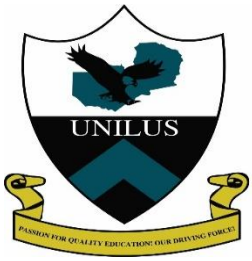


UNIVERSITY OF LUSAKA

# School of Postgraduate Studies

RESEARCH DISSERTATION

**CHALLENGES OF E-WASTE DISPOSAL**

**A CASE OF LUSAKA CITY**

**BY**

**MUSONDA SHARON MABENGWA**

**LONG PAPER SUBMITTED TO THE UNIVERSITY OF LUSAKA IN PARTIAL FULFILMENT OF THE REQUIREMENT OF THE DEGREE OF MASTER IN ENVIROMENTAL MANAGMENT**

**THE UNIVERSITY OF LUSAKA**

**LUSAKA**

**2024**

## DECLARATION

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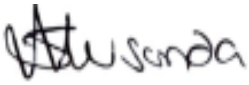
Signature: ____ 

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## ABSTRACT

The management of e-waste is a serious environmental challenge. In relation with waste generation, there is inadequate infrastructure for waste collection, transport, treatment, and disposal. The paper wishes to highlight on the current e-waste management practices in Lusaka city, highlighting on challenges of e-waste disposal by residents of selected areas in Lusaka to cure the problems waste management and establish initiatives to improve e-waste disposal for a better sustainable waste management in the district. The following are the specific objectives, to assess the e-waste awareness in selected areas Lusaka, to ascertain the challenges faced by waste management companies and to find out strategies of e-waste hazardous waste management in Lusaka city. The study applied mixed methods of qualitative and quantitative methods with a sample size of 60 comprising 50 questionnaire-based respondents and 10 interview based informants. Random and purposive sampling methods were used in the study. The findings of the study will indicate the management of e-waste in Lusaka and recommendations will be drawn from the results.

The household participant's understanding and knowledge of e-waste was high they demonstrated that they are aware about e-waste. 80% of the respondents stated that they had the full knowledge of what e-waste is and 20% did not know, nonetheless the respondents did not know how and where the waste is supposed to be disposed, the repair shop owners also shows that they understand the e-waste but do not now how to disposed or where it can be recycled.

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## DEDICATION

I dedicate this paper to my supportive husband, children, and my entire family.

## ACKNOWLEDGEMENTS

I would like to recognize and appreciate the following individuals for their support and assistance during my studies:

i. My husband, my kids, my family, and friends who supported and encouraged me consistently during this journey.

ii. My supervisor for their guidance, motivation, and continued support during my Research. Your regular emails, check-ins and immense knowledge on the subject enabled me to complete my studies.

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## ABBREVIATION AND ACRONYMS

| | |
|---|---|
| E-WASTE | Electrical waste |
| US | United States |
| EU | European Union |
| ICT | Information and Communications Technology |
| NGO | Non- Governmental Organizations |
| DVD | Digital video disc |
| NEMA | National Environmental Management Authority |
| CPCB | Central Pollution Control Board |
| EPR | Extended Producer Responsibility |
| ASSOCHAM | Associated Chambers of Commerce and Industry of India |
| EPR | Extended Producer Responsibility |
| SEEE | system Electrical and Electronic Equipment |
| WEEE | Waste Electrical and Electronic Equipment |

# CHAPTER ONE: INTRODUCTION

## 1.0 Introduction

This chapter gives the background to the study and discusses the challenges of e-waste disposal in selected areas of Lusaka. The chapter commences with the background to the study and the statement of the problem, it then highlights the research objectives, research questions, rationale of the study, theoretical framework and concludes with the structure of the long paper.

## 1.1 **Background study**

Humanity continues to develop and produce waste that characterizes contemporary society, dating from the industrial revolution to fulfil its most fundamental needs of life. However, the resulting production and consumption of resources end up with prominent problems regarding e- waste generation and management in diverse parts of the world.

Hazardous wastes generated by human activity pose the risk of damage to human health and to the environment, and their negative impact is accentuated when wastes are not managed properly. Sound management of hazardous wastes covers activities right from the point of generation to the point of disposal of such waste. According Macauley et al (2003) hazardous wastes are those that may contain toxic substances generated from industrial, hospital, some types of household wastes. These wastes could be corrosive, inflammable, explosive, or react when exposed to other materials Hazardous wastes that are disposed of causes potential hazard to human health or the environment (soil, air, and water) when it is not properly managed

Quantity of E-waste generated and the content of toxic and valuable materials, has become an emerging problem throughout the world. In 1994, it was estimated that approximately 20 million that is about 7 million tons of PCs became obsolete (Woodell, 2008). In 2010 this figure has increased to over 150 million laptops. Over the past two decades, the global market of EEE continues to grow exponentially, while the lifespan of those products becomes shorter and shorter. In the United States (US) market, less than 80 million communication devices were sold in 2003, 152 million by 2008, a growth of over 90 percent in 5 years and by 2015 this numbers would be skyrocketing. Meanwhile, in 2006, more than 34 million TVs have been exposed in the market, and roughly 24 million PCs and 139 million portable communication devices have been produced (Woodell, 2008).

Worldwide, in the decade between 1994 and 2003, about 500 million personal computers containing approximately 718,000 tons of lead, 1,363 tons of cadmium and 287 tons of mercury, reached their end of life (Smith et al., 2006). In the European Union (EU), the total units of electronic devices placed on the market in 2009 were more than 3.8 billion units, including 265 million computers, roughly 245 million in home consumer electronics, and 197 million consumer appliances. In China, approximately 20 million refrigerators and more than 48 million TVs were sold in 2001, and nearly 40 million PCs were sold in 2009. The situation is exacerbated by the rapid turnover of electronic devices. Because of the fast pace at which technology is evolving, most electronics have only a 2-to-3-year useful life. Apple sells more than 300,000 new phones every day in the world market and in this same time frame, more than 150,000 new Blackberries are also sold and 700,000 new Android phones are being activated. Most of the phones that are replaced by these new devices end up in a draw or in municipal landfills (Khurram et al 2011)

Electronic waste has raised concerns because many components in these products are toxic and are not biodegradable. Based on these concerns, many European countries banned E-waste from landfills long before in the 1990s. Alarming levels of dioxin compounds, linked to cancer, developmental defects, and other health problems in the samples of breast milk, placenta, and hair, these compounds are linked to improper disposal of electronic products. Furthermore, surveys have indicated that much exported, E-waste is disposed of unsafely in developing countries, leaving an environmental and health problem in these regions. Impacts from those countries, especially Asia, have already been reported. Meanwhile, recycling and disposal of E-waste are also grown in the regions beyond Asia, particularly in certain African countries. Today's paradigm is one of disposable electronics, and as a result we now stand at the forefront of a growing environmental catastrophe Khurrum et al (2011)

### 1.2 E-WASTE IN LUSAKA

Lusaka city, with an estimated area of about 360 km2, is one of the largest and fastest growing urban centers in Zambia (Majura, 1997). Up to 75 per cent of the city's population live in peri – urban areas, mostly in unplanned settlements, which are characterized by overcrowding, inadequate sanitation and limited access to refuse collection and acid disposal services. Management of urban waste in Lusaka is a responsibility of the Lusaka city council and other waste management companies. However, most of the companies face several problems including

shortage of equipment, inadequate funds and a low capacity in skilled labor force making it unable to continue serving the city adequately and effectively.

Zambia, like many other developing countries has however been constantly been developing in terms of technology. Information and telecommunications technology (ICT) and computer Internet networking has entered nearly every aspect of modern life and is affecting every individual even those in rural areas of Zambia. This rapid growth of ICT has advanced the capacity of computers, cell phones and other electric equipment but products lifetime because of which increasingly large quantities of waste electrical and electronic equipment (e-waste) are generated annually. Second hand or refurbished equipment are the most dominant particularly across Africa of which are imported without confirmatory testing for functionality.
Zambia at large s facing a significant waste management challenge including e-waste. About 1.3 million tons of waste each year, but only 10% of this waste is collected and disposed of properly and the rest of the waste ends up in open street dumps and littering causing health and environmental problem. However, these statistics show that Gweme, 2015).

However, this waste management challenge also presents an opportunity for the country to explore alternative waste management practices, including waste to energy. Waste to energy technologies convert waste into energy, such as electricity, heat, or fuel, while reducing the volume of waste sent to landfills. This presents a sustainable solution to the waste management challenge, while also creating new economic opportunities and contributing to the country's economy through the formulation of value on scrap and recycling companies (Gweme, 2015).

E-waste comprises of electronics/ electrical goods no longer fit for use and have reached their end-of-life things such as mobile phones, computers contain some hazardous components some which may need complete disposal others recycling. Unfortunately, Zambia like many other African countries is on the receiving end and does not have mechanisms to dispose of the waste nor have facilities to manage such waste.

Fred Gwene, 2015 explains how Zambia and Zimbabwe are trying to look at measure that can be taken to combat hazardous waste but does not address issues of disposal of already generated hazardous waste. This is a huge problem not only for Zambia but Africa because most African countries lack the capacity to handle and recycle the hazardous materials generated which contain

e-waste. Furthermore, the common practice of e-waste existing dumpsites represents a source of environmental pollution due to toxicity, e-waste creates real health hazards for nearby communities (Gweme, 2015).

In Zambia the current practice is that all the e-waste generated must be exported to the neighboring South Africa which has the facilities. This shows that we are failing to manage such materials.

This research will endeavor to look at the challenges that surround Zambia as a country from establishing its own e-waste facility. This will be in terms of policies and regulations that currently available. The author will look at the legal framework available and establish reasons why Zambia does not have such a facility and continues to export its hazardous waste and in the Concluding chapters will give recommendations based on the need assessment to expedite the processes in establishing such a facility which our country is in dare need of and would also potentially serve other neighboring countries and earn foreign exchange which would later contribute to the economic development of our country.

Having a standard e- waste facility in a nation like Zambia is a step in the right direction as far as participating in sustainable development is concerned. This implies that a country can manage its e-waste materials generated in an environmentally friendly manner. This means that you protect the environment and all that lives in it from potential harm that such materials may cause not only to the environment but humans as well. The importance of having such facilities cannot be over emphasized (Mambwe, 2015).

e wastes may pose a potential hazard to the human health or the environment (soil, air, water) when improperly treated, stored, transported, or disposed or managed. Currently in India even though hazardous wastes, emanations and effluents are regulated, solid wastes often are disposed of indiscriminately posing health and environmental risk. In view of this, management of hazardous wastes including their disposal in environment friendly and economically viable way is very important and therefore suggestions are made for developing better strategies. (Virenda Misra 2005)

Having emphasized the importance of such a facility Zambia currently does not have such a facility and this research seeks to address some of the that have hindered the private sector in engaging the government in establishing such a facility. The government would be the best organ to run

such a project but with its challenges currently being faced under the solid waste management in the country which is a huge problem it may be even more challenging to establish such a facility by the government yet its importance cannot be overemphasized.

