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THE ROLE OF REGULATORY FRAMEWORK ON E-WASTE IN KENYA: Case of Nairobi County (2010-2022).

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MPA: RESEARCH PROJECT

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DECLARATION

I hereby declare that this research project report is my original work and has not been presented for a degree award in any other university.
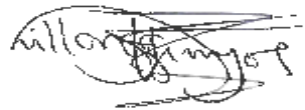
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ABSTRACT

This study examined the role of regulatory framework on e-waste in Kenya, case of Nairobi County as from 2010-2022.The absence of regulation, guiding policy and strategy, insufficient capacity, resources, skills, and infrastructure such as recycling systems to tackle the electronic and electrical challenge effectively has increased the level of human exposure to unhealthy environmental conditions. The study intended to determine the trends driving e-waste generation in emerging economies; to assess the challenges faced by the absence of policies and regulations on e-waste in Kenya; and to assess the role played by institutions, regulations, and policies on e-waste in Kenya. This literature identified that there is a need to place a proper legal framework to tackle e-waste management in Kenya and this need is reflected through governance theory and system theory. The study used qualitative research design where exploratory and phenomenological research design methods were applied using unstructured questionnaires. The target population was Nairobi with a sample population being acquired from Nairobi industrial area and CBD to form 46 respondents. The data was collected using secondary sources and as well as relying mainly on primary sources. The study identified that there is huge volume of unmanaged e-waste in Nairobi County a clear indication of lack of disposal mechanism. There exist institutions, such as Ministry of ICT, Ministry of Environment, Public Procurement Oversight Authority, County Government of Nairobi, that have been working closely with NEMA to not only formulate but also to implement the e-waste management. This led to formulation of ICT policy, EMCA, Public Procurement and Disposal Act, among other policies and legal instruments. However, there is still a feeling of the implementers such as Nairobi City County government, waste collectors and recyclers not doing enough to manage e-waste in Nairobi county. This has been driven partly due to lack of proper awareness on e-waste management for the public and private sectors (WEEE centre, Computer for schools, Safaricom, JKUAT) to engage in the management of e-waste. The Nairobi County Government should work closely with the National Government of Kenya to ensure that an operational legal framework replaces the draft e-waste regulations of 2011. This will also ensure that there is a special ministry or department focusing on e-waste to support NEMA and the Ministry of Environment in managing e-waste. However, Nairobi County government lacks an institution that works closely with other institutions to ensure that e-waste is properly managed and recycled where possible. The study recommends for close cooperation among stakeholders to achieve e-waste management goals, actualizing the existing legal framework and policies on e-waste to be operational in Nairobi county through proper coordination, and that these policies and framework should be subjected to periodic review to ensure they tackle contemporary issues in e-waste management, and finally expand the number of institutions to complement the existing institutions in e-waste management.

ACKNOWLEDGEMENT

ACRONYMS

Ag: Silver

Ba: Barium

Be: Beryllium

BFRs: Brominated Flame Retardants

Cd: Cadmium

Co: Cobalt

Cr VI: Hexavalent Chromium

Cr: Chromium

Cu: Copper

EACO: The East African Communication Organization

EPR: Extended Producer Responsibility

Fe: Iron

Hg: Mercury

ISWA: International Solid Waste Association

ITU: The International Telecommunication Union

Li: Lithium

Mn: Manganese

Mo: Molybdenum

NEMA: The National Environmental Management Authority

Ni: Nickel

PAHs: Polyclic Aromatic Hydrocarbons, and Polybrominated dibenzo – p - dioxins

PAHs: Polycyclic aromatic hydrocarbons

Pb: Lead

PBDD/Fs: Polybrominated Dibenzo- P- Dioxins and dibenzofurans

PBDEs: Polybrominated diphenyl ethers

PCBs: Polychlorinated Biphenyls

PCDD/Fs: Dibenzofurans

POPs: Persistent Organic Pollutants

SDGs: The Sustainable Development Goals

UNEP: The United Nations Environmental Program

UNU: The United Nations University

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CHAPTER ONE

1.1 STUDY BACKGROUND

The prevailing unsustainable treatment of end-of-life electronic waste around the world such as incineration, burning to extract valuable components and burying in the ground, or dumping, all present serious present and future danger to the natural environment which in turn negatively affects human health. With this trend, the attainment of any goals in the Sustainable Development Goals (SDGs) regarding health will continue to be a pipedream.

It, therefore, calls for a better understanding of e-waste treatment challenges to the realization of SDGs concerned with environmental protection (Goals 1, 11, 12 and 14) and health (Goals 3) so does Goal 8 for employment creation and economic growth that comes as a result of the creation of jobs by driving entrepreneurship with good e-waste governance.

Globally, the increasing threat from growing piles of e-waste is a culmination of many trends. The ever-growing speed and quality of communication equipment such as handheld gadgets like phones, an increasing fad of competing for the 'best and latest' technology by a growing number of takers of the consumerism craze. This has not been helped by manufacturers of these gadgets on the road to competing in launching the better, latest version of the newest gadget every year, even before the older version has been around for more than 3 years- considered the optimal use period. These moves have made the generation of fans and consumers ditch the older version for the newer ones, meaning an ever-increasing amount of e-waste.

The global average as of 2018 stood at 44.7m metric tonnes valued at 55bilion Euros worth of raw materials. This trend is projected to increase going into the next decade. Nairobi's current population stands at 4 Million capable of generating about 2500 tons of solid waste daily, with each person producing 0.61kg. This population is projected to reach 6 million in 2030, with waste generation at 3990 tons daily. The solid waste problem is worsened by the ever-changing technologies, fashion, and consumption patterns associated with materialism, thus generating new waste streams such as plastic, electrical and electronic waste. (Nairobi City County, 2016)

According to Omari, Mutwiwa, & Mailutha, (2016), only 22% of e-waste is recycled in Nairobi County. These findings were collected from research conducted in 2009. Estimates indicate that as of 2009, Kenya's documented e-waste generation in tonnes was 11,400 refrigerators, 2,800 television sets, 2,500 computers, 500 printers, and 150 in mobile phones.

Significantly, the second-hand market held a lot of more near-end-of-life electronics; the reason being the tendency by developed economies at selling their near-end-of-life electronic products to least developed and developing countries having weak regulatory safeguards to such imports. This often endangers the human health of the citizens who have little to no knowledge of proper ways to protect the environment from the indiscriminate and destructive impact of poorly managed e-waste. If handled with care, the program can act as a source of employment as well as consistent source of innovation that is in a position to unlock immense economic possibilities to the citizens. On the contrary, this has rarely been implemented. Therefore, this study attempts to assess the role of existing regulatory framework on improving the e-waste management in Nairobi County and further focuses on its effect on the well-being of the society as from 2010-2022.

1.2 Problem Statement

Since the turn of the 21st Century, the trend in manufacture and consumption of electronic products has been rising, and fast. At 4 percentage growth, this represents the fastest rising stream with 44.7 million metric tonnes every year, mainly blamed on the increased market access to developing countries and the growth of the replacement market in developed nations (Baldé, et al, 2017).

Despite Kenya being a member of the East African Communications Organization (EACO) that has a regional strategy and attempting to align its interventions with that of East African regional initiatives by developing the national E-waste Strategy as the main performance contract targeted in the 2018-2019 financial year, a lot still needs to be done to realize the management objective. Omari, Mutwiwa, and Mailutha (2016) analysis found out that only 22 percent of the total generated e-waste was recycled in Nairobi. This exposed the generated e-waste (11,400 refrigerators, 2,800 television sets, 2,500 computers, 500 printers, and 150 in mobile phones) to

emit poisonous gases to the environment when not properly disposed of. As a result, the residents living around the dumping sites are prone to diseases.

Therefore, the absence of regulation, guiding policy and strategy, insufficient capacity, resources, skills, and infrastructure such as recycling systems to tackle the challenge effectively has increased the level of human exposure to unhealthy environmental conditions. The existing efforts put up by firms such as Nokia's recycling scheme, Computer for Schools refurbishment programme as well as 3 major licensed recyclers in Kenya, and some Kenyan County governments, as such as County Government of Machakos (County Government of Machakos, 2015) is not enough to be in a position to curb E-waste menace to the environment and residents' health. The challenge is further driven by the fact that most of these informal operators lack adequate skills which not only lack registration but also authority hence operating within the secretive platform.

Poor disposal habits are cited by a UNEP study on medical records in a Catholic Church sponsored dispensary located at Kariobangi showing that about 9,121 residents were diagnosed and treated with respiratory tract associated problems; skin disorder cases; eye infection; abdominal problems, among others, as linked to the Dandora dumping sites (International Solid Waste Association, 2017). These health challenges are likely to increase in consideration of the growing trend in ICT innovation and drive for the public and private institutions to embrace modern technology at a cheaper cost and existence of few e-waste management institutions and experts with minimal knowledge on e-waste management. These may increase the level of risks in the country especially in Nairobi County.

Discarded e-waste poses serious challenges due to its toxic nature. This is because most electronic devices are functional and get passed on by their original users to others. Those no longer working can be refurbished, resold, or given away for free. The process of deciding whether to treat e-waste domestically, export, dispose of or recycle it, raises regulatory issues. Therefore, E-waste poses one of the greatest environmental challenges in Kenya. This is linked to the country's need for industrial growth brought about by provisions in the vision 2030 (Republic of Kenya, 2007) which guides the policies on where the country will need to invest in for the realization of the shared national vision.

1.2.2 Research Gap

Against this background, the study sought to examine the role of regulatory framework on e-waste in Kenya with a case of Nairobi County from 2010-2022. This period is important because the Constitution of Kenya was promulgated in 2010 which changed the governance structure and created Nairobi City County.

1.3 Research Questions

In order to achieve the research goals and objectives, the following questions guided the research

   i.   What is the role of technology advancement on e-waste management in developing countries cities like Nairobi-Kenya?

   ii. To what extent does the absence of proper policies and regulations participate in an increase in e-waste related diseases in Nairobi County- Kenya?

   iii. What is the role of institutions on e-waste in Nairobi County in Kenya?

1.4 Objectives of the Study

1.4.1 General objective

The study intends to examine the role of regulatory framework on e-waste in Nairobi-Kenya as from 2010 to 2022 period.

The focus on Nairobi is guided by the National solid waste management strategy of 2015 report estimates that identifies the six largest towns in Kenya leading in e-waste generation to be: Nairobi with 2400 tons per day followed by Mombasa (2200), Nakuru (250), Kisumu (400), Thika (140), and Eldoret (600) tones per day follow respectively (NEMA, 2015). This affirms that Nairobi County as the most significant case in Kenya for the study focus on in terms of waste management. Therefore, this study seeks to examine the role of governance in the management of e-waste in Kenya with a case of Nairobi City County from 2010-2022. Again, this period from 2010 is important since it is the time the present Kenyan Constitution was promulgated, giving rise to a new governance framework of devolved units, in this case, Nairobi City County.

1.4.2 Specific Objective of the Study

The research sought to assess the following;

   i. To determine the trends driving e-waste generation in emerging economies such as in Nairobi

   ii. To assess the challenges faced by the absence of policies and regulations on   e-waste in Nairobi

   iii. To assess the role played by institutions, regulations, and policies on e-waste in Nairobi

1.5 Justification of the Study

1.5.1 Academic

The higher learning institutions have been viewed by the government as one of the foundations to identifying and coming up with solutions to major challenges facing Kenya. Though the higher learning institutions have greatly contributed towards transforming the country to middle income status, which led to increase in electrical and electronic products use, the institutions have not engaged in coming up with solutions to solve the risks associated with e-waste to the desired expectations.

The higher learning institutions should therefore ensure that electrical and electronic waste management strategies are not only taught, but also implemented at local, national and international level. Therefore, this study seeks to increase awareness in risks associating with the consistent growth in electrical and electronic waste in the Nairobi County and the need for higher learning institutions to take an active role in managing e-waste in the country. This will ensure that the County will have sufficient expertise to help manage the high e-waste levels and associated risks in the County.

1.5.2 Policy experts

Environmental governance, not least, e-waste governance, has been a major challenge in Nairobi. Fidelity to policy commitments to national, regional, or international protocols has been a weakness with poor coordination of the resulting roles. Of concern is the inadequate management monitoring systems, weak capacity in responding to e-waste associated environmental challenges and general inability to mainstream environmental economics to county and national policies, strategies and plans; not least is the evidence of weak structures for collaboration in the sector, ensuring that conflicts in the sector have remained unresolved.

Studies elsewhere in the world have suggested the enormous potential inherent in treating electrical and electronic waste as a resource in the circular economy. Indeed Ghana (Labunska et al, 2008), China (Hicks et al, 2005), (Wei & Liu, 2012), India (Jha et al, 2011) and The Netherlands (Leijting, 2011) have all set up a mechanism to tap into this sector with varying degrees of intensity, resources and governance interventions.

The attendant results are equally valid in this sector that is estimated to be worth over 55 billion Euros (64.5 Billion Dollars or Ksh 6.5 Trillion) as of 2016 estimates. As e-waste volumes keep rising with little being recycled, the estimates in 2016 recorded a world e-waste generation at 44.7 million metric tonnes and this is going to rise to 52 million metric tonnes by 2021. Of these, only a fifth is recycled in the right manner (Baldé et al, 2017)

In Kenya, there is little to no published concrete recent data on statistics about the e-waste sector. The country has not undertaken any field research on the subject of regulatory framework on e-waste in Kenya to gather findings on how these emerging segments of the economy are likely to be performing presently or future projections including trends that may help in calibrating effective policy and other governance interventions. United Nations University (UNU), International Telecommunications Union (ITU), and International Solid Waste Association (ISWA) report that there is a lack of reliable e-waste data at the national level with only 41 countries collecting international statistics on e-waste. (Baldé et al, 2017) Nevertheless, many of the studies have failed to tie policy with the management of e-waste as a regulatory issue particularly in Kenya and Nairobi County in the last decade.

