



THE REGULATORY FRAMEWORK: FOSTERING CIRCULAR ECONOMY PRACTICES IN E-WASTE MANAGEMENT

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ABSTRACT

This research seeks to evaluate the sufficiency of the e-waste management regulatory mechanisms available. Every nation whether it is developed or still in the process of developing, is facing the problem of e-wastes and has come up with measures in order to curb the issue. As for the data gathered it could be stated that the given issue of e-waste management in Africa is dissimilar to that of developed world in the terms of reasons that affect it as well as the ways it is managed. It is imperative to include the newer approach from other staker holders in the rule making for managing e-waste effectively. The nations need to create awareness on the impacts of e-waste, put in place and enhance e-waste related institutions and innovate on appropriate technologies in the management of e-waste.

KeyWords

Regulatory framework, Circular economy, E-waste management, Legislation, Sustainable development.

INTRODUCTION

E-waste refers to all sorts of electrical and electronic equipment (EEE) and their components that have been dumped as garbage by the owner with no intention of reuse (StEP, 2014). The OECD defines e-waste as any appliance that uses an electric power source and has reached the end of its useful life (OECD, 2001). The Synthetic Approach (StEP). Draft Project Document, 2005) characterises e-waste as a reverse supply chain in which devices that are no longer desired by a consumer are collected and refurbished for other consumers by recyclers. According to the United Nations Environmental Programme (UNEP), the amount of e-waste produced in 2012 was enough to fill 100 Empire State buildings, with an average of more than 6.8 kg (15 lb) for every live person. According to the StEP Annual Report (2013), China generated 11.1 million tonnes of e-waste in 2012, while the United States produced 10 million tonnes. E-waste is one of the world's fastest growing waste streams [42]. According to a 2012 UN report, worldwide e-waste will increase by 33% by 2017, rising from 49.7 million to 65.4 million tonnes per year [26]. The exponential increase in total E-waste output could be attributed to a variety of issues, including customer demand for improved designs and features, a high obsolescence rate due to bad quality EEE items, and wasteful purchases of EEE. In response, circular economy (CE) models have arisen as a viable alternative to today's wasteful economies [33]. They can create significant economic value by reusing e-waste, not just via consumption, and can also postpone a product's end of life, minimising the negative effects of material overconsumption.

METHODS

Peer-reviewed publications on e-waste from the last ten years were compiled using searches on academic research publication databases such as PubMed, Science Direct, and Google Scholar. Publications, government and regulatory agency reports, and directives were obtained through both formal and informal means. The following keywords were used to search the literature: e-waste, circular economy in e-waste management, used electronic equipment, e-waste management, and e-waste rules and guidelines

E-WASTE FLOWS INTO DEVELOPING COUNTRIES

The complexity of e-waste flows and inadequate record-keeping by industry and other participants make estimating the quantities of e-waste difficult [10]. However, a survey shows that nearly 7.1 million computers, 16 million TV sets, and ~190 million mobile handsets are expected to be part of the e-waste pool in India in 2012 [5]. In 2019, the world generated an estimated 53.6 million metric tonnes (Mt) of e-waste, equivalent to 7.3 kg per person. Furthermore, only 17.4% was officially reported as being adequately collected and recycled. Africa generated 2.9 Mt of e-waste in 2019, or 2.5 kg per person, the world's lowest regional rate (Andeobu et al., 2023). The rising demand for electrical equipment is a major element driving UEEE flows into developing countries. Approximately 25% (2.1 million tonnes) of the projected 8.7 million tonnes of e-waste produced in the European Union (EU) each year is collected and recycled in formal processing plants where workers are protected by current industrial regulations. The remaining 75% contributes to the "hidden flow" of untraceable and undocumented e-waste. It is estimated that 75% to 80% of the 20 million to 50 million tonnes produced each year are sent to Asia and Africa for "recycling" and disposal purposes [14]. In 2015 and 2016, almost 60,000 tonnes of UEEE were imported into Nigeria in this manner. The most came from China, followed by the United States. Many of the goods are used, damaged, or have outlived their usefulness. According to Waweru (2017), 60% of the UEEE distributed to beneficiaries in Kenya was beyond repair. These items become e-waste, contributing significantly to the rapid rise of e-waste in Africa.