The problem therefore is that, despite the development of e-waste disposal strategies across the world, the trend of having e-waste not well disposed has continued in Zambia, from observation general waste is mixed with other waste which is also a problem. Little research has been conducted on the challenges of e-waste disposal in selected areas of Lusaka hence, this study.

## 1.2 Problem statement

Electronic wastes (E-waste) are wastes which contain harmful and toxic components that can harm the environment and human health. E-waste management is cardinal for any nation but majority of the developing countries such as Zambia face challenges of managing E-waste in terms of how and where to be disposed World Health Organization (2022). the common scenario is that people seem not to care about throwing and dropping used up items anyhow and anywhere carelessly, Waste generation has been increasing enormously at an average annual rate of 8.96% (Karanjit et al, 2006). Various studies have been done on general waste management however, most of the waste are produced from industries and households. Therefore, to reduce environmental hazard, proper attention is required during storage, segregation, transportation, and disposal of e-waste. It was vital that the study of this nature was to be done so that safe methods of disposing e-waste can be used from the results of the existing methods. Furthermore, to achieve the sustainable development goal of having a sustainable city cannot be achieved if the issues of e-waste disposal are not addressed. Hence there is a critical need to assess the challenges of e-waste disposal in Lusaka district.

## 1.3 Aim

This is to ascertain the challenges of E-waste disposal by people in selected areas in Lusaka.

**Specific objectives**

1. To assess the awareness e-waste disposal by residents in selected areas Lusaka.

2. To ascertain the challenges of e-waste disposal faced by people and waste management companies.
3. To find out initiatives to improve e-waste management in Lusaka.

## 1.4 Specific research questions

1. What is the extent of e-waste awareness by residents in selected areas of Lusaka?
2. What are the challenges faced by people and e-waste management companies in disposing electronic waste?
3. What are some of the initiatives that can be put in place to improve electronic waste management in Lusaka?

## 1.5 Significance of study

The world is in an era that requires sustainable environment for it to well function. However, this study endeavors to achieve the sustainable development goal number 11 which states that there should be sustainable Cities and Communities through assessing e-waste management challenges and propose initiatives that can be implemented to improve the e-waste infrastructure. This research has an objective to have an improved wellbeing of people living in Lusaka city especially those in highly populated area. The research will provide recommendations for the following.

**Policy implementation**: The research will provide valuable recommendation from the results that will be obtained and enabling the effectiveness of environmental policies and regulations. It will assist in formulating sustainable waste management strategies that align with the goals of the sustainable cities' goals.

**Infrastructure Planning**: infrastructure management is another important aspect for the research, the study will guide the planning and development of necessary facilities and systems to handle the increasing hazardous waste. This includes improving waste collection, sorting, recycling, and disposal facilities (Mbvundula et al., 2016). The research will support infrastructure investments that are aligned with sustainable waste management practices

**Environmental Protection**: Understanding the environmental impacts associated with hazardous waste environmental management. The research will help identify potential environmental risks

and guide the implementation of measures to minimize pollution and contamination caused by the disposal of hazardous waste (Asghar et al., 2021).

## 1.6 Delimitation and scope of study

This study was limited to selected areas in Lusaka district, this study area was chosen because the researcher identified it as an area of need to conduct research. From observation Lusaka has the highest rate of waste disposal hence the target area of study

**Health and Safety Considerations:** The study's insights into the health risks and hazards associated with disposal of hazardous waste will contribute to ensuring the safety of waste handlers, nearby communities, and the public. It will facilitate the adoption of proper waste management practices, including appropriate handling, recycling, and disposal methods, to minimize potential health impacts (Sander et al., 2020).

## 1.7 Theoretical framework Socio-ecological theory

Socio-ecological is a theory that originates from biological sciences and refers to the interrelationships between organisms and their environments. Ecological and social ecological theory of human behavior have evolved over several decades in the fields of sociology, psychology, education, and health and focus on the nature of people's interactions with their environments Environmental health behaviors, including proper waste disposal, are thought to be improved when environments and policies support healthy choices, and individuals are motivated and educated to make those choices (World Health Organization 1986). Educating people to make environmentally healthy choices when environments are not supportive will not be effective in making behavioral change. Social-ecological theory concedes that it takes a combination of both individual level and environmental/policy level interventions to achieve substantial changes in health behaviors, including proper waste disposal behavior.

The social-ecological theory enables the identification of opportunities to promote participation of individuals, industries in hazardous waste management. Various factors are recognized that influence an individual's behavior.

**Components of the social-ecological mode**

Below are four major components of the socio-ecological model

**The individual**

Individual is at the center of the model; it includes the personal factors that increase or decrease the likelihood of an individual being physically active. An individual has certain factors that influence people's participation such as socioeconomic status, level of education attitudes, behaviors knowledge, perceived barriers, beliefs, and motivation. An individual can only change when the strategies employed to focus on changing an individual's knowledge, attitudes and behavior including education and awareness programs

**Social environment**

Surrounding the individual in the social-ecological model is the social environment. The social environment comprises the relationships, the culture, and the society with whom the individual interacts. The social environment has a significant influence on waste management behavior. The social environment includes cultural background, socioeconomic status of the community, institutions, and organizations, such as schools, workplaces and community organizations, access to social support networks versus social isolation etc. Strategies which bring change at the social environment level include community education, support groups, awareness programs, workplace incentives and social marketing campaigns. These are used to promote positive community attitudes and awareness to participation in proper waste disposal.

**Policy**

Policy refers to legislation, these registration guide on how certain things are to be done. Policy making actions that have the potential to affect waste management, these are taken by local or state governments but also can be informal local policies or rules in settings such as communities or workplaces because they are often formal legal actions. Examples of policies may include education policies as mandating time for environmental education classes, health policies, environmental policies, and funding policies.

**Physical environment**

Physical environment includes the natural environment and the built (or man-made) environment. The physical environment includes natural factors such as availability and access to facilities such as waste bins, and dumping sites. The built environment provides opportunities such as provision of waste collection services educational or community awareness initiatives are attempted. In some instances, educational initiatives encourage impossible or unrealistic behavior. For example, media campaigns that encourage people to exhibit proper waste disposal behaviors will be ineffective in communities where there are no waste bins.

The social-ecological theory needs to be tailored to suit behaviors and population groups. While the components of the social-ecological model will remain the same and can be used in a range of populations, the specific examples within each component will vary depending on the population group (Elder, 2007). This theory was deemed relevant to this study in that it outlines several factors that are at play in the way people behave and perceive hazardous waste management. It also highlights the importance of education in behavioral change. In this study the specific aspects of the social ecological theory used include the individual factors, policy, and the physical environment. The study sought to establish how attitudes and knowledge influence residents to bring about change in attitudes and behavior. The policy environment is said to influence the behavior of individuals, this study therefore wanted to establish challenges of hazardous waste management policy influences hazardous waste disposal behaviors in Lusaka. The physical environment such as availability of waste bins is important to shape individual behavior. This study also sought to establish how the physical environment provided opportunity for intervention in waste disposal practices.

## 1.8 Structure of the dissertation

The structure of this dissertation has chapters with concentration on the specific subject areas, among which have been broadly outlined in the objectives above. This paper has six chapters were chapter one introduces the topic of research and the background. Chapter Two highlights the literature review of existing literature that is significant to the research focusing on the studies on challenges of hazardous waste disposal around the world and in Zambia. Chapter Three focuses on the research methodology which explains the methods used for data collection, chapter four provides the presentation of data. Chapter Five discusses the findings and chapter six outlines the

measures that have been put in place to address the factors. Then the conclusion summarizes the contents of the substantive chapters and thereafter makes policy recommendations for further research.

**SUMMARY**

In conclusion of this chapter, the researcher has provided and explained the background to the study, statement problem, and significance of study, the research objectives, research questions, theoretical framework, and delimitation of study. Next chapter, the researcher reviews the literature review to the study

# CHAPTER TWO: LITERATURE REVIEW

## 2.0 INTRODUCTION

In this chapter the research reviews literature related to the study by providing a background upon which the study was based. It reviews literature relevant to challenges of hazardous waste disposal on the following objectives; to assess the waste disposal facilities in Lusaka, to ascertain the challenges faced by waste management companies in managing hazardous waste and to find out strategies of hazardous waste management in Lusaka city.

## 2.0 GLOBAL E-WASTE AWARENESS AND MANAGMENT

Waste is an unavoidable by-product of most human activity economic development and rising living around the world. However, waste management is one of the main aspects of maintaining a good environment, it has been noted that the generation of waste increases with increasing population, industrialization, and urbanization. The rapid growth in the industrial sector has contributed to the large quantities of hazardous material such as electronic wastes, radioactive waste. However, there is rapid growth in the industrial sector and has contributed to the generation of large quantity of hazardous waste material and each country has its own ways of segregation, transportation, and disposal of hazardous waste. Each country around the world has various challenges and strategies to manage hazardous e-waste.

## 2.1 Electronic waste in Jamaica

e-waste is likely to pose a significant challenge soon in Jamaica the electronic and electrical appliances, consist of a variety of different parts made from hundreds of different substances including plastics, metals, glass as well as organic and inorganic compounds. While some of these parts can be recycled, others need special treatment and disposal systems. More potentially hazardous and diversified e-wastes are being generated with the liberalization and continued expansion of the Information and Communication Technology (ICT) sector. The magnitude of the

impact of growth of waste for this sector is demonstrated by the change in the profile of this sector (National Research Council, 1985).

For example, Jamaica's mobile penetration stands at 93.3 per cent (Economic and Social Survey Jamaica, 2006) representing a tenfold increase in the number of cellular phones over 2000. Apart from changes in cell phone technology, the cell phone is for some a fashion item to be discarded and replaced. There being no formal facility for the treatment of hazardous waste, the country has a serious challenge in dealing with used instruments (National Research Council, 1985).

## 2.2 E-Waste management in Uganda.

Government of Uganda identified information and communications technology as a factor that can enhance social-economic development for the country. However, there has been an increased uptake of information and communications technology both in government and private sector. Analysis from data collected indicate that the government owns the highest number of ICT equipment in the country followed by Non- Governmental Organizations NGOs at about 75%, large enterprises at about 20%, private households, small and medium enterprises SMEs and others at about 5%. The relevance of electronic equipment in doing business, education has increased over the years in government, educational institutions, and the private sector. This, results into increased production of electronic equipment that is more efficient and cheaper in cost, which in turn leads to the old equipment being disposed of to obtain improved versions of the technology.

