

THE REPUBLIC OF UGANDA

MINISTRY OF INFORMATION AND COMMUNICATIONS TECHNOLOGY

Guidelines for E-Waste Management in Uganda



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March 2016

Foreword

In the past few decades, there has been a revolution in the use of both electric and electronic devices as a result of rapid technological advancements. This technological progress has seen electric and electronic devices being replaced by newer devices even before they reach their expected end of life. It is these electric and electronic equipment that has contributed to the exponential growth of electronic waste (E-Waste).

The Basel Convention on the control of trans-boundary movement and disposal of hazardous waste, to which Uganda is a member, defines E-Waste, as: "all discarded electrical and electronic assemblies, scrap, components and batteries". Some of these contain hazardous materials such as cadmium, mercury, lead, and polychlorinated biphenyl. Therefore, E-Waste includes a broad range and growing number of electronic devices ranging from large household appliances such as refrigerators and air conditioners, to personal products such as handheld cellular phones, personal stereos, consumer electronics and computers.

It is believed that besides global warming, E-Waste is one of the new environmental threats arising out of huge global sales of electric and electronic equipment, with symmetric volumes of waste generated after, whose disposal is a complicated process especially for developing countries like Uganda. In these countries, open dumping still remains the most prevalent waste-disposal method. It is estimated that by the year 2025, more than 2.2 billion tons of E-Waste will be generated annually worldwide. Rapid technological advancements, urbanization, industrialization, increasing population and economic development are all contributing to the rise in E-Waste and also to its increasing complexity and hazardousness.

Against this background, Government of Uganda developed the E-Waste Management Policy whose overall objective is to guide, promote and ensure the safe management of E-Waste in Uganda and contribute to reduction of environmental degradation. Subsequently, a strategy for the implementation of the policy was developed. To operatonalise the strategy, Government has developed guidelines to ensure clarity on the role of each category of stakeholders in the lifecycle of electronic and electric products.

I wish to acknowledge the support extended to the Ministry by stakeholders and development partners. I particularly thank UNDP for their technical and financial support. All actors are urged to internalise and actively participate in implementation of these Guidelines so that we can alleviate the effects of E-Waste to both human health and the environment.



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MINISTER

MINISTRY OF INFORMATION AND COMMUNICATIONS TECHNOLOGY

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Definition of Terms

Basel Convention and Bamako Conventions. The Conventions recommend that signatories ensure that the generation of hazardous waste and other waste within a country are reduced to a minimum, taking into account social, technological and economic aspects. Secondly, where a country exporting hazardous waste does not have the technical capacity, necessary facilities or suitable disposal sites to dispose of the waste in question in an environmentally sound and efficient manner, steps must be taken to minimise pollution and its consequences to health.

Chlorofluorocarbon (CFC) is a compound consisting of chlorine, fluorine, and carbon. CFCs are commonly used in refrigerants, solvents, and foam blowing agents.

Collector means a person who receives E-Waste directly from a residence for recycling or processing for reuse. 'Collector' includes, but not limited to, manufacturers, recyclers, and refurbishers who receive E-Waste directly from the public.

Electrical Equipment includes any machine powered by electricity. They usually consist of an enclosure, a variety of electrical components, and often a power switch. Examples of these include: major appliances, microcontrollers, power tools and small appliances. It also often refers only to the components that are part of the electrical distribution system such as: an electric switchboard, distribution boards, circuit breakers and disconnects, electricity meter and transformers.

Electronic Equipment is equipment that involves the controlled conduction of electrons (especially in a gas or vacuum or semiconductor) e.g. amplifier, audio and sound system, cassette player, CD player, Cathode Ray Oscilloscope, detector, equalizer, mixer, modem, telephone, etc.

Environmental Audit (EA) is a systematic evaluation of activities and processes of an ongoing project to determine how far these activities conform to the Environmental Management Plan of that specific project and sound environmental management practices.

Environment Impact Assessment (EIA) is a systematic examination conducted to determine whether or not an activity or project will have any significant impacts on the environment, provide mitigation for the adverse impacts and optimize the positive impacts.

Extended Producer Responsibility (EPR) is an environment protection strategy that makes the producer responsible for the entire life cycle of the product, especially for take back, recycle and final disposal of the product.

E-Waste is a term encompassing various forms of electrical and electronic equipment that are old or end-of-life electric or electronic appliance that have ceased to be of any value to their owners. (Definition by UNEP)

Hydrochlorofluorocarbon (HCFC) is a compound consisting of hydrogen, chlorine, fluorine, and carbon. The HCFCs are one class of chemicals being used to replace the CFCs.

Polychlorinated biphenyls (PCBs) are widely used for many applications, especially as dielectric fluids in transformers, capacitors, and coolants. They are toxic and are classified as Persistent Organic Pollutants (POPs).

Producer Responsibility Organisation (PRO) is a delegated Extended Producer Responsibility (EPR) by the producer to a third party, which is paid by the producer for spent-product management.

Recycler is a person who engages in treating or processing (of used or waste materials) to make them suitable for reuse.

Recycling is the processing of used materials (waste) into new products to prevent waste of potentially useful materials, reduce the consumption of fresh raw materials, reduce energy usage, reduce air pollution and water pollution by reducing the need for "conventional" waste disposal or producing a new product from a recyclable material.

Refurbisher means a person who renovates or processes E-Waste for reuse, but does not include telecommunications carriers, telecommunications manufacturers, or commercial mobile service providers with an existing recycling programme.

Strategic Environmental Assessment (SEA) is a system of incorporating environmental considerations into policies, plans and programmes. It is sometimes referred to as Strategic Environmental Impact Assessment.

Acronyms

ARF	Advanced Recycling Fee
BAT	Best Available Technology
BC	Broadcasting Council
CFCS	Chlorofluorocarbons
CDF	Constituency Development Fund
CoP	Conference of Parties
CPU	Central Processing Unit
CRT	Cathode Ray Tube
CSR	Corporate Social Responsibility
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination
E-Waste	Electronic Waste Management
HIV	Human Immunodeficiency Virus
HCFCS	Hydrochlorofluorocarbons
ICT	Information Communications Technology
KCCA	Kampala Capital City Authority
LCD	Liquid Crystal Display
LCF	Licensed Collection Facility
LG	Local Government
PC	Personal Computer
PCBs	Polychlorinated Biphenyls
PVC	Polyvinyl Chloride
PRO	Producer Responsibility Organisations
MDA	Ministries, Departments and Agencies
MDG	Millennium Development Goals
MoFPED	Ministry of Finance Planning and Economic Development
MoLG	Ministry of Local Government
MoICT	Ministry of Information and Communications Technology
MoU	Memorandum of Understanding
NGO	Non Governmental Organisations
NEMA	National Environmental Management Authority
MTIC	Ministry of Trade, Industry and Cooperatives
MWE	Ministry of Water and Environment
NITA-U	National Information and Technology Authority-Uganda
TMT	Top Management Team
UCC	Uganda Communications Commission
UICT	Uganda Institute of Information and Communications Technology
UNDP	United Nations Development Programme
ULF	Unified Licensing Framework
UPSs	Uninterrupted Power Supplies
UNBS	Uganda National Bureau of Standards
URA	Uganda Revenue Authority
WEEE	Waste Electrical and Electronic Equipment

1 Executive Summary

These guidelines are a reference document for handling and disposal of E-Waste. They provide a situational analysis and current regulatory and institutional framework. These guidelines seek to implement the 4Rs (Reduce, Repair, Reuse and Recycle) to effectively minimise the E-Waste. The last 3Rs (Repair, Reuse and Recycle) are heavily dependent on the efficiency of the collection systems and E-Waste treatment infrastructure. In this report, the different collection systems based on the collection channels are strongly emphasized.

The guidelines are a realization of the international and national efforts to manage E-Waste. The E-Waste concept came to light as far back as in 1970s and 1980s following environmental degradation that resulted from hazardous waste imported to developing countries (Shinkuma & Huong, 2009). In reaction to hazardous waste importation, the Basel Convention on the control of transboundary movements of hazardous waste and its disposal was instituted in 1992 to control the situation. In Uganda, the E-Waste management policy was approved by parliament in 2012.

The major options for disposal of E-Waste in the absence of any treatment option are landfilling and incineration. However, the presence of hazardous elements and compounds in E-Waste offers the potential of increasing the intensity of their discharge in environment due to landfilling and incineration (UNEP). Formal E-Waste recyclers do not exist in Uganda. However there are recycling options for different waste streams generated by a personal computer, which includes the plastics and metals such as Aluminum, Copper and Iron. There are no recycling options for printed wiring boards, cathode ray tubes and hazardous fractions, such as batteries. No signs were found for the existence of any informal activities to extract precious metals from E-Waste (e.g. gold recovery). It has to be expected that cables and probably other parts from electrical and electronic equipment's are burned in open fires in order to recover copper.

