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E-WASTES MANAGEMENT: THE NIGERIAN CASE (OVERVIEW)

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ABSTRACT

This work is to evaluate the management e-waste in Nigeria, with the country ranked as the major receiver of used electrical and electronic equipment (UEEE) by the United Nations Environmental Programme (UNEP) among African countries and, consequently, the highest source of waste electrical and electronic equipment (WEEE) due to the large amount of UEEE imported into the country annually.

The quantity of UEEE entering the country (Nigeria) is over half a million annually, and this number is feared to be on the rise even as the country's population is exponentially increasing, thereby increasing the demand for technological equipment. Waste management is a global issue, with many developed countries harnessing the economic power of waste management either by employing stiff policies or the deployment of advanced technology.

In doing this, we seek to critically look into e-waste management practices in the country and analyze some of the harmful substances and their health hazards for humans and the public in general. And taking a look into the laws governing the importation of UEEE and the disposal of WEEE by the National Environmental Standards and Regulations Enforcement Agency (NESREA).

The country's e-waste management is relatively below average, and there is a need to enhance a more technological way of managing e-waste and also harness the opportunities in optimizing e-waste, basically by practicing the reduction, re-use, and recycle (RRR) method. This, in a way, can help the country grow economically and improve a healthy living environment.

Keywords: E-wastes, Management, UEEE, WEEE

INTRODUCTION

Electrical and Electronic (EE) gadgets have continually provided a high level of comfort to humans through advancements in technology. The more comfort derived from these EE gadgets, the more waste they generate. In 2002, waste was referred to as anything that no longer adds any value to the user or has ended its useful life [1]. E-waste refers to any waste items derived from the usage of any electrical and/or electronic devices and their parts [2]. Electrical and/or electronic items that are deliberately thrown away without any intention of recycling or reuse are referred to as e-wastes [3]. In the category of waste, E-waste has become one of the fastest-growing wastes globally due to demand for technological gadgets [4]. The global disposal of Waste Electrical and electronic equipment (WEEE) or Used Electrical and electronic equipment (UEEE) has become a global concern. WEEE, such as computers, mobile phones, and other electronic entertainments, as well as other non-electronic products in the traditional sense, such as refrigerators or ovens, have been discarded as waste without any intention of re-use [5]. With the increase in economic dependence on technology, which has increased demand for Electrical and Electronic Equipment (EEE), the waste generated from these technologies has increased globally [6].

Excessive exposure to WEEE either through occupation or environmental accident has been reportedly linked to the cause of many cancers [7]. Proper management of E-waste would not only boost the public health of the immediate habitants but would also add to the economic growth of the habitants. Waste management is one sector in the global economy that has continuously proven difficult to manage due to the involvement of various industries, institutions, and municipalities, which makes monitoring of each waste category difficult for its agents [5].

There have been reported cases of high rates of mismanaged waste around the world, with plastic taking the lead and e-waste closely following [8]. Hazardous substances or materials should be handled and treated safely in a way that is environmentally friendly and reduces the risk of pollution of public resources. Global waste production continues to grow with an increasing population and increasing per capita consumption associated with economic growth [8]. The exponential growth in the volume of e-waste has gradually become a global issue. The number has doubled in the last decade [9]. However, E-waste management revolves around proper disposal and treatment practices, which are generally unsafe, unhygienic, and unwholesome. Therefore, it could potentially be hazardous to the ecosystem and human health [10] [11] [12]. As a matter of fact, improper management of this E-waste in many developing countries, like Nigeria, has caused the country great economic harm [13] [14].

According to [15], It has been reported that the quantity of e-waste produced annually is on the rise. In 2021, an estimated 57.4 Mt (Million Metric Tonnes) of e-waste was produced globally. The quantity is on the increase with an average estimation of 2Mt per year.