The e-waste challenge information communication technology has caused a revolution in modern living and business in various forms, including fast communication gadgets, e-commerce, e-banking, e-government, tele-medicine, among others. This is being sustained by production of increasingly sophisticated information communication technology equipment and electronics. As a result, an estimated 50 million tons of e-waste are now generated every year, with most of this heading to developing countries for use and disposal, where less than 20% can afford new equipment. The last ten years has seen tremendous increment in electronic and electric equipment use in Uganda, in both government and the private sector.

Enabling factors have been the policies such as liberalization of the telecom sector, and waiver of trade barriers on ICT equipment. Importation of household appliances, electrical and electronic

tools, lighting equipment, toys, medical devices, ICT equipment, and consumer equipment such as cameras, DVD players and radios, among others has all increased, with more volumes out of use. By 2007 Uganda had built up an estimated computer stock of 80,000 or 2000 tons of computer waste, including desktop units and CRT screens (EMPA, 2008). This is estimated to have more than doubled by 2012.

## 2.3 E-waste awareness and education in Uganda

There is limited e-waste awareness in the public and private sector. There have been initiatives in the private sector at a low rate geared towards e-waste awareness. In the public sector, the National Environmental Management Authority (NEMA) has carried out preliminary e-waste awareness initiatives, but they are not sufficient to change the attitude of Ugandans towards E-waste management.

## 2.4 E-waste management in South Africa.

South Africa is one of the developing countries in Africa with a rapid increase in the technology and much developed comparing it with other African countries. However, e-waste from electrical and electronic appliances and devices is becoming a major problem for South Africa, about 36000tones of e-waste is produced every year where Gauteng's province accounts 55% of that volume. The typical electrical and electronic appliance or devices are found I n most if not all South African houses or businesses. These include, power tools, reusable and disposable batteries, and cables, domestic appliances, electricity generation and storage devices, lighting, digital devices, and computers.

These appliances contain potential potentially explosive, poisonous, or otherwise hazardous to humans and animals hence such appliances are not supposed to be in normal refuse bags, dumping grounds or landfills because it can potentially contaminate surrounding areas as they break down. A recent assessment done in south Africa conducted by the Pretoria based base convention regional center suggested that, except for South Africa, electronic waste (e-waste) was given little or no priority in the countries surveyed. Instead, the problems with waste management were far more basic, and included a lack of awareness of hazardous waste, and inadequate legislation, controls, and facilities to deal with waste.

**E-waste infrastructure in South Africa**

Its level of economic development means that it is likely to be amongst the first countries in Africa to encounter e-waste as a serious concern. It therefore offers a learning opportunity, and the potential for developing best practices that could be applicable elsewhere on the continent.
About 70% of the country's e-waste is thought to be in storage most of this held by the government. This percentage represents about 10- 20 thousand tons of e-waste, which is expected to double in 10 years' time to 30-40 thousand tons. (Lombard, 2005. Int) the high level of storage in government departments is attributed to difficulties in writing off technology from asset registers. Other reasons include a lack of public awareness of what to do with old technology, and a general absence of processes that facilitate its easy collection and disposal. Psychological factors, such as the belief that old technology has a latent value, and issues such as fear of data theft also contribute to the storage of disused technology.

## 2.5 E-waste management in India

At present in India there is no e-waste police-waste is considered as a hazardous waste and is mentioned in hazardous waste legislation. There are also no statistics available on e-waste in India. The Central Pollution Control Board (CPCB), a federal government organization, is trying to document the data, and the process is on-going through a rapid assessment study. Some data on the national capital of Delhi and the South Indian city of Chennai (formerly Madras) was compiled by Toxics Link in their reports 'Scrapping the Hi-Tech Myth' and 'Time is Running Out. Campaigners feel that India, which projects itself as a rising IT superpower, could push for better disposal techniques of e-waste, restriction of hazardous substances in the manufacturing of electronics and the transboundary movement of e-waste and Extended Producer Responsibility (EPR) guidelines for big IT companies and the like. But campaigners point out that rather than going in for a new institutional arrangement.

## 2.6 CHALLENGES FACED BY PEOPELE AND ELECTRONIC WASTE MANAGEMENT COMPANIES AROUND THE GLOBE.

**Quantifying the e-waste problem**

According to the Global E-waste Monitor, 44.7 million tons (Mt) of e-waste was generated globally in 2016, translating to an average of 6.1 kg per inhabitant. This is forecast to grow at an annual rate of three to four per cent as the world embraces technology further, and as devices reach the end of their lives, reaching 52.2 Mt by 2021. However, south African estimated e-waste production varies according the research hence the statistics are not for example The Global E-waste Monitor reports that 321 000 tons of e-waste was generated by South Africa in 2016 By contrast, a study by Finlay in 2005 estimated e-waste generation to be between 1.12Mt and 2.1Mt per annum a sixfold increase over the Global E-waste Monitor estimate. The estimates especially in Africa are not accurate due to unreliable data bases, a study done by Lydall, Nyanjowa and James found that only 17 733 tons of e-waste was declared as processed, representing a small percentage of total e-waste generated. Irrespective of the estimated produced e-waste in South Africa, there is still a significant opportunity to increase the percentage and volumes of e-waste that enter the recycling system

## 2.7 E-Waste Problem in India

India ranks 177 amongst 180 countries and is amongst the bottom five countries on the Environmental Performance Index 2018, as per a report released at the World Economic Forum (2018). This was linked to poor performance in the environment health policy and deaths due to air pollution categories. Also, India is ranked fifth in the world amongst top E-Waste producing countries after the USA, China, Japan, and Germany and recycles less than 2 per cent of the total E-Waste it produces annually formally. Since 2018, India generates more than two million tonnes of E-Waste annually, and imports huge amounts of E-Waste from other countries around the world. Dumping in open dumpsites is a common sight which gives rise to issues such as groundwater contamination, poor health, and more. The Associated Chambers of Commerce and Industry of India (ASSOCHAM) and KPMG study, Electronic Waste Management in India identified that computer equipment account for almost 70 per cent of E-Waste, followed by telecommunication equipment phones (12 per cent), electrical equipment (8 per cent), and medical equipment (7 per cent) with remaining from household E-Waste.

E-Waste collection, transportation, processing, and recycling is dominated by the informal sector. The sector is well networked and unregulated. Often, all the materials and value that could be

potentially recovered is not recovered. In addition, there are serious issues regarding leakages of toxins into the environment and workers' safety and health. Seelampur in Delhi is the largest E-Waste dismantling centre of India. Adults as well as children spend 8–10 hours daily extracting reusable components and precious metals like copper, gold, and various functional parts from the devices. E-Waste recyclers use processes such as open incineration and acid-leeching. This situation could be improved by creating awareness and improving the infrastructure of recycling units along with the prevalent policies. Most of the E-Waste collected in India is managed by an unorganized sector.

Also, informal channels of recycling/reuse of electronics such as repair shops, used product dealers, e-commerce portal vendors collect a significant proportion of the discarded electronics for reuse and cannibalization of parts and components.50 to 80 per cent of E-Waste collected by the US is exported to India, China, Pakistan, Taiwan, and several African countries. This is done because cheaper labour is available for recycling in these countries. And in the US, export of E-Waste is legal. E-Waste recycling and disposal in China,

India and Pakistan are highly polluting. Of late, China has banned import of E-Waste. In India, recycling of E-Waste is almost entirely left to the informal sector, which does not have adequate means to handle either the increasing quantities or certain processes, leading to intolerable risk for human health and the environment. The current practices of E-Waste management in India encounters many challenges like the difficulty in ineffective regulations, wretched and insecure conditions of informal recycling, poor awareness of consumers and reluctance on part of the stakeholders to address the issues.

**Poor infrastructure to recycle e-waste**

Sadly, India has very few recognized and government-approved recycling centers to dismantle and repurpose electronic waste. Did you know that the Indian government has introduced a grant scheme for proficient e-waste management facilities? As per the grant, the government would readily fund 25% to 50% of the expenses in setting up infrastructure to repurpose electronic waste efficiently and responsibly. Even then, recycling centers and organized supply chains are very few.

## 2.8 Challenges of e-waste Finland

The Finnish waste management system is based on an integrated approach. Sustainable waste management is a combination of legislation, regulatory guidance and control measures, practices and incentives aimed at intensifying separate waste collection, technologies, and environmental education. All these elements complement each other, making it possible to transform waste into a resource for a circular economy. Finland's waste management system has developed in close cooperation between municipalities, private companies involved in waste treatment and producer responsibility organizations. The leading role of municipalities in waste management formed the basis for the management of MSW, and ensured the availability of services under all circumstances. Finland has moved from collecting waste and dumping it in landfills to reusing waste as raw materials and energy in a relatively short period of time. In the early 1990s, about 80% of MSW and construction waste was sent to landfills.

The development of technologies has expanded the possibilities of waste treatment, and waste recycling has become in many cases a profitable business. The development of a circular economy is one of the priorities of Finnish and EU policy. The circular economy is a new economic model, the main purpose of which is the conservation of natural resources and the efficient and sustainable use of materials. Already in 2016, Finland published the world's first roadmap for the circular economy, and in 2021 – a strategic program for promoting the circular economy. The goal of the program is to initiate a change that will create the basis of a new economy by 2035. The transition to a new model will require the development of new forms of cooperation, innovation, and a change in attitude to waste, and thus creates new models of work and sustainable business.

**Legislative inadequacies**

Legislative inadequacies are one of the challenges in e-waste management for instance the chines government has long been aware of the environmental and health consequences of electronic waste and is one of the first global supporters of banning exports of e-waste to developing countries. However, China has failures in its legislation and come from its inexperience of how to manage e-waste and its overall ambiguous, contradictory legislation as judicial authorities that enforce regulations struggle with ambiguities and contradictions in the regulations where imports often walk the line between illegal smuggling and legal import. For example**,** waste imports that are marked as "recycling copper or aluminum" would be a legal import under the Notification on

Importation of the Seventh Category of Wastes, creating a loophole for e-waste to legally enter China for many years.