At each stage of an electronic/electric product life cycle, different stakeholders play crucial roles in the process of effective management of E-Waste. To ensure clarity, the guidelines have been categorized based on the stakeholders at each stage of the life cycle of the electronic products right from manufacturing to disposal at the end-of-life.

This report therefore presents: -

i. A review of the E-Waste management policy, the E-Waste management strategy and other relevant documents.

ii. Clear and separate guidelines to respective E-Waste stakeholders such as consumers, learning Institutions, manufacturers, Assemblers, people living near dumping sites, Government bodies, recyclers, Transporters, disposal entities, e waste collectors, refurbishers and importers.

iii. Clear terms of incentives for encouraging both local and foreign investors to establish E-Waste facilities in Uganda. The incentives target manufacturers, Assemblers, recyclers, Transporters, disposal entities, E-Waste collectors, and refurbishers.

The guidelines also include collection systems as well as guidelines for setting up E-Waste unit treatment facilities. This set of guidelines is seen as fundamental step towards comprehensive management of E-Waste in Uganda. The guidelines provide a basis for development of E-Waste regulations in Uganda. The following activities have been identified as necessary complementary to the development of the guidelines:

- The development of a regulatory framework to enable proper collection, recycling and to set the required standards for E-Waste management.

- To ensure that health and safety aspects of the people involved in the operations are protected, along with issues of emissions and waste emerging from such operations.

- The need to not only streamline the existing E-Waste management systems from different stakeholders in the private and public sector but to also attract recylcers who could make the recycling process safe and efficient. This will create opportunities for employment through economically viable activities as a result of processing E-Waste.

- Development of economic instruments by Government such as land, financial subsidies etc., so as to ensure an efficient collection and recycling system and attract would be investors in the field.

- Engage into an effective awareness campaign to all stakeholders on the dangers, benefits and effected E-Waste management practices so as to ensure conscience participation of stakeholders at different levels.

These guidelines have been divided into eight chapters. The background and rationale for the development of the guidelines are provided in Chapter 1. Chapter 2 presents the global and national context on the status of E-Waste. Chapter 3 elaborates on the legal and institutional framework on national laws and international conventions and agreements relating to environmental management. The different categories of E-Waste that have been included in these guidelines are highlighted in Chapter 4. Guidelines for specific target groups are outlined in Chapter 5 while Chapter 6 elaborates incentives for different stakeholders. The document ends with a discussion of the guidelines for collection and disposal systems, treatment technology for E-Waste, and the establishment of integrated E-Waste recycling and treatment as highlighted in chapters 7 and 8.

2 Introduction

2.1 Overview

In the recent years, there has been increasing use and dependence on electrical and electronic gadgets like mobile phones, personal computers, laptops, servers, data storage devices, photo copying machines, TV (CRT/LED/LCD), washing machines, refrigerators and air conditioners, among others resulting into generation of large quantities of E-Waste. The high rates of obsolescence of the above mentioned items coupled with steady rise in the demand have aggravated the growth in E-Waste generation. Most generators of the E-Waste are still keeping the items, and where efforts to dispose the items are made, proper procedures are not followed. The electrical and electronic equipment (EEE) are a complex mixture of valuable materials and hazardous/toxic substances in their components. However, un-scientific attempts to retrieve useful components/materials or open disposal may cause health risks and damage to the environment.

As a resource, E-Waste contains useful materials of economic benefit for recovery of plastics, iron, glass, aluminium, copper and precious metals such as silver, gold, platinum, palladium, lead, cadmium, mercury, etc. However, at the same time presence of heavy metals (Arsenic, Cadmium, Mercury, Lead, etc.) and other toxic substances such as polychlorinated bi-phenyls (PCBs), imprinted chemicals, etc. may pose risk to health and environment during handling and recovery operations. E-Waste is a problem of increasing proportions especially when crude methods are adopted for recovery of useful components.

There is a need to encourage recycling of all useful and valuable materials from E-Waste so as to conserve the ever-depleting natural resources. Electronic components are increasingly made from recycled materials, for example, for making new LCDs, more than 50% of indium is sourced by recycling used LCDs. E-Waste thus presents a scenario of urban mining for recovery of valuable metals in addition to plastics and glass. However, presence of hazardous and toxic substances in the component of E-Waste necessitates environmentally sound management of E-Waste including collection and recycling/treatment in an environmentally sound manner.

For a developing country such as Uganda, effective E-Waste management is a topical issue, particularly because a large percentage of E-Waste is generated through imports and there is careless and uncontrollable dumping in landfills. The majority of the consumers, sellers, producers, importers and other stakeholders are oblivious of the specific and key roles to play for effective and efficient management of E-Waste in order to make the environment safe and healthy.

An effective strategy should focus on E-Waste diversion and minimisation. The guidelines are designed to optimize the extraction of valuable materials without endangering the individuals and the environment. Extraction of valuable resources creates jobs especially for the informal economy. The key challenges to E-Waste management include:
Absence of proper processing facilities

Absence of recycling of focus material

Limited capacity building and knowledge sharing

Absence of regulatory framework

Limited funds and other resources

2.2 Specific brief background

The rapid advance of electronic technology creates a rapid pace of electrical and electronic products becoming obsolete. Presently Uganda is faced with problems related to the disposal of these items once they became waste. Most of the electronic items contain hazardous material and haphazard disposal of these items poses high risk to the human health and to the environment. It is evident that E-Waste is growing faster than other waste streams and it needs a priority attention in order to avoid adverse effects to human health, the environment and eco-system.

Noticeable efforts in Uganda to provide proper management of E-Waste started in 2008 with a needs assessment survey for E-Waste conducted by Microsoft, UNIDO and MoICT with intention to understand the extent of the E-Waste problem. It was estimated that a stock of up to 800,000 E-Waste computers had accumulated in the country most of it within government departments and educational institutions. Later an E-Waste task force that comprises of members from NEMA, Ministry of Water and Environment, NITA- U, UCC, KCCA and MoICT was setup.

2.3 General Objective

The general objective is to develop a comprehensive set of E-Waste management guidelines that addresses key E-Waste management policy objectives. The core policy objectives to be addressed are: -

i. To mobilize and sensitize the Government, private sector and the communities on the proper management and handling of E-Waste on a sustainable basis.

ii. To provide for the putting in place of specific E-Waste standards, and regulations for the acquisition, handling and disposal processes;

iii. To develop a critical human resource base knowledgeable in E-Waste management;

iv. To provide for resource mobilization for efficient management and disposal of E-Waste.

v. To establish incentives for encouraging both local and foreign investors to establish E-Waste facilities in Uganda.

2.4 Specific objective

To develop draft E-Waste management guidelines that ensures sufficient implementation of the E-Waste management policy objectives.

2.5 Rationale/Justification

E-Waste generation is a process that starts with the manufacturing of the electronic products, distribution to wholesalers, purchase by consumers, product usage and final disposal mechanism. During the product life cycle, each key stakeholder at the different stages of the product has a role to play for a comprehensive integrated E-Waste management. These roles need to be clearly articulated and inter-linked for effective operationalization and implementation. The guidelines therefore serve to :-

(1) Articulate the duties and responsibilities of each stakeholder

(2) Propose best techniques and approaches for each stakeholder

(3) Define linkages between the different duties and responsibilities of the stakeholders

(4) Provide a coherent E-Waste management framework.

Previously the volumes for E-Waste were very small but they are now growing. In order to prevent pollution, and to save valuable resources, E-Waste requires specific treatment. As compared to other waste streams, E-Waste is highly complex; it must be collected separately and treated carefully to enable environment-friendly and safe treatment.

These guidelines come in handy as a reference document for handling the disposal of E-Waste

2.6 Situational Analysis

A study on E-Waste in Uganda by UNIDO in 2008, indicated that Government owns the highest number of ICT equipment in the country at 75% , followed by NGOs large enterprises at 20%, private households, Small and Medium Enterprises (SMEs) and others at 5%. The “zero tax policy on importation of computers” that was terminated in the 2014/2015 budget created a large portion of imported second-hand computers not registered through customs and this led to proliferation of electronic equipment.

Individual Government Institutions do not dispose of obsolete ICT equipment in a well-planned and managed manner. The same applies to the private sector and households. Equipment is damped on outdoor garbage heaps and landfills. There is shortage of qualified manpower to handle the safe processing and/or disposal of E-Waste in Uganda.

Uganda as a country does not have any E-Waste handling facility and most of the E-Waste disposal is currently dominated by the informal sector and is carried out in an irresponsible manner that endangers both the environment and individuals. There is limited E-Waste awareness among the population. The National Bureau of Standards does not have specific standards addressing E-Waste. Specific Laws and regulations governing management of E-Waste are also lacking

Government and large enterprises replace computers after 3-5 years and often auction them for second-hand use, where the computer is used for another 5-8 years. Imported second-hand computers through professional refurbishment centers have a life span of approximately 5 years. Based on these numbers, it was estimated that around 53,000 computer units reached their end of life in 2007.