The study, therefore, sought to establish the role of regulatory framework on e-waste in Kenya within a case of Nairobi County from 2010 – 2022. The result of this study is to provide a guide to policymakers to consider in the formulation of policies, laws, and regulations that will help better govern e-waste sustainably. The Ministry of Environment and Forestry with other stakeholders in Nairobi County will be well guided and informed by this research study in their process of policymaking towards e-waste management in Nairobi County and the country in general.

It is worth noting that regulatory framework is a key driver of economic social and political progress in any country, Kenya included. It is therefore equally worth noting that no research has been conducted to ascertain the effectiveness that this regulatory framework has on e-waste management in Kenya.

1.6. Scope of the study and Limitations

The study was confined to Nairobi City County as defined in the county delineation maps (Maps of the World, 2018-Appendix ii) in Kenya from the period of 2010 to 2022.

The basic unit of measurement for the population interacting with activities on e-waste management was the household; defined as the basic unit of population settlement in the census by KNBS. In the 2013 figures, being the latest figures available, Nairobi County has 985,016 households in an area of 10,323km2 (KNBS, 2012)

This study was further confined to the period between the years 2010-2022. This is to bring focus to the study to the period after the promulgation of the Kenya Constitution (Republic of Kenya, 2010) which fundamentally changed the governance structure of the country into a devolved system. This study looked into the regulatory framework in e-waste management. It was important to confine the research to the period after the enactment of the principal law around which all laws are aligned, to give the research the relevance that goes with this period. This was to assist in strengthening the existing structures by identifying gaps that are exploited by environmental management defaulters and providing relevant recommendations that can be used by the concerned agencies and the government institutions.

Nairobi is a cosmopolitan area with the representation of all Kenya's population demographics being the capital city of Kenya and the most important city in the country. The study focused on

Industrial Area and Nairobi Central Business Zone due to the target area is highly populated with various technological oriented industries and presence of most of the public institutions as well as private and the impact of the poor e-waste management on the neighboring residents' health. The study area targeted also harbors health center facilities that may provide a valuable record on the health status of the residents.

A successful study was impeded by various challenges namely the very short period available to the researcher due to work constraints. This limited the time available for a more extensive study of the variables. Another challenge was the limited financial resources available to the researcher for carrying out a comprehensive examination of the expansive area with a dense population especially in the administration of questionnaires and holding many focus group discussions. Even more challenging was the perceived low interest and understanding by respondents on the subject of the study- e-waste management- as noted by past researchers.

To overcome these challenges, the researcher used a purposeful sampling approach to make sure only respondents well versed with the topic got chosen to contribute to the research. This sampling approach ensured all areas of Nairobi were represented by choosing respondents from various parts of Nairobi demographics such as age groups, gender, spatial area, economic, social strata, and representation from both government and private sector.

The above approach saved the research time, resources, and ensured no bias in the sample. By using focus group discussion forums, it ensured the time taken was greatly reduced while capturing the essence of the research study.

1.7. Definition of Study concepts

1.7.1. Governance

United Nations Environmental, Social and Community Organization report present governance as processes and structures designed to inject accountability, stability, constitutionalism, equity, as well as active inclusive participation. In addition, the term refers to distribution of power, crafting of policy, setting goals and holding stakeholders responsible to their actions (UNESCO, 2017)

Governance as well is perceived as a means through which governments and other social institutions associates, associates with citizens, and makes decisions in the contemporary complex environment. This informs Graham, Amos and Plumptre to define governance as a process through which the society or institutions carry out essential decision and assess their engagement in the implementation process (Graham, Amos, & Plumptre, 2003).

This concept is further elaborated by Rosenau and Czempiel definition of governance in his work 'the New Governance concept of governance', by associating governance to the concept of developing, carrying out, and implementing diverse activities guided by cleared shared goals formulated in institutions with the assistance or without the assistance of formal police (Leary, 2004).

Operational Definition

In this research, the operational definition of governance was taken as the system of institutions and individuals sharing roles and powers and involved in the formulation of policy, laws, regulations, and implementation of activities under the existing laws and constitutional framework.

1.7.2 E-waste

E-waste:

Electronic waste has been defined by Mihai (2016) as discarded electrical or electronic devices set for re-use, resale, refurbishment, recycling, or disposal.

On the other hand, e-waste is defined by the National Environmental Management Authority (NEMA) (2010) as waste from electrical and electronic equipment, their components, and sub-assemblies. However, Asiimwe and Åke (2012) define it as electronic equipment considered toxic and which is not useful unless refurbished. Schluep (2010) on the other hand defines e-waste as equipment that is no longer useful but meant only for material recovery, recycling, or disposal.

In this study, e-waste was used to mean end-of-life electrical or electronic equipment that is no longer in use but destined for recycling, refurbishment, resale, re-use, or disposal.

E-waste makes this study significant in that; components that makeup e-waste are the elements that interest the many stakeholders involved in their re-use, recycling, mining, or disposal. E-waste is said to be composed of such elements/components as lead, cadmium found in circuit boards, lead oxide, and cadmium in TV and computer monitors, including mercury which is now being phased out by the Minamata Convention on mercury due to its toxic nature to human health. Mercury is common in flat-screen monitors and switches. Other equally toxic compliments include polychlorinated biphenyls (PCBs) in older capacitors and transformers; brominated flame retardants on printed circuit boards, plastic and polyvinyl chloride (PVC) in cable insulation (Nicholas, 2004)

1.7.3 Recovery:

Means "any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfill a particular function" (GoK, 2019). The study will use the term to refer to the process of managing the e-waste to minimize risks associated with e-waste through pursuing proper disposal measures.

1.7.4 Recycler:

This is defined as any individual or an entity that get involved in recycling or as well used in reprocessing electronic and electrical devices or assemblies or alternatively their component (GoK, 2019). In this study, recycler is used to refer to those private sector players involved in recycling electric and electronic waste such as WEE Centre, Computer for schools, Safaricom and Jomo Kenyatta University of Agriculture and Technology.

1.7.5 Recycling:

This indicates any event through which the waste materials are reproduced as substances, materials or products either for initial or other purposes (GoK, 2019).

1.7.6 Refurbisher:

Means "any person who repairs, dismantles or re-assembles electrical and electronic equipment to extend the working life of the product; 'refurbishing' means the action of repair, dismantling, improvement of E-waste to extend the working life of the product" (GoK, 2019);

These components on their own can be quite hazardous to the environment and human health if not properly handled. They can also be of great value to those interested in recycling them hence the growing sector on urban mining where scavengers openly burn e-waste in order to extract these valuable components for sale, thereby jeopardizing their health in the process.

The study referred to e-waste management to mean that process which follows when electronic and electrical equipment has been declared or considered as waste and need to be moved on for disposal within a sustainable framework that is safe for the environment and human health.

2. CHAPTER TWO:

LITERATURE REVIEW

2.1 Introduction

This chapter focused on the analysis of various available literature as per the study objectives to be able to assess the findings of other authors tackling related topics. The study breaks the literature into themes such as e-waste trends, challenges, and effects of poor e-waste management, and rules, laws, regulation, and institutions.

2.2 Trends driving e-waste generation in emerging economies

An agenda specific to sustainable development was in 2015 adopted by the United Nations as well as its Member States. The agenda focused on 17 Sustainable Development Goals (SDGs) and 169 objectives to bring poverty to an end, protect the world, as well as ensure prosperity for the next 15 years. However, the increasing e-waste levels and improper as well as un-secure treatment and disposal of e-waste via landfills and incineration pose significant threats to human health and the environment, as well as to the SDGs goals (Balde, Forti, Gray, Kuehr, & Stegmann, 2017). Better management and knowledge of e-waste is closely associated with Goal Number 3 (Good health and well-being), Goal Number 6 (Clean Water and Sanitation), Goal Number 12 (Responsible Consumption and Production), Goal Number 14 (aquatic life), and Goal Number 8 (employment and economic growth).

Balde, *et al*. (2017) indicates that e-waste when inadequately treated may pose serious health challenges, since e-waste contains hazardous components, such as contaminated soil, water, and air, and exposing an individual's health at risk. Additionally, degrading processes inconsiderate of satisfactory means, facilities, and trained personnel regarding electronic waste management act as a possible platform posing more challenge to individual health and the planet at large. The SDGs attempt to address these issues posing threats to the world and human beings.

There exist several factors that drive the e-waste generation. This included but not limited to an increase in multiple device ownership, the attempt to electrify non-electrical devices, an increase

in the data centres among the population, growth in the cloud as well as shorter replacement cycles.

Though the African continent hosts the least population of direct EEEs manufacturers, it holds a substantial burden of contributing toward the international e-waste challenges by generating approximately 2.2 metric tonnes (Mt) e-waste yearly from domestic output. A larger portion of this output is acquired from imports of new as well as used devices, and few from locally assembled plants. According to Secretariat of the Basel Convention (2011) report, locally acquired e-waste output comprises of approximately 50 percent to 80 percent of the total e-waste output, while the rest of the waste is generated from the Trans boundary or foreign illegal imports from the industrialized states in Europe and Americas, as well as China. In reference to Badley *et al*. (2017) report, the annual national e-waste generation in developing countries such as Egypt producing 0.5 Mt, South Africa, and Algeria respectively generating 0.3 Mt, ranking the highest in the African continent. In the same perspective, smaller but richer states in the African continent, such as Mauritius and Seychelles, generate approximately 8.6 kg/inh (inhabitant) and 11.5 kg/inh respectively, in relations to the Africa average of about 1.9 kg/inh as well as the World average of approximately 6.1 kg/inh. This generation of e-waste at the local level is anticipated to increase in the future with the increase in foreign goods consumption and the growing interest in comfort associated with consumer commodities.

2.2.1 Improving living standards and obsolete devices

The electrical and electronic consumption generally has indicated rapid growth throughout 2000 to 2016, a clear indication that emerging economies with 'low Purchasing Power Parity (PPP)' possess the fastest growth rates annually in EEE consumption. Balde *et al*. (2017) identify fridges, electric furnaces, washing machines, flat-panel TVs, and electric localized heating units as main products that have reflected absolute consumption growth in the developing economies. The increase in demand for the EEE products reflects higher living standards which are anticipated to grow in the developing world. However, some of the technologies acquired became obsolete especially in portable video, portable audio, Cathode Ray Tube (CRT) televisions, and bulky CRT televisions.

Kiddee, Naidu, and Wong (2013) identify new technologies as rapidly surpassing millions of analogue appliances resulting in their disposal in the identified landfills despite their capacity to harm the environment. Over the past 20 years, there has been an increased obsolescence on electronic devices following consistency in innovating "smart" functions, new designs and technology. Balde et al. (2017) further concurs with Kiddee, Naidu, and Wong (2013) by noting that the level of obsolete devices usually to be driven by relatively short replacement cycles. Due to the fast transformation of technology, many users are likely to change their devices, such as the mobile phone, regularly if not often even before it reaches its maximum usage limit or breaks. Though, Balde, *et al*. (2017) note that smartphone lifecycle is presented as a tool to measure 'how close the average consumer's device is to the technical state-of-the-art version it is also an indication of the growing amount of e-waste' (p. 20). There exist other devices apart from smartphones which consumers change regularly such as PCs. Laptops, TV sets, routers, as well as other devices. In most situations, older devices are replaced despite not being obsolete or broken, but with a simple indication as outdated. This is evident in the current conversion or switchover from analogue to digital TV broadcasting where many TV sets were discarded constantly. Tough analogue televisions can receive digital signals, through using a digital box, many of consumers opt to upgrade to a new TV set, where the switchover process had an essential contextual effect that left the world exposed to a lot of Carbon-Ray-Tube TVs (ITU, 2015; ITU, 2017). It is notable that the lifespan of a lot of electronics devices has undergone substantial shortening due to electronic advancement, attractive consumer designs as well as marketing and compatibility aspects evident in a decrease in new computer's lifespan from 4.5 to 2 years between 1992 and 2005 resultant to more computers being disposed and/or exported to developing countries (Kiddee, Naidu, & Wong, 2013).

Moreover, there has been increase in debate as well as criticism on the growing levels of 'throwaway society' marked by consumer appetite and the character of purchasing and eliminating things instead of enhancing sustainability as well as repairing the worn-out ones. Therefore, the increasing international middle-class community with a higher income always prefers to purchase new tools or commodities presenting a perception of status trend that is acknowledged in the contemporary society. Balde, *et al*. (2017) further note that some users may prefer to purchase new products just to shy away from any future stress due to the warranty as well as data security issues linked with repaired products.

According to ITU (2016) report, many efforts are being pursued to attempt and limit the volume of obsolete equipment and devices and to minimize the amount of energy required for EE and specifically ICT devices. The ITU (2016) and ITU (2017) reports identify this to be composed of the creation of universal power chargers and adapters. Therefore, the volume of e-waste is likely to continue to increase; however, clear policies and solutions for recycling as well as better data are required to tackle the e-waste menace.

Kiddee, Naidu, and Wong (2013) note that though it is challenging to quantify the e-waste volume generated in diverse categories in Japan, China and US as per the 1997-2010 data, the report approximates that over 130 million television sets, computers and monitors become obsolete yearly and that the number is growing annually in America. In the report, approximately 500 million computers turned out to be obsolete between the year 1997 and 2007 in America. In December, 2010, the obsolete computer numbers grew to 610 million in Japan. Since 2003, China approximately produces 1.11 million tonnes of electronic waste per year remitted from household and IT products/appliances as well as processes in production, electrical and electronic manufacturing (Kiddee, Naidu & Wong, 2013).

Generation of e-waste in some developing states is noted as the cause of concern at the initial stage due to the smaller volumes and longer half-lifespan of electronic commodities in those states because of financial challenges, on both national and local community scales. Kiddee, Naidu, and Wong (2013), further adds that, the major e-waste challenge in developing economies to emerge from the importation of electronics and electrical commodities from industrial states because it is the worn out, fewer levels of ecologically friendly devices that are disposed from these industrialized states 80 percent of all e-waste into the third world states as exports.

In some situations, a single device which has single functionality is likely to be replaced with multiple functionality devices, such as a laptop or mobile phones. Balde *et al*. (2017) note that more individuals own interconnected devices. In their argument, Balde *et al*. state that most people in many states currently own more than one phone and multiple devices, such as laptops, e-book readers, and phones. In 2016, every person in developed countries like the United States possessed a phone, and as well every second individual owned a tablet computer while approximately 25 percent owned an e-book reader (Anderson, 2015). Anderson further adds that

the data collected between the 2012-2015 period indicated that 36 percent of American adults owned tablets, smartphones, and a computer.

