A Regulatory Framework for Electronic Waste Management In Nigeria

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ABSTRACT

Electronic waste, or e-waste, is a term for electronic products that have become unwanted, non-working or obsolete, and have essentially reached their end-life. Because technology advances at such a high rate, many electronic devices quickly become "trash" after a few years of use. These wastes are considered to be non-biodegradable, harmful to the environment due to toxic and hazardous element that is inherent in them and subsequently harmful to humans. The quantum increase in manufactured electronics devices has its major challenge in the rapid obsolesce of the system which has further become a major problem to the environment. It has become imperative that the total number of electrical and electronic equipment imported into the country have escalated beyond expectation. The end-of-life of this equipment requires that they be properly disposed in a way that is environmentally friendly and void of harmful toxins that could hurt human health. This paper proposes a regulatory framework for the management of electronic waste in Nigeria.

Keywords: ICT, e-waste, Recycle, Regulations, EEE

1. INTRODUCTION

Information Technology (IT) and electronic industries has become one of the fastest growing global manufacturing industries in recent times (Egwali and Ekong, 2012, Mburu and Tuduetso, 2013), revolutionizing several sectors such as business, entertainment, development and Information and communication technology (ICT). The broad arena of ICT applications constitutes the fastest growing activity in the world. Decades of extraordinary technological advancement and our insatiable consumer demand have led to huge increase in the production of new electrical and electronic equipment (EEE). For instance, well over 167 million Nigerians use mobile phones and 97 million use the Internet (NCC, 2016). This coupled with the continuous and astonishing rapid replacement by consumers has resulted in the new widespread problem of disposing large amounts of the electronic waste (e-waste) generated when EEE is discarded.

E-waste has been defined by many authors. Obaje (2013) define e-waste as the disposal of electronic goods such as cell phones, mp3 players, television, and computers. Ighalo (2012), define e-waste as waste electrical and electronic equipment (WEEE) that are non-biodegradable, industrial and synthetic. European Union (EU) in 2002 defines e-waste as EEE which is waste, including all components, subassemblies and consumables which are part of the product at the time of discarding. E-waste has been considered to be harmful to human health and dreadful to the environment causing environmental degradation due the toxic and hazardous elements that are inherent in them (Obaje, 2013). EEE are considered to be indecomposable. These items produce complicated multi-material waste with different proportions of metals, plastics and glass that can further pollute the environment if they are not adequately treated, managed and finally disposed.

E-waste has been boosted over the years by the massive importation of ICT equipment for use in virtually all private and public organization, industries and homes in Nigeria. The consuming desires of Nigerians to have the latest technology has drastically reduced the useful life of EEEs such as mobile phones (18 months), computers (3 years) and other EEEs (between 1 and 15 years), thus maximizing the turnover and rapidly increasing the volume of e-wastes in the country (Chukwudebe and Dialla, 2015). Most discarded EEE such as computers, monitors (Cathode ray tubes) printers, photocopying machines, televisions, mobile phones and electrical toys may contain large amounts of many potential harmful environmental contaminants such as Lead, Cadmium, Beryllium, Ascenic, Mercury and Brominated flame retardants (BFR), as well as valuable metals that can be recycled. And most of these e-wastes are disposed or mishandled in unregulated and inappropriate ways (Wong et al., 2007; Obaje, 2013).

The end-of-life (EoL) of EEE requires that they are properly disposed in a way that is environmentally friendly and void of harmful toxins that could hurt human health. By EoL we mean equipment that have reached their expected life span and are either considered as obsolete or discarded. As a consequence e-wastes represent human health risk when not properly managed and disposed. The disposal of e-wastes thus needs to be managed in an environmentally sound fashion to minimize environmental damage and health hazards, thus the need for a regulatory framework to guide this process.

First, it has been discovered that the massive importation of fairly used EEE from developed countries in Nigeria is as a result its populace not having the purchasing power to acquire branded or new EEEs. As such the fairly used or second-hand ('Tokumbo") EEEs readily have a thriving market in Nigeria. However, over the years, the accumulation of these EEEs has become a menace to the environments thereby causing health hazards to the populace. Major causes of these problem include but not limited to; absence of infrastructure for appropriate e-waste management, absence of legislation dealing specifically with e-waste, absence of a regulatory framework for EoL product uptake and implementation of extended producer responsibility (EPR) (Osinbanjo and Nnorom, 2007). This has resulted into high importation of fairly usable EEEs such as mobile phones and computers which are sold at relatively low prices compared to new branded ones. Reports show that most of these equipment are near obsolete systems. Table 1 highlights the major harmful materials and toxins inherent in EEEs,