Additionally, legislation and regulations have been accepted by the developed countries against illegal exportation of e-waste, the high number of illegal shipments continues to exacerbate the e-waste problem in China. For example, the members of the European Union agreed not to transport any waste subject to Basel convenient but illegal shipments are still rising in China and other developing countries. For instance, the members of the European union agreed not to transport any waste subject to one of the main incentives for them to export e-waste is that the cost of domestic e-waste disposal is higher than the exportation fees

Moreover, e-waste brokers make large profits from the trade and get paid twice: once for acquiring the e-waste, once for shipping it. Informal e-waste recycling in China is so prevalent that it makes regulatory programs less effective. Regulatory pilot projects usually fail to collect sufficient e-waste because they do not incentivize consumers to safely dispose of their end-of-life electronics. Even though many Chinese consumers realize that it is important to recycle e-waste safely, they still value the monetary value of their products and choose informal recycling instead. As many as 90% of the consumers are reluctant to pay for e-waste recycling because there is still monetary value in the end-life of products. While electronic devices and waste are collected in different Chinese regions and impart various environmental and health problems on the area, many activists argue that the distributors and source countries are not being held significantly responsible. While international regulations have increased domestic recycling programs in these source countries (such as the United States), shipment of Electronic Waste has not completely been eradicated and remains a significant global issue

**Collection rates and effects generally**

Collection rates of e-waste are poor around the globe. Asia is the largest e-waste-producing continent, and yet only recycles 15 per cent of the 18.2 Mt that it generates annually. Finland is considered to have among the best e-waste management plans in the world, with an environmentally conscious population; yet there are still challenges at the collection stage. South Africa can be considered to have an established recycling industry, with collection rates for tin-

plate steel cans and paper at 63 per cent and 52 per cent respectively however, the collection of e-waste is estimated at only 11 per cent

**Challenges of e-waste Nigeria**

Furthermore, the challenges facing Nigeria in E-Waste management are many. Firstly, there is lack of a broad-based national policy on E-Waste. The Nigerian national policy on the environment (1998) also made no express mention of E-Waste management. Furthermore, apart from a few uncoordinated attempts, there is the paucity of national measures aimed at proper management of the E-Waste. In Nigeria unlike in many developed countries, waste management including E-Waste management is largely seen as the responsibility of either the state or the federal government in contrast to having an integrated programme of waste management that will involve both the three levels of government and the private sector in and integrated but complimentary way. There challenges include the absence of national infrastructure for appropriate E-Waste management (for formal recycling), and the absence of any effective framework for product take-back or implementation of Extended Producer Responsibility (EPR) system.

In fact, even the collection and disposal of the waste is a huge problem as there have not been any systematic approach adopted or developed by the various governments (past or present) in the country. This is an area that has received very little attention compared to the attention given to environmental degradation and related issues. Storage of waste in a disposal facility serves to minimize the effects of waste on the environment. Where the control is absent or inadequate, disposal facilities may even become veritable sources of groundwater contamination.

Poor public enlightenment on the dangers associated with the environmentally sound management of E-Waste, poor material and Waste from Electrical and Electronic Equipment (WEEE) recycling, little capital investment in controlled landfills, poorly structured waste logistics operation, poor regulation of industry, poor or near absence of corporate responsibility by the industry, patriotism, weak global and regional response to E-Waste issues, lack of data on the volume of E-Waste imported into the country or generated domestically among others, all contribute to make the E-Waste disposal system in Nigeria inadequate.

**Absence of infrastructure**

The challenges facing the developing countries in e-waste management include: for appropriate waste management, an absence of legislation dealing specifically with e-waste, an absence of any framework for end-of-life (EoL) product take-back or implementation of extended producer responsibility (EPR). This study examines these issues as they relate to practices in developing countries with emphasis on the prevailing situation in Nigeria.

Effective management of e-waste in the developing countries demands the implementation of EPR, the establishment of product reuse through remanufacturing and the introduction of efficient recycling facilities. The implementation of a global system for the standardization and certification/labelling of secondhand appliances intended for export to developing countries will be required to control the export of electronic recyclables (e-scarp) in the name of secondhand appliances.

**Challenges of e-waste in Sub Saharan Africa**

The advent of the knowledge economy has put immense pressure on the developing world to embrace digital technologies to join the global village. The rapid modernisation, industrialisation and consumer appetite for better products has exacerbated E-Waste management challenges. The lifespan of computers and peripherals reduced from 5–10 years previously and now ranges between 3–4 years as this equipment is built with a focus on replacement instead of repairing.

Wang et al (2013) postulate that developed countries had enacted policies, infrastructure, and technical skills to manage E-Waste. Developed countries embraced the Extended Producer Responsibility (EPR) policy which places the burden of managing E-Waste in the hands of the manufacturers of EEE (Fraige et al., 2012). The EPR adopted by most developed countries allows consumers to return obsolete EEE to the manufacturers for a fee paid to the consumer. In developed countries such as United States, Japan, Germany, Sweden, and Switzerland and others, E-Waste collection and recycling are coordinated by producers and municipalities through effective policies. China established over 109 formal recycling centres which have collected over 43 million units beyond the country's recycling need.

Though the Global North has developed policies and set up the infrastructure to recycle E-Waste, it remains lucrative to ship it to the Global South, where there are no policies and legislation to govern its management. Worryingly, the recipient countries lack policies, knowledge, and

appropriate disposal facilities, thus resulting in the accumulation of E-Waste. Recipient countries had no policies and infrastructure to handle E-Waste, therefore posing a danger to the environment and human health. Developing nations face unprecedented strain on the environment and human health as global E-Waste output is likely to exceed 53 million metric tonnes by 2021. Developing nations' domestic E-Waste was 25.4 million tons, and for the first time, it exceeded that of the developed world's domestic E-Waste that stood at 23.5 million tons. By 2030, the developing world will dispose of over 700 million obsolete computers, yet few studies on E-Waste management were conducted in Africa.

The detrimental effect of improper handling of E-Waste on the environment and human life made developed countries enact policies that govern E-Waste management. In most developing countries, E-Waste handlers use rudimentary means of processing E-Waste through incinerating or open burning in dumpsites. The most affected and vulnerable groups are; the illegal E-Waste workers who use rudimentary means, with no appropriate tools, the public which reside near informal recycling dumpsites, children, and pregnant women.

There have been reports of illegal transboundary movement of hazardous waste from the Global North disguised as commercial goods to developing countries. About 80% of the E-Waste produced by the Global North was exported illegally to developing countries in the Global South. An increase in intra-African E-Waste movement from countries such as South Africa, Nigeria, and Tunisia to other countries with porous borders such as the Democratic Republic of Congo, Zimbabwe, and Mozambique among others. Although E-Waste contains toxic and hazardous metals such as barium and mercury among others, it also contains non-ferrous metals such as copper, aluminium, and precious metals such as gold and copper, which if recycled could earn income over 55 billion euros.

Despite the evident E-Waste disaster, most developing countries do not have legislation and appropriate infrastructure, so E-Waste is handled by illegal recyclers who pollute the environment and threaten public health. Scholars have posited that there is little information on the volume of E-Waste in developing countries who often do not have systems to deal with E-Waste. South Africa, Rwanda, and Uganda are some of the countries in the Sub-Saharan Africa region that have taken many steps in managing E-Waste through enacting various policies and laws. There is a need

for more developing countries to enact policies that guide the management of E-Waste to prevent environmental degradation and adverse effects on human health. Limited research and a lack of national effort in managing E-Waste in most developing countries are the causes for the unavailability on information on E-Waste volumes generated in these countries. Little work has been carried out on E-Waste management in developing countries and previous works have not comprehensively considered Africa or the Sub-Saharan Africa in particular.

Most African countries lack the capacity to handle and recycle the hazardous materials contained in e-waste. Furthermore, the common practice of disposal of e- waste on dumpsites represents a source of 3 environmental pollution. Due to its toxicity, e-waste creates real health hazards for the nearby communities (Gweme, 2015). The modalities of e-waste problems are little known in Zambia. There exist no minimum specifications for second-hand equipment in the fields of Information and Communication Technologies. As a result, second-hand computers received in Zambia are often not fit for purpose. Even if second-hand electronic goods are usable, their limited lifespan accelerates descend into e-waste. Shipping of used computers to African countries often represents dumping. Second-hand computers, whether usable or not, often end up in the informal sectors of the economy. Here computers sustain informal employment and a livelihood. Due to its nature, the informal sectors are rather immune for government policies and regulation.

As e-waste contains electronic components that contain valuable metals, the extraction of these metals gets attention by the informal sector. Subsequently, e-waste is mostly handled by unregistered, unauthorised informal recyclers. Crafts persons in the informal sectors do not necessary possess knowledge and skills on how to recover valuable components in a safe manner. Poignant documentaries from Kenya and 4 Ghana show e-waste being burned to dispose of its encapsulating parts. Burning puts lethal toxins such as lead, cadmium, and beryllium and brominate flame retardants into the air.

Zambia does not have government approved e-waste recyclers. There are no entities that are individually licensed to collect, process, and dispose of e-waste. Therefore, e-waste involves informal recycling in a context of inadequate legislation and a continued lack of awareness of the stakeholders. The tantalising problems of e-waste “Only a few countries in the developed world can scientifically recycle or dispose the E-waste they generate. In other developed countries only

a fraction of the E-waste is properly recycled, the rest is either incinerated or sent to landfills" which are solutions that cause serious secondary problems. Worse still, a sizeable portion of the Ewaste generated in the developed world is exported to developing countries where it is recycled or dumped without any concern for the gross pollution that is being caused. It can be said that if the situationvis-a-vis E-waste is posing a challenge in most developed countries, it is alarmingly bad in the developing world." (Spiegel & Maystre, 1998).

Loopholes in the current Waste Electrical and Electronic Equipment (WEEE) Directives allow the export of e-waste from so-called developed to so-called developing countries (Schluep et al., 2011). 70% of the collected WEEE ends up in unreported and largely unknown destinations. Spiegel and Maystre (1998) already saw that "altogether it is roughly estimated that during the past few years, at least 250,000 tons of e-waste per annum 'illegally entered the ports of the five selected West African countries ... This number is comparable to the total amount of e-waste generated in small European countries such as Belgium or the Netherlands, and equates to approximately 5% of all e-waste generated in the European Union". Wolfe and Baddeley (2012) state that "the size and the complexity of the E-waste problem is increasing at much faster rate than the efficacy of our strategies to contain it. This trend is not likely to reverse soon and the only viable means to solve the problem is to drastically reduce generation of waste."

Progressive legislation regulating e-waste has been adopted at both regional and international contexts. However, little is done to assist African countries to come up with their national legislation or strategy on dealing with e-waste. Most countries in Africa, like Zambia, have ratified the international treaties on e-waste management without transposing it into national law. As a result, regulatory efforts and supervising efforts are fragmented. Therefore, the implementation of international e-waste policies and legislations remains a challenge since there is no national laws and regulations to support them. Among the general challenges faced in Zambia are the limited capacity and capability of responsible institutions, lack of implementation of legal instruments, strained participation among stakeholders, and lack of resources. As e-waste is mostly handled in informal industries, there is no reliable data on the volume, costs, and benefits. The United Nations Environment Programme published its e-waste estimates in 2009 (Hayden, 2009). Virtually all electronic equipment contains toxic materials that can be harmful to people and the environment.

A lot of this hazardous materials are found in the circuit board, and it includes the lead found in the solder and the mercury that is found in relays and switches (Allsopp et al., 2006).