The top set of barriers to formal E-Waste processing relates to obtaining enough used equipment. Some of the reasons for this include current legislation that does not support re-use by organisations through adequate financial incentives for and enforcement of E-Waste re-use. In addition, re-use options are not being incorporated into collection and recycling initiatives. Furthermore, some equipment manufacturers do not allow their products to be re-used, to avoid competition with new products. Instead, these manufacturers require used equipment to be recycled, even when it could be re-used. In addition the transition form analog to digital TVs has increased on the E-Waste.

2.7 General Description of E-Waste Guidelines

There are generally five options for end-of life management for E-Waste that include: -

(1) Reuse of functional electronics

(2) Refurbishment and repair of electronics

(3) Reuse and recovery of electronic components

(4) End-processing for recovering metals

(5) Disposal

Reuse, refurbishment or repair of electronic products is most desirable since this option increases the lifespan of the electronic product in order to achieve greater resource efficiency. However, in order to reuse electronics, the equipment must be functional and working. Recycling of electronics allows for precious and special metals to be recovered, reduces the environmental impact associated with electronic manufacturing from raw materials, and ensures that hazardous substances in electronics are handled correctly. It should be noted that reuse and recycling are not alternative options; reused products need to be recycled properly and efficiently at the end of their useful life.

E-Waste processing (InfoDev, 2012) can be broken into three major steps; (1) collection, (2) sorting/dismantling/mechanical processing (including shredding, magnetic separation, etc.), and (3) end-processing. See Figure 1 below.

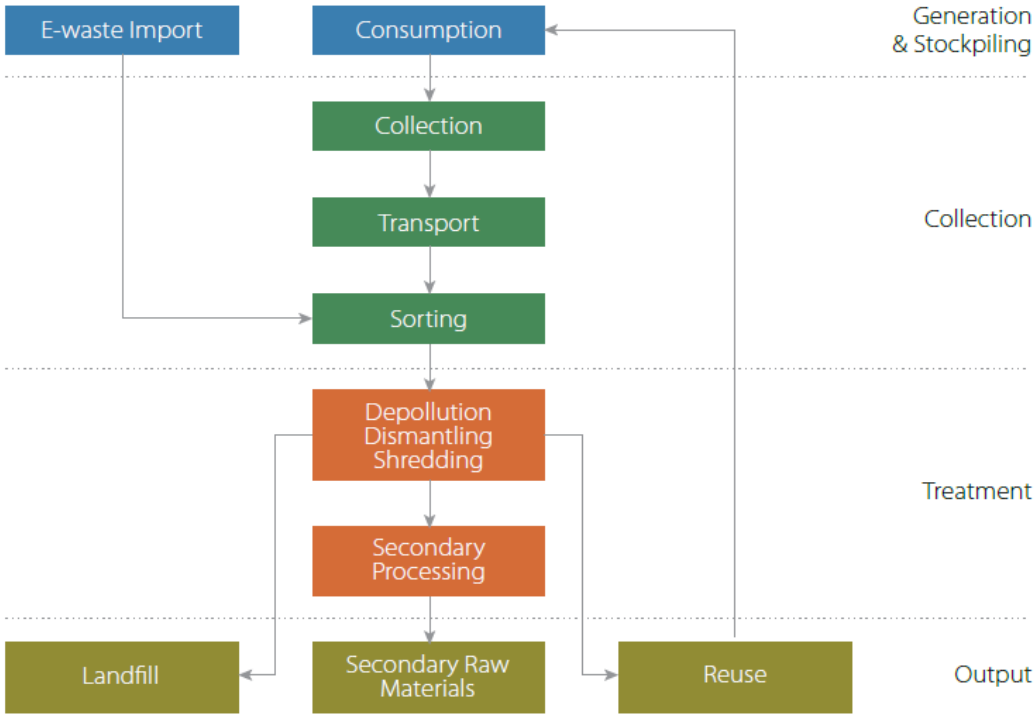


Figure 1: Source: *info*Dev (The World Bank Group). *Wasting No Opportunity: The case for managing Brazil's electronic waste.* April 2012.

One common approach to sustainable E-Waste management is the Extended Producer Responsibility (EPR). EPR assigns collection and recycling responsibility to the manufacturer. EPR is defined as "an environmental protection strategy to reach an environmental objective of a decreased total environmental impact of a product, by making the manufacturer of the product responsible for the entire life-cycle of the product and especially for the take-back, recycling and final disposal". The purpose of EPR is to promote social responsibility by encouraging manufacturers to take into account end-of-life management during the product design phase.

In addition to recycling E-Waste, electronic manufactures can take the following actions to achieve a level of EPR:

(1) Use recycled and environmentally friendly materials

(2) Design products that minimize resource use

(3) Re-use byproducts and waste of manufacturing process

(4) Minimize packaging or use recyclable packaging

(5) Reduce toxic and hazardous substances used in the manufacturing process and product itself

(6) Recycle E-Waste through certified electronic recyclers to ensure that E-Waste is properly managed

Overall, a sustainable E-Waste management framework needs to embrace different options. Listed below are some of the options that could be employed in deploying E-Waste management techniques.

(1) Government should provide regulatory framework, through empowerment of relevant agencies, in form of laws, control mechanisms and procedures to manage E-Waste.
(2) Fixed (permanent) E-Waste collection facilities should be installed at accessible and well-identifiable locations. Usage of such facilities should be enforced.
(3) E-Waste take-back programmes should be established with manufacturers and sellers. Consumers should be encouraged to make use of the programme.
(4) Advance disposal fees for E-Waste should be implemented and collected at the point of sale with the aim of using the proceeds to support management and eventual disposal at equipment's end of life.
(5) The 'polluter pays' principle should be adopted, while the possibility of extended producer responsibility should also be considered.
(6) Establishment of E-Waste recycling facilities should be encouraged with adequate incentives from government.

2.8 Scope of E-Waste Guidelines

These guidelines apply to the handling and management of the various categories and elements of E-Waste in Uganda. The guidelines provide a systematic mechanism for management of E-Waste throughout its life cycle.

The E-Waste hierarchy is as follows: -

1. Prevention
2. Preparation for re-use, and re-use
3. Recycling
4. Incineration with state-of-the-art flue gas cleaning and energy recovery
5. Incineration with state-of-the-art flue gas cleaning without energy recovery
6. Disposal on landfill sites

2.9 Stakeholder characteristics

Each category of stakeholders identified as depicted in Figure 2 have their own role to play in effectively and efficiently managing electronic waste in Uganda, though some of the roles are complementary and may even overlap.

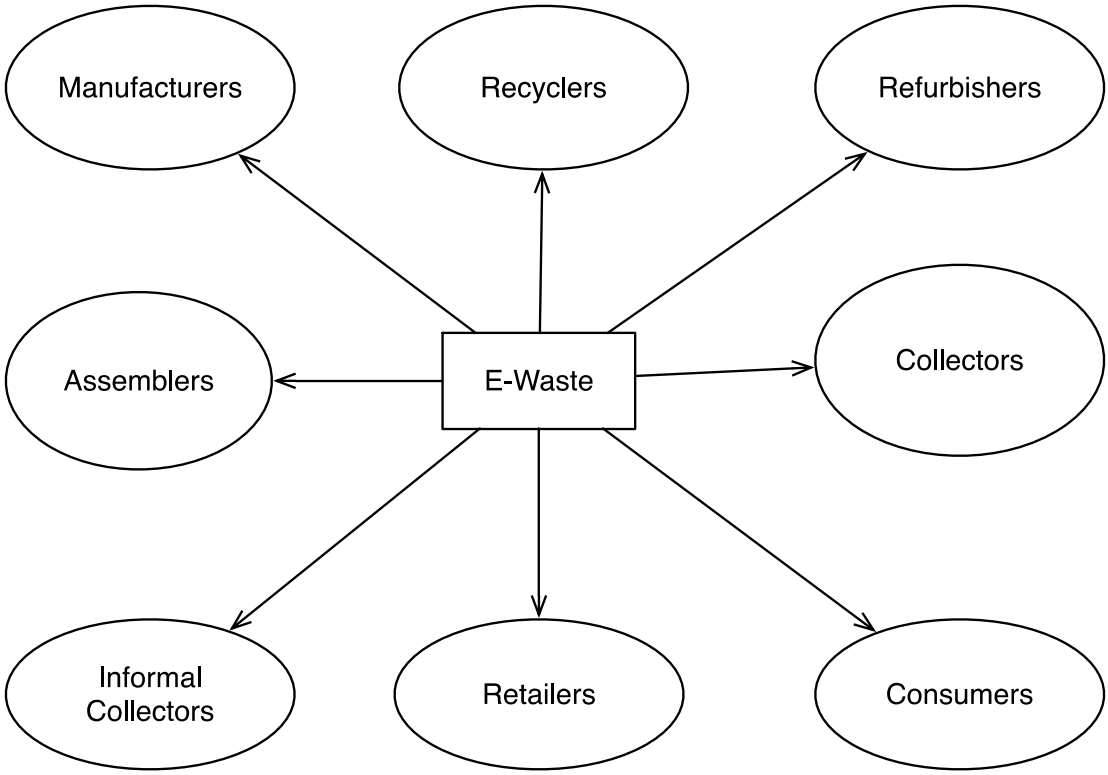


Figure 2: E-Waste management key stakeholders

3 Legal and Institutional Framework

3.1 Legal and regulatory framework

The E-Waste management guidelines for Uganda have an objective that addresses E-Waste. Based on the National ICT policy Priority area 2.7, the E-Waste policy was developed in 2012.