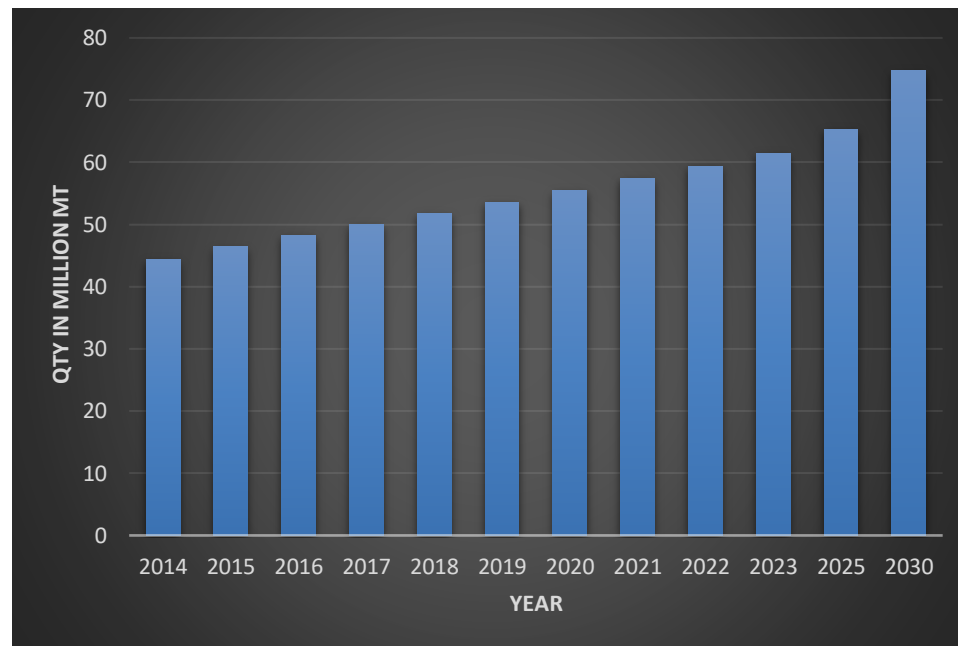
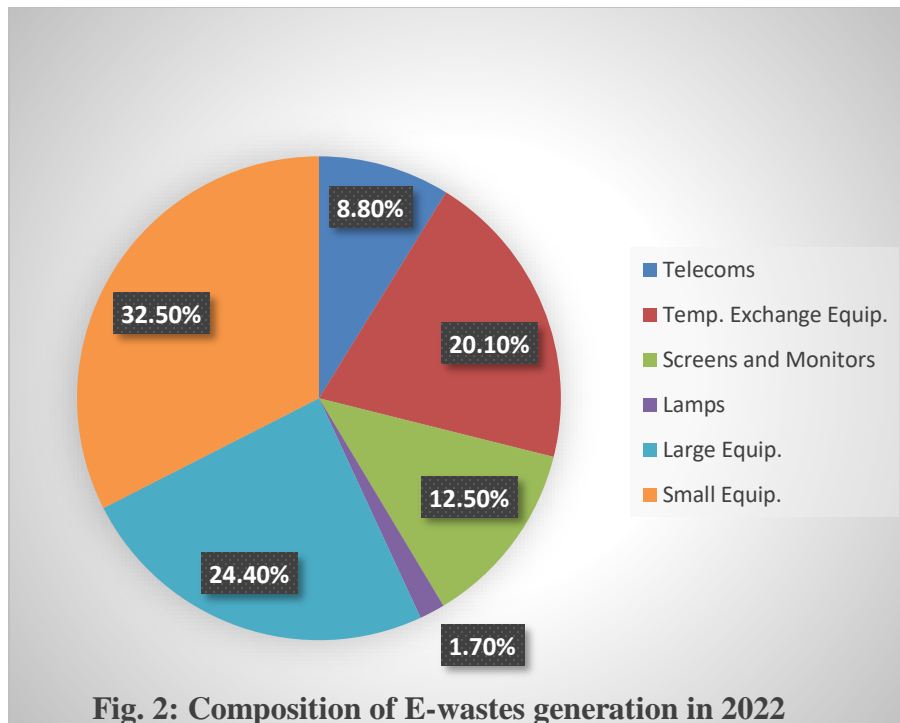


Fig 1: Annual WEEE production and projection till 2030. [15]