Recycling and disposal of e-waste is a risky undertaking, and the risks do go beyond the area where recycling is being done due to the leakage of hazardous materials such as mercury and lead from landfills and incinerator ashes (Spiegel 8 & Maystre, 1998). In the meantime, the ICT industry is affected by the globalised phenomenon of consumerism and what one is called a 'built in obsolescence' of equipment (Charisa, 2013; Chitotombe, 2013).

**A serious lack of awareness**

Most consumers have little or no knowledge of the consequences of reckless e-waste disposal. The idea of sustainable waste management is equally vague. Furthermore, very few cities or locations have dedicated collection points where consumers can drop off their so-called electronic scraps voluntarily It has been found that most obsolete electronics in South Africa are simply stored and never enter the waste stream. These poor formal collection rates result in economic value not being derived from e-waste, and potentially have environmental consequences, including informal collection that can result in the illegal processing of e-waste. Both the trade in e-waste and its processing are highly regulated by the Basel Convention and by country-specific environmental laws. Informal trade and processing operate outside of these regulations, and can thus be used interchangeably with the term 'illegal processing.' The informal and illegal processes often result in the dumping of waste in developing countries, open-pit burning, and acid-based processing. These informal processes have all been shown to have significant health and environmental effects.

**Mismanagement of products**

In the present times, sourcing e-waste is challenging. Circular economy, although a term in use for years, is a new entry in the business channels. Companies ranging from start-ups to the top e-waste management companies in India invest heavily to establish collection hubs or adhere to circular economy standards. The information barriers are real. For example, there is a lack of knowledge about cost-effective and efficient e-waste management techniques, as well as how to maximize the utility of end-of-life products.

**Financial constraints**

Financial constraints at the national and individual level sometimes lead to practices that can increase human exposure to hazardous wastes. For example, the use of pesticides that are banned in developed countries is sometimes due to a lack of an alternative option. Also, in extreme cases, poverty and famine have been known to force people to wash the pesticide coating off grain seeds and eat the seeds even when people know that this can expose them to ill-effects or death.

Diverse locations and types of sources of hazardous wastes make identification and follow-up difficult. Is one of the challenges of faced by developing countries, Economic liberalization can also led to the growth of industries and other economic establishments that produce hazardous wastes in areas that were previously reserved for other uses, for example in residential areas or near water sources. High population growth accompanied by economic development has also caused a massive increase in the production of solid waste, including hazardous wastes.

## 1.3 INTIATIVES TO IMPROVE E-WASTE MANAGEMENT

### Policy formulation and implementation

The explosion of electronic products over the last decade or so and the corresponding rapid rise in e-waste pose a significant environmental challenge to the governments, particularly in developing countries. The limited impact that India's seven-year-old regulations have had is an indication of the challenges that the country faces as far as e-waste management is concerned

Review of current regulations: is one of the ways India is trying to improve waste management, The regulatory infrastructure is inadequate in monitoring compliance and enforcing the existing e-waste rules despite its government does not acknowledge

This situation is unlikely to improve in the next few years since the state currently does not acknowledge its inadequacy. This situation can only be altered by another regulatory framework and governance mechanism. The current arrangement of state and central pollution boards requires a serious rethink, perhaps more powers, faster decision-making capability, and accountability of individual officials. Role of the informal sector will require to be addressed in view of the current tax regime clearly defining the dos and don'ts. List of items that are currently placed in the schedules will need review based on their hazard component rather than generic criteria, while

acknowledging the need for repairs and refurbishments both in formal and informal sector thus minimizing waste generation.

**Waste incentivization and data generation:**

The volumes of waste flow in informal sector, and population directly or indirectly engaged in e-waste is purely based on weak or inadequate information, which inhibits drawing up a sound legal framework and effective implementation mechanism. The government, in collaboration with grassroots organizations, should generate more accurate estimates of people whose livelihoods depend on waste collection and processing. More generally, inadequate data on e-waste has been a matter of serious concern. The issue of waste generation and its incentivization has never been seriously attempted. Incentivization and assessment of life span for a product also requires a scientific and rationale approach.

**Development of online systems:**

The current regulatory and monitoring mechanisms draw immensely of the strength of human resource and an opaque system of paper trails almost impossible to manage. An online portal is a substitute for bringing in transparency and accountability into the system. Lessons must be drawn from the GST system that tracks movement of goods and free riders. Waste generation and its movement until its final disposal should be tracked by an online system and technology must be used to identify and track all goods until its final disposal.

This should also include all goods that are handled by the informal sector being transported inwards and outwards by paying GST. Such a system would serve two immediate and long-term objectives of generation of credible data and effective monitoring, thus reducing environmental load and fostering circular economy.

**Repair and re-use**

The finest solution for handling with E-wastes is to decrease the amount. Electronic devices should be built for repair, re-use and/or enhanced while designing. Focus should be use of easily recoverable, recyclable, and less toxic materials which can be used for disassembly, refurbishment, and reuse and remanufacturing. The probable solution to diminish e-waste is recycling and reuse of material.

In developed countries like Australia, US forming an integrated e-waste recycling system are mandatory to prohibit informal e-waste recycling. In our belief, such recycling system must be adopted in the developing countries who lack in proper handling of E-waste may include these steps. The first step is to set up and enhance the building of certain new subsidy scheme which integrate an Extended Producer Responsibility and Advance Recycling Fee. The second step we think we can build an efficient E- waste assembling system, which can incorporate informal curbside collectors and secondhand markets into it, and convert from informal E-waste recycling system into formal E-waste recycling system with enhanced monetary support and technology enhancement.

**recycling**

We can incorporate curbside assembler into the official e-waste recycling system, with hostile e-waste generated into informal recycling system, State-civic-business alliances: As mentioned above, there are multiple actors with diverse objectives implicated in e-waste management in India. To devise and implement a sustainable working model, there is a desideratum for across-the-board collaboration involving regime, NGOs, informal sector, and formal recycling businesses. There is consequential evidence to suggest that immensely colossal scale transformation in subsisting consumption and engenderment patterns would require collaborative efforts of actors with diverse objectives. Hub and Spoke Model for Infrastructure: A high-tech refinery that can excerption precious metals from sorted e-wasteland components needs billions of dollars in investment funds. Therefore, it is only possible to install such plants to cater to an entire region, while state-wide material recovery facilities and city -wide collection infrastructure is required to provide adequate amount of material for the regional refinery.

This strategy for developing hub and spoke model for infrastructure can play a crucial character in maintaining viable recycling businesses. The guidance of the Central Pollution Control Board is needed for developing such models that require a cross-state planning, strategic orientation for development of adequate and appropriate infrastructure. Capacity Building of Regulators: With the introduction of new e-waste rules, it is crucial to devote significant investments for capacity building of regulators. While training modules are available or are being prepared there is a need for handholding and mentoring of officers at the local level to ensure enforcement. The Department of Electronics and Information

**Initiatives to improve e-waste disposal in Zambia**

To ensure effective management of waste, the Municipality works in partnership with private waste management companies Franchise Contractors and Community Based 6 Organizations that service conventional and peri-urban areas in the city. Currently, the Council has 16 waste management districts and of these, 15 are manned by the private sector while the other one that covers Central Business District is under the Council. A franchise system has been implemented in Lusaka that encourages the participation of the private sector in solid waste collection.

A franchise contract provides a private waste collector with the sole right and obligation to collect and transport waste from all premises in a franchised waste management district to the dumpsite. The franchise collector awarded with a franchise contract has the responsibility for collecting waste fees for the services provided. The fee range depending on different factors is set in liaison with all stakeholders with a ceiling set by the Council. The fees vary depending on the residential areas. In peri-urban areas, Community Based Enterprises have been given the mandate to collect waste within these areas.

E-Waste Mitigation Measure and Management/Disposal Plan This E-waste management plan contains proposed mitigation measures through which all E-waste can be managed in accordance with Zambian law, WB ESF, WB ESHG, and GIIP. The mitigation measures or guidelines have been designed to avoid, minimize, and reduce negative environmental and social impacts at the project level. The mitigation measures are presented in table 2 in a descriptive format.

**Awareness and Sensitization**

Awareness and sensitization of teachers who will use the electronic devices on the proper disposal of once they become damaged, irreparable or at their end of life. The schools should include in the sensitization the usefulness and significance of E-waste recycling and the need for returning all-electronic items procured by the project to a collection center that should be established at each hub and satellite center.

**Summary**

In this chapter, the theoretical perspectives on people's perceptions and behaviors in e-waste management were discussed. Several factors that affect people's behavior towards the

environment such as physical environment and the policy were also discussed. The conclusion that can be drawn from this chapter is that the social, physical and policy environments influence the behavior of the individual, while at the same time behavior of the individual, group or organization also impact on the wellbeing of their environments. The environment can control or set limits to proper waste disposal behavior that occurs within it**.**

# CHAPTER 3 RESEARCH METHODOLOGY

## 3.0 INTRODUCTION

This chapter presents the methods and procedures that were used in the study, it includes research design, data collection methods, sampling techniques and sample size. Research instruments, data analysis and ethical considerations

### 3.1 RESEARCH DESIGN

This research used a case study design which is an all-inclusive research method that uses sources of evidence to analyze or evaluate specific phenomena. It also focuses on analysis of events and relationships bound by some unifying factors which are suitable for evaluating the achievement of a program of the intended outcomes. Based on this definition, a case study design will be used to understand in depth study of the challenges of hazardous waste disposal. This study deployed mixed methods of data collection offering an opportunity to use multiple sources of evidence which will increase the validity and reliability of the findings. A case study was helpful to facilitate an in-depth analysis of the findings and logical explanations in helping to yield qualitative data (Orodho, 2008).

## 3.2 SAMPLE

A sample is a finite part of a statistical population whose properties are studied to gain information about the whole. The sample consisted of 60 residents Lusaka

## 3.3 SAMPLING TECHNIQUES

Sampling is the procedure a researcher uses to select people, places, or things to study. It is a process of selecting several individuals or objects from a population such that the selected group contains elements representative of the characteristics found in the entire group. This study will utilize random and purposive sampling (Kombo & Troup, 2006). The main reason the researcher used these techniques is to obtain samples that were rare and to collect data from the sample that is well informed. Purposive sampling involved the researcher choosing participants considered to be knowledgeable and well informed because they possess rich background knowledge on the topic under study. The use of purposive sampling can, therefore, be justified by stating that the technique ensures that only rich information for in-depth analysis related to the central issues being studied is gathered as opposed to having a larger number of participants (Kombo & Troup, 2006).

## 3.4 SAMPLE SIZE AND POPULATION

A total of 60 respondents were selected for this study: 50 residents and 10 key informants from waste disposal companies and electronic repair shop.

## 3.5 TARGET GROUP

The target group of this research was mainly the residents of Lusaka constituency and key informants including council, electronic shop repair and other waste collection companies' residents were randomly selected and key informants were purposely selected.