The National Environment Act enacted in 1995 is the framework law on environment. It provides for sustainable management of the environment and established the National Environment Management Authority (hereafter referred to as NEMA) as the principal government agency for the management of the environment. NEMA is mandated to coordinate, monitor and supervise all activities in the field of the environment.

The National Environmental Act, Cap.153 that provides for sustainable environment, addresses solid waste management in general. It is silent on E-Waste management. There is, therefore, no specific E-Waste legislation in Uganda; though NEMA is in the process revising the National Environment Management Policy, 2015 that is expected to include E-Waste as a separate category.

Internationally, Uganda is signatory several international conventions related to E-Waste. The participation and endorsement of international conventions is based on The Ratification of Treaties Act 5/1998 that provides for the procedure for ratification of treaties in accordance with article 123 of the Constitution, which allows Uganda to ratify international conventions related to E-Waste. Key treaties inline with E-Waste management include; the Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal, the Stockholm Convention of Persistent Organic Pollutants, the World Charter for Nature (1982) and Vienna Convention for the Protection of the Ozone layer(1985)

3.2 Institutional framework

As outlined in the E-Waste management policy (2012) the E-Waste management guidelines will be implemented through collaboration among stakeholder intuitions. The roles of key MDA's are outlined in the next subsections

3.2.1 Ministry of Information and Communications Technology (ICT)

(1) Coordinate the establishment of safe E-Waste disposal mechanisms and facilities.

(2) Coordinate the management and operations of the E-Waste fund;

(3) Supervise, guide and provide technical support to MDAs as well as undertake monitoring and evaluation;

(4) Take the lead in E-Waste awareness programs.

(5) Participate in the specifications of standards for different electronic equipment

(6) Maintain and publish records of Green Star Ratings

(7) Maintain and publish records of E-Waste mass flows

3.2.2 Ministry of Finance Planning and Economic Development (MoFPED)

The Ministry of Finance planning and Economic development shall give guidelines on:

(1) Set the advance recycling fees to be paid by different stakeholders including importers, manufactures and consumers as part of the E-Waste fund;

(2) Collect the advanced recycling fees; E-Waste levy on communication services among others;

(3) Define the eligibility criteria of access to and utilization of the fund based on volumes of E-Waste processed, location and technology used;

3.2.3 Ministry of Trade and Industry and Cooperatives (MTIC)

The Ministry of Trade and Industry and cooperatives shall:

(1) Liaise with the World Trade Organization (WTO) with a view of informing the development of standards and regulations regarding importation of electronic and electric equipment into the country; and

(2) Audit and monitor compliance of incoming electrical and electronic equipment with set standards and regulations.

3.2.4 Ministry of Health (MOH)

(1) Provide technical support in developing standards for health related electronic and electric equipment

3.2.5 National Environment Management Authority (NEMA)

NEMA shall:

(1) Issue and enforce E-Waste handling licenses in the country for entities dealing with collection, transportation and disposal/recycling of end-of-life equipment;

Participate in the informative studies on E-Waste such as baseline surveys; and

Monitor the implementation of E-Waste management

3.2.6 Uganda Communications Commission

(1) Enforce E-Waste management into licensing and renewal of license conditions of telecommunications and broadcasting service providers;

Provide technical support in matters of E-Waste management in the communications sub-sector;

3.2.7 National Information Technology Authority – Uganda (NITA-U)

The National Information Technology Authority shall:

(1) Enforce standards and regulations on E-Waste management; and

(2) Provide technical support and advice on assessment of E-Waste disposal to the public and private sector.

3.2.8 Uganda National Bureau of Standards (UNBS)

Uganda National Bureau of Standards shall;

(1) Develop a mechanism to audit and monitor compliance of electric and electronic equipment with set standards.

3.2.9 Uganda Revenue Authority (URA)

Uganda Revenue Authority shall;

(1) Enforce compliance of all imported electric and electronic equipment with set standards at the Point of Entry; and

(2) Maintain statistical records of imported electric and electronic imports.

3.2.10 Local Governments

The Local Governments shall;

Mobilize and participate in sensitizing the communities about the threat of E-Waste and how it can be safely managed.

3.2.11 Private sector

The private sector shall;

Take up the opportunity of the enabling a conducive policy and legal framework to invest and create business as well as employment around E-Waste management.

3.2.12 The role of other Stakeholders

All other sectors, including, but not limited to Agriculture, Health, Education, Tourism, Finance, Trade and Industry, Justice, Law and Order, Gender, Civil Society as well as the development partners, shall;

(1) Develop institutional E-Waste policy guidelines;

(2) Develop and operationalize implementation plans; and

(3) Participate in E-Waste awareness campaigns.

4 Guidelines for target groups in E-Waste management

4.1 Guidelines for producers/manufacturers

There are very few manufacturers of electronic equipment in Uganda. The guidelines for manufactures are positioned to encourage design of products that facilitate source reduction, reuse and recycling; reduce toxicity; and increase recycled content. Producers and manufacturers need to:

(1) Clearly label products for easy identification and to show the contents of the product

(2) Implement individual take-back schemes

(3) Get organised into sectoral or sub-sector Producer Responsibility Organisations (PRO) that encompass Extended Producer Responsibility (EPR).

(4) Establish channels to collect the waste at the end of its life cycle.

(5) Build the cost of product take-back and disposal into the purchase product price

(6) Promote use of safer alternative components in building their products

(7) Provide information to recyclers on how to dismantle their product at the end of life and the location of any hazardous substances or items within the product

(8) Should own a treatment facility or have evidence of formal arrangement with a licensed treatment facility in a given client country.

(9) Promote use of recycled components into their products.

4.2 Guidelines for importers

There are two types of importers; importers of new products and importers of used products. Importers need to:

(1) Specify standards for products on the expected remaining lifespan of the equipment's and electrical appliances.

(2) Notify relevant MDA's for consent to transport E-Waste through Uganda subject to stated conditions.

(3) State the number of years; equipment has been in use before importation. The specifications should be stated according to the regulations on importation of pre-owned hand electronic and electric equipment.

(4) Ensure used electric and electronic goods reach the pre-destined end users.

(5) Keep a record of customers to facilitate waste collection.

(6) Indicate an envisaged lifespan of used units when importing used equipment and bear responsibility for this by ensuring that take-back mechanisms are in place.

(7) Equipment imported should be inspected and certified by relevant agencies before they can be given to consumers

(8) Desist from importing hazardous E-Waste.

4.3 Guidelines for assemblers

An assembler needs to:

(1) Clearly label products for easy identification of product constituents.

(2) Clearly indicate Extended Producer Responsibility (EPR) on electrical and electronic equipment.

(3) Comply with Uganda standards on the assembly of electronic goods as set by relevant MDA's

(4) Provide a clear description of the overall level of the hazard

4.4 Guidelines for refurbishers

The refurbisher extends the functional life of equipment and feeds it into the second-hand market. A refurbisher needs to:

(1) Ensure unusable material is transferred to collection centres or licensed recyclers

(2) Provide incentives to the consumer to donate used devices

4.5 Guidelines for recyclers

These are organisations and individuals who dismantle, separate fractions and recover material from E-Waste after the lifespan of the equipment. A recycler needs to:

(1) Establish recycling infrastructure and environmentally sound technologies to manage electrical and electronic waste

(2) Ensure that dismantling is done in an environmentally safe manner.

(3) Provide recycling processes to be approved and licensed by relevant authority

(4) Ensure that revenue generated through sales of the materials recovered will support the administrative, plant and machinery and other overheads

4.6 Guidelines for government organisations

These are the organisations that are involved in the formulation and enforcement of regulations regarding generation, handling and disposal of E-Waste. They include but not limited to, Ministry of Local Government, KCCA, NEMA, URA and Ministry of Health. Government organisations need to:

(1) Prepare a framework with appropriate legislation to support E-Waste management

(2) Monitor the processes of E-Waste handling regularly

(3) Create a management plan with responsibilities for different target groups

(4) Provide incentives to entrepreneurs to set up E-Waste collection and treatment facilities

(5) Regulate / control the number of E-Waste facilities within a geographical area

(6) Approve innovative E-Waste management technologies that are environmentally sound

(7) Form multi-stakeholder monitoring committees to oversee the implementation of the E-Waste management guidelines

(8) Create awareness among all the stakeholders through the legislative framework of E-Waste management

(9) Develop standards to prevent the importation and donations of useless or harmful E-Waste

(10) Determine the impact of and come up with strategies for managing technology changes such as analogue-to-digital television equipment and deciding the procedure for Strategic Environmental Assessments

(11) Putting in place the relevant policies, regulations and laws

4.7 Guidelines for consumers

The consumer can either be an individual or a corporate organization that owns a device which falls into one of the E-Waste categories and which is considered to have ceased to be of any value. A Consumer needs to:

(1) Separate E-Waste from other wastes to facilitate collection, treatment and recycling

(2) Dispose E-Waste generated to the E-Waste collection centres

(3) Sell or donate E-Waste to a licensed refurbisher

(4) Take-back equipment to the manufacturer, importer or assembler, if they allow it.