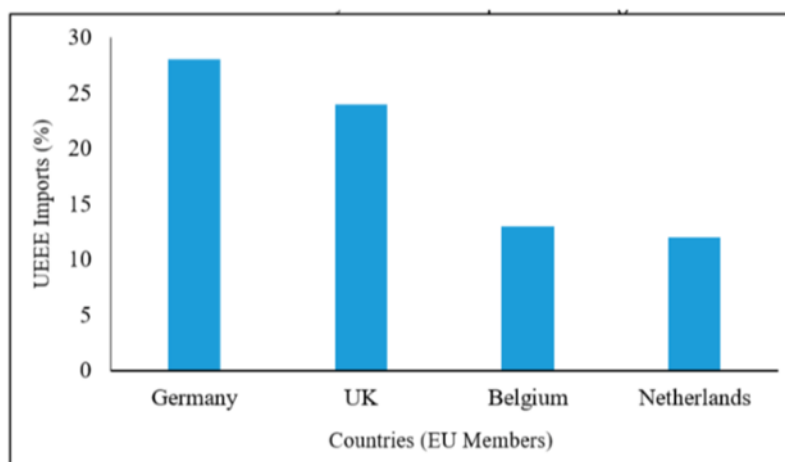


Figure 1. Imported UEEE loaded in vehicles sent to Nigeria from EU countries (Balde et al., 2017)

UNDERSTANDING CIRCULAR ECONOMY IN E-WASTE MANAGEMENT

E-waste generation and management is one of the most visible global environmental issues, but the infrastructure to manage it effectively remains underdeveloped and insufficient in most developing nations [5]. Transitioning to a circular economy has never been more important. To maintain our present consumption levels, we would need 2.3 planets' worth of resources by 2050. However, by transitioning to a circular economy, we can decouple global growth from net new consumption [39]. The circular economy (CE) is an industrial system that offers an alternative to the extremely extractive and resource-intensive linear economy paradigm of take-make-dispose. CE substitutes the end-of-life idea with restoration and regeneration, focusing on the use of superior materials, products, systems, and business models to eliminate waste [30].

Recently, there has been a surge in interest in the Circular Economy (CE), a type of economic system that aims to eliminate waste through resource utilisation, hence lowering pollution to maintain materials in continuous use and encourage the renewal of natural systems [9]. Resource security and environmental sustainability can be enhanced by using EEE waste, which is regarded as one of the richest sources of secondary raw materials. The circular economy has the potential to have a big economic influence in the EEE industry. The complex and varied materials needed for EEE manufacture are resource-dependent. This forces the industry to adopt a more circular strategy. In addition to saving associated expenses, the sustainable and circular products will reduce e-waste output and improve resource recovery from e-waste [44]. This will relieve pressure on extraction, particularly for rare earth elements, which are primarily located in biodiversity-rich areas. Utilising resources responsibly and circularly can also help reduce greenhouse gas emissions and fulfil climate change objectives. Reducing conflict and displacement in mining areas as well as enhancing the health and welfare of nearby populations are possible outcomes of reduced extraction pressures brought about by the implementation of CE measures [21].

CIRCULAR ECONOMY BEST PRACTICES IN EEE SECTOR

Presidents and prime ministers in nations across the globe have stressed the need to embrace the circular economy model to achieve a secure and healthy physical environment, for the reason that they have realized from practicing legislation and regulations. Increasing numbers of governments also legislate the circular economy strategies, which is more like a transitional stage from the old linear economy to the new complete circular economy [19]. In practice, each country may have a unique understanding of the circular economy concept, which can be translated into a variety of policy implementation areas. China and the European Union's circular economy policies serve as examples [29]. The European Commission's Circular Economy Action Plan includes legislative and non-legislative measures aimed at promoting circular economy processes, fostering sustainable consumption, and ensuring that resources are used as long as possible in the EU economy [3].

E-WASTE REGULATIONS, POLICIES, LEGISLATIONS AND STANDARDS

International conventions, treaties, and agreements are regarded as one of the driving forces behind the establishment of national frameworks and providing a common point of reference for e-waste [20]. These provide a common platform for countries to begin the process of assessing their condition, establishing their needs, comprehending the socioeconomic and environmental implications, and developing a legislative framework to achieve the goals.

Table 1: Relevant Conventions for E-waste Management

Convention	Description
Basel Convention (Global)	The overarching aim of the Basel Convention is aimed at averting the effects of hazardous wastes on human beings as well as the biophysical environment. It covers a wide range of wastes that is categorized as "hazardous waste" given its source, content and the features they possess.. Its scope encompasses a broad spectrum of wastes classified as "hazardous waste" based on their origin, composition, and characteristics. It also includes two types of waste classified as "other wastes": home waste and incineration ash.