## 3.6 DATA COLLECTION INSTRUMENTS

This study used three main data collection tools namely; self-administered semi-structured questionnaires, in-depth interview guide and observation. The semi-structured questionnaire will be used to collect data from 50 residents of Lusaka and the interview guide will be used to collect qualitative data from key personals.

**Direct observation**

Direct observation used to do during the study to supplement semi structured interview findings as it will provide additional information to the findings. Direct observation is the method of collecting and evaluating information in which the evaluator watches the subject in his or her usual environment without altering that environment. This method will allow the physical identification readily seen features will allow the physical identification and analysis of the problem (Drury, 1995).

### 3.7 DATA ANALYSIS

The data from the questionnaire was analyzed using a thematic data analysis while data from the key informants was interpreted into major themes that emerged based on thematic analysis (kiger & Varpio, 2020). The data will be presented using tables and charts because they are easy to interpret and understand.

## 3.8 ETHICAL CONSIDERATIONS

This research was conducted only for academic purposes, all participants will be assured of total and maximum confidentiality. All participants are not asked to state their names during the research and the information that was collected was highly secured (Kombo & Troup, 2006).

**Researcher and participant relationship**; during the research, a favorable atmosphere will create for the respondents by according them with maximum respect of their views which they brought out during the interview.

**Time and validity of research design; t**he time spent on each interview and validity of the research design was communicated to the respondents before the commencement of the interaction with them. This was to ensure the successful collection of the much-needed data without wasting both the researcher and respondent's time. Thus, they were being informed in advance of their right and reason to participate and withdraw from the study at any time if they decided to do so.

**Assurance of confidentiality; t**he respondents' right to privacy, dignity and informed consent was followed and guaranteed.

Thus, the names of the respondents were then referred to respondent 1, 2, 3…respectively.

**Reciprocity;** in this study, the respondents' views and contributions were highly appreciated and the researcher demonstrated this fact by thanking the respondents for their cooperation at the end of the interaction.

## SUMMARY

In this chapter, the researcher has presented the techniques that will used for data collection, data analysis and the reasons for which these were selected. Thus, the researcher will purely use a qualitative research design and purely descriptive approach.

# CHAPTER FOUR; PRESENTATION OF DATA

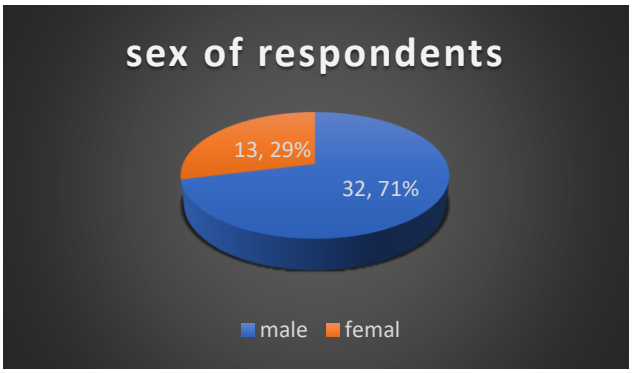
## 4.0 INTRODUCTION

This chapter provides an analysis of results from the research conducted in the study area with participants from household, electronic shops, and waste management companies.

**Background of respondents**

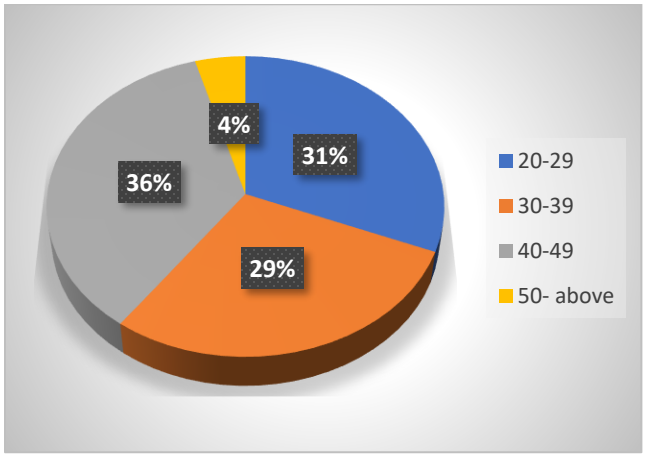
A total of 50 questionnaires and 10 interviews were distributed to households, waste management companies and electronic shops within selected areas of Lusaka. and all the questionnaires were completed satisfactorily. This translates to a response rate of 100% of the total sample and was adequate to draw conclusions. Additional information was collected through observations from the waste dump and collection points.

Figure 4.1 Respondents' distribution according to sex.




The figure above represents the sex distribution of the respondents, the study it shows that 71% percent of the respondents were male and 29% female. The study was dominated by the male

Figure 4.2 Respondents according to age.



The figure above shows the distribution of age of the respondents 36% 40-49, 31% were 20-29, 29% were between 30-39 and 4% above 50. This shows that most of the respondents were below 50,

**Types of e-waste generated in the study area**

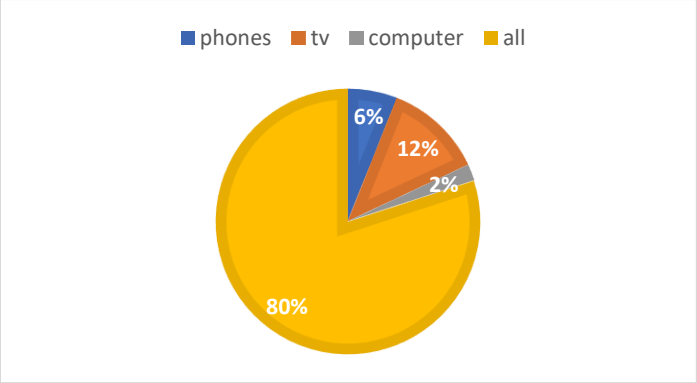
**Introduction**

The study was based on electronic equipment in use as and obsolete at the time of the research. The study focused on five groups of e-waste, namely waste from small equipment, large equipment, lighting equipment, entertainment equipment, and information technology and communication (ICT). The respondents mentioned that the waste is mainly generated from old unwanted or broken laptop and desktop computers, computer screens, photocopier machines, printers, tablets, telephones, cell phones and smartphones. The second most prevalent waste type after ICT waste was waste from entertainment equipment such as obsolete TV's, LCD screens, audio systems, stereo systems and others which were mentioned by the 80 percent of the participants. The LCD TV screens, old TV sets and headphones were the most 60 dominant type of entertainment equipment. Most of the respondents owned smartphones, computers, and other electrical devices.

**Electrical devices owned by respondents.**

The figure 4.3 below shows the most dominant electric equipment's owned by the resident's 80 percent of the respondents had all the appliances of suggested by the researcher which are tv, phones and computer. 6 percent of the respondents only had phones and not the other appliances. 12 percent had TVs and not the other appliances and lastly 2 percent had computers only.

Figure 4.3 Electrical devices owned by respondents.




**From the interview the following were the main e-waste that is collected**

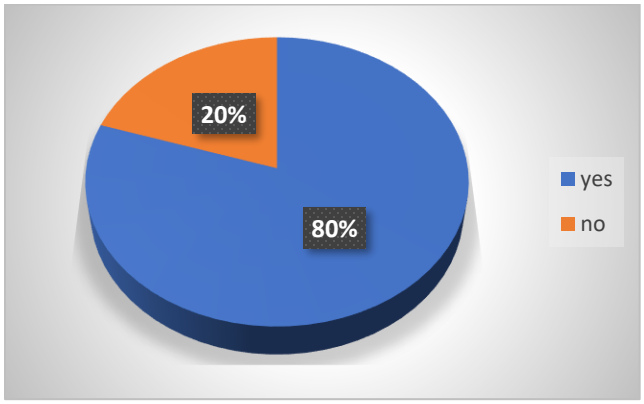
- *PCBs – Printed Circuit boards*
    - *These are collected and stored until quantities are reached for them to be exported to PCB recycling centers abroad. There are no such recycling facilities in Africa, only now are they setting up In Rwanda.*
- *Metals.*
    - *These are sent to local recycling companies. Usually in Electronics, we find copper, Steel and Aluminum.*
- *Plastics – Mainly ABS*
    - *The Plastics used in most electronics is ABS, which is a rigid plastic and most local recycling companies do not recycle as the products from ABS are limited. As E-TECH recycling, has partnered with ECO- UNIT (The environmental department of Chilanga Cement). They use the plastic in the kiln for heat retention and the ash is used as an additive in the cement production.*

      *https://www.geocycle.com/co-processing*
- *Glass*
    - *Currently we are storing the glass, with the hope that we will eventually get a local recycling company to be off taking the glass. But in the interim we are looking crushers to crush the glass, as it is accumulating and taking up space*

**Aware of the components in electronic waste**

The diagram below shows the awareness of electronic waste 80 percent of the respondents from the household responded that they are aware of what electronic waste is and how harmful they are to the environment, only 20 of the respondents stated that they did not know what electronic waste was.

Figure 4.4 e-waste awareness




**Ways of storage and disposal of E-waste.**

From observations and responses received, majority of unused electronic equipment were stored inside the house. Electrical equipment in most households was also kept in its original state and had not been stripped or interfered with or dismantled. This significantly reduced the risk of any chemicals from leaching into the ground. This practice of retaining and old or broken appliances is also common in Vietnam where citizens prefer to retain their old equipment for sentimental value.

The table 4.5 below shows that 70 percent of the respondents just keep the electrical worst home, 22 percent the dispose in the waste bins and reuse some parts of the appliances for reuse.

Table 4.5 Ways of storage and disposal of E-waste.

| WAY OF DISPOSAL | RESPONDENTS | PERCENTAGE |
|---|---|---|
| Disposed in bin | 11 | 22% |
| Dumped in recycling for usable parts | 4 | 8% |
| Keep home | 35 | 70% |

**From the interview the e-waste management company stated how they dispose the e-waste**, "*Now we are storing the Solar panels. The eventual disposal will involve the crushing of the panels (in a green room) and eventually washing out the glass, leaving the cadmium in the water solution, as cadmium is water soluble. The paste after drying can be easily incinerated."*

***Another respondent stated "****Separation of the glass and the silicon wafer through thermal, mechanical, or chemical processes; and/or Separation and purification of the silicon cells and specialty metals (e.g., silver, tin, lead, copper) through chemical and electrical techniques"*

**Total waste generated by a waste company.**

Table 4.6 below shows the quantity of waste collected by a waste management company and showing how the waste was segregated.