Though trends in cloud computing can result in a reduction in the number of devices due to nearly every service being accessed from one device, an increased number of cloud computing means more data centres and thus more e-waste generation (Balde *et al.,* 2017). In this perspective, the traffic levels specifically from cloud services as well as the number of data centres have been increasing and therefore likely to consistently grow in the future (Cisco Global Index, 2016).

2.2.2 Reduced prices

The major factors of the spread and achievement of EEE and the internet can be identified as a high level of competition seen in the telecommunication market, advancement in the technological sector, especially in computing power as well as mobile broadband technologies, and reduction in the prices of devices and services. In Balde, *et al*. (2017) view, the services in prepaid mobile-cellular especially have become relatively affordable in most countries, and mobile- broadband services prices have continued to fall.

In the same approach, the IT equipment prices, such as peripheral computer equipment, computer devices, laptops, Televisions, mobile handsets, and printers are drastically falling. In developing countries, lower prices in handsets have emerged due to manufacturer's efforts being aligned towards producing increasingly affordable entry-level smartphones targeting low-income users (Balde et al, 2017).

2.3 Challenges facing e-waste management and its effect on the environment

 The presence of limited legislations, safeguards, laws (enforcement), and policies of securely imported e-waste and electronic commodities disposal has resulted in serious challenges to the environment and humans in developing countries. This is reflected in the case where discarding e-waste affects human health to extreme levels that have been experienced in countries like China (Xin et al., 2009 as cited in Kiddee, Naidu & Wong, 2013).

Increased concern continues to brew in society today on large imports of e-waste and toxic chemicals into third world countries such as polybrominated diphenyl ethers (PBDEs) as well as

polychlorinated biphenyls (PCBs). Large volume of toxins exposed to the environment and human settlement as in a pose extreme health risk to the habitats and resident's wellbeing (Robinson, 2009). In the same context, Kiddee, Naidu and Wong (2013) further affirms that electronic as well as electrical waste are capable of exposing majority of developing economies and transition economies into risks (Cambodia, Nigeria, China, Indonesia, India, Thailand and Pakistan, and African states). This is seen in cases where these states have resorted to be involved in importation of substantial e-waste levels from developed countries despite the specific threats posed by e-waste effluents thus resulting in diversity in challenges facing states. This can be seen in the African states reusing mainly disposed of electronic products while Asian states dismantle these products usually using unsafe procedures (Wong et al., 2007 as cited by Kiddee, Naidu & Wong, 2013)

Human health and social problems have been identified in some developing states leading to countries such as India, China, and some of the Asian states recently amended their laws to tackle the disposal and management of e-waste imports. Further, safe disposal protocols such as landfill as well incineration as adopted through technological advancements still pose human and environmental risk. Specifically, landfill products transport toxic material into groundwater while combustion in an incinerator produces poisonous gas to the environment. As a result, more toxic material is evident in the environment characterized by metals such as Cobalt, iron, Copper, lithium, mercury and lead among others (Widmer et al, 2005). In support to this, Kiddee, Naidu, and Wong (2013) assert these pushes countries to e-waste management challenges resultant in pursuit of improved/new managerial tools on universal and national level. These tools include Life Cycle Assessment, Multi-Criteria and Material Flow Analysis executed via the Extended Producers Responsibility (EPR).

Badley *et al*. (2017) note that though most of the African states are currently aware of as well as concerned with the hazards linked to poor e-waste management, the legal and infrastructural platforms for realizing this sound management remains still far from being achieved in most of the countries. Very few states in the African continent, inclusive of Rwanda and Uganda, have been in a position to develop some level of formal government policy documents focusing on e-waste management. More so, though nearly all African states have assented to the Basel Convention, most of them have domesticated the convention by domesticating it through appropriate legislation for different waste streams. However, only Madagascar in 2015, Kenya,

and Ghana in 2016 respectively have formally began processing e-waste bills to then be drafted into law (Badley, *et al*. 2017: 60). In relations to the convention domestication, several other African states (Zambia, South Africa, Nigeria, and Cameroon) are working toward achieving this goal in parliament while a draft was being pursued in 2017 in Nigeria to enforce officially the e-waste control by the national environment regulators agency (Badley, *et al*., 2017).

The existing e-waste management practices in Kenya are poorly structured becoming a potential platform for risk for both the environment and human beings. In this context, the policy level programmes aligned towards managing electronic and electrical waste are not put into action. In Songa and Lubanga (2015) view, the serious challenge in e-waste and its policy level effects has hardly been visible in various government authorities. The existing policy has not been able to curb the effect associated with the e-waste due to government liberalization of computer importation and flexible government regulation for telecommunication and media companies. The measures taken by the government have to a larger extent contributed to the influx of electronic products especially mobile phones, television sets, computers, and appliances. In addition to the environmental destruction and illegal importation of electronic and electrical appliances in developing states, Songa and Lubanga (2015) identify e-waste to possess a destructive effect on human health. This health effect is caused by the presence of physical and chemical characteristics in the e-waste environment making it distinct from other kinds of waste that are generated by industrial waste or human activities (Songa & Lubanga, 2015).

The e-wastes are composed of both valuable and hazardous components that need specialized skills in handling, disposing of as well as recycling to prevent contaminating the environment and protect human health. In Songa and Lubanga (2015), their assessment identifies contaminants harbored by e-wastes to range from heavy metals (copper used in electronic components manufacturing), to those that are produced when disposed of through fire (polycyclic aromatic hydrocarbons -PAHs), to distinct components from other components (batteries like lithium composting materials as well as fire retardants) while others may include LCD monitor Chips span (Songa & Lubanga, 2015). Therefore, this indication that the e-waste environment and the concentration of the contaminant found in e-waste is highly reliant on the type of items that are disposed and the elapsed time since it was discarded. This is evident in concentration for e-waste elements, such as Nickel, Copper, Cadmium, Zinc, and Lead affect human health and the environment when exposed to the surrounding.

Anyango and Munyugi (2018) indicate that considering that Kenya's recycling industry is not well established neither is it executed effectively, the contaminant levels could have been prevented from leaking into the environment, endangering human life. The preventive approaches could have removed or reduced some of the contaminants exposed to the environment (Anyango & Munyugi, 2018). In addition, due to most of Kenya's dumping sites using either landfills or fire where a large volume of contaminants ends up to landfills, the result is usually high concentration of the components that are in a position to reach out to the immediate environment adversely impacting on the human health and the environment.

Kenya produced over 44,000 tons of e-waste (electronic waste) items like old phones and laptops that lead to environmental pollution. A lot of waste electronic equipment and electronic sites originate from government institutions (Anyango & Munyugi, 2018). However, most of the private individuals dispose of most of their e-waste on the streets, in gardens, or dustbin or as well in water bodies. There is a total lack of substantial awareness in e-waste management in the country.

2.3.1 Effects of poor e-waste management on developing states wellbeing

Despite Kenya being a member of EACO that has a regional strategy and attempting to align its interventions with that of East African regional initiatives by developing the national E-waste Strategy as the main performance contract targeted in the 2018-2019 financial year, a lot still needs to be done to realize the management objective. Omari, Mutwiwa, and Mailutha (2016) analysis found out that only 22 percent of the total generated e-waste was recycled in Nairobi. This exposed the generated e-waste (11,400 refrigerators, 2,800 television sets, 2,500 computers, 500 printers, and 150 in mobile phones) to emit poisonous gases to the environment when not properly disposed of. As a result, the residents living around the dumping site get prone to diseases.

Therefore, the absence of regulation, guiding policy and strategy, insufficient capacity, resources, skills, and infrastructure such as recycling systems to tackle the challenge effectively has increased the level of human exposure to unhealthy environmental conditions. The existing efforts put by the firms such as Nokia's recycling scheme, Computer for Schools refurbishment programme as well as 3 major license recyclers in Kenya, and the specific county as such as

County Government of Machakos (2015) is not enough to be in a position to curb E-waste menace to the environment and residence health. The challenge is further driven by the fact that most of these informal operators lack adequate skills which not only lacks registration but also authority hence operates within the secretive platform.

Poor dumping habits are reflected by UNEP study on medical records identified in Catholic Church sponsored dispensary located at Kariobangi reflecting that about 9,121 residents were diagnosed and treated from respiratory tract associated problems; skin disorder cases; eye infection; abdominal problems among other linked to the Dandora dumping sites (International Solid Waste Association, 2017). These health challenges are likely to increase in consideration of the growing trend in ICT innovation and drive for the public, private institutions, and public institutions to embrace modern technology at a cheaper cost and existence of less e-waste management institutions and experts with minimal knowledge on e-waste management may increase the level of risks in the country especially in Nairobi County.

2.4 Rules, regulations, policies and institutions in e-waste management

2.4.1 Rules on e-waste management

E-waste management is influenced on a great deal by the policy found in a given country. Liu & Themelis, (2014), while analyzing e-waste recycling in the USA, with potential application in China, look at this framework from the angle of a developed nation's treatment of e-waste (or lack thereof) versus that of developing nations. In addition, Liu's argues that the e-waste management in developing countries, represented by China, was more to do with an informal approach where cheap labour drove the policymakers to recommend a more labour intensive practice such as sorting, dismantling and open burning which, however dangerous and pose a greater risk to human health, was considered the way to go and even proposes that the government can make use of this informal sector to promote industrialization and processing by making it a state-owned enterprise. After careful development, the same can be privatized and driven by the market.

Liu suggests this basing his argument on what his study found out; the existing informal nature of the e-waste sector is very unattractive to formal industries because of its low returns, labour intensive and poor yields. Liu & Themelis, (2014) suggests a policy framework that protects

indigenous informal e-waste sector to keep the many informal jobs that the sector has created from possible encroachment from a more mechanized approach to e-waste management that is less labour intensive but more profitable like those driven by modern, developed western economies such as the USA.

Liu & Themelis, (2014) continues to advance the policy angle of dealing with e-waste adopted by the USA and other developed nations as encouraging the export of e-waste to developing countries because doing it locally portends a costly exercise and since labour is cheaper in developing nations, recycling is way cheaper there than in developed ones. In addition, Liu even suggests that the definition of e-waste in the USA is uniquely different from that of Europe. In Europe, a more detailed view sees e-waste categorized into 10 sectors but broadly describes it as discarded electrical or electronic equipment. In the USA it's not clearly defined but mainly refers to e-waste as consumer electronics that are near or at the end of its useful life. Liu's view tends to contradict the concept presented by Seeberger et al. (2016) asserting the United States to be a major e-waste producer but this country has not fulfilled duties related with responsibility associated with practicing standard e waste management as well as adoption of policy regulations.

Seeberger et al. (2016) and Liu & Themelis, (2014) note that the existing challenges in regulation policy on e-waste management in the USA attempts to address associate's health challenges that adversely affect workers in the workplace. The two studies have served to deal with e-waste management from different perspectives; the USA has for some time managed e-waste by exporting most of it to developing countries like China for economic reasons while using landfills to bury the rest. However, the role played by the policy framework is not spelled out as both studies look into the economic and health reasons for the USA's treatment of e-waste.

Namias (2013), while studying the future of e-waste recycling in the USA, argues that despite the clear benefits of recycling e-waste, its rate of recycling in the USA is relatively low. She explains it as a lack of recycling and regulatory framework. Namias further explains that regulators' push for e-waste recycling is the major determinant for the practice while some countries lack e-waste regulations to guide its recycling. Therefore, the USA does not have integrated smelting capacity, meaning it processes none of the e-waste generated internally

(Namias, 2013). This is interesting since the USA is the biggest generator of e-waste and considered the most technologically advanced country in the world.

It is therefore interesting to find out how other nations, particularly the developing nations manage the e-waste they generate in addition to the one imported from developed countries such as the USA.

At the regional level in Europe, the EU made two policy directives on the restriction of the use of certain hazardous substances in electronic equipment. This directive enforced an Extended Producer Responsibility (EPR) system while encouraging 3R- reduce, recover, and recycle principal (Peralta & Fontanos, 2006). Indeed, the authors contend that governments around the world have adopted EPR whereby in Japan, this has been done through a take-back –scheme where manufacturers are obliged to take a product at the end of its life cycle for eventual disposal or recycling. Here, the law compels consumers to be charged a rate for the collection and recycling of appliances.

The key factor in all the above cases is that some countries in the developed world have some structured policy on handling e-waste be it by managing it locally or exporting it for more economical recycling processes. However, the obvious gap in all of them is their silence on the kind of treatment that this e-waste undergoes when it gets to developing countries, especially in Africa.

Osibanjo, (2015) observes from a gender perspective with a study finding women and girls making up 30% of e-waste pickers in Nigeria, suffering the most risk to their health. The study further suggests a growing tendency towards child labour in the informal collection/scavenging of e-waste, burning to extract valuable metals from components and hawking of e-waste wares. Despite observing that the state of health risk to e-waste scavengers could be replicated throughout Africa, Osibanjo fails to suggest any policy approach in place to deal with this situation. Moreover, Osibanjo's study does not refer to any policy- whether existing or suggest remedial action even though the article was appearing in the armpit Basel convention framework of action.