Stockholm Convention (Global)	The production and use of persistent organic pollutants (POPs) are to be prohibited or limited under this convention. POPs are persistent organic pollutants that have a negative influence on both the environment and human health over time. They are also resistant to environmental degradation. Governments have been urged to take action in response to the "alarmingly high levels" of specific POPs found in e-waste that are now entering the food chain near the locations where hazardous operations or burning of e-waste are conducted.
Bamako Convention (Regional)	This treaty, adopted by the Organisation of African Unity's Member States, went into effect in 1998 and aimed to prohibit imports and control the flow of hazardous wastes inside Africa. It arose from the necessity to address specific difficulties that the Basel Convention was unable to fully address. The pact barred all waste imports, with no exceptions, and offered a much stronger mechanism for preventing hazardous waste trade to developing countries.
Minamata Convention (Global)	<p>It is a United Nations Treaty with 128 signatories and 105 parties. Its purpose is to protect human health and the environment from human-caused emissions and releases of mercury and mercury compounds. Mercury's particular qualities make it appealing for use in material extraction and the creation of commodities such as electrical and electronic items, among other applications. Unintentional mercury emissions occur as a result of power generating, cement manufacture, and mining.</p> <p>The Minamata Convention specifies restrictions and reductions for a variety of industries, products, and processes that use, release, or emit mercury, as well as measures pertaining to the full life cycle of the metal.</p>

Table 2: Relevant Standards for E-waste Management

Standard	Description
European Electrotechnical Committee for Standardisation (CENELEC)	In Europe, CENELEC is in charge of standards in the field of electro-technical engineering. The EN 50625 Series of standards is intended to serve as Europe's WEEE treatment reference standard. It guarantees that the WEEE Directive is followed in the collection, transportation, and treatment of e-waste.
WEEE Label for Excellence (WEEELABEX)	The non-profit WEEELABEX organisation was founded to provide auditors with training on WEEELABEX standards and to encourage Member States to adopt these standards for improved e-waste management.

Electronic Product Environmental Assessment Tool (EPEAT) Standards from the USA.	EPEAT is the premier global ecolabel for the information technology (IT) industry. The EPEAT programme independently verifies manufacturers' claims, and the EPEAT online Registry contains sustainable products from a wider range of manufacturers than any other ecolabel.
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Table 3: Organizations Regulations and Infrastructure for E-waste Management.

Organization	Role
Department for International Development (DFID)	Commissioned research on sustainable management of e-waste in the off-grid renewable energy sector in Rwanda' and 'Electronic waste (e-waste) impacts and mitigation solutions in the off-grid renewable energy sector.
United Nations Development Programme (UNDP)	The Ministry of Environment, in conjunction with the Ministries of Health, Communications, and Information Technology of Egypt, is implementing a safe health and electronic waste management strategy to limit emissions of dangerous solid organic pollutants.
UN Environment	Through its Switch Africa Green project in Ghana, the EPA and the Ghana National Cleaner Production Centre collaborated to implement an e-waste project and build the Ghana e-waste model, which served as the foundation for the Hazardous and Electronic Waste Control and Management Act (2016). As a result, the Ghanaian government planned to establish an e-waste recycling factory at Agbogbloshie.
East African Communications Organisation (EACO)	EACO is preparing a five-year Regional E-Waste Management Strategy for its Member States. The approach will contribute to addressing the e-waste problem in the Member States in a sustainable and productive manner.
Southern African Development Community (SADC)	EACO is developing a five-year Regional E-Waste Management Strategy for its member states. The method will help to solve the e-waste problem in the Member States in a sustainable and productive way.
International Renewable Energy Agency (IRENA)	Prepared the 'End-of-Life Management: Solar Photovoltaic Panels' report in collaboration with the International Energy Agency Photovoltaic Power Systems Programme (IEA-PVPS).

EFFECTIVENESS AND CHALLENGES OF CURRENT REGULATIONS

The various countries and unions have evolved distinct methods to e-waste management, with differences in both statutory scope and tool efficacy [27]. In 2019, national e-waste legislation impacted 71% of the global population. However, just 13 African countries have national regulations governing the disposal of e-waste. One of the major problems to e-waste management in Sub-Saharan Africa is a lack of particular legislation, as most nations' current policies only address general hazardous waste and cannot prevent illegal e-

waste imports and recycling [18]. The 1989 Basel Convention, which has been signed by 181 countries, restricts the export of e-waste. Despite export laws, this convention contains a loophole that allows e-waste exporting if it is meant for "re-use." As a result of this detail, a substantial amount of EEE nearing the end of its life gets exported [6]. This shows that, despite existing legislation, unlawful e-waste importation occurs often due to inadequate adherence to and enforcement of rules.

European Union

The European Union (EU) has addressed e-waste issues and has enacted extensive and progressive e-waste regulations since the 1990s. The Waste Shipment policy (WSR), enacted in 1993 and revised in 2007, was the first specialised e-waste policy (Skinner, et al., 2010). It emphasises that no EU member state may export hazardous e-waste to non-OECD countries. Non-OECD countries are subject to various requirements. The EU passed the e-waste Directive / legislation in 2003 to change product designs, increase recycling rates of discarded WEEE, and restrict the use of certain hazardous compounds (RoHS) [32].