Table 4.6 total waste generated per month

| | **Quantity (KG)** |
|---|---|
| Year 2022 per month | |
| Total e-waste collected | 10 |
| refurbished | 2 |
| recycled | 2 |
| Disposed | 6 |

## 4.3 CHALLENGES OF WASTE MANAGEMENT

**Waste segregation**

Waste segregation was one of the challenges which the respondents most of the points where garbage is disposed is not segregated hence all the different types of waste are

from the interview, one of the waste management companies stated that they do not provide waste bins for the public for waste segregation on of the company stated that "*From research and trials, we discovered that introduction of bins in open public areas does not work as people will not only throw in e-waste. Also, we have given bins to companies such as MTN, and it has been over 1 year and we have not been asked to them. People in general has the hogging syndrome. They assume that that expensive iPhone 5 handset will eventually work in future"*

**Waste management company**

People assumption that disposal is free one of the respondents from the interview stated that **"***Most people assume that disposal is free. What they do not understand is that even solid waste is collected by the municipality or private companies at a cost, but for e-waste they always assume, the management company will collect for free."*

Waste management companies do not put an emphasis on the Places of disposal The residents responded that there are designated places for disposing e-waste, they stated that the places they are forced to dispose the material with any other material or waste.

## 4.4 INITIATIVES TO IMPROVE WASTE MANAGEMENT

**Policy formulation and implementation**

The respondents stated that there should be a solid policy that can guide communities, utility companies and the public on how and where to dispose. This policy should also include the consequences on individuals who will not be complying with the policy requirements. With the formulation and implementation of such a policy will be helpful with re-use and recycling requirements.

From the interviews, the waste management companies stressed about the implementation of an e-waste management policy and one of the respondents stated that

> *"Government needs to set-up a deliberate e-waste policy, which now is on paper and "never" implemented. In fact, Government is the biggest culprit when it comes to non-compliancy to correct disposal."*

**Sensitization**

Firstly, sensitize the effects of e-wastes disposal and provide areas where they be disposed There is need for more sensitization on how to dispose, most of the respondents stated that there should be constant dissemination of information about E-waste.

One of the respondents stated that "*I had no idea that electronic waste influences the environment, I have only come to know that e-waste must even be separated from the other waste only after this interaction. I know there are several people who are like me and do not know about electronic waste."*

Furthermore, another respondent suggested that "*every person who buys an electronic appliance they must know how and where to rightfully dispose of them because not everyone is able to read hence even verbal sensitization during the time of purchase would help ".* not only that *conduct Awareness and campaign to the community in market areas, Facebook, radio, television people are now using social medial for sensitisation and these platforms would increase the rate at which the communities will aware of how to dispose electronic waste.*

*The e-waste management policies should specify on what sensitisation strategies that should be put in place by waste management companies such as having labelled waste bins and Sensitization programs on proper waste disposal procedure and the environmental impacts they pose.*

**Increase the Recycling**

The respondents explained that there is need of introducing e-waste recycling stations There should be a designated place where they should be taken for proper disposal or recycling where possible,

one respondent stated that "*I think recycling, putting value of the waste so that something else can be made from them of them, when the e-waste can either be sold for re-use or completely recycle."* From the interview, the respondents stated that **"***Reduce the cost of licensing fees and increase sensitization to the public and increase cooperate workshops on this."*

**Waste segregation**

Waste segregation is one of the strategies that was suggested by the respondents, if waste is properly segregated at the point of disposal or collection there would be less mixture of e-waste with general waste. The e-waste can easily be identified and taken for refurbishing or recycling. Special bin or damping sites should be put up and educate people on how to dispose different e waste. Waste segregation and specific waste disposal facilities.

**Waste management vendors engagement**

The respondents suggested there should be companies that can specifically dealing with e-waste, if a company is mainly paying attention to the collection of e-waste there would be an improvement in waste segregation at points of collection. the vendors to have specific waste collection points which can be known to the community and lastly encourage companies to be involved in e-waste.

**Introduce disposal sites**

One of the respondents responded that, *"think E-waste should be taken back to the store or identify companies that recycle e waste Dedicated disposal sites for e-waste However, neighbourhoods need places where the items can be dumped prior to collection by e-waste disposal companies Securing the collection points Enhance the collection by working with the men who go round neighbourhoods collecting used batteries and geysers. Understand where they take the collected items and what incentives exist."*

**Value on e-waste**

The polices guiding the e-waste management should include the valuing of electronic waste just like steel or metal which is sold as scrap with such in place, the electronic waste will be managed in an orderly way. One of the respondents stated that when the people see that having

# CHAPTER FIVE: DISCUSSION OF STUDY FUNDINGS

## 5.0 INTRODUCTION

The chapter discusses the study findings in line with the proposed study objectives upon which this paper is anchored. The discussion is based on the following objectives, to assess the awareness e-waste disposal among residents in selected areas Lusaka, to ascertain the challenges faced by people and e-waste management companies in managing electronic waste and to find out initiatives to improve e-waste management in Lusaka.

**Background of respondents**

A total of 50 questionnaires and 10 interviews were distributed to households, waste management companies and electronic shops within selected parts of Lusaka. and all the questionnaires were completed satisfactorily. This translates to a response rate of 100% of the total sample and was adequate to draw conclusions. Additional information was collected through observations from the waste dump and collection points.

Before delving into the research-based objectives, the study foremost discussed the demographic characteristics of the respondents.

**DEMOGRAPHIC CHARACTERISTIC OF THE RESPONDENTS**

Based on the demographic characteristics of the study, the findings are indicative that most of the respondents were male, the study it shows that 71% percent of the respondents were male and 29% female and the distribution of age of the respondents 36% 40-49, 31% were 20-29, 29% were between 30-39 and 4% above 50. This shows that most of the respondents were below 50 years of age.

## 5.1 AWARENESS ON THE COMPONENTS IN ELECTRONIC WASTE

The study reveals that the population of study is aware of what electronic waste is 80% of the respondents from the household responded that they are aware of what electronic waste is and how harmful they are to the environment, only 20% of the respondents stated that they did not know what electronic waste was. The respondents were able to give out the electrical appliances that they own, the researcher suggested several appliances which they owned and most of the respondents had them. electric equipment's owned by the resident's 80% percent of the respondents had all the appliances of suggested by the researcher which are tv, phones and

computer. 6% of the respondents only had phones and not the other appliances. 12 % had TVs and not the other appliances and lastly 2 % had computers only.

**From the interview the following were the main e-waste that is collected**

- "PCBs – Printed Circuit boards where some of the waste collected and stored until quantities are reached for them to be exported to PCB recycling centers abroad. There are no such recycling facilities in Africa, only now are they setting up In Rwanda.
- Metals are part of the cables which are sent to local recycling companies, metals found mainly copper, Steel and Aluminum.
- Plastics – Mainly the plastics used in most electronics is ABS, which is a rigid plastic and most local recycling companies do not recycle as the products from ABS are limited. As E-TECH recycling, has partnered with ECO- UNIT (The environmental department of Chilanga Cement). They use the plastic in the kiln for heat retention and the ash is used as an additive in the cement production. https://www.geocycle.com/co-processing
- Glass is Currently being stored at the time of data collection, with the hope that there would be a local recycling company to be off taking the glass. But in the interim they are search for glass crushing machines

## 5.2 CHALLENGES OF E-WASTE MANAGEMENT

**Waste segregation**

From the study Waste segregation was one of the challenges which the respondents most of the points where garbage is disposed it is not segregated hence, all the different types of waste are mixed in one bin. The other thing is that the

from the interview, one of the waste management companies stated that they do not provide waste bins for the public for waste segregation on of the company stated that

**Waste management company**

People's perception about how and where to dispose the waste is one of the challenges of waste management. Most people do not have resources to pay for waste disposal hence they just dump

anywhere without considering the importance of waste segregation. one of the respondents from the interview stated that

> **"***Most people assume that disposal is free. What they do not understand is that even solid waste is collected by the municipality or private companies at a cost, but for e-waste they always assume, the management company will collect for free."*

**Ways of storage and disposal of E-waste.**

The research findings revealed that majority of unused electronic equipment were stored inside the house. Electrical equipment in most households was also kept in its original state and had not been stripped or interfered with or dismantled. This significantly reduced the risk of any chemicals from leaching into the ground. This practice of retaining old or broken appliances is also common in Vietnam where citizens prefer to retain their old equipment for sentimental value. 70 percent of the respondents just keep the electrical worst home, 22 percent the dispose in the waste bins and reuse some parts of the appliances for reuse. This data shows that most of them just kept the-waste home without knowing what to do with it.

From the interview the e-waste management company stated how they dispose the e-waste, "*Now we are storing the Solar panels. The eventual disposal will involve the crushing of the panels (in a green room) and eventually washing out the glass, leaving the cadmium in the water solution, as cadmium is water soluble. The paste after drying can be easily incinerated."*

Another respondent stated that ***"****Separation of the glass and the silicon wafer through thermal, mechanical, or chemical processes; and/or Separation and purification of the silicon cells and specialty metals (e.g., silver, tin, lead, copper) through chemical and electrical techniques"*

**Total waste generated by a waste company.**

Table 5.1 below shows the quantity of waste collected by a waste management company and showing how the waste was segregated.

| | **Quantity (KG)** |
|---|---|
| Year per month of 2022 | |
| Total e-waste collected | 10 |
| refurbished | 2 |
| recycled | 2 |
| Disposed | 6 |

From the table 5.1 above, the statistics shows that most people do not know what to do with the e-waste and hence store them in the house. If a recycling company is only receiving 10 kg of waste

entails that there is lack of knowledge on the disposal of electronic waste. The amount of waste received does not match with the number of electronic appliances being bought or used.

## 5.3 INITIATIVES TO IMPROVE WASTE MANAGEMENT

**Policy formulation and implementation**

The respondents stated that there should be a solid policy that can guide communities, utility companies and the public on how and where to dispose. This policy should also include the consequences on individuals who will not be complying with the policy requirements. With the formulation and implementation of such a policy will be helpful with re-use and recycling requirements.

From the interviews, the waste management companies stressed about the implementation of e-waste management policy and one of the respondents stated that

> *"Government needs to set-up a deliberate e-waste policy, which now is on paper and "never" implemented. In fact, Government is the biggest culprit when it comes to non-compliancy to correct disposal."*

**Sensitization**

Firstly, sensitize the effects of e-wastes disposal and provide areas where they be disposed There is need for more sensitization on how to dispose, most of the respondents stated that there should be constant dissemination of information about E-waste.