In the East African community, Asiimwe & Åke (2012) opines that the region considers e-waste as a serious issue but lacks solid solutions to mitigate the problem. To this end, the study attempts to suggest possible practical solutions. Interestingly, Asiimwe attempts to base his study

on a definition of e-waste as, "electronic equipment that is considered to be hazardous, and do not in their functional state serve any purpose to any intending user unless the equipment has been refurbished". This definition seems to suggest offhand that all e-waste is hazardous and the only way to make use of e-waste is by refurbishment. This is inaccurate in that only some components of e-waste can be hazardous when subjected to unsafe disposal practices like burning in the open air. Reuse is just one of 3 ways used to manage e-waste, the others recycling, reduce, and recover. It is notable that Asiimwe's study only dealt with ICT equipment from e-waste categories in the EU WEEE directive

The Kenyan experience with e-waste as noted by Otieno and Omwenga, (Otieno, & Omwenga, 2016) is, mainly at the informal level, posing a great challenge. They posit that low levels of citizen awareness, weak policy framework, and absence of end-of-life framework, product take-back, and implementation of EPR are among the key reasons why proper e-waste management remains a big challenge. Kenya therefore, according to the two authors just like the rest of developing countries, relies heavily on the informal sector to use crude methods 'Backyard recycling,' agreeing with Osibanjo's observation (Osibanjo, 2015). Of interest are the parallels between Kenya and the rest of Africa's experience of an absence of a framework for EOL EPL and policy and a complete contrast with Japan which has a framework for EPR where consumers have to pay for recycling with a policy to back this up (Peralta & Fontanos, 2006).

Indeed, attempts to implement a product take-back scheme by Safaricom did not succeed owing to challenges related to the siting of collection centres, low awareness levels, and absence of incentives for consumers. This absence of proper disposal mechanism resulted in most consumers holding unto excessive stock of e-waste (Otieno & Omwenga, 2016). The authors however did not collect nor analyze any data and only performed an exploratory study and analysis of e-waste management trends in Kenya in their methodology.

Given the weaknesses in the studies highlighted above, the study sought to establish the role of a policy framework on e-waste management in Kenya from 2010-2022 to fill the gap identified in the previous studies.

2.4.2 Laws on e-waste management

E-waste management to a great extent depends on laws and regulations enacted to govern the process in a given country. The International Telecommunications Union (ITU), the global UN body charged with creating international standards in ICT processes, provided a guide to countries on issues to be considered in any regulation or (law) to be issued regarding e-waste (Sandra, 2017) Specifically, the document recommends for some aspects to be included in a legal framework, minimum standards required for specific regulations as part of sound e-waste management in the world. In addition, the document asserts that one of the key causes of high e-waste generation that results in a negative impact on health and environment is the lack of legislation for sound e-waste management and where it exists it is neither adequate nor enforced.

The author, Sandra, (2017), agrees that legislation represents a significant step towards solving problems associated with e-waste from ICT. She posits that this legal framework works in two major components; Organization of ICT/WEEE management systems that recognize the legal framework; and implementation of ICT /WEEE management systems which involve a legal framework with specific regulations.

Interestingly, the ITU (Sandra, 2017) proposes several basic aspects that may be included in a legal framework of ICT/WEEE- for instance on stakeholder responsibility, the government is assigned the role of designing, managing and monitoring an information system, among others while; producers feed and periodically update the information system, providing technical and relevant information on used ICT /WEEE managers and consumers.

This proposal is interesting for the reason that the Kenya government has not been able to formally enact draft e-waste regulations (National Environmental Management Authority (NEMA, 2013) because of a contentious issue on the e-waste registry. The producers want the registry to be out of government control while the government through NEMA insists it is within their mandate. This standoff has led to draft regulations missing out on gazettement to be legally binding thus denying Kenya e-waste sector a proper legal structure within which to operate from 2010-2022

This study sought to find out the implication of the role proposed by Sandra, (2017) that specifies that Government shall design an information system and designate a public entity to be responsible for the system administration: Stakeholders shall be responsible for feeding the

system and timely upgrading the data put on the market, information on generation and management used. The Government shall use the information for planning purposes to adjust regulations and to exercise supervision and control activities.

The gap that exists in understanding and implementing the above criteria by ITU, the worldwide industry umbrella body, that sets regulatory standards for all countries in the world, shall form the basis of this research's exploration into the role of the legal framework in the e-waste management in Kenya

The East African community has a draft e-waste policy and regulations to guide the legal aspect of trans-boundary e-waste within the Basel convention on trans-boundary hazardous e-waste (Basel Convention, 2012) while Kenya has general environmental law, (Republic of Kenya, 2015) but as Sije et al, (2013) contend, the country lacks dedicated legal regime in the country to guide proper e-waste management in the country. Sije et al, (2013) work have left gaps in their study having only confined their research to mobile phones in e-waste. They have not clearly stated the other forms of e-waste which may make up a greater percentage and bulk of the problem.

The gap in Sije *et al*, (2013), being the very limited scope of the study, our research shall endeavor to establish the role of the law in all other aspects of e-waste management and collaborate the evidence as brought out in Omari et al. (2016) who also found a weak legal mechanism in Nairobi county to be a hindrance to e-waste management without directly linking the role of the legal framework and conduct of the management of e-waste in Nairobi.

The aforementioned shortcomings in the text shall, therefore, form a basis for a study into the role of the legal framework on the management of e-waste in Kenya from 2010-2022 with an emphasis in Nairobi. This was looked at against the framework set out in other countries like Japan, EU, which have specific laws governing the e-waste sector. It's against this background that we sought to find out how the framework of laws and regulations could be related to the current strategy of management of e-waste in Kenya particularly Nairobi in 2010-2022.

2.4.3 The relevance of institutions in e-waste management

A careful study of available literature on regulatory frameworks at the institutional level dealing with e-waste management worldwide reveals a picture of a world at various stages of abilities

and strategies to combat the growing challenges from e-waste. According to the United States Environmental Protection Agency, (EPA) 2018 report states that one of EPA's roles is to support the United States Strategy for Electronics Stewardship (NSES); enhancing the management of electronics through the product-life-cycle (EPA, 2018).

It also works with other governments and stakeholders around the world on e-waste management. NSES cites the executive order of the President of the United States issued (March 19, 2015) - planning for federal sustainability in the next decade -as outlining the steps and goals set to reduce waste, including e-waste, and gives directions to various institutions from federal agencies and individual companies in a strategic plan of action to build a clean economy that sustains health and environment in the face of climate change, by reducing greenhouse gas emission.

The EPA (2018) report indicates that the NSES revolves within four goals: incentivizing the design of environmentally friendly electronics, enhancing innovation, increasing the safe management of e-waste and reducing the harm of US e-waste exports and improving the handling of e-waste in developing countries. Therefore, the above shows a structured framework of handling e-waste in the USA exemplified by NSES having an inter-agency task force on electronic stewardship with membership from 14 major departments of the US government including DOD, EPA, FCC, Department of State and Education. The roles and goals of this structured approach in the USA are said to involve; increasing capacity for e-waste management for green jobs, strengthening domestic and foreign markets, for viable and functional used electronic products, and preventing health risks at home and abroad. The reports for NSES, from 2014 and 2017 show federal agencies working together on several initiatives towards this goal (www.epa.gov)

Across the border in Mexico, Denogean, (2016) observes that a structured attempt at e-waste management like its northern neighbor, USA has been frustrated by bureaucracy and corruption from waste pickers and informal recyclers' syndicate. The middle and upper class is aware of the situation and has started private initiatives. Denogean makes a recommendation for the creation of links between various sectors such as copper smelting, e-waste recyclers. Currently, a structure of Secretariat, State, and Federal government that exists and guided by the law- the general law of ecological balance and protection of the environment which cites article 137 of

the Mexican constitution (Denogean, 2016). The link is meant to ease operating cost burden and assure smelters and recyclers of a wider range of sources of raw materials.

At the East African region level, various member government agencies and telecommunications regulators under EACO framework, and EAC body, came up with a model for institutional governance in the e-waste sector. It outlines roles and responsibilities for various government ministries, agencies, and institutions in proper e-waste management ranging from importation, manufacture, to disposal. For example, EACO, (2013) stipulates the role of the "ministry in charge of ICT to spearhead the development of e-waste policy, a strategic plan with responsibilities for relevant stakeholders. The ministry in charge of environment and related natural resources, to develop/review environment Acts to incorporate e-waste specific legislation". However, a careful study within national boundaries in Kenya paints a different picture. Despite a model framework being passed in 2013, neither the e-waste policy, strategic plan, nor development/ review of e-waste-specific legislation, has been undertaken and concluded by the concerned ministries.

The constitution of Kenya as enacted in 2010 (Council for Law Reporting, 2010) spells out a devolved system of government where matters of waste management, in general, are devolved to counties while the national government deals with policy, national and legislation and regulatory functions through NEMA (National Environmental Management Authority, 2013). This led to the environment policy being passed in 2013 and the EMCA law amended in the same year (EMCA, 2013) to be in line with the new constitutional duties on the structure of government giving various roles to the two tiers of government. Even though not much has been done within this governance framework whereby counties collect and dispose of municipal waste, not much is being done in the e-waste component of waste. There is also limited information on available literature on the governance structure in the management of e-waste in Kenya or Nairobi. Muhani, (2012) affirmed this view by mentioning that, creation of more structures under EMCA such as NEC creates more confusion and overlaps in the governance structure with overlapping mandates. He further observed that strategies have not been fully implemented due to inadequate capacity and resources to mobilize and link activities effectively within and between sectors.

In the same legal context, the various institutions set up by the constitution (Council for Law Reporting, 2010) such as the City County government of Nairobi with the environmental

directorate, ministry of environment, Judiciary under Land and Environment Court and those set up by EMCA (2013) such as NEMA, as the principal regulator of matters environment in Kenya, Kenya Bureau of Standards, among other stakeholders should come up with proper legal structures on how to handle the waste. However, there is a lack of clarity on how each stakeholder will carry out their mandate and role in e-waste management within the governance structure that is still a long way off the sophisticated structures in the USA mentioned earlier.

Given the weakness highlighted above, the study sought to establish the roles of regulatory structures in the management of e-waste in Kenya from 2010-2022 to fill the gaps identified.

2.5 Theoretical Framework

2.5.1 Systems Theory

Systems Theory is an organizational theory that looks at interactions between systems (Friedman & Allen, 2011). Here, Von Bertalanffy defined it as a world view based on system inquiry. Its central concept being 'system'; meaning a multiplicity of parts connected by a web of relationships. Von Bertalanffy defines the system as 'elements in a standing relationship'.

The system view was based on many other ideas, a web of relationships within elements of a system, with common patterns, behaviors, and purposes that one can analyze and use in developing deeper insight into characteristics of complete phenomena to move closer to a unity of the sciences. Indeed, Von Bertalanffy, a biologist, wanted to bring together the organismic science he had observed in his work in Biology. He wanted to use the term 'system' for the principles common to systems in general. (Friedman & Allen, 2011)

As the precursor to system theory Von Bertalanffy writes on general systems theory as models, principles and laws that apply to generalized systems or their subclasses notwithstanding their specific kind, the nature of their component elements, and the relationship of forces between them 'it is fair to ask for a theory of universal principles applying to systems in general' (Friedman & Allen, 2011)

The study draws on systems theory to enable us to understand the components, roles, and dynamics of related systems to interpret problems and develop balanced intervention strategies. This has the goal of enhancing the 'goodness of fit' between individuals and their environment.

As John Meyer, (1983) explains, "Systems theory does not specify the particular theoretical framework for understanding problems nor does it direct the social scientists to particular interventions. It helps to organize a conceptual framework for understanding.

Looking at E-waste Management as composed of many parts that have to be considered together for it to function optimally, the study relies on systems theory to understand these individual parts represented here by policy, legal and institutional framework.

This is so because general systems theory is equated to a science of a whole. Von Bertalanffy Ludwig, (1968) saw it as "an organismic conception in biology that emphasized consideration of the organism as a whole or a system, thus the main objective of biological sciences being the discovery of organizational properties that can be applied to organisms at various levels for the analysis- 'the whole is more than the sum of its parts". The organizational properties have two conditions that this study will draw from; an interaction occurs between parts" when these two are present, the interaction is measurable and can be subject to scientific inquiry.

System theory has influenced Talcott Parsons (Parsons, 1951) who was also influenced by Durkheim and Weber, further showcasing the specific functions of social systems into a 'structured functionalism' explaining that social structures involved interactions and relationships among actors and defined as a functional imperative in the larger social environment (Friedman & Allen, 2011). The basic weakness of system theory is the assumption of organization and environment in concrete terms. Functional unity is not always possible in the real world as some variables get antagonistic and not always pulling together. However, despite these weaknesses, it is a strong theoretical framework upon which we shall base our study.

The study relied on systems theory to establish the roles played by various parts of the governance systems such as policy, legal and institutional framework within the whole organizational approach of management of e-waste in Kenya in the last eight years, especially in Nairobi City County. They were looked at as parts of a system that only works optimally when all systems are well-tuned for the purpose.

2.5.2 Governance Theory

According to Chhotray and Stocker (2009), governance is the rules of decision-making being taken collectively in a context of a plurality of organizations or actors, and no formal governance system can manipulate the terms of the association between these organizations and actors. Governance theory has four tenets; the rules guiding the theory are elastic and, in a position, to reach both formal and informal context where guidelines used to make the decisions are generally presented as institutions that can be stable over a specific period despite the dynamic environment.

The interest in governance is usually based on formal arrangements rather than decision-making structure and engagement of informal practices, customs, and conventions when challenges arise. Chhotray and Stocker (2009) term this approach as 'rule in use' as it integrates both formal and informal institutions that may have an impact on contemporary governance issues in the community. In this context, the e-waste management in Nairobi will only be effective when various actors in waste management engage in a formal discussion to come up with policy formulation and implementation. Creation of relevant governing institution to coordinate with existing institutions, such as NEMA and Ministry of Environment, will ensure that private sector and public will participate in management of e-waste. This will only be ensured through the constitution, policy and guidelines to govern e-waste management.

The theory also focuses on the 'collective' concept that propagates that decision formulation as generally a responsibility of the society or group of individuals. The concept advocates that though the existing platforms provide different avenues that may be preferred by individuals in decision making, the final decision is usually bestowed on the group or community. In this context, collective decision making in the existing institution, both private and public, will be effective when proper guidelines are developed to enhance accountability of those in authority. In addition, the collective concepts not only engage every actor in e-waste management but also ensures that those contravening the set laws by the institution are made accountable. This concept points to NEMA, Ministry of Environment, City County Government of Nairobi, and other relevant institutions that have to ensure that e-waste management is achieved both at administrative, institutional or local authority levels.