(5) Dump E-Waste at the licensed dumping site specified for the E-Waste

(6) Be responsible for following recommended disposal methods or procedures especially dates of expiry or end of usage period of the product

4.8 Guidelines for learning institutions

Learning institutions can be those associated with basic education or higher education. They are recipients of electrical and electronic goods. Unfortunately, most of the second hand products are not inspected before they are donated. Coupled with poor handling and use, their lifespan becomes shorter resulting in huge amounts of E-Waste in most learning institutions. In order to manage E-Waste, learning institutions need to:

(1) Create awareness and conduct sensitization campaigns on responsible E-Waste management

(2) Develop Memorandum of Understandings (MoUs) with PROs for take-back, recycling and refurbishing of E-Waste at end of life

(3) Develop mechanisms to ensure that inspection certificates clearly specify end-of-life date and who bears responsibility thereafter

(4) Develop and mainstream E-Waste education in curricula

(5) Develop training programmes for repair and recycling

4.9 Guidelines for transporters

A transporter needs to:

(1) Ensure E-Waste is properly stored

(2) Ensure vehicles transporting E-Waste obtain a waste transport license from relevant authority

(3) Ensure E-Waste is disposed in licensed dumping sites

4.10 Guidelines for disposal authorities

A Disposal authority needs to:

(1) Develop disposal standards for each type of toxic waste, including procedures for disassembling and recycling

(2) Provide efficient transport for E-Waste

(3) Develop proper infrastructure for E-Waste collection and disposal

(4) Set manageable fees to sustain E-Waste management

4.11 Guidelines for informal sector E-Waste collectors

(1) Informal sector E-Waste collectors will only need to acquire a license if they collect E-Waste from various sources

(2) Ensure the E-Waste is transported in a responsible manner

4.12 Guidelines for people leaving near dumpsites

(1) People living near dumpsites need to be educated on how to detect potential health hazards, through organised workshops by the E-Waste management stakeholders and environmental health practitioners

5 Guidelines for Collection Systems

These guidelines seek to implement the 4Rs (Reduce, Repair, Reuse and Recycle) to effectively minimize the E-Waste.

5.1 General Guidelines

(1) Collection mechanisms for E-Waste in terms of packaging, labelling and transportation shall be as per the existing guidelines.

(2) Collection centers shall be established by producers/dealers, manufacturers, importers distributors and large agencies users such as learning institutions. They shall seek approval from relevant national and local authorities and their details shall be published for public use.

(3) Collection centers shall store the E-Waste after sorting it into various categories for easier access by downstream users as well as to facilitate record keeping on the quantities of various categories of E-Waste

(4) Producers/dealers, manufacturers, importers and distributors have to enrol in an E-Waste collection scheme by virtue of the fact that they introduce electrical and electronic equipment into the environment

(5) Producers/dealers manufacturers, importers and distributors should have the extended producer/manufacturer responsibility to ensure that at the end-of-life span of the equipment the disposal is managed responsibly.

(6) Relevant authorities and key government stakeholders will regulate collection, recycling, refurbishing and disposal of E-Waste.

(7) Records of licensed facilities as well as occupational health and safety concerns of various facilities will be monitored by relevant authorities.

(8) Awareness creation on delivery mechanisms of waste to these centres shall be the responsibility of relevant government agencies, the producers, local authorities, distributors and importers.

5.2 Guidelines for selection of collection channels/method

These collection systems have been described in terms of the collection channels and infrastructure required to make these channels operational. The commonly used collection channels are MDAs/LG collection sites, retailer take-back, and producer take-back. The collection mechanisms are described below.

5.2.1 Retailer Take Back and Storage

(1) Consumers take back E-Waste to retail stores that distribute similar products

(2) Consumers may give back the product at the retail store depending upon purchase of a new product, or without any purchase required.

(3) Distributors may also provide take back schemes to ensure availability and accessibility

of free of charge of designated collection facilities

(4) Take back fees may be included in the cost of sale and refunded on delivery/return

5.2.2 Producer Take Back and Storage

(1) It usually applies to larger commercial equipment and operates on the principle of "new equipment replacing the old ones"

(2) E-Waste taken back by producers either directly at their facilities or designated collection centers that feed into the E-Waste system

(3) The collected E-Waste should be stored on-site or directly fed into the E-Waste treatment system

(4) The collected waste is stored on site to be transported for treatment elsewhere or on the site

5.2.3 MDA/Local Government Collection and storage

(1) Consumers and businesses should be able to leave E-Waste at MDA sites

(2) Sorting containers should be provided at municipal collection sites

(3) The collected waste should be stored on-site or directly fed into the E-Waste treatment system

5.2.4 Other collection and storage

E-Waste can be specifically dropped at specially created sites or centers

There can be specialized sorting centers controlled by entities such as Producer Responsibility Organisations (PRO) or third party sites, whose operators may be remunerated for the provision of space.

5.3 Guidelines for assembling and collection and storage infrastructure

The operation of collection system described above requires storage and transportation infrastructure. Collection infrastructure requires establishment of E-Waste collection points and storage areas. The following are guidelines for establishing collection points and storage areas;

(1) Collection points and storage areas should provide sorting infrastructure to effectively separate E-Waste from other municipal waste

(2) Collection facilities should be available and accessible taking into account the population density.

(3) Collection and transport of separated E-Waste should be done in such a way that enables reuse and recycling of those components or whole appliances

(4) Sites for storage of E-Waste prior to their treatment should have impermeable surface

for appropriate areas with the provision of spoilage collection facilities and where appropriate decanters and cleanser-degreasers.

(5) Sites for storage of E-Waste prior to their treatment should have weather-proof covering for appropriate areas.

5.4 Guidelines for design and technical specifications of E-Waste collection points

A licensed collection facility (LCF) should:

(1) Be accessible to members of the public

(2) Have signs to direct members of the public to deposit E-Waste to the relevant container or area to prevent mixing of E-Waste with other waste or allow contamination with hazardous materials.

(3) Enable household E-Waste to be collected from the LCF streams of either large household appliances other than cooling appliances and display equipment containing CRTs amongst other waste.

(4) State the maximum quantity that can be deposited on the site

(5) Have impermeable surface with a sealed drainage and impermeable drains which do not leak to ensure that all liquids are in a sealed sump except where they may be lawfully discharged

(6) Have a weather-proof cover

(7) Have a Collection Point and Storage Facility adequate to serve the geographical area and the volume separated E-Waste tonnage captured.

(8) Have adequate collection points and storage facilities to serve the population size

(9) Be located where it meets the requirements of the collection option identified for retailer take back collection center, municipal collection center or any other.

(10) Be able to handle the number of trucks or trailers of different capacities required to transport the E-Waste

5.5 Guidelines for operation of Producer Responsibility Organisations

Producer Responsibility Organisations are committees that take responsibility for the end-of-life disposal of products being manufactured or assembled. They can be established with the support of all manufacturers largely responsible for the management of E-Waste in an environmentally sound manner. Manufacturers should implement take-back policies for used devices to ensure that they do not turn into E-Waste

5.5.1 About the PRO structure

(1) The PRO will be expected to operate as a Non-profit committee premised on the Corporate Social Responsibility (CSR) and be an active participant in this sector.

(2) The cost of establishing these structures shall be supported by manufacturers. The details on the contribution made by individual companies can be worked out through detailed deliberation. A part of revenue can also be generated through the sale of the E-Waste by the recycler.

(3) The PRO should operate with all stakeholder participation (including representatives of the informal sector) and with the full operational transparency to ensure efficacy in its implementation

5.5.2 Roles of Producer Responsibility Organisation

(1) The PRO will have overall responsibility for the complete recycling process of E-Waste with different levels of engagement in various processes.

(2) The PRO will take on direct responsibility of collection and storage of all waste resulting on the dismantler/recycler for a price

(3) The nature of goods being classified as E-Waste, have an intrinsic material value and this value is key to the complete financial plan of this structure. E-Waste has a material value assigned and all recyclers procure E-Waste at a price and make profit by reselling the recovered materials

(4) The PRO will pay the manufacturers for the materials collected and provide free collection system. The fee to be paid for different end-of-life products will be fixed by the PRO from time to time.