It is also estimated that there are about 350 metric tons of unrecycled e-waste available on earth as of August 2023 [15]. The countries with the greatest number of generated e-waste are found to be China, India, and the US. Among all this generated e-waste, only 17.4% of it is estimated to be properly managed by either recycling or reuse for economic purposes. Countries with the most managed e-waste profiles, Estonia, Iceland, and Norway, have benefited from the proper management of e-waste with a market value of about \$50,000 million [15]. The e-waste recycling market was estimated to be worth \$1 billion as at 2020[15]. Rapid economic growth, coupled with growing urbanization and lifestyle changes as well as growing demand for material goods, has led to an increasing production of Electrical and Electronic Equipment (EEE) and consequently the accumulation of WEEE over [16]. Globally, E-waste is one of the fastest-growing waste streams. The technology boom of the 1990s gave us e-mail and e-commerce, not to mention the fact that the whole world is becoming a global village with the role of EEE, and as equipment would eventually turn to E-waste [17].

The kind of WEEE varies in composition and size, though there were about 60 Mt of WEEE generated in 2022. Among these, small equipment, which includes vacuum cleaners, toasters,

kettles, radios, hairdryers, and toys, is about 17.4 metric tons, and large equipment, which includes tumble dryers, cookers, washing machines, and stoves, is about 13.1. While equipment like refrigerators, air conditioners, heat pumps, and freezers weigh about 10.8 metric tons, Also, equipment like laptops, monitors, notebooks, tablets, and televisions weigh about 6.7 metric tons. Information and Technology gadgets like wireless routers, phone cases, e-readers, GPS, keyboards, and pocket calculators are about 9.7 Mt. while the rest belong to equipment like bulbs, lamps, and LEDs in these categories [15].



E-wastes in Nigeria

In Nigeria, most E-waste passes through the Seaport in Lagos, the major capital city of the country. It was estimated that about 500 shipping containers filled with UEEE are brought in monthly through Lagos port [18]. However, e-waste does not originate in Nigeria and is not produced there; the major sources of e-waste entering the country are the United Kingdom, European Union, Japan, Korea, Malaysia, China, the United States of America, and Singapore, to mention a few. Through the transboundary movement of goods and services, African countries are the major recipients of many electrical and electronic gadgets and, conversely, are greatly affected negatively by the movements of e-waste. The major sources of these UEEE wastes are the USA and some European countries. as electronic products and E-waste are commonly traded across national boundaries. Nigeria has had a history of involvement in the E-waste trade, with

no computer recycling facilities or effective management system in place. Efforts by the regulatory authorities, such as the Standard Organization of Nigeria (SON) and the Computer Professionals Registration Council of Nigeria (CPN), have not effectively controlled the E-waste trade [19].



Fig. 3: Newly imported used electrical and electronics equipment (UEEE), (Premium Times, 2019).



Fig. 4: Used electrical and electronics equipment (UEEE), (Guardian, 2016).

In 2005, the Basel Action Network together with BCC Nigeria, revealed that Nigeria takes in close to 500,000 used electrical and electronic gadgets annually through her major seaport in Lagos, and most of these imported used gadgets are computers. About 0.25 of these imported UEEE are functional used electronics, while the remaining 0.75 are either damaged beyond servicing and eventually dumped as waste or will require a total overhaul before use.

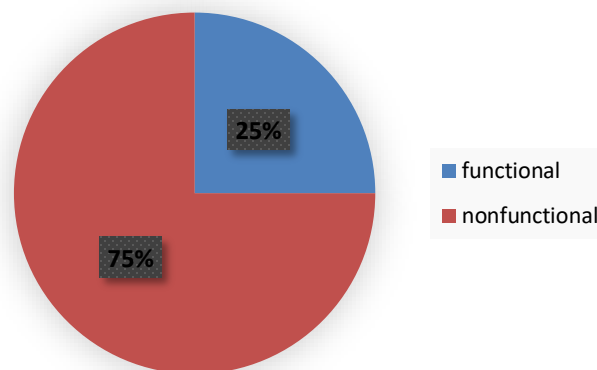


Fig. 5: Percentage of functional UEEE imported into the country

A surface study conducted around some major electrical and electronic markets in Lagos by the National Environment Standard and Regulation Enforcement Agency (NESREA) of Nigeria showed that the volume of imported used electrical and electronic equipment was: 15 tons in Computer Village, 100 tons in Alaba International Market, 15 tons in Oshodi, 30 tons in Lawanson Market, and 40 tons in West Minister. However, due to the country's increase in population, these numbers are expected to increase because of the high demand for electrical and electronic equipment, which in turn will demand an effective waste management policy from the agencies.