The opponent of inclusive governance points at the aspect of uncertainty as well as irregularity as among the weak aspects of the theory. According to the critiques, shallow exercise is practiced in institutions where programmatic elements are just highlighted rather than the institutions to take it as their responsibility. Though the inclusive governance concept promotes future change by empowering citizens, the concept may be undermined through use of collective decision making where senior or elites in the society are likely to attempt to risk the governance credibility in an attempt to hinder reform aligned towards curtailing technocrat powers or engage citizens consultation that may initiate changes towards enhancing development and safety.

The presence of inclusive governance towards management of e-waste in Kenya will ensure that the trends being embraced in the country do not impact negatively on citizens and environmental wellbeing. Inclusive governance will ensure that the institutions engage all actors such as the e-waste recyclers, garbage collectors, public and private institutions, the public, and the concerned legal and waste management institutions to solve the e-waste issues through legal and policy framework implementation.

2.6 Research Hypotheses

The research adopts an alternative hypothesis, thus;

i. The industrialized states as the main producers of e-products should assist Kenya to come up with effective e-waste management policy.

ii. Most of recycling firms and public have been relying on the general guidelines provided by NEMA and Ministry of Environment to manage e-waste in Nairobi, Kenya

iii. The absence of specific institution managing e-waste and rules guiding e-waste disposal has led to poor disposal measures by the garbage collection firms in Nairobi.

3.0 CHAPTER THREE:

RESEARCH METHODOLOGY

3.1 Introduction

This chapter focused on identifying the right research method to help in realizing the study goal. The research method covers; research design; sample technique; population; sample size; data collection; data analysis procedure and ethical issues surrounding the study. In this context, mixed approach elements such as qualitative and quantitative research design was used where descriptive and phenomenological approaches were employed in the process of using semi structured interview questionnaires or structured questionnaires for collecting and analysis of collected data.

3.2 Research Design

The study opted for a mixed approach, where qualitative research design employed phenomenological and exploratory research design methods. The qualitative research design approach enabled the research to include physical chronological events and as well restating phenomenon of institutions or individuals and especially through participants' view where phenomenological research design method will be administered through non-structured interview questionnaires. Phenomenological research design method is designed for consciousness of respondents while excluding the immediate environment. The study therefore examined the reality of electronic and electrical waste management and the regulatory frameworks in Kenya to assess the level of legal frameworks effectiveness towards managing e-waste in the country.

The study also used an exploratory approach that was important for the study on e-waste management and legal frameworks due to the limited or lack of substantial information on the study topic. The sector on e-waste management has not been widely researched in Kenya and thus leading to some policies guiding on e-waste management being only presented as draft.

3.3 Population

Mugenda and Mugenda (2003) define the term population as the sum total of individuals, events or objects sharing the same observable character traits and where deduction can be conducted by a researcher. The population therefore is termed as the largest set observable within a study. This study will focus on the Industrial area, Nairobi Population as the targeted population.

The basic unit of measurement for the population interacting with activities of e-waste management shall be the household; defined as the basic unit of population settlement in the census by KNBS. In the 2013 figures, being the latest figures available, Nairobi County has 985,016 households in an area of 10,323 square km. Our target population shall be 985,000 as based on the number of households. This study shall be looking into the regulatory framework in e-waste management, it is important to confine the research to the period after the enactment of the principal law around which all laws are aligned, to give the research the relevance that goes with this period.

3.4 Sampling Research Technique

Due to complexity of the topic, the study used stratified techniques, where only those with deep knowledge of e-waste management and legal system in Kenya were engaged in the data collection process. Therefore, purposive sampling was integrated in the process to include only those respondents who are fit for the study. This approach was essential in retrieving data from individuals who were potential respondents in the areas.

The interview schedule was administered to 46 respondents drawn from various government ministries (NEMA, County government of Nairobi and Ministry of Environment), private sector (WEEE Centre, Safaricom, JKUAT) and scholars from Nairobi University Department of political science and public administration. The respondents were grouped into 4 groups (PA, PB, PC, PD) each composed of 6 individuals on one hand, 12 experts (4 Ministry of Environment, 3 from NEMA, 1 Ministry of ICT, 1 Ministry of Industrialization, and 3 from City County of Nairobi) another 10 were given questionnaires to fill and submit online

The criteria of selection of the participants was informed by the need for inclusivity of all actors in the study with an aim to capture all stakeholders' views. This assisted in reducing the level of bias that one sector might have in their response. However, the study never engaged those

outside the area of study and the under age. This ensured that only those with knowledge on e-waste management participated in the study thus increasing the likelihood to acquire relevant information.

3.5 Sample Size

This study administered questionnaires and interview 46 targeted respondents in the industrial area, Nairobi.

In Mugenda and Mugenda (2003) view, a representation of 10 percent to 30 percent presents a reflection of the population under study and thus 46 respondents are 16 more than the standard figure to allow for response rate. The individual respondents were identified through purposive sampling techniques where respondents were informed on the study area. The respondents were drawn from different age brackets (20-35, 35-50, above 50 years), gender, public and private sector backgrounds, academia, and business including those working in the e-waste sector among others with an expert background in the sector. In short, the sample size was 46 respondents. Therefore, the study mixed maximum variation with expert sampling to ensure we gain a great understanding of e-waste regulatory framework by looking at it from various angles and got expert elicitation.

3.6 Research Tools

This research study used a focus group discussion and in-depth interviews/ structured interviews which employed a questionnaire. Primary data was from document reviews of policies and laws in Kenya, interviews with the stakeholders in policy, regulatory and operational areas of the e-waste sector, as well as administration of questionnaires from individuals sampled using purposeful random sampling. The focus group discussions and in-depth interviews/ structured interviews gathered data from institutions, individual households, and businessmen and women in Nairobi County at a particular time using questionnaires.

In order to avoid bias in the sample, the research structured the distribution of the questionnaires based on the set of attributes, namely; Public/private sector, sex, occupation, spatial, income levels, households, among others; all geared towards making sure each demographic is fairly represented and had an equal chance of being chosen. As such, this study designed an interview

guide for the focus group discussion and in-depth interviews/ structured interviews that was used to collect qualitative data from respondents to answer the research questions.

3.7 Data Collection and Data procedure

The study not only used secondary data collection from books, journals, scholarly articles, and documentaries in addition to KNBS; the Kenya Housing and Population 2019 report as per the Kenya Constitution of 2010 (4th Schedule Part 1 Item 11); the Statistics Amendment Act, 2019; as well as the Statistics (Population Census) Order in 2018; Legal Notice No. 205; as well as the Cabinet Memorandum of May 2017 in the 2019 population and housing census process implementation. The study also incorporated the reports from the National Environmental Management Authority (NEMA) and the government and non-governmental institutions formed part of secondary data.

The data collection procedure majorly focused on primary data collection technique using un-structured interview questionnaires. By using detailed unstructured interview questionnaires and in-depth interviews, the study ensured that the time taken was greatly reduced while capturing the essence of the research study. Though purposive sampling can be prone to researcher bias, it is in a position to offer a platform to conduct generalization from the sample under study- be it theoretical, analytic, and/or logical.

There were discussions on the thematic areas in the process of engaging respondents from targeted institutions such as NEMA, Ministry of Environment, Public and Private institutions, and households. This led to the interview schedule being administered to the target participants from Ministries such as NEMA and Ministry of Environment; County government of Nairobi; Public and Private personnel such as WEEE Centre, Computer of schools, Safaricom and JKUAT and private recyclers; the general public i.e. student residing in Industrial area Nairobi and Scholars.

The data was pursued using social media platforms such as WhatsApp and Skype, emails, and voice calls to trace contacts of potential respondents. The data collection was facilitated through an introductory letter from the Nairobi University to facilitate the collection of data within a legal framework.

3.8 Data Analysis

The study collected qualitative data – a non-numerical data capturing concepts and opinions from the respondents. The study further proceeded to analyze it in order to organize, interpret, and identify patterns before tying the data to research questions and finally using this analysis to make informed and verifiable conclusions. The study adopted the deductive approach using our 3 research questions as a guide.

The following steps were followed in the analysis of this study data; transcription of the data from the interviews, organization of the data using the research objectives/questions by tabulating it, coding the data into descriptive coding using concepts, properties and patterns. Data validation followed in every step to ensure validity and accuracy of design methods and procedures for consistent and dependable results. The study finally proceeds to the conclusion of data analysis which involved giving research findings and outcomes based on the research objectives. The final report states the implications of this research to policy and academic discourse based on the theoretical framework

3.9 Chapter Summary

The study opts for a cross-section research design where qualitative data collection was used. The study further identified Industrial Area and CBD areas in Nairobi County to form the target area for data collection. In this context, the study opts to use an interview questionnaire to collect primary data which was collected from the 4 focus groups and expert individuals among key subjects. The analysis was subjected to coding using the study themes.

3.10 Chapter outline

This study was organized into five chapters. Chapter one discusses the introduction while chapter two deals with the Literature review and theoretical framework. Chapter three discusses the methodology used in the research while chapter four presents research findings and analysis. Chapter five is the summary, conclusions, and recommendations.

4.0 CHAPTER FOUR

DATA ANALYSIS AND PRESENTATION

4.1 Introduction

This chapter analyzed the various findings in relation to the study objectives; assessed the role played by rules, laws and regulations and by the institutions on e-waste in Kenya. Data was acquired through open and closed ended interview questionnaire that were administered to respondents who were selected through convenient sampling approach. The respondents were bundled into 4 different groups with each group having 6 participants. The groups were coded as per the level of awareness they possessed; PA (Waste Management Institutions i.e. NEMA personnel); PB (Public and Private personnel); PC (the general public i.e. student from Nairobi University) and PD(Scholars). Therefore, 46 respondents informed our analysis on the role of regulatory framework on e-waste in Nairobi-Kenya.

4.1.1 Response rate

The study focused on the public, stakeholders in waste management, and private and government institutions such as NEMA, County Government of Nairobi, WEEE Centre and Safaricom among others based in Nairobi County. The interview schedule was administered to 46 respondents drawn from various government ministries (NEMA, County government of Nairobi and Ministry of Environment), private sector (WEEE Centre, Safaricom, JKUAT) and scholars from Nairobi University Department of political science and public administration. The respondents were grouped into 4 groups (PA, PB, PC, PD) each composed of 6 individuals on one hand, 12 experts (4 Ministry of Environment, 3 from NEMA, 1 Ministry of ICT, 1 Ministry of Industrialization, and 3 from City County of Nairobi) another 10 were given questionnaires to fill and submit online

4.1.2 Profile of Respondents

Table 1: Socio-Demographic Characteristics of the Respondents

| Variables		Frequency	Percentage
Gender	Male	27	59.0
	Female	19	41.0
Designation	Senior Level Management	12	26
	ENTRY/Middle-Level	22	48
	Scholars	14	26

 Source: Author (2022)

The profile of the respondents was marched with variables such as gender and designation that pointed out their level of experience or expertise in the field of waste management. As indicated in the above table female respondents were represented by 41% of the total while males were the larger participants with 59% where the respondents were drawn from various levels of job entry while some were scholars in the field of political science and public administration.

4.2 E-Waste Management

Kenya produced approximately 44,000 tons of e-waste and above especially involving gadgets such as old phones, laptops, radios, among others that causes environmental pollution if not well managed. According to expert's respondents in the study, they note that only 22 percent of total generated e-waste was recycled in Nairobi, clearly indicating that the unmanaged generated e-waste is 78%. This has exposed residents living around the dumping sites to various diseases.

Figure 1 e-waste management response
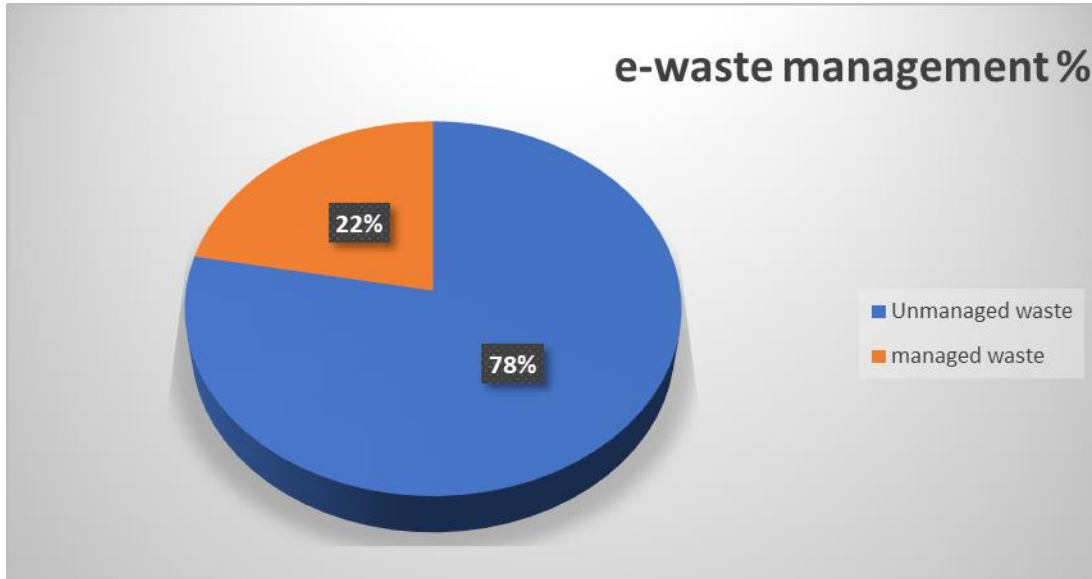
Source: Author 2022

Table 2 unmanaged e-waste expert respondents

Items	Quantities
Refrigerated	11,400
Television	2,800
Computer	2,500
printers	500
Mobiles	150

Source: Author 2022

The level of awareness on e-waste ownership or confusion on the best method of disposing the waste was reflected through all the clusters response:

PA/PB/PC/PD: I own more than one telecommunication devices such as cellphone, television, and radio. Some of the devices were bought due to growth in technology advancement and lack of proper disposal criteria