(5) The revenue generated by the PRO through sales of this E-Waste to recyclers will be utilised for financing the take-back process from the consumers (cost paid for the E-Waste) as well as the collection and storage of the waste.

(6) Dealers selling such household products will have to take back the old products and the household manufacturers will get a discount on the new purchase of electrical and electronic goods (the end-of-life cost can be fixed according to product type). These products will be then transferred back to the PRO with proper reporting.

6 Incentives for stakeholders

6.1 Financing the Recycling of E-Waste

Approaches to financing E-Waste recycling depend on many factors including state legislation and policies, social preferences, commodity prices, and available recycling facilities. Although many programs offer "free" recycling to the consumer, recycling is never truly free because of costs associated with collecting, transporting, processing, refurbishing, and disposing electronic waste. There are two main financing models for E-Waste collecting and recycling efforts; Extended Producer Responsibility (otherwise known as Manufacturers Responsibility), and Advance Recycling Fee.

The E-Waste fund shall be generated as follows-

(1) Based on a series of consultations with experts, producers, importers and recyclers related to E-Waste generation and treatment, the fee and subsidy rates are set. The rates are adjusted according to the change in cost for collection and disposal of E-Waste when needed, but should be based on consultations with the relevant enterprises and associations

(2) Advance Recycling Fee- The Advance Recycling Fee (ARF) is a fee paid by the customer at the point of purchase, depending on the size and type of the electronic or electric equipment. The fee is then deposited into a state-recycling fund, which is used to pay qualified E-Waste collectors and recyclers to cover the cost of managing E-Waste.

6.2 Green Star Status rankings

The green star ranking system to be awarded by relevant authority and reviewed every year can be used as a non-monetary incentive to encourage stakeholders to comply with different regulations. The star system can be emphasized if MDAs transact with highly regarded green star partners.

Collectors, government institutions, manufactures, assemblers and recyclers may be graded using a prestigious green star. The following criteria may be used;

(1) There should be five levels of stars starting from 1 to 5. Five is the highest possible rating

(2) General grading should be based on

a. Proper record keeping of all electronic equipment
b. Design of the storage for E-Waste to encourage good recycling practices
c. Availability of well-labeled containers for collection of E-Waste
d. Storage facilities for E-Waste
e. Use of recycled materials

(3) The star rating can also be published annually.

6.3 Incentives for collectors

(1) Payment from the Advance Recycling Fee based on a collection targets

(2) Star grading system be awarded to collectors based on the technology used and compliance

6.4 Incentives to consumers

(1) Consumers buying replacement products be exempted from collection fees

(2) To encourage collection and returning of materials to formal collection centres, a discount when purchasing a new product be given to consumers.

6.5 Incentives for importers

(1) Lower taxes on importation of brand new equipment

(2) Total ban on importation of second hand equipment

(3) Government should institute a policy to buy recycled electronic equipment where they meet the technical requirements

(4) Green star rating

6.6 Incentives for e-learning intuitions

(1) Green star rating

(2) Tax cuts on purchase of new electronic products

7 Guidelines for Treatment Technology for E-Waste

The presence of hazardous elements and compounds in E-Waste offers potential for increasing the intensity of their discharge in the environment due to landfilling and incineration. Therefore the recommended approach to treating E-Waste is to first reduce the concentration of these hazardous chemicals and elements and finally dispose E-Waste fractions through either incineration or landfilling or a combination of both.

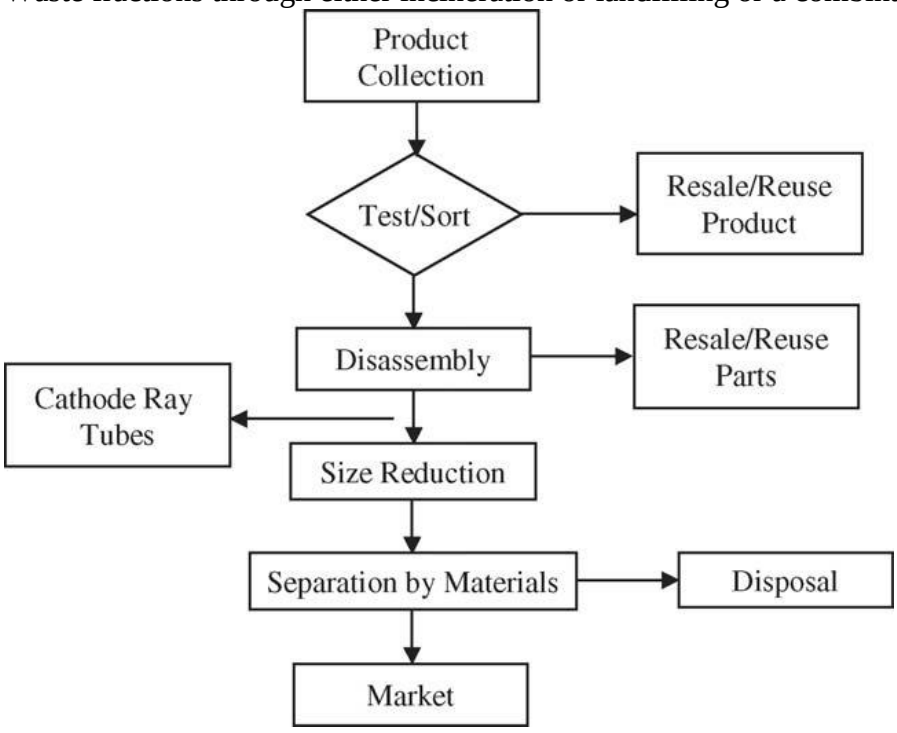


Figure 3: Source: Hai-Yong Kang, Julie M. Schoenung, E-Waste recycling: A review of U.S. infrastructure and technology options, Resources Conservation & Recycling 45 (2005) 368-400, Elsevier

The E-Waste treatment options should include the following unit operations:

a) *Decontamination and Dismantling*: This is done manually and will include:

   i. Removal of parts containing hazardous/dangerous substances (CRCs, Mercury (Hg), switches, PCBs).

   ii. Removal of easily accessible parts containing valuable substances (cables containing copper, steel, iron, and precious metals, e.g. contacts)

   iii. Segregation of hazardous/dangerous substances and removal of easily accessible parts

b) *Segregation of ferrous metals, non-ferrous metals and plastics*: This separation is generally carried out after shredding and is followed by mechanical and magnetic separation process

c) *Recycling or recovery of valuable materials*: E-Waste fractions after segregation

consisting of ferrous and non-ferrous metals are further treated. Ferrous metals are smelted in electrical arc furnaces whereas non-ferrous metals and precious metals are smelted in smelting plants.

d) *Treatment or disposal of dangerous materials and waste*: Shredded light fractions are disposed of in landfill sites or sometimes incinerated, CFCs are treated thermally, Polychlorinated Biphenyls (PCBS) are incinerated or disposed of in underground storages, Mercury (Hg) is often recycled or disposed of in underground landfill sites.

7.1 Guidelines for development of E-Waste treatment technology

An E-Waste treatment process should include the following components;

(1) Testing of E-Waste in order to sort reusable and non-reusable E-Waste separately

(2) Dismantling non-usable E-Waste and sorting E-Waste fractions into reusable and non-reusable parts

(3) Size reduction, separation and recovery of different materials from non-reusable E-Waste

(4) Disposal of remaining E-Waste fractions

A detailed E-Waste treatment system falls in a hierarchy of three levels: -

i. First level treatment

ii. Second level treatment and

iii. Third level treatment

7.1.1 Guidelines for development of a first level E-Waste treatment

Inputs: They include E-Waste items like TVs, refrigerators and Personal Computers (PCs)

Unit Operations: There are three unit operations at the first level of E-Waste treatment and these are:

i. *Removal of all liquids and gases*: this treatment step is to decontaminate E-Waste and render it non-hazardous. This involves removal of all types of liquids and gases under negative pressure, their recovery and storage

ii. *Dismantling (manual or mechanized breaking):* The decontaminated E-Waste or the E-Waste requiring no decontamination are dismantled to remove components from used equipment. The dismantling process could be manual or mechanized requiring adequate safety measures to be followed during operations.

iii. *Segregation:* After dismantling, the components are segregated into hazardous and non-hazardous components of E-Waste fractions to be sent for third level

treatment. All the three unit operations are dry processes, which do not require use of water.

Outputs from First level E-Waste treatment are:

i. Segregated hazardous wastes like CFCs, Hg, Switches, batteries and capacitors.

ii. Decontaminated E-Waste consisting of segregated non-hazardous E-Waste like plastics, CRTs, Circuit boards and cables.

iii. Emissions that include air, water and noise.

