. The result of these is resale of obsolete or almost end of life electronic and electrical appliances as one of the ways to deal with e-waste. Such decisions are as a result of unavailable resources as many hold that the cost of technology deters them from effective management of e waste. This study therefore has established that, in Kenya, there no adequate finances allocated to the management of e-waste, efficient and effective technology is missing to help recycle, refurbish and dispose obsolete electronic and electrical appliances. Therefore this study adds to the body of knowledge

that, availability of financial resources, technology, people awareness and regulatory framework influence effective management of e-waste.

5.5 Recommendations

- I. The study has established that, there is no financial allocation to specifically deal with electronic and electrical waste. The government should put into consideration e-waste as different from normal garbage and thus, technical people and resources should be availed to keep the country secure from health hazards emanating from e-waste disposal.
- II. The study recommends the establishment of public-private partnerships to increase availability of financial resources required for effective e-waste management and make it economically viable.
- III. The government regulatory framework is not clear in managing such e-waste. Therefore, it is recommended that, the government through legislation should come up with a comprehensive law that provides for e-waste regulation, management and proper disposal in Kenya. Such a law should; empower the relevant agency to sensitize the public, supervise and regulate the activities of e-waste management; formulate legal procedures for reporting of illegal e-waste dumping by the general public; lay down legal procedures to be used in cases of default with stiff penalties for defaulters based on the toxicity of the waste, severity of environmental pollution, severity of health hazards etc.
- IV. The study recommends creation of public awareness, with the aid of the media and the county government personnel, to change the attitude of e-waste generators and inform them of the need for proper segregation and disposal of e-waste. One of the ways people can be sensitized on management of e-waste is directing them to a point where the waste can be dumped. The study recommends special bins, fixed or mobile, to be put in place so that, end-of life appliances can be safely disposed and to make it easier to manage the waste unlike when mixed with daily household garbage.
- V. The study also recommends adoption of environment friendly technology of managing e-waste. Whenever possible, there should be adoption of environmentally sound methods of resource recovery by direct reuse, alternative use, refurbishment or recycling. Further, technical guidelines, case studies, demonstration and pilot projects for integrated e-waste

management need to be prepared and disseminated. Similarly, research and development work is required to adapt these technologies to suit local conditions.

5.6 Suggestion for Further Study

Further study can be done to investigate the role of government on managing e-waste in Kenya. In addition, another study can be undertaken to analyse effectiveness of policies controlling importation and donation of second-hand electrical and electronic appliances.

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APPENDICES

APPENDIX I: LETTER OF TRANSMITTAL

Edward Muthigani Mwathi

University of Nairobi

P.O Box 30197-00100

Nairobi

Dear Sir / Madam,

RE: REQUEST FOR YOUR PARTICIPATION IN AN M.A RESEARCH PROJECT

I am a student at the University of Nairobi pursuing Master of Arts in Project Planning and Management. As part of my coursework, I am expected to submit a research project report on the Factors influencing effective management of electronic waste among cyber cafes in Nairobi Central Business District.

Kindly assist in completing the attached questionnaire. I assure you the information you provide is purely for academic purposes and will be treated with utmost confidentiality. Names will not be disclosed. Your participation in this study will be highly appreciated. A copy of research report, upon completion can be availed at your request. A copy will also be available at the University of Nairobi Library.

Yours Faithfully,

Edward Mwathi

**APPENDIX II: QUESTIONNAIRE FOR CYBER MANAGERS/
ADMINISTRATOR**

RE: INTRODUCTION

Dear Respondent,

This questionnaire is aimed at establishing factors influencing effective management of e waste in cyber cafes in Nairobi Central Business District. You are kindly requested to fill in the questions depending on the instructions given. The information you provide will be treated with utmost confidentiality and will be used for the purpose of accomplishing academic goals. Do not include your name anywhere in the questionnaire. Please note that there are no wrong or right answers.

PART A: Background information

1. How long has your cyber café been in operation?
 - a. 0-2 years
 - b. 3-4 Years
 - c. 5-6 years
 - d. Over 6 years

2. Please indicate your highest level of educational qualifications
 - a. Primary
 - b. Secondary School Level
 - c. College (Certificate)
 - d. College (Diploma)
 - e. University (Degree)
 - f. Post graduate qualifications (Masters)
 - g. Others.....

PART B: Factors influencing effective management of e waste

The following statements indicate related factors affecting effective management of e waste in Nairobi's Central Business District. You are kindly requested to indicate your level of agreement

with the statements provided. Use ; 1- Strongly agree (SA), 2- Agree (A) 3- Neutral (N), 4- Disagree (D), 5- Strongly Disagree (SD)

PART B SECTION I: Effect of finances on effective management of e- waste

Statement	1-Strong Agree	2- Agree	3- Neutral	4-Disagree	5-Strongly Disagree
1. We have adequate resource to upgrade our computer systems					
2. We have adequate resource to refurbish used machines for reuse					
3. We have employed enough workers to dismantle used machine for recovery of valuable items					
4. We have no well-established e waste disposal mechanisms					
5. The government provides incentives to facilitate management of e waste					
6. The cost of e waste management is more than financial resources we gain out of it					
7. It is hard to access funds for e waste management					

PART B SECTION II: Influence of Awareness on management of e waste

Statement	1-Strong Agree	2- Agree	3- Neutral	4-Disagree	5-Strongly Disagree
8. I am aware of existing policies regarding e waste disposal					
9. Government agencies regularly undertake sensitization programs on e waste management					
10. We are well aware of how we should undertake e waste management					
11. There is a well-established e waste collection system for cybercafés within Central business district					
12. We occasionally receive technical support from the government on e waste management					
13. I have attended workshops on e waste management					
14. It is hard to access funds for e waste management					

PART B SECTION III: Influence of regulatory framework on effective management of e waste

Statement	1-Strong Agree	2- Agree	3- Neutral	4-Disagree	5-Strongly Disagree
15. There are legal provisions governing e waste management in Kenya					
16. We have central point within which we can take e waste					
17. There are no rules and regulations governing how computer systems are purchased					
18. We are well familiar with government agencies dealing with e waste management					
19. We are familiar with primary, storage, collection and recycling of e waste in Kenya					
20. We are aware of our duty in dealing with hazardous and non-hazardous waste					
21. We are familiar with various classification of e waste as described in the regulatory framework					

PART B SECTION IV: Influence of technology on effective management of e waste

Statement	1-Strong Agree	2- Agree	3- Neutral	4-Disagree	5-Strongly Disagree
22. We have computer refurbishing systems in our cyber					
23. We have the culture of upgrading the technology we are using on the existing systems					
24. We have the technical knowhow to recover valuable components from our computer systems					
25. We have enough technical expertise on disposal of e waste					
26. The cost of technology deters us from effective management of e waste					
27. We do not consider e waste as a major issue in our cybercafé					
28. Demand for electronic wastes leads to resale as the only way to deal with old products					

PART B SECTION V: Effective Management of e waste

To what extent do you rate your cyber café as far as efficiency in the following e waste management activities are concerned. Use- 1 – Very High 2- High 3 – Average 4- Poor 5- Very poor

Statement	1-Very high	2- High	3- Average	4-Poor	5-Very Poor
29. Upgrading of systems in instead of repurchasing new ones					
30. Refurbishing of old machines					
31. Donating machines to non- profits organizations					
32. Separation of hazardous and non-hazardous waste					
33. Dumping of waste at designated dumping sites					
34. Recycling and reuse of electronic products					

End

Thank you for your cooperation.