One of the respondents stated that "*I had no idea that electronic waste influences the environment, I have only come to know that e-waste must even be separated from the other waste only after this interaction. I know there are several people who are like me and do not know about electronic waste."*

Furthermore, another respondent suggested that "*every person who buys an electronic appliance they must know how and where to rightfully dispose of them because not everyone is able to read hence even verbal sensitization during the time of purchase would help ".* not only that *conduct Awareness and campaign to the community in market areas, Facebook, radio, television people are now using social medial for sensitisation and these platforms would increase the rate at which the communities will aware of how to dispose electronic waste.*

*The e-waste management policies should specify on what sensitisation strategies that should be put in place by waste management companies such as having labelled waste bins and*

*Sensitization programs on proper waste disposal procedure and the environmental impacts they pose*

**Increase the Recycling**

The respondents explained that there is need of introducing e-waste recycling stations There should be a designated place where they should be taken for proper disposal or recycling where possible, one respondent stated that "*I think recycling, putting value of the waste so that something else can be made from them of them, when the e-waste can either be sold for re-use or completely recycle."* From the interview, the respondents stated that **"***Reduce the cost of licensing fees and increase sensitization to the public and increase cooperate workshops on this."*

**Waste segregation**

Waste segregation is one of the strategies that was suggested by the respondents, if waste is properly segregated at the point of disposal or collection there would be less mixture of e-waste with general waste. The e-waste can easily be identified and taken for refurbishing or recycling. Special bin or damping sites should be put up and educate people on how to dispose different e waste. Waste segregation and specific waste disposal facilities.

**Waste management vendors engagement**

The respondents suggested there should be companies that can specifically dealing with e-waste, if a company is mainly paying attention to the collection of e-waste there would be an improvement in waste segregation at points of collection. the vendors to have specific waste collection points which can be known to the community and lastly encourage companies to be involved in e-waste.

**Introduce disposal sites**

One of the respondents responded that, *"think E-waste should be taken back to the store or identify companies that recycle e waste Dedicated disposal sites for e-waste However, neighbourhoods need places where the items can be dumped prior to collection by e-waste disposal companies Securing the collection points Enhance the collection by working with the men who go round neighbourhoods collecting used batteries and geysers. Understand where they take the collected items and what incentives exist."*

**Value on e-waste**

The polices guiding the e-waste management should include the valuing of electronic waste just like steel or metal which is sold as scrap with such in place, the electronic waste will be managed in an orderly way. One of the respondents stated that when the people see that having.

# CHAPTER SIX: CONCLUSION AND RECOMMENDATION.

## 6.0 INTRODUCTION

This chapter presents the conclusion and recommendation made from the findings of the study. The study sought to ascertain the challenges of E-waste disposal in selected areas in Lusaka, the conclusions are presented first then followed by recommendation.

### CONCLUSION

The overall objective of this study was to establish challenges of E-waste disposal in selected areas in Lusaka. The study was premised on the following specific objectives: To ascertain the level of awareness about e-waste disposal among residents in Lusaka. To ascertain the challenges faced by people and e-waste management companies in managing electronic waste. To find out initiatives to improve e-waste management in Lusaka.

In line with the objective of ascertain the level of awareness of e-waste disposal amongst the residents of selected areas in Lusaka. The study shows that the people were aware of the e-waste but did not have the information on how and where to dispose the waste. The importance of this objective to the study was to know the understanding of the respondents about how electronic waste is disposed, who disposes and what effects it has. In conclusion with this objective people are aware about what e-waste is about the challenge is they do not know where and how they are supposed to dispose the waste hence most of their waste is kept home.

Regarding the challenges of disposal, companies face challenges on cost of service of disposal most of the people have a perception that e-waste is disposed for free. Most of the respondents from the waste management companies outlined the process of waste segregation which happens after e-waste is collected.

Furthermore, there are no recycling companies for some e-waste components exist in Zambia such as those of glass hence, the waste pile up onsite waiting of export. With the cost of export shows that e-waste can never be disposed without a cost on it. Lusaka being a high residential area, the mount of e-waste might increase because it has not been collected much as it is supposed to, from the study 10 kg of e-waste is approximately collected every month and the statistics do not correlate with the population of Lusaka and how electrical appliances are used.

## 6.1 RECOMMENDATIONS

In quest to establish the challenges of e-waste disposal, the study recommends the following, the

i. The government through the ministry of green economy and environment should develop a policy that will guide the public on the disposal of

ii. Prioritise education campaigns for the public through public campaigns, social media platforms such as Facebook, Instagram and other to raise awareness on e-waste mismanagement challenge.

iii. Consider dedicating at least one day a month for collection of e-waste only.

iv. Introducing e-waste sensitisation on point of sell of electrical appliances.

v. To build partnerships to eliminate the challenges and risks contributing to mismanagement of e-waste.

vi. Government to partner with waste producers and recyclers for the provision of e-waste collection containers in all public areas such as walkways to act as drop off centres for larger waste equipment.

vii. Set clear recycling and collection targets for known high risk products,

viii. Introduce value on e-waste like that of metal scrap metal, this can encourage the public to collect and sell e-waste to e-waste dealers.

ix. To encourage more entrepreneurs in the waste economy sector and consider having an integrated waste license application as well as exemption.

x. Lastly, enforce compliance among the public to transform the consumer behaviour. Rules on correct management of household e-waste should be incorporated in the environmental policies in Zambia.

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APPENDIX I


Dear respondent

I am a postgraduate student pursuing a Master of Environmental Management at the above institution conducting research on the challenges of e-waste disposal in Lusaka. This semi-structured questionnaire is specifically for academic purposes, and you have been randomly selected to be part of the research. Be assured that your responses will be highly confidential and only to be used for educational purposes. Your valuable insights on the challenges on e-waste management are important to the challenges of waste management

Fill in the spaces provided for structured question mark as (X) to show the response

**SECTION-A PERSONAL INFORMATION**

1. Sex of the respondent.

a. Male ( )

b. Female ( )

2. Age of the respondent.

   a. 20 – 29 ( )

   b. 30 – 39 ( )

   c. 40 – 49 ( )

   d. 50 and above ( )

3. marital status:

   a. single ( )

   b. married ( )

c. divorced ( )

d. widowed ( )

4. What is your highest level of education?

a. Secondary ( )

b. University or college. ( )

c. Never been to school. ( )

**SECTION B-AWARENESS ON E-WASTE**

5. What do you know about e-waste?

……

……

……

6. Do you think e-waste has effects on the environment?

a. Yes ( )

b. No ( )

7. Are you aware that the e-waste has negative effect on the environment?

a. Very aware ( )

b. Somewhat Aware ( )

c. Somewhat not aware ( )

d. Unware ( )

8. Are you concerned about your environment?

a. Not concerned ( )

b. Barely concerned ( )

c. Concerned ( )

d. Very concerned ( )

9. Do you know that some components of electronic devices contain toxic/hazardous materials?

a. Yes ( )

b. No ( )

10. If yes, are you aware that these toxic/hazardous materials require special treatment for environmentally sound disposal?

a. Yes ( )

b. No ( )

11. Does the disposal/treatment method in use for electronic waste have any impact on the environment?

a. Yes ( )

b. No ( )

c. Not sure ( )

12. If yes, indicate the part(s) of the environment affected and rate the impact

a. ……

b. ……...

c. ……

13. Do you know what an electrical appliance is?

    a. Yes ( )

    b. No ( )

14. Which of the following electrical appliances do you own?

    a. Television ( )

    b. Cellphone ( )

    c. Computer ( )

    d. Other ( )

15. From the appliances mention above, which one of them have you disposed once or more?.....

16. If you disposed, how did you dispose the appliance?

    …….

17. Did you have any challenges when disposing the appliance?

    a. Yes

b. No

18. If yes, outline some of the challenges you faced during disposal

a. ……

b. ……

c. ……

d. ……

19. What are some of the initiatives that can be put in place to improve e-waste disposal?

    a. ……

    b. ……

    c. ……

20. What are the challenges faced by e-waste management companies in disposing electronic waste?

21. What are some of the initiatives that can be put in place to improve electronic waste management in Lusaka?

THANK YOU FOR YOUR RESPONSE

APPENDIX II


Dear respondent

I am a postgraduate student pursuing a Master of Environmental Management at the above institution conducting research on the challenges of e-waste disposal in Lusaka. This semi-structured questionnaire is specifically for academic purposes, and you have been purposively selected to be part of the research as a waste management company. Be assured that your responses will be highly confidential and only to be used for educational purposes. Your valuable insights on the challenges on e-waste management are important to the challenges of waste management

Fill in the spaces provided for structured question mark as (X) to show the response

1. As a waste management company, do you collect E-waste?

   a. Yes

   b. No

2. If yes, is the E-waste segregated from other waste during collection?

   ……..……

3. What challenges do you face during E-waste collection?

   ……
   ……
   ……
   ……

4. How does your organization deal with their E-Waste?

a. Vendor buy back and exchange

b. Sell as Scrap

c. Sell as Second hand

d. Sell to employees

e. Sell to recycling companies/ Recycle themselves

i. Other (Please Specify :) …….

……

5. Is there a proper record about the quantity of E-waste collected and their Management measures?
   a. Yes
   b. No.
6. If yes what is the total quantity of E-waste collected?.....
   .....
7. Total quantity of e-waste collected or channelized to recyclers or dismantlers for processing during the year for each category of electrical and electronic equipment by Producers……

8. The waste generation at the source level? Yes/No. If Yes, please specify

…… …….

…….

9. Facility of accumulation and segregation particularly of e-waste through and labeled

Containers.

   a. Yes
   b. No.

10. If yes, please specify

…….

…….

10. E-waste details:

(a) Total quantity E-waste generated…….

(b) Quantity refurbished (applicable to refurbished) ……..

(c) Quantity sent for recycling……

(d) Quantity sent for disposal…….

11. As a waste management company, do you know that the materials that are in solar panels cannot be disposed of in a landfill due to the presence of toxic substances, such as mercury, lead, and cadmium?
    a. Yes
    b. No.
12. If yes, then how do you dispose your e-waste?
    ……
    ……
    ……
    …….

13. Are your client active participants in the separation of waste?
    ……
    ….
14. Do you provide bins to the clients for waste segregation? …….
    b) a) Do you have any corporate social responsibility projects? ……
15. If yes, Is Waste Separation awareness part of your programs? ……
16. How best can waste management companies be helped in order to have proper E-waste management systems?

THANK YOU FOR YOUR RESPONSE

APPENDIX III


Dear respondent

I am a postgraduate student pursuing a Master of Environmental Management at the above institution conducting research on the challenges of e-waste disposal in Lusaka. This interview specifically for academic purposes, and you have been purposively selected to be part of the research. Be assured that your responses will be highly confidential and only to be used for educational purposes. Your valuable insights on the challenges on e-waste management are important in resolving waste management challenges

**Involvement in electrical generation and disposal**

1. Age?
2. Sex?
3. What is your marital status
4. Highest level of education?
5. How long have you been in the electronic business?
6. Which electrical equipment do you mostly repair?
7. When you repair do you have any material which remains as waste which cannot be used?
8. If there any, how do you dispose the waste?
9. Do you think there should be a better way of e-waste disposal?
10. Suggest some of the ways in which waste can be disposed?

THANK YOU FOR YOUR RESPONSE.