7.1.2 Guidelines for development of second level E-Waste treatment

Inputs: Decontaminated E-Waste consisting segregated non-hazardous E-Waste like plastic, circuit board and cables

Unit operations: There are three unit operations at second level of E-Waste treatment;

i. Hammering: Size reduction

ii. Shredding: Size reduction

iii. Special treatment process comprising of;

- CRT treatment consisting of separation of funnels and screen glass
- Electromagnetic separation
- Eddy current separation
- Density separation using water

Outputs: Materials from second level treatment technology include:

- Ferrous metal scrap (secondary raw material)
- Non-ferrous metal scrap mainly silver, gold and palladium
- Plastics consisting of sorted plastics, plastics with frame retardants and plastic mixture

7.1.3 Guidelines for development of third level E-Waste treatment

This is carried out mainly to recover ferrous and non-ferrous metals, plastics and other items of economic value. The major recovery operations focus on ferrous and non-ferrous metal recovery, which is either geographically carried out at different places or in an integrated facility.

7.1.3.1 Plastic recycling

There are three different types of plastic recycling options i.e. mechanical recycling, chemical recycling, and thermal recycling.

- In chemical recycling process, waste plastics are used as raw materials for petrochemical process or as reductant in a metal smelter
- In mechanical recycling process, shredding and identification process is used to make new plastic products
- In thermal recycling process, plastics are used as alternative fuel.

The two main types of plastic resins, which are used in electronics, are "thermo sets" and "thermoplastics". Thermo sets are shredded and recycled because they cannot be re-melted and formed into new products, while thermoplastics can be re-melted and formed into new products.

Mechanical Recycling process: -

(1) The first step is the sorting process, where contaminated plastics such as laminated or painted plastics are removed.

(2) Shear-shredder and hammer mills are generally used for size reduction and liberation of metal (coarse fraction) followed by granulation and milling for further size reduction.

(3) Magnetic separators are used for ferrous metals separation, while eddy current separators are used for non-ferrous metal separation

(4) Air separation system can be used to separate light fractions such as paper, labels and films.

(5) Resin identification can be carried out by using a number of techniques like turboelectric separator, high speed accelerator and X-ray fluorescence spectroscopy

(6) X-ray fluorescence spectroscopy is effective in identifying heavy metals as well as flame retardants

(7) After identification and sorting different resins, they are extruded and palletized

7.1.3.2 Chemical recycling process

Mixed plastic waste is de-polymerized, de-halogenated, metals removed and hydrogenated to produce high quality products like off gas and syncrude obtained by hydrotreatment, which are sent to the petrochemical process

7.1.3.3 Thermal recycling process

Plastics recovered in the second level treatment are used as fuel to provide energy. Since plastics have high calorific value, which is equivalent to or is greater than coal, they can be combusted to produce heat energy in cement kilns.

7.1.3.4 Metals recycling

Metal recycling includes lead recycling, copper recycling and precious metal recycling. After sorting of metal fractions at second level E-Waste treatment, they are sent to metal recovery facilities.

8 Guidelines for Establishment of Unit Treatment Facility, an Integrated Processing Treatment Facility and Disposal sites for E-Waste

The establishment of E-Waste Recycling and Treatment Facilities in Uganda shall be inline with the existing waste management regulations applicable for establishing and operating Recycling, Treatment and Disposal Facilities. These E-Waste facilities should meet the following guidelines:

8.1 Guidelines for Setting-up and Management of a Unit Treatment Facility or an integrated E-Waste facility

Any processing and recycling facility that receives designated materials must ensure:

(1) Facility is fully licensed by all appropriate governing authorities.

(2) An Environment Impact Assessment (EIA) is undertaken and an EIA license issued.

(3) Facility is registered as a recycler under the relevant Waste Management Authorities.

(4) Facility takes sufficient measures to safeguard occupational and environmental health and safety.

(5) Facility has a regularly implemented and documented monitoring and recordkeeping program that tracks key process parameters, compliance with relevant safety procedures, effluents, emissions, stored incoming and outgoing materials and waste.

(6) Facility has an adequate plan for closure. The closure plans and financial guarantees to be determined by the applicable laws and regulations taking into consideration the level of risk.

8.2 Guidelines for facility operation requirements

The facilities can exist as a separate unit operation or as an integration of all unit operations under one roofing. The key facility operation units include;

(1) An effective collection channel and infrastructure.

(2) Adequate storage area.

(3) An elaborate dismantling and segregation section.

(4) A recycling plant / unit.

(5) A Treatment and Disposal unit.

8.2.1 Guidelines for collection systems for E-Waste

(1) The collection systems shall be in line with the guidelines provided in Chapter 5

(2) The individual producers can have direct contact with dismantlers or recyclers to get back the re-usable components from their obsolete equipment for use in production.

(3) The system may charge fees, provide free collection or provide discount on purchase of new items.

8.2.2 Guidelines for Storage Areas

(1) The location can be within the facility (on site) or outside the facility (off site).

(2) It should be well covered to store waste until it is recycled or treated.

(3) The covering should be weather proof to minimise the contamination of clean surface and rainwaters. It will also facilitate the reuse of whole appliances and components intended for recycling and to assist in the containment of hazardous materials and fluids.

(4) The type of weather proof covering required will depend on the types and quantities of waste, the storage and treatment activities undertaken.

(5) E-Waste items should be separated and kept in appropriate well-marked containers.

(6) The storage area should have impermeable surfaces and a sealed drainage system. This will ensure that no liquid will run off the pavement and all liquids entering the system are collected in a sealed sump.

(7) Spillage collection facilities should be provided. They should include the impermeable pavement and sealed drainage system as the primary means of containment.

(8) An appropriate storage site should be provided for disassembled spare parts (e.g. motors and compressors) that contain oil or other types of fluids. They should be stored in containers that are secured that will not allow oil and other fluids to escape with an impermeable surface and a sealed drainage system.

(9) Components and residues arising from the treatment of E-Waste should be contained for disposal or recovery. If they contain hazardous substances they should be stored on impermeable surfaces and in appropriate containers or bays with weather proof covering.

(10) Containers should be clearly labelled to identify their contents and must be secure from liquids and rainwater seepage.

(11) Components should be segregated having regard to their eventual destinations and the compatibility of the component types.

(12) Batteries should be handled and stored with a clear knowledge of their potential fire risk.

8.2.3 Guidelines for Dismantling and Segregation of Dismantled Parts

Dismantling and segregation are the first steps towards recycling of the E-Waste. These are cost effective and labor-intensive activities and are mostly carried out in the informal sector, which needs to be brought into mainstream recycling.

E-Waste segregation involves separation of equipment according to its level of difficulty to dismantle, and its hazardousness. Segregation can be done either before the equipment is dismantled or after.

(1) Dismantling of E-Waste may be carried out manually or mechanically depending upon the scale of operations and the E-Waste being handled.

(2) Manual dismantling should only involve used electronic and electrical equipment where there is no likelihood of contact with hazardous substances.

(3) An integrated facility should provide a mechanical dismantling facility to dismantle E-Waste containing hazardous substances.

(4) Sorting of E-Waste is encouraged at source to enable easier identification and access to particular E-Waste streams.

(5) Identification will be carried out in three categories;

i. Items in good condition that can be reused

ii. Items that can be repaired/refurbished

iii. Items for dismantling for recovery or disposal

(6) Dismantling shall be carried out after verification that items are no longer usable.

(7) The electrical components are dismantled, classified and broken apart.

(8) Removal of parts containing dangerous substances; removal of easily accessible parts containing valuable substances (cable containing copper, steel, iron, precious metal containing parts, e.g. contacts).

(9) Useful parts can be recovered and sold to the second hand market for some profit (or donated) as refurbished.

(10) Occupational health and safety concerns of facilities for storage and dismantling of the equipment shall be as per the stipulated Occupational Safety and Health Act (OSHA), 2006.

(11) NEMA shall monitor the facilities through control environmental audits to determine the handling facilities in terms of physical status and mitigation measures in place to ensure safety of workers as well as protection of the environment.

8.2.4 Guidelines for Recycling and Recovery of E-Waste

Recycling is encouraged at a formal level where all institutions shall ensure that E-Waste is collected and delivered to the designated collection centers. The following guidelines shall apply: -

(1) NEMA in collaboration with relevant lead agencies shall register and recognise collection schemes as well as recycling centres for regulation through licensing.

(2) The supplier will be required to supply records of the amounts collected.

(3) An integrated E-Waste recycling facility should opt for the Best Available Technologies (BAT) and provide the state of the art facility complying with all the environmental laws in the terms of emissions, effluents, noise, waste treatment and disposal amongst others.

8.2.5 Guidelines for Developing a Treatment and Disposal Unit

(1) Provisions should be made of equipment for the treatment of water, including rainwater, in compliance with health and environmental regulations. Operators of treatment facilities should take appropriate steps to minimise the contamination of clean waters.

(2) Impermeable surfaces should be provided for appropriate areas. The impermeable surface should be associated with a sealed drainage system and may be needed even where weather proof covering is used.

(3) Spillage collection facilities that include the impermeable pavement and sealed drainage system as the primary means of containment should be provided. However, spill kits to deal with spillages of oils, fuel and acids should be provided and used as appropriate.