Figure 2 unmanaged e-waste expert respondents
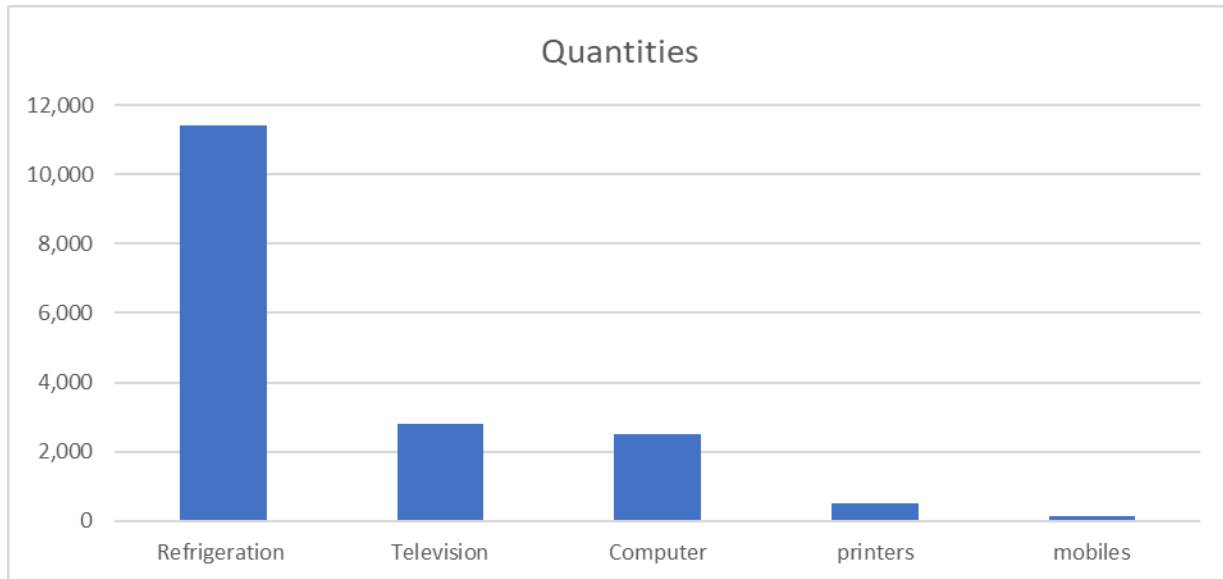
Source: Author 2022

The above figure 4.2 confirms the respondent feedback that out of the 70 percent unmanaged electronic and electrical waste in Nairobi county refrigerated equipment's has a bigger volumetric tonnes of unmanaged waste due to long term service and innovation associated with the item. However, the respondents will have to purchase new gadgets such as television, computers, printers, and mobile phones present the increased rate of innovation that marches the markets interest and will to purchase new ones. In this context, all the respondents generally agreed to owning either of the small gadgets due to availability of shop repairs who sometimes purchase the machines for their spare parts. Therefore, lack of proper disposal or individuals with interest to take over the nonfunctioning second hand refrigerated gadgets leads to the malfunctioning fridge equipment piling up in waste collection or disposal point.

How familiar are you with activities dealing with electronic and electrical waste in Nairobi County?
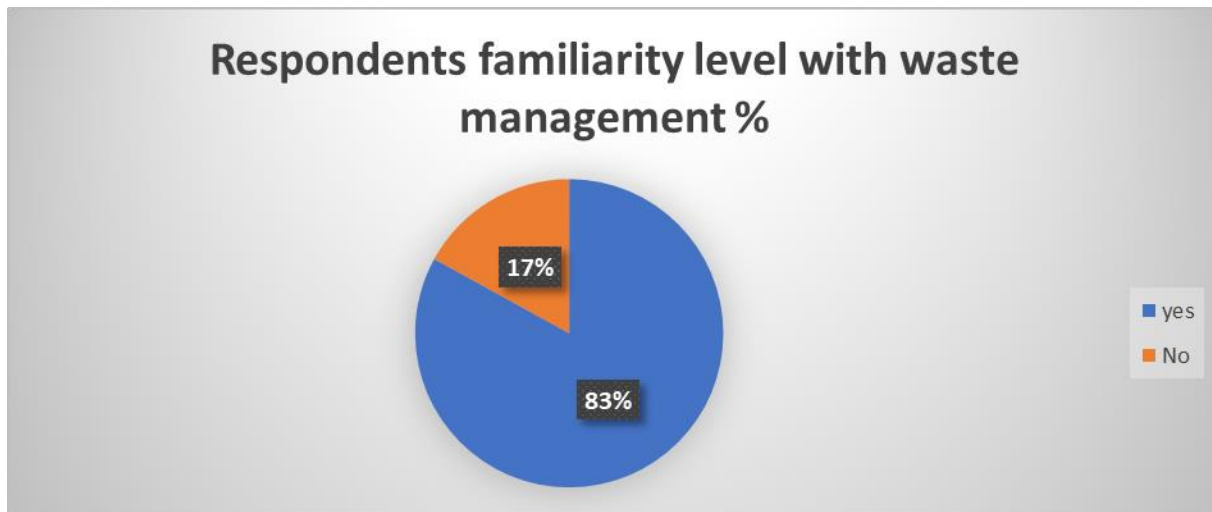
Table 3 Respondent's familiarity with electric and electrical waste

Respondents	frequency	%
Yes	38	83
No	8	17

Source: Author 2022

Most of the respondents (83 %) were familiar with the activities surrounding electronic and electrical waste within Nairobi county. In this context, most of the large population in the study were identified to have emerged from the waste management firms, e-waste management firms, national environmental programmes among others. Those whose feedback formed a marginal percentage of 17 % emerged from the residents and a few employees. This is reflected in the **Figure 3 Respondent's familiarity with electric and electrical waste**

Most of the participants forming cluster PA and PD were quite familiar with activities dealing with electronic and electrical waste management in Nairobi. However very few to none of the respondents in cluster PC had knowledge on the activities dealing with electric and electrical waste in Nairobi. There is a high likelihood that those in cluster PB were aware of the activities surrounding electronic and electrical waste in Nairobi County had contracted such organization which were provided with NEMA licenses. These findings are supported further by the ICT policy that requires the EEE dealers to showcase their support to minimize their programs effect on the surrounding environment prior to their license renewal application by the Communication Authority (GoK, 2019b).

From the in-depth interviews carried out on three expatriate individuals at the National Environment Authority, it emerged that the dealers in waste management have fulfilled or show a willingness to fulfill the ICT policy. This is reflected by the three individual interviewees (PE) drawn from the waste management firms, NEMA, and recycling firms presenting that:

> *The ICT policy though presents a guideline for EE dealers to come up with*
> *programs to minimizes pollution of environment while common good,*

cannot be fully achieved due to the free rider's mentality among the public and some implementers.

The guidelines ensure that organizations producing e-waste take full responsibility towards sustaining and implementing conservation measures on the environment from WEE harmful effect. However, according to the respondents this measure is not easily achieved as the government is perceived as the major driver of maintaining or protecting the environment for the common good. This varies from provision of proper e-waste management procedures which might exist but are ignored by the public and private sectors. This view is supported further by NEMA 2010 E-waste framework as provided for by the National E-Waste Guidelines, to assist the private sector, government, learning institutions and other stakeholders to control WEEE efficiently towards sustaining environmental conservation. The shared activities are mostly protection of environment; e-waste treatment technologies; creation of environmental awareness; categorizing e-waste; and disposal guidelines

PC: *NEMA has been the only institution in the frontline to advocate for environmental awareness creation; e-waste categorization; and providing disposal guideline to both the public and private institutions as well as residential areas on disposal guidelines*

The PC cluster response on NEMA as an enforcement institution clearly indicate the level of awareness in the country on activities involving e-waste management. The relevant institutions should come up with regulation approach on management of e-waste by putting in place legal frameworks specifically to tackle the legal, policy, regulatory and awareness frameworks surrounding the electronic waste management. This is a clear indication that activities carried out by NEMA, ICTA, CA and the Public Procurement and Oversight Authority (PPOA) is not clear to the Kenyan public on their legal and policy framework guiding e-waste management.

4.3 Agencies, institutions and department role in e-waste management

What are some of the agencies, departments or organizations in Nairobi County that are involved in collection, recycling or disposal of discarded electronic and electrical equipment?

PA/PD/PB: Some of the key institutions, agencies and departments working on e-waste management are NEMA, ICTA, CA, WEE centre and private e-waste institutions such as Nokia and other international Agencies.

Though the respondents were quite familiar with some institutions such as NEMA, ICTA, E-waste Management, policy and private institutions like Nokia working towards realization of e-waste management, regulatory bodies such as the Public Procurement and Oversight Authority and private institutions such as WEE centre for recycling e-waste are not familiar to most individuals in the country. Therefore, the level of e-waste management framework should be improved to the public by conducting public awareness so as to inform the institutions and individuals on the available institutions to assist in reducing or eliminating poor e-waste management.

PC: The WEEE centre has been collaborating with different institutions such as Taka Ni Mali, IRCK, UN-SDSN Youth Initiative, Safaricom, and Total energies. This institution has assisted in ensuring that the organizations who manufacture or deal with electronic and electrical materials are working towards informing their customers on the best way to manage e-waste.

Though this collaboration is effective in creating awareness, the conflicting aspect is that the organization manufacturing the electrical and electronic gadgets are reluctant to share critical and sensitive designed data. This makes it challenging to identify the components used in assembling or manufacturing the gadget and their expiry period. In this context, the government is perceived as an agent that can compromise critical information by sharing data with the competitor who might use the information to gain competitive advantage against the organization. Therefore, developing countries such as Kenya will be facing major challenges in acquiring e-waste data due to a lack of safeguards to assure manufacturers that their sensitive design data is safe from spying. This has impeded the growth in the country's E-waste recycling endeavors.

This is a clear indication that Kenya is not likely to achieve sustainable electric and electrical waste management without bringing in a legal framework to govern the acquisition and management of e-waste gadgets. The provision of e-waste management regulatory framework will assist in providing information of the expiry period and how

the manufacturers and recyclers can collaborate to assist the public in managing the exploding E-waste volumes.

4.3.1 Specific government and private institutions dealing with e-waste management

a. *The level of respondent familiarity with any organization, institution within the government, at national or county that is charged with managing electronic waste in Nairobi*.

There are no specific institutions mandated solely to operate in managing e-waste in Nairobi county. However, most of the respondents in PB and PC felt that NEMA played a key role supported by WEE Centre and Safaricom to ensure that there is control in collection, sorting, and disposal of e-waste. However, NEMA takes a regulatory role in management of waste in the country which limits its capability to focus on e-waste management.

Table 4 respondents' feedback on e-waste management firms

Organization in e-waste management	frequency	%
WEE Centre	8	17
NEMA	17	37
County Government	17	37
Safaricom	4	9

Author 2022

The respondent's feedback on e-waste management firms reflected lack of proper awareness even among the experts. Most of the experts identified Safaricom and WEE Centre as a e-waste management hubs while presenting a lack of any government institution in the e-waste management. The lack of proper awareness is further reflected in most respondents identifying the county government of Nairobi and NEMA as management bodies of e-waste. This element gives an impression of lack of proper information as NEMA is mandated with formulation and enforcement of the policy while the county government assist NEMA with waste collection. However, county government and NEMA are not involved in the e-waste management. This is well reflected in the figure 4.3 below.

Figure 4 tabular representation of respondent's feedback on e-waste management firm

Familiarity with e-waste management firms in Nairobi county
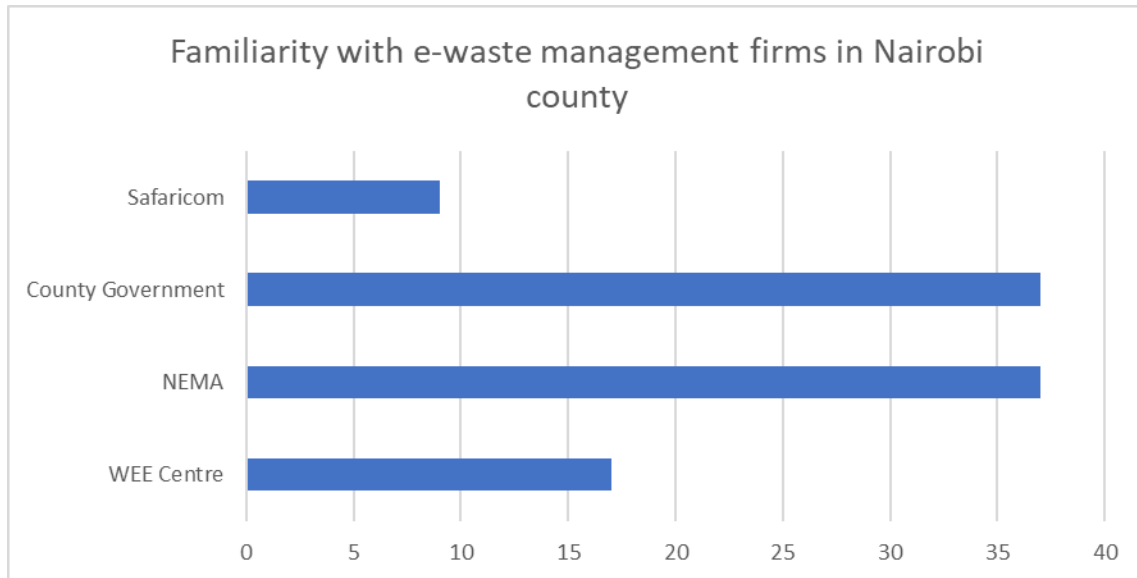
a. *functions associated with e-waste management firms mentioned above*?

The existing institutions are aligned towards managing e-waste, transport and disposal of waste through a licensed dealer. However, the law does not provide substantial guidance on the cases where recyclers do not show interest in purchasing bids for e-waste disposal. The bureaucracy involved in the process of purchasing bids of e-waste is slow and may lead to accumulation of huge obsolete computers stock as well as other WEEE under public institutions storage (GoK, 2019b).