Table1: Hazardous Substances in e-waste materials (Source: Obaje, 2013)

Item	Hazardous Substance
Cathode ray Tube (CRT)	Lead, Mercury, Antimony, Phosphorus
Liquid Crystal Display	Mercury
Circuit board	Lead, Beryllium, Antimony Organohalogen compounds, BFR
Flourescent lamp	Mercury, Phosphorus
Batteries	Lead, Lithium, Cadmium, Nickel, Mercury
Electrical wiring	Pithalate plasticizer, BFR
Insulation	ODS in foam, asbestos, refractory ceramic fibre
Plastics	BFR, Pithalate plasticizer, Polychlorated bipheryl (PCB)
Drum	Sellenium

Secondly, it has been observed that in most cities in Nigeria these e-wastes are inadequately dumped along-side decomposable wastes at the nearest dump sites available. Scavengers in their numbers visit these dump sites to select the metals in the e-waste which are sold to companies for re-cycling purposes. The non-re-cyclable materials are burnt openly, sand filled or even left unattended to which further become harmful to humans and the environment. This work aims at developing a framework that will regulate and control the accumulation of EEEs in Nigeria and provide a roadmap for the recycling and disposal of the e-wastes in an environmentally friendly manner when they finally get to their EoL.

2. RELATED WORKS

E-waste generation has become a global problem world over. In the developed countries such as the United State, Switzerland, the United Kingdom and others there exist laws and regulations on how to best control and dispose these equipment. A comprehensive report on laws and regulations in these countries is reported in Wath et al., (2010). Among these regulation is the exportation of used equipment to developing countries in the name of charity at low cost price with little or no import duties/charges paid on them. The major reason is to enable developing countries have these equipment in order to meet up with the global ever evolving field of IT. Switzerland is among the first developed country to have a working e-waste management system with well over 11kg/capita e-waste recycled as against European Union (EU) recommended 4kg/capita (Wath et al., 2010).

The system is based on an EPR model which makes producers/manufacturers and exporters physically and financially responsible for environmental handling, recycling, and disposal of e-waste. An Advanced Recycling Fee (ARF) is charged on importers on every equipment imported while the final consumers pay the recycling fee of new or used EEE purchased alongside its original price. These charges ensure availability of funds for the proper management of the e-waste. The fees also guarantee the disposal of obsolete equipment that has reached their EoL from the consumers free of charge. These e-wastes are freely deposited to any retail shop or other 500 official collection points where they are collected by the two major Producer Responsibility Organizations (PROs)-the Swiss Association for Information Communication and Organizational Technology (SWICO) and Stiftung Entsorgung Schweiz (SENS) management agencies for further processing. The system also ensures control of importation and exportation of equipment in and out of the country. In India, the Ministry of Environment and Forest (MoEF) is the authority responsible for legislation of e-waste management. The Hazardous Materials Management, Handling and Trans-boundary Movement rules exist to guide the disposal of e-waste (Kiddie et al., 2013; Wath, et al., 2010).

With a total WEEE generation of over 420,000 tonnes per year, e-waste is still not formally developed in India due to administrative delay in enforcements and as such WEEE is treated as municipal waste with no special treatment, or activities relating its collection, handling, or disposal. E-waste is commonly handled by unskilled workers who go about picking these materials by paying some amount of money to customers (rag pickers) from whom they collect these material. These rag pickers further sell the materials to customers (scrap dealers) that finally sell them to recyclers who want to use them for other purposes. This process is considered to be highly risky since the collectors have direct contact with the hazardous substances from these equipment.
Ghana has regulations on importation of fairly used EEE. The regulation requires a fee to be paid on every imported product whose manufacture date must not be above five years. They also operate a code of conduct on e-waste disposal but these efforts notwithstanding, there is growing increase in the importation of used EEE into the country. In Cameroun, regulations to control e-waste is still very poor, while in Senegal an executive institution that deals with e-waste exist however, their activities are not fully effective (Chukwudebe and Diala, 2015).