(4) Records should be maintained on the treated E-Waste to inform on E-Waste entering a treatment facility and components and materials leaving each site (together with their destinations).

8.3 Guidelines for E-Waste Disposal Sites

(1) Disposal should be done in specialised cells or sections in a licensed landfill site.

(2) Owners / operators of disposal sites shall be licensed by NEMA and Local Authorities.

(3) Owners / operators must demonstrate technical knowledge and understanding of the hazardous nature of E-Waste.

(4) Disposal sites shall be published after licensing for the general public to be aware of the existence of the same.

(5) Disposal shall be paid for and the disposer shall be issued with a certificate of safe disposal.

(6) Disposers shall keep a record of the amounts and categories of E-Waste, which NEMA may access upon request or during inspection of E-Waste handling facilities.

(7) Incineration of unusable disposable parts is not recommended in the country due to the unsuitability of existing incineration facilities. In future, development of incinerators will include compulsory installation of E-Waste gas purification systems to deal with dioxins and furans in incineration flue gas.

(8) Burying is strictly prohibited as contaminants may easily leach into the soil and pollute both soil and groundwater resources.

9 Appendices

9.1 APPENDIX A: Hazardous components of E-Waste

Substance	Component	Health/Environmental Effects
Antimony trioxide	A flame retardant, added to cathode ray tube (CRT) monitor glass, found in printed circuit boards and cables	Toxic to humans in ways similar to arsenic; fatal in large doses
Arsenic	In older cathode ray tubes and in light emitting diodes	Arsenic is a known cancer-causing substance (carcinogen). It is known to cause skin and lung cancer.
Barium	In CRT	When aquatic organisms absorb the barium compounds, barium will accumulate in their bodies.
Beryllium	Often allied with copper to improve copper's strength, conductivity and elasticity. Old motherboards, contact springs found in printed circuit boards, relays, and in the mirror mechanism of laser printers. In power supply boxes which contain silicon controlled rectifiers and x-ray lenses	Long term exposure can be carcinogenic, especially for the lungs. Extreme exposure can lead to a potentially fatal condition known as Acute Beryllium Disease
Cadmium	Circuit boards and semiconductors, rechargeable NiCd-batteries, fluorescent layer (CRT screens), printer inks and toners, photocopying-machines (printer drums)	Breathing high levels of Cd can cause lung damage and death. Long term exposure to low levels of Cd can cause elevated blood pressure and kidney damage. Cadmium is a known carcinogen.
Chlorofluorocarbon (CFC)	Cooling unit, Insulation foam	Converts to Chlorine in the atmosphere that attacks ozone molecules causing ozone layer Depletion, Inhaled in large volumes could result in respiratory distress.
Chromium	In steel as corrosion protection, Data tapes, floppy-disks, circuit boards, photocopying-machines (printer drums)	Chromium has a variety of effects depending how it enters the body. Chromium is a carcinogen if inhaled. Chromium may also cause DNA damage

Chromium VI	Data tapes, floppy disks	Shortness of breath, coughing, and wheezing
Cobalt	Component in steel for structural strength and magnetivity.	This agent is carcinogenic in experimental animals at a relatively high dose
Lead	Cathode ray tubes, solder, batteries, printed wiring boards (circuit boards), solder on components, mobile phone coatings,	Initial symptoms of exposure are lack of appetite (anorexia), muscle pain, general discomfort(malaise), and headache. Long-term exposure to lead decreases the overall performance of the nervous system. High level exposure causes brain damage and death.
Lithium	Batteries including mobile phone batteries	Burning sensation. Cough. Labored breathing. Shortness of breath. Sore throat.
Mercury	Switches (mercury wetted) and housing, fluorescent lamps providing backlighting in liquid crystal displays (LCDs) for monitors and laptops, batteries, printed circuit boards	Short term exposure to all forms of mercury causes lung damage, nausea, vomiting, diarrhoea, increases in blood pressure or heart rate, skin rashes, and eye irritation Long term exposure permanently damage the brain, kidneys, and developing foetus.
Nickel	Batteries, electron gun in CRT, printed circuit boards	Nickel fumes are respiratory irritants and may cause pneumonitis
Polybrominated flame retardants (including polychlorinated biphenyls (PCB), polybrominated biphenyls (PBB), Polybrominated biphenyl ethers (PBDE), and tetrabromo bis-biphenol-a (TBBA)	Plastic casings, cables, and circuit boards, condensers, transformers	May cause disruption of ; steroid , thyroid and hormone regulation.
Polyvinyl Chloride (PVC)	Cable insulation	When burnt it produces highly toxic dioxins; research is finding if PCV is a hormone

		disruptor.
Selenium	Circuit boards as power to supply rectifier, photocopying-machines (printer drums)	Gastrointestinal distress, hair loss, white spots on nails, fatigue, and irritability
Zinc Sulphide	Interior of CRT screens, printed circuit boards	High doses may be hazardous in case of eye contact , ingestion and inhalation

9.2 Appendix B: Categories of E-Waste generated from Electrical and Electronic Equipment

Category	**Used electrical & electronic equipment**	**E-Waste**
CAT-A1	Large household appliances	• Refrigerators and freezers • Other appliances used for refrigeration, conservation and storage of food • Washing machines • Clothes dryers • Dish washing machines • Cooking ranges/stoves • Electric hot plates • Microwaves • Other appliances used for cooking and other processing of food • Electric heating appliances • Electric radiators • Other fanning, exhaust ventilation and conditioning equipment
CAT-A2	Small household appliance	• Vacuum cleaners • Carpet cleaners • Other appliances used for cleaning • Appliances used for sewing, knitting, weaving, and other processing for textiles • Iron and other appliances used for ironing and care of clothing • Toasters • Fryers • Grinders, coffee machines and equipment for opening or sealing containers or packages • Electric knives • Appliances for hair cutting, hair drying, tooth brushing, shaving, massage and other body care

		appliances • Digital clocks, watches and equipment for the purpose of measuring indicating of registering time scales
CAT-A3	Toys, leisure and sports equipment	• Electric trains or car racing sets • Hand-held video game consoles • Video games • Computer for biking, diving, running, rowing, etc • Sports equipment with electric or electronic components • Coin slot machines
CAT-A4	Electrical and electronic tools (except large-scale stationary industrial tools)	• Drills • Saws • Sewing machines • Equipment for turning, milling, sanding, grinding, sawing, cutting, shearing, drilling, making holes, punching, folding, bending or similar processing of wood, metal and other materials • Tools for riveting, nailing or screwing or removing rivets, nails, screws or similar uses • Tools for welding, soldering or similar use • Equipment for spraying, spreading, dispersing or other treatment of liquid or gaseous substances by other means • Tools for mowing or other gardening activities
CAT-A5	Medical devices (except implanted and infected products	• Radiotherapy equipment • Cardiology • Dialysis • Pulmonary ventilators • Nuclear medicine • Laboratory equipment for in-vitro diagnosis • Analysers • Freezers • Fertilization tests • Other appliances for detecting, preventing, monitoring, treating, alleviating illness, injury or

		disability
CAT-A6	Monitoring and control instruments	• Smoke detector • Heating regulators • Thermostats • Measuring, weighing or adjusting appliances for household or as laboratory equipment • Other monitoring and control instruments used in industrial installation (e.g. in control panels)
CAT-A7	Automatic dispensers	• Automatic dispensers for • beverages • hot /cold bottles or cans • solid products • money • All appliances which deliver automatically all kind of products

9.3 Appendix B: Consultative meetings

A meeting was held on with the E-Waste management steering committee was held on 29th May 2015 at ministry of ICT. Regional meeting were organized as follows. The final draft report was reviewed by the E-Waste management task force from 26th November to 15th December 2015

Date	**Region**	**Place**
30th June 2015	Eastern Region	Mbale
18th November 2015	Western	Mbarara
19th November 2015	South Western	FortPortal
24rd November 2015	Northern	Gulu
26th November 2015	North West	Arua
15th December 2015	Central	Kampala

9.4 Appendix C: E-Waste Taskforce Members

Name	**Organization**
Dr. Jimmy Saamanya	Ministry of ICT
Dr. David Turahi	Ministry of ICT
Mr. Paul Mafabi	Ministry of Water & Env't
Mr. Keneth Bagarukayo	Ministry of ICT
Mr. Godwin Kahuuta	Ministry of ICT
Mr. Nathan Mununuzi	Ministry of Water & Env't
Eng. Geofrey Agoi	Ministry of ICT
Mr. Najib Lukooya	KCCA

Eng. Paul Odoi	Ministry of ICT
Mr. Richard Obita	NITA - U
MS. Helen Ssekasala	UCC
Mr. Silas Ngabirano	Ministry of ICT
Mr. Michael Ocero	Ministry of ICT
Mr. Fred Onyai	NEMA
Ms. Gloria Katuuku	Ministry of ICT

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