> *PA/PD: The tendering process as presented by the policy guideline and regulatory frameworks discourages potential bidders from showing interest in the process of e-waste management. The process is also not very economical and lack rewards for those who show interest.*

The respondent especially in PC identified NEMA and city County Government of Nairobi to be only the government institution which are mandated in waste management that is inclusive of e-waste. However, this notion is misinformed since NEMA plays the role of waste regulator and issue licenses while the City County just assist in enforcing the laws, policies developed in waste management and collection of waste. This brings up the case of the relevance of e-waste management institution among the public and private sector where the number of players in e-waste management in Nairobi County is very low in comparison to the volume of e-waste channeled out by the public and private sector. However, the PA

respondents correctly identified private institutions, such as Safaricom and WEEE centre, as institutions engaging in e-waste management. This is because these institutions perform a special role in implementing e-waste management in the county of Nairobi by engaging in recycling of electrical and electronic wastes in this context, implementation of e-waste management is slowed down by existence of a limited number of e-waste recycling firms in the Nairobi county.

b. *other institutions or individuals outside government involved in recycling, collection or disposal of electronic waste in Nairobi currently*

Most respondents were not aware of individual or private institutions operating electrical recycling, collection or disposal of electronic waste in Nairobi currently. The respondents are clearly not aware of any individuals or institutions working outside the government involvement in recycling, collection or disposal of electronic waste in Nairobi. However, the respondents confuse NEMA as a key organ mandated to manage e-waste in the country. Firms such as WEEE Centre, Safaricom, and Nokia, works closely in attempt to   manage e-waste.

d. *some of the activities that recycling individuals or institutions are involved in*

> *PA/PD: The existing private institutions and individuals engaging in e-waste management are responsible for recycling, collection or disposal of electronic waste. However, the institutions or individuals are not well established to manage large amount of e-waste hence may engage exportation of some e-waste abroad.*

The level of knowledge by various respondents on existence of individual or institutions working outside government influence in electronic waste management, is a clear indication that WEEE centre and other related institutions such as Jomo Kenyatta University of Agriculture and Technology and Safaricom engages in recycling, collection, and disposal of electronic waste in the county. However, to enhance their potential in e-waste management these institutions need to work together to finance e-waste management platforms in Nairobi to reduce the level of toxic gas being emitted by these wastes.

Table 5 private firms in e-waste management

Private e-waste recycling firm	Frequency	Percentile
Safaricom	8	17
JKUAT (Nairobi Campus)	2	5
WEEE Centre	20	43
Computer for schools	10	22
None	6	13
Total	46	100

Source: Author 2022

Figure 5 Private e-waste recycling firms
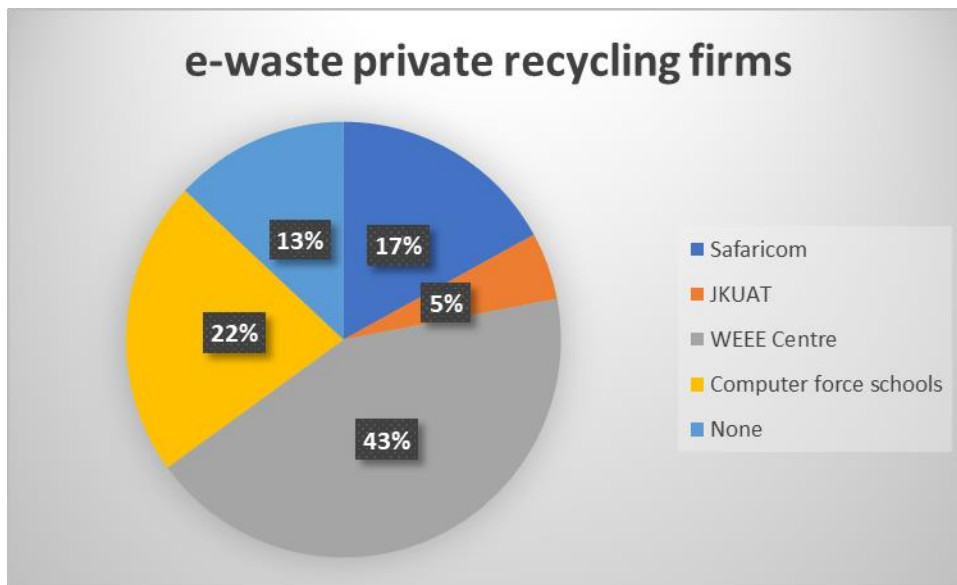
Source: Author 2022

Most of the respondents were able to identify at least one private institution engaged with collection of e-waste within Nairobi County. This 87 % of the respondents also identified that these e-waste firms were engaged in collection, recycling, and disposal of the e-waste. However, the e-waste composed of different metal and plastic elements could not be recycled in totality due to these firms such as Computer for schools only using specific electronic parts as spares rather than recycling everything. Therefore, most of e-waste in the county is not recycled or disposed in totality as some parts remain without being properly

managed. However, a small section of respondents of about 13 % were not sure of the private institutions that engages in e-waste management in the county hence confusing with city County Government of Nairobi which has a different role.

4.3.2. Effectiveness of institutions in e-waste management

Satisfaction level with the work being undertaken by the government institutions – either national or county government – in e-waste management activities

All the respondents agreed that they were not satisfied with the existing measures taken by the county government and national government in electronic waste management.

> *PB: NEMA as government institutions is sometimes caught in compromising situations by engaging in corruption and engaging players in unethical deals. There is a low number of employees under the NEMA umbrella hence compromising the quality in e-waste management.*

The assumption that NEMA as a regulator and licensing institution to e-waste recycling firms has failed in its mandate is over simplified approach. NEMA as a National body regulates waste management also focuses on e-waste management through development of policies government collection, recycling and disposal of e-waste at national and county level. The role of e-waste collection, recycling and disposal is in the hands of County County Government of Nairobi in collaboration with private waste collection firms. This element is identified by respondents who posit that the county government role in management of e-waste to be dissatisfactory due to lack of proper guidelines on household and institutions on sorting e-waste at collection points. Lack of proper approach in waste management at collection point has made it challenging for the lowly equipped county government and private firms to sort out the right materials required for recycling and disposal at their e-waste management centres.

> *PC/PB/PD: the county government of Nairobi has not created enough awareness to the public on how to sort waste at collection point making it challenging for waste collection firms to sort out the waste for disposal and recycling at collection centres… The county government lacks contemporary machines that are capable of assisting the private firms and national government in sorting out e-waste for recycling and disposal purposes.*

Table 6 The satisfaction level on county government activity in e-waste management

County Government e-waste program in Nairobi County	Satisfied frequency	Dissatisfied frequency	Total frequency
Collection	13	33	46
Recycling	0	46	46
Disposal	22	24	46

Source: Author 2022

The general response on the level of satisfaction on the services offered by the county government inclusive of collection, recycling and disposal is not high. Most of the respondents believed that City county government of Nairobi has been doing a good work in either enforcing or engaging in collection of waste in general and e-waste specifically in the county. However, there are a substantial number of respondents who posit that on e-waste management the county government has done little to ensure that e-waste is specifically collected separately to avoid disposing off together with the rest of waste. This has made it challenging for easy management of e-waste in the county of Nairobi.

On recycling of waste, all respondents agreed that the county government of Nairobi does very little or not at all in engaging in recycling of e-waste from household, public and private offices. This has led to backlog of e-waste in these areas and acting as an opportunity for the private sector to only engage in scavenging for spare parts while leaving the bigger load unattended. As a result, the unattended e-waste parts when exposed to the atmosphere might cause health related ailments or alter the soil that impact on vegetation growth.

On disposal of e-waste, some respondents confused with general waste collection and acknowledged on county government taking an active role in waste collection and issuing licenses to private firms to gather and dispose waste from Nairobi County and using Dandora dumpsite as a sole area for disposal of wastes. However, substantial number of respondents identified specifically that the county government of Nairobi has done little or no effort at all in safe disposal of collected e-waste from county government of Nairobi. This is further made complex by lack of specific e-waste dumping site and thus leading to Dandora dumping site acting as a general site for waste disposal. This element has made it harder for both private and public sector institutions to engage in safe e-waste disposal in the county hence exposing the

neighboring residential areas to airborne and water-borne related ailments. Therefore, both levels of government have been reluctant in implementing policies and regulations as well as setting up special institutions focusing on e-waste management.

Are there any more activities that these organizations can be involved in for better e-waste management?

The public institutions such as Nairobi City County government and the private institutions such as WEEE Centre, JKUAT, and Safaricom should engage in collection of e-waste products, which they might have sold to the public or for recycling purposes. This will ensure that they reduce the volume of e-waste owned by the public and private institutions.

> *PB/PC/ PD: The institutions and individuals engaging in e-waste management should buy the obsolete or outdated electronic life to motivate individuals to release those devices they are attached to. Moreover, the recycling institutions or individuals need to provide a data backup system to retrieve the locked information in the devices prior to disposal.*

The presence of proper procedure and guidelines to recycle obsolete electronics and electrical materials through repurchasing the items from household or offices will ensure that individuals are in a position to detach themselves with that equipment they value. This will assist in reducing the volume of electronic and electrical waste in the community.

The expert respondents from PA and PC affirmed that proper information dissemination channels on e-waste management to the public has not been done effectively. Therefore, awareness creation through various communication media is important in ensuring that the public is familiar with the right procedure to waste disposal and recycling.

> *PA/PC: The institutions operating in waste management should come together and create more awareness through various communication media in order to sensitize the whole community on the proper methods of e-waste management right from collection, recycling to disposal.*

Increase of awareness in community through various channels of communication that engages all government agencies and private sector will ensure that the community is empowered with knowledge on how to manage e-waste right from collection, recycling to disposal. In addition, information sharing by both parties ensures that the public and

various agencies will be in a position to identify the best approach to use in collection, recycling and disposal of e-waste in a sustainable manner.

4.4 Policies guiding e-waste management

The level of familiarity of respondents with any policy on electronic waste disposal in Nairobi?
The respondents identify the various policies and legal frameworks that guides on e-waste collection, recycling, and disposal.

> *PA/PD: The environment policy has been used as a key guideline to support e-waste management…the various institutions also have their own policies that guide in e-waste management.*

The Ministry of Environment and Forestry developed three essential policy documents to assist in not only managing the waste in Kenya but also to support the 2010 Kenya Constitution on waste management at national and county level. The formulated waste management policy focused on; national sustainable waste management policy; national sustainable waste management bill; and e-waste strategy. The respondents realized that the documents were aligned towards providing measures to be achieved to ensure that there is smooth transition of the country into circular economy with zero waste capacity. The goal will be achieved through reducing waste production, separation of waste at the source, increase collection of waste, recycle waste, re-use waste as well as disposing of non-recyclable waste to ensure presence of safe sanitary landfills.

The respondents PA and PD were quite conversant with some policies guiding electronic waste on disposal in Nairobi. They noted that these policies in Public Procurement and Disposal Act, ICT Policy, and Environment policy as some of the key waste policies being used to regulate e-waste management. However, these policies were developed to support the EMCA and NEMA to support disposal of e-waste in public institutions. This specialized kind of approach has remained challenging for government e-waste as tones of e-waste remain uncollected or undisposed due to the long bureaucracy required by NEMA to assign transfer of e-waste ownership.

b. *If NO to the above question, should there be one in place?*

The respondents acknowledged that there is a need to have a policy that separates e-waste from general waste and should be followed up with reasoning that supports e-waste management at different level (production, marketing, and buying). The existing policy if left open may be exploited by non-Kenyans who will take advantage of the general description on waste management rather than specifying it to e-waste management.

4.4.1 Importance of effective policy frameworks in e-waste management

What are some of the things that the policy can help deal with that you find important?
According to the respondents PB/PD:

> *The policy when narrowed down to focus on e-waste informed by the local challenges rather than external challenges, individuals will be in a position to implement guidelines that are supportive to the local entrepreneurs. The policy further should take a bottom up approach to integrate the locals view on e-waste management.*

The localization of policies such as Environment and ICT policy and the Nairobi County waste management, the categorization process will be informed by local challenges which can be subjected to local solution rather than developed countries-oriented solutions. Therefore, there should be a financing pool to ensure that the formulated policies are implemented.

Are you satisfied with the current policy on e-waste? Please explain your answer.

> *PA/PB/PC/PD: No. The policy should provide avenues to empower the entrepreneurs in engaging in businesses such as e-waste management. The policy draft and EMCA should be informed by local's views to ensure ownership of the policy rather than adopting the western challenges where there are already major steps towards managing e-waste using much complex technology in e-waste management program. Nairobi County Waste Management of 2015 should be specific in categorization process of e-waste management and the handlers to clarify to citizens the effect of poor disposal of electronic waste.*

The existence of policies which are mostly in draft form and having a western approach makes it hard to implement a local approach to e-waste management. This attempts to kill the entrepreneurial level in the country as the draft advocates for those with complex technology to

access program through bidding. Therefore, the policy needs to be restructured or rewritten informed by the local challenges rather than external challenges. The policy as informed by national interest should be implemented slowly in order for drafts such as E-waste regulations to take the local shape in order to reduce the cost of doing business.

4.5 Laws guiding e-waste management

Are you aware of any law that guides the handling of waste, electrical and electronic equipment in Nairobi currently?

> *PA/PB/PC/PD: EMCA has been the only act that has been in place to manage environment since 1999 as the rest of laws put in place are in draft form.*

The respondents in PA/PB/PD realized that EMCA need to be contextualized rather than left focusing on regional transactions, as this brings in many barriers from difference in state regulations. These localization efforts on EMCA will contextualize the major requirements needed to trade without poor management of e-waste. Kenya has been rolling out the e-waste regulations platform guided by the EMCA of 1999. This is further regulated by "the Public Procurement and Disposal Act" that assist in regulating disposal of commodities and services in government owned institutions.

4.5.1 Challenges linked with e-waste management

> *PA/PB/ PD: The international actors and foreign states have been given an upper hand using EMCA e-waste draft regulation and other policies. This is partly due to a lot of red tape and kickbacks taking place between government officials and foreign/international actors.*

The respondents feedback indicates that the existing e-waste management programs are compromised by both international actors and the local officials leading to influx of e-waste due to entrance of short-lived products. Therefore, the implementers of the existing regulations and policies do not ensure that e-waste management is fully rolled out and implemented in the country.