2.1 E-Waste Management In Nigeria
Nigeria is considered as one of the largest countries in sub-Sahara Africa with high percentage of EEE usage and penetration. The introduction of IT and mobile wireless communication with the various mobile devices associated with them has caused the country to witness tremendous change in information processing and dissemination. Although the benefits associated with the use of IT are numerous, however it's not void without challenges. Majorly among others is the huge hardware equipment involved in processing these information which easily get obsolete or discarded because of new innovations. Nigeria as a non-manufacturing nation of these equipment is known as the number one importer of EEE in Africa. This has resulted in huge number of WEEE in the country. Although the Nigeria situation is not that different from the Indian scenario, efforts have been made to control and manage these hazardous equipment. First, is the 1991 Control of Trans-boundary Movement and Management of Hazardous Waste Agreement that banned the importation of waste into African countries. This did not yield much result since most African countries like Nigeria were inadequately equipped to manufacture its own resources. To ameliorate this challenge, in 2008, the Durban declaration was enacted which allowed individual countries to decide on its mode of operation in regulating e-waste.

Secondly, agencies such as the National Environmental Standards and Regulations Enforcement Agency (NESREA) established in 2007, and the National Toxic Dump Watch Programme (NTCWP), were enacted as national agencies in charge of implementing laws, regulation, guidelines and registration of importers on the control of e-waste in Nigeria (Chukwudebe and Diala, 2015). Although these agencies are functional, its effects on EEE generation and importation are far from expectation. This is connected with the crude method of disposal and lack of recycling plants in the country resulting in open burning and land fillings of these equipment thereby releasing hazardous substance to the environment causing health problem to the populace.

3. PROPOSED FRAMEWORK

The ever increasing e-waste generation especially in Nigeria requires a proper regulatory system in order to control, segregate, recycle, dispose, and monitor all e-waste equipment in an environmentally friendly manner void of human health hazards. This can be achieved if developed countries regulations that suite the Nigeria environment are incorporated in-line with the country's local regulation for a working system. The proposed framework as represented in Figure 1 formulates a functional Waste Management Authority (WMA) framework. The framework is made up of five sections including evaluation/decision tools, awareness creation, stakeholders, waste management agencies and e-waste processing. These five sections are incorporated together to form the working system.
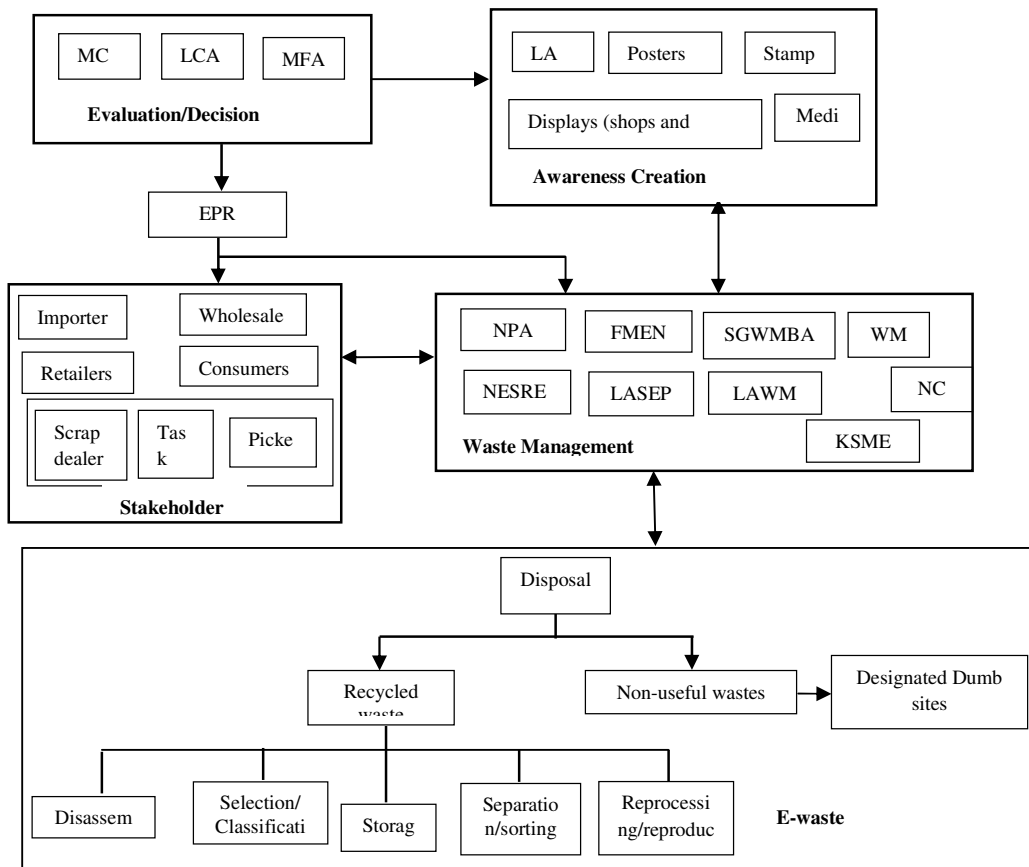