Improvement of international regulations, such as the Basel Convention, is crucial in fighting environmental pollution associated with e-waste flow into the continent of Africa and can help reduce the number if the Basel Convention can be absorbed [20]. Africa's countries are most vulnerable to the import of hazardous e-waste items, which are further treated in poorly equipped facilities while workers are exposed to critical public health threats [21][22].

More needs to be done in terms of E-waste management in the country, even though there are countless environmental policies guiding and protecting these hazardous wastes.

Hazards in E-Waste

In spite of laws governing e-waste disposal in the country, UEEE or WEEE are dumped at so many illegal sites around the country, especially in the densely populated urbanized regions. These serve to improve the quality of the lives of people living around them and can lead to national problems, especially at these illegal dumping sites, due to the hazardous components used in the manufacturing of the EEE products. Table 1.1 summarizes a few of the components (pollutants), sources, and effects on human health. Though these components may not have an immediate impact on human health, prolonged exposure and their finding their way into water bodies are dangerous to human health.

Table 1: Summary of few components (pollutants), sources, and effects on human healths

Components (Pollutants)	Sources	Effects on human health
Mercury	Batteries (clocks, phones, calculators), LCDs steam iron etc.	Negative effects on nervous system, irritability.
Lithium	Batteries of mobile phones and video games, photographic equipment	Muscles weakness, fatigues and heart disease (in high percentage).
Chrome	Dyes and pigments, switches etc.	Damage to Liver and skin irritation.
Cobalt	Batteries of mobile phones and insulators	Respiratory disorder
Nickel	Batteries, semi-conductors, pigments	Skin irritation.
PCBs (polychlorinated biphenyls)	Transformers and capacitors components, paint, glue and plastic as softeners.	Damage to Liver and skin irritation and exposure to pregnancy can results in behavioral deficit in newborns.
Selenium	Pigments in phones, Photoelectric cells, and photocopiers.	Skin irritation. Excessive hair loss, nails and lack of mental alertness.
Cadmium	Monitor cathode ray tubes (CRTs), Batteries in phones, laptops. Pigments, solder, metal alloys, electrical circuit boards.	Disruption in bones compositions.

E-waste Management in Nigeria

The National Environmental Standards and Regulations Enforcement Agency (NESREA) is the main agency handling environmental regulations in Nigeria, though there are many others in various states in the country. The agency's main objective is to ensure that environmental factors are considered in the decision-making process while likely adverse or hazardous environmental impacts are identified and minimized. Environmental Impact Assessment (EIA) is necessary when considering any environmental issue. The agency is saddled with the responsibility of making sure that EIA is conducted before and after the importation of these UEEE, especially at the point of entry into the country. There are various acts with penalties as high as imprisonment and fines. These are three of the environmental acts guiding waste.

1. Harmful Waste (Special Criminal Provisions) Act, Cap. HI, 2004
2. The National Environmental (Sanitation and Waste Control) Regulation 2009
3. Environmental Impact Assessment Act, Cap E1

In spite of these regulations, more needs to be done in managing e-waste in the country, and it is about time the authorities and agencies concerned looked into some promising areas that would be beneficial to the economy rather than a menace to the immediate inhabitants.

Proposed Treatment and Disposal of E-Waste

The wastes from UEEE are hazardous to public health, and the treatment and proper disposal should be done with the utmost concern and care. However, due to the complexity of their components, specialized and, in some cases, scientific approaches should be employed in proper disposal and site treatments to avoid long-term damage to natural resources and, consequently, to public health. Unfortunately, the unavailability of scientific or specialized techniques in a developing country like Nigeria poses a threat to adequate waste treatment and disposal. Therefore, localized environmental and health hazard control methods should be employed. A few of these methods are:

1. Incineration: In this e-waste treatment method, the UEEEs or WEEEs are completely combusted. This is for the UEEEs and WEEEs that are not recyclable and are referred to as one-time use. The benefits of this method of e-waste treatment are that the volume of waste compilation will be reduced, and the energy derived from this combustion can be used in other processes.
2. Re-Use: This is used when the UEEE and WEEE can be refurbished. It will be done after little adjustments have been made to the original version of the products or refurbishing, and the damaged products will then have an extended useful life for a more significant

period of time. This is commonly done in electronic products like phones, computers, laptops, etc. A better approach to this method is the buying or returning of WEEEs that have exceeded their useful lives by the manufacturers of such products. This will enable users to refrain from illegal dumping of WEEEs.