> *PC: The existence of short-lived technological devices has made it easier for low income earners to acquire the essential technology though near obsolete. Moreover, the obsolete*

technological devices disposed at electrical workshops are used as spares which are recycled in repairing a different device with the same characteristics such as phones.

This view is a clear indication that most of Kenyan public lack enough awareness on the existing regulations on e-waste management at international and national level with the dangers associated with accumulating electronic waste for poor disposal practice.

some of the problems associated with e-waste that this law is trying to handle

PA/PB/PD: The e-waste law targets at managing e-waste through providing proper collection, sorting, and disposal of e-waste to eliminate exposure to hazardous environment. To fulfil the requirement, one has to have several licenses in order to operate an element that kills trader and e-waste dealer's zeal in engaging in business.

PC: The Chinese products are short lived but cheap driving the durable expensive products out of market. This has worsened the level of e-waste management in the country.

All the respondents identified that the law does not do enough on its own without the assistance of committed government personnel. The requirement of several licenses and the influx of substandard products permitted by government institutions is an evident of lack of will to provide proper framework to manage e-waste in the country.

4.5.2. Effectiveness of laws on e-waste management

The level of satisfaction achieved with the current law on matters concerning e-waste and its management in Nairobi

PA/PD: Though the 2010 Kenya Constitution campaign for e-waste management by advocating for the right to every Kenya citizen to access clean as well as healthy environment as provided for in Article 42, law does not make it mandatory for institutions or policy and legal implementors to ensure e-waste is realized. This is despite further Article 69 mandating the national and county government to eradicate any activities that pollute the environment. However, the existing Nairobi city county Act, 2015 No. 18 on west management has a general approach on waste management ranging from collection, transportation, and disposal.

Though Kenya Constitution of 2010 has major legislations such as Environmental Management and Coordination Act of 1999, later revised in 2015, and the 2006 Waste Management

Regulations, has been put in place to provide guidelines for e-waste management, the full implementation is not yet realized due to lack of institutions dealing with e-waste management. This is despite both laws as well as Nairobi city county gazette supplement Act, 2015 No. 18 prohibiting firms handling, transporting as well as disposing off waste without proper permit from the National E-waste Guidelines to enhance e-waste management by various actors.

some of the areas or issues that you feel need more emphasis in the law in Nairobi

There should be a revolving fund to support innovativeness within the e-waste management platform in order to encourage actors engaging in e-waste management. Moreover, the law should entrench guidelines on developing an independent institution that governs the e-waste. The various institutions should work together to re-work on existing drafts and implement the laws governing the e-waste management at county and national levels of government.

The government in collaboration with international, regional, private, and individuals should work together in formulating and implementing the e-waste management legal platform. Reluctance by the government through its ministries to implement the international and regional laws governing e-waste management exposes the country to health consequences.

4.6 Chapter Summary

This study identified that the e-waste is poorly managed in Nairobi County government as a result of narrow collection, recycling and disposal policies and rules on e-waste management. The study identified that there exist policies such as environment policy and ICT policy that guides on e-waste management to support the EMCA regulations and public procurement act which act as regulation for e-waste management. These regulations and policies are regulated under NEMA and enforced through city county which gives authority to waste management firms to implement the e-waste processes. However, according to the findings there are only a few firms dealing with e-waste management varying from Safaricom, to JKUAT, to WEEE Centre. However, these firms face challenges in sorting out the e-waste from unsegregated waste collected from various collection centres and this leads to the waste being disposed under one centre which exposes the locals to health challenges. This unclear approach is facilitated by lack of proper tools to sort out the e-waste hence the organizations only prefer recycling the e-items as spare parts that leave the unused part un attended.

5 CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Discussion

The study identified that Nairobi has a large amount of unmanaged e-waste (refrigerated, television, computer, printers, and mobiles) that presents an absence of clear disposal criteria. This is also an indication of lack of relevant institutions to implement e-waste formulated laws and policy in the County of Nairobi leading to different institutions (County Government of Nairobi, Garbage collectors, and private recyclers) replicating roles in managing e-waste. The other reason driving poor electronic and electrical waste management within the county of Nairobi is due to lack of improper awareness levels.

The findings indicate that the manufacturing or assembling of electrical and electronic devices have taken a passive role apart from sales in sharing of sensitive information that might assist in managing the waste thus contributing to limited knowledge availability to the citizens. The challenge has been experienced when the authority is not in a position to access the components used to develop a product which might be harmful if poorly disposed. These challenges are equally shared by EPA (2018) report that recommends that the manufacturing home governments should design environmentally friendly electronics that promote innovation and management of e-waste that will assist developing states manage e-waste. On the other hand, the government also has failed to enforce measures that control and manage e-waste in the County.

The government has been identified by manufacturing electrical and electronic product firms as able to compromise data security by exposing the information to the competitor. This factor might have participated to some level towards discouraging the manufacturing from sharing key

information on their products with the government and the public thus leading to risks associated with poor e-waste management. These challenges might lead Sije et al. (2013) findings noting that absence of a dedicated legal regime within the country to properly manage e-waste and thus might hinder the country to achieve the Basel Convention goal on trans-boundary.

Absence of legal framework governing institution on provision of information of expiry and collaborative approaches by recyclers and manufactures on improving managing the increasing e-waste volumes, makes it challenging to achieve the sustainable goal. This affirms Omari et al. (2016) findings that note weak legal approaches within Nairobi County to be among the major hindrance to management of e-waste within the region.

There is a clear gap in the law's provision of guidelines on how to engage dealers with limited interest in purchasing e-waste disposal bids. The existing policy or laws implementation is slowed further by the long bureaucracy surrounding e-waste bid purchasing process thus encouraging accumulation of huge obsolete computers stock and other e-waste under public institution storage (GOK, 2019). The participant views affirm existence of legislation on ICT (Sandra, 2017), draft regulations (NEMA, 2013) among other policies that aligns towards managing e-waste.

There is a lack of clear roles on specific institutions that regulate and issue licenses as well as enforce the existing policies and laws in e-waste waste management. This is clearly presented in Nairobi where NEMA takes the role of regulators through licensing while County County Government takes the enforcement approach by working with limited recycling and waste collectors. The few e-waste dealers, such as WEEE centre and Safaricom, capacity to handle the waste for recycling is limited thus most of the Nairobi County e-waste is not properly managed. This challenge reflects the reason for Denogean (2016) to recommend creation of links among

different stakeholders such as manufacturing, regulators, and recyclers in e-waste management. This will ensure that bureaucracy is reduced to ensure that the stakeholders involved in the process receive immediate support promoted by relevant institutions, legal frameworks and policies.

The presence of few or no firms managing or enforcing e-waste management also affirms the reason why there is limited knowledge on awareness. This has led to the public presenting limited knowledge on the institutions or individuals apart from government institutions engaged in recycling, collecting or disposing e-waste in Nairobi.

The low satisfaction level among the public on the services provided by e-waste management stakeholders is a reflection on lack of proper procedures by institutions, such as NEMA, towards regulating effectively e-waste platforms. Secondly, though the County Government of Nairobi has been engaging in waste management collection, the firm plays a limited role in e-waste collection and recycling leaving the private recycling firms with the huge burden of managing the large volume of e-waste in Nairobi. As a result, the respondent associated the incompetency in e-waste collection and disposal to County Government of Nairobi lack of proper measures.

Nairobi County uses existing national policies and legal frameworks; such as Public Procurement and Disposal Act, ICT Policy, Environment Policy, EMCA, and NEMA legal frameworks to guide in e-waste management. These measures have assisted various sectors in Nairobi County to work towards managing e-waste in the county through waste collection, waste recycling, among other approaches.

The localization of policies guiding e-waste management assists in ensuring that the challenges facing specific counties are handled in accordance with the priority of the county. This will ensure that approaches used fit to solve local solutions while providing a platform to pool funds

to manage the risks associated with e-waste. Balde, et al. (2017) relates the importance of policies and laws due to the urge for some users in specific regions to have a growing need to purchase new devices just to keep up with the new technological trend and warranty issues associated with security data. As a result, Nairobi e-waste is likely to be influenced by consumer's preferences determined by purchasing power and globalization rate in the area. In addition, the affordability rate of mobile devices has driven the rate of most people residing in urban areas in Africa owning the device.

5.2 Conclusion

The policy framework guiding e-waste management in Nairobi County is an approach, which entails all institutions in public and private sector. The environment policy that was developed by the ministry of environment and the ICT policy developed by Ministry of ICT assist in guiding on e-waste management was strengthened further by individual institutions policies on e-waste management. However, these policies alone are not in a position to enhance management of e-waste management without the presence of a proper legal framework.

The study identified that there is lack of a fully functional legal framework except for a draft e-waste regulation that were developed in 2011 that support e-waste management in Nairobi County. This has led to the formulating and implementing institutions like NEMA and Ministry of Environment in Nairobi using existing legal and policy frameworks, such as ICT Policy, Public procurement and disposal acts and EMCA, to try manage e-waste in the country. However, management strategies in the county are not enough to manage the situation. Therefore, the institutions in Nairobi opts to support the existing regulations and policies by using policies or frameworks developed by NEMA that acts as a regulator and to guide in issuance of license to other stakeholders. In addition, the existing strategies developed by NEMA also has been acting as guide to the City County of Nairobi to implement the regulations through collection of waste in the county.

However, these waste management institutions in Nairobi County have not achieved the goal of fully managing e-waste due to lack of awareness in the public, lack of modern equipment, and absence of enough recyclers of e-waste and disposal of the same in the county. This has left the

private dealers such as WEEE Centre and Safaricom trying to fill the gap in Nairobi County and with further assistance from Computer for School and JKUAT from neighboring counties attempting to fill the gap. As a result, there should be increase in advocacy for the government to come up with specific institutions dealing in e-waste management through either purchasing the e-waste from the public, creating more awareness, or periodic collecting wastes.

Area for further Research

The findings of this study point to the need to put in place proper institutions and legal frameworks to guide e-waste management in Nairobi. This will require all stakeholders in Nairobi County to be involved in order to come up with proper and effective waste management programs to eliminate risks associated with the electrical and electronic waste.

There is need for further studies to focus on the hazards associated with poor e-waste management in the County of Nairobi and assist the County in coming up with more health-conscious and environmental risk mitigation strategies.

5.3 Recommendations

1. The Kenyan Government and the County Government of Nairobi should team up with stakeholders and come up with proper incentives in both legal, institutional and financial ways to promote proper management of e-waste using modern technologies. This will involve having equipment that is fit for purpose in recycling, reusing and reengineering the e-waste that is available and constantly being generated. By so doing the present informal sector in e-waste will be formalized, profitable and generate more jobs while the working environment will be healthy and akin to any blue-collar jobs that are available.

   This approach is likely to benefit the country by cleaning the environment and ensuring that the technology that is in place is both sustainable and predictable thus eliminating current challenges of unmanaged e-waste with poisonous elements that cannot be recycled because of a lack of proper technology within the country.

2. The existing policies and legal frameworks around E-waste should be put into practice by ensuring that they are fully implemented by all stakeholders while ensuring that there is proper coordination between all concerned parties.

3. The existing policies and legal frameworks should be periodically reviewed to match the situation and the e-waste regulation drafts should be entrenched in law to support the existing policies. This will help the county in giving a structured framework of dealing with this emerging waste problem.

4. The presence of limited number of institutions dealing with collection and recycling of e-waste in Nairobi has made it much more challenging for NEMA and Ministry of Environment to effectively manage e-waste. This clearly indicates that if the country is to move forward, there will be need not only to develop strong institutions that work closely with stakeholders in waste management platforms but also to promote investment in e-waste collection and recycling in Nairobi County.

5. More scholarly research into e-waste as an emerging waste issue is recommended to ensure timely data is provided to inform decision making.

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7.0 Appendices and Annexes

Appendix i: focus group discussion/ interview question guide

Disclaimer:

Thank you very much for agreeing to participate in this survey. This questionnaire is in aid of a research being conducted by Omari Rodney Mosomi, a student at the University of Nairobi as partial fulfillment for award of a Master's degree in Public Administration. The study title is **"the role of regulatory framework on e-waste management in Kenya: case of Nairobi City County (2010-2022)".**

The information provided by you in this questionnaire will be used for research purposes. It will not be used in a manner which would allow identification of your individual responses. Your assistance and cooperation will be highly appreciated.

Instructions: the following questions are to serve as a guide to the discussion and free expression is encouraged.

Section A

General Information

    a. Individual/household.

    b. an organization:
       1. Private
       2. Public

Please describe the disposal criteria you or the institution use for electronic and electrical wastes.

    Section B.

    1. How familiar are you with activities dealing with electronic and electrical waste in Nairobi County?

A. Institution, rules and Policies

2. What are some of the agencies, departments, institutions or organizations in Nairobi County that are involved in collection, recycling or disposal of discarded electronic and electrical equipment?

3. Are you familiar with any rules on electronic waste disposal in Nairobi?

   a) If not, should there be one in place?

4. What are some of the things that the rules can help deal with that you find important?

5. Are you satisfied with the current rules on e-waste? Please explain your answer.

6. Are you aware of any law that guides the handling of waste, electrical and electronic equipment in Nairobi currently?

B. Challenges Associated with e-waste

7. What are some of the problems associated with e-waste that this law is trying to handle?

8. Are you satisfied with the current law on matters concerning e-waste and its management in Nairobi?

C. Possible solution to e-waste challenge

9. What are some of the areas or issues that you feel need more emphasis in the law in Nairobi?

10. Are you familiar with any organization, institution within the government, whether national or county that is charged with managing electronic waste in Nairobi and if so, what are some of their functions?

11. Are there any other institutions or individuals outside government involved in recycling, collection or disposal of electronic waste in Nairobi currently?

12. What are some of the activities that these individuals or institutions are involved in?

13. In your opinion, are you satisfied with the work being undertaken by the government institutions – either national or county government – in e-waste management activities?

14. Are there any more activities that these organizations can be involved in for better e-waste management?

15. In your own words, what needs to be done – and by whom, to ensure electrical and electronic waste is properly managed for a clean environment?

Appendix ii: Map of Nairobi City County

Image courtesy of: (Maps of the World, 2018) https://www.google.com/url.mapsofworld.com