Figure 1: A Regulatory Framework for E-Waste Management in Nigeria

3.1 Evaluation/decision tools

This section comprises of three major tools; Life Cycle Assessment (LCA), Material Flow Analysis (MFA) and the Multi Criteria Analysis (MCA). These three tools are decision tool that have been used in most developed countries to control/appraise EEE products to see if they meet set standard. Since Nigeria is not a manufacturing country, the Waste Management Agencies therefore must evaluate all imported new or used equipment to see if they meet the evaluation standard. The LCA specifically, is a tool used to design/manufacture environmentally friendly (eco-design) EEE devices and evaluate the impact of EoL product in order to reduce e-waste problems (Kiddie et al., 2013). This tool have been mostly in the developed country such as Switzerland, and other European countries. MFA on the order hand, is a decision support tool used the monitor the movement of material into the recycling sites or disposal area. It keeps track of all EEE products in space and time. MFA assesses the environmental, economic and social values of these equipment and flow control from collection source through its pathway down to the final destination of the products. Finally on this section, is the MCA which is used in solving complex multi criteria problems that include qualitative and quantitative aspects of the problem.

The tool also aid in discovery and organizing new ways of managing e-waste especially those associated with hazardous substances. To have an optimal evaluation and decision tools these three tools must wrong in conjunction with the EPR. The EPR as discussed earlier, makes manufacturers responsible in taking back products after use based on polluters pay principles. All equipment that has reached their EoL are collected and exported for recycling purposes and this help to minimize the amount of e-waste material in the country. Another strategy is to place a recycling fee on every product imported or purchased by the wholesalers, retailers and final consumers within the country. The fee is to enable proper recycling of the product after usage by recycling industries within the country. This practice is evident in the Switzerland e-waste management.

3.2 Awareness Creation

This section is managed by government waste management agencies to create awareness and disseminate important information to the appropriate channels. Consumers need to know what to watch out for before purchasing any product. For example, ascertaining the manufacture year, expiration year and handling conditions of the product. Importers and exporters also need to be aware of the various conditions before a product can be imported or exported into or outside the country. These may also include allowable year of manufacture of product, import duties, and so on. This awareness is disseminated through posters, stamps, displays on shops and markets, through the stipulated law, and the media.

3.3 Waste management Agencies

The waste management agencies are the major authorities approved by government to manage the influx and flow control of WEEE. It utilizes the evaluation/decision tools for decision making on how to effectively manage, control and generate wealth through e-waste. They are also responsible for information dissemination to the appropriate channel as at when due and generally manage the formal recycling and disposal of e-waste while controlling the activities of all stakeholders involved in the process. Various agencies involved in this process include the National Environmental Standards and Regulations Enforcement Agency (NESREA), National Toxic Dump Watch Programme (NTCWP), Nigeria Port Authority (NPA), Waste Managers (WM), Federal Ministry of Environment (FMENV), Lagos State Environmental Protection

Agency (LASEPA), Kano State Ministry of Environment (KSME), Nigeria Custom (NC) and Lagos Waste Management Authority which were enacted as a national agencies in charge of implementing laws, regulation, guidelines and registration of stakeholders on the control of e-waste. They equally ensure that all waste management stakeholders in the country are registered with the WMA. This will help in tracking and identifying who is involved in the production, importation and sales of EEE.

3.4 Stakeholders

The stakeholders are those directly involved with the buying and selling of EEE materials. These groups include the wholesalers, importers, exporters, retailers and finally the consumers. Others that are indirectly involved include the pickers, task force and scrap dealers who work with the management agencies.

3.5 E-waste Processing

The e-waste section of the framework deals with the actual processing of WEEE materials. The disposed products are first separated to useful recyclable waste and non-useful waste. The non-useful wastes are considered to be waste that are have no useful need by the recyclers or are decomposable. Theses wastes are disposed to designated dumpsites. The recyclable waste are disassembled into particles and further selected and classified into different part for various reproduction stages. These selected parts are stored in different storage containers and separated for stakeholders who either export them or transport them to the different reproduction sites for further processing. During the process of disposal hazardous materials are carefully process in an environmental friendly manner void of health problems.

4. CONCLUSION

An EEE regulatory framework has been presented in this paper. E-waste when properly managed can generate wealth and enhance the living standards of any nation. However, effective regulation demands synergy and support between manufacturers, government agencies and stakeholders in order to have an environmentally friendly country that is free from health hazards.

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