3. Recycling involves the uncoupling of the products, or, in other words, the removal of various parts of the WEEE that could be harmful to public health. These removed parts would be used in the manufacturing of another useful product.
4. Site Treatment: There should be regular site treatment of all dumping sites; this should be done so as to avoid any form of hazards from these wastes finding their way into the soil to pollute any agricultural produce and also into the water bodies for aquatic animals.

CONCLUSIONS

Waste management is a continuous activity, especially in a country with a growing economy and population like Nigeria. Although there are many regulations guiding the importation of UEEE and WEEE dumping, more needs to be done to avoid the country becoming a dumping site for UEEE and, consequently, WEEE. There is a need to look more in the direction of reduction, recycling, and reuse of e-waste. Technological methods of waste management should be applied from the very start so as to optimize the e-waste management processes. Proper waste management could lead to economic growth in the country and, consequently, good public health for the immediate inhabitants. The country, through its agencies, can emulate successful countries like Estonia, Norway, and Iceland in managing e-waste and using it as an economic booster. Adequate policies that enable proper e-waste management can be a huge benefit to the country in ways, like:

1. Healthy Environment: Due to the material composition of WEEE, some of its components have been found to be cancerous in nature. Excessive exposure to these components is dangerous to human health and public health in general.
2. Reduction in unemployment: According to [23], unemployment rates in Nigeria hit 41% in the first quarter of 2023, and this should be a great concern for the government of the country. By creating WEEE collectors locally, it can help the government reduce the rate of unemployment. E
3. Economic Growth: Countries like Germany, the UK, China, Japan, and France have e-waste recycling rates of 52%, 57%, 16%, 22%, and 56%, respectively [15]. These countries, in one way or another, derive economic benefits from the recycling of e-waste, thereby boosting their economies. Nigeria can also look in the direction of these countries to invest in the technology of WEEE recycling and shed some economic weight off the crude oil.

RECOMMENDATIONS

It is therefore recommended that the government look into the brighter side of waste management and invest in research and development (R & D), especially in e-waste, as there are many untapped resources like revenue generation, energy generation, a healthy environment, economic growth, a reduction in the rate of unemployment, etc. The policymakers should engage various experts and stakeholders in order to plan strategically for the importation of more functional UEEE and also derive plans for the non-functional UEEE so that it does not become a hazard to the public. It is therefore recommended that there should:

1. **Designated Dumping Sites (DDS):** There should be designated dumping sites for e-waste in the country. There is no doubt that Nigeria is densely populated; however, the government, through its agencies, can organize a local collector of e-waste materials in various localities, and the collected e-waste can be taken to the designated dump in each state of the country.
2. **Public Awareness:** The general public needs to be sensitized to the dangers of illegal dumping of UEEE in undesignated dumping sites. The relevant agencies for these sets of wastes should embark on a vigorous door-to-door campaign for the 3 R's (reduce, reuse, and recycle) of e-waste. Attractive incentives may be applied to encourage compliance.
3. **Policy:** Although there are acts guiding the importation of UEEE, the government needs to do more to ensure 100% compliance with these laws and possibly mandate a higher ratio of functional UEEE to nonfunctional UEEE importation into the country. Policies that will ensure a longer useful life of these imported UEEE should be put in place so that the country will not be a dumping site for WEEE without a proper plan for it.
4. **Modern Technology:** The government needs to emulate countries with positive success stories in WEEE recycling, such as Estonia, Germany, Japan, France, and the UK, which have undoubtedly invested the most in technologies for WEEE sorting. These technologies will help in separating the e-waste by size, shape, materials, and other useful information that will enable easy recognition and the commencement of the recycling process.

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