The East African Communication organization

The East African Communications group (EACO) is an autonomous group that brings together players from the telecommunications, television, and postal sectors in six East African countries. The working group on e-waste and counterfeit devices management seeks collaboration to: evaluate the quantity and impact of e-waste, identify best practices, and implement environmentally sound e-waste management solutions [13].

United State of America

There is no federal legislation directly targeting national management or WEEE export in the United States, hence segment-wise formulation and enactment of directives, legislations, and regulations has occurred [28]. As of now, there are just two federal regulations addressing e-waste and its export: The Resource Conservation and Recovery Act of 1976 (RCRA) and the Environmental Protection Agency's (EPA) CRT Rule. RCRA controls WEEE disposal only when the substance meets the act's definition of hazardous waste. Most e-waste that is disposed of in landfills in the United States does not fulfil this classification; when deconstructed abroad, exposure to toxins rises [8]. The EPA has established exemptions for the export of some hazardous products. Individual US states have begun to address their own e-waste through laws and effective management systems. Nearly 23 states have approved legislation to limit the disposal of specific categories of e-waste [12].

China

Over the last decade, the Chinese government has released a number of environmental legislation, regulations, standards, technical guidance, and e-waste management norms. Some examples include the Catalogue for Managing the Import of Waste; MEP, MOC, NDRC, GAC, and AQSIQ, 2009, No.36; Technical Policy on Pollution Prevention of WEEE (SEPA No.115); Ordinance on Management of Prevention and Control of Pollution from Electronic and Information Products (MIIT No.39); Administrative Measures on Pollution Prevention of WEEE (SEPA No. 40); and Regulation on Management of Recycling and Disposal of Waste Electrical and Electronic Equipment [44]. China is party to both the Basel Ban Amendment and the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, which is a multinational environmental pact [1].

Nigeria

The 1988 Koko incident case in Nigeria made the international community and the Nigerian government aware of the dangers of hazardous waste and the need for action to stop the flow when five ships carried 8,000 barrels of hazardous garbage from Italy to the Nigerian town of Koko [25]. The Nigerian government responded by enacting the Hazardous Wastes Decree. The legal foundation for the efficient management of toxic and hazardous waste disposal into any environment inside Nigeria's borders is provided by this decree. This led to the Federal Environmental Protection Agency (FEPA) being established as a regulating agency in 1988 [7]. Nigeria's standard working document for environmental preservation and conservation was created to expedite this process: The National Policy on the Environment. The proper methods of getting rid of the abandoned EEE, which is already creating a threat, have not, however, been sufficiently covered by Nigeria's EEE regulatory frameworks [23]. The administrative establishment of environmental regulatory organisations by State and Local Government Councils aimed to preserve high environmental quality in relation to their specific regions (NESREA, 2011). Although the NESREA Act does not specifically address e-waste, it is possible to include it under section 37's description of hazardous chemicals. The EIA Act was enacted as Decree No. 86 of 1992, with the intention of limiting the execution of public and commercial projects that lack a thorough evaluation of their environmental impact. The National Environmental (Sanitation and Waste Control) Regulations 2009 do not specifically address e-waste; however, end-of-life waste is defined as "a post-consumer waste product, appliances equipment, machinery that may have physical integrity but have lost its utility value" in part 7, section 106 of the Regulations.

Switzerland

Switzerland has been a pioneer in e-waste management regulations [15]. The Swiss Federal Office for the Environment (FOEN) enacted the Ordinance on the Return, Taking Back, and Disposal of Electrical and Electronic Equipment (ORDEE) in 1998 [40]. Voluntary initiatives by producers, forerunner to PROs, began prior to the legislation, establishing formal e-waste collection and management.

India

The rapid development of e-waste has become a challenge for environmental performance in a country with a large population density, such as India [11]. Guidelines for Environmentally Sound E-Waste Management (2008). This guideline was initiated by the Government of India and endorsed by the Ministry of Environment and Forests and the Central Pollution Control Board. It classified E-waste based on its many components and compositions, with a focus on E-waste management and treatment procedures. The guideline included notions like "Extended Producer Responsibility". Hazardous Wastes (Management and Handling) Amendment Rules, 2003. E-waste in India is governed by the E-Waste (Management) Rules, 2016, which were issued by the Ministry of Environment, Forests, and Climate Change (MoEF&CC) on October 1, 2016. These rules have succeeded the previous version, the E-waste (Management and Handling) Rules, 2011, which took effect on May 1, 2012.

Ghana

Ghana has many environmental laws, but none that specifically address recycling e-waste [17]. The EPA established a National Working Group in 2005 to assist in developing a plan for recycling e-waste, but the results of their discussions have not yet been made public. Nonetheless, Ghana has ratified the Basel Convention, which aims to establish a framework for global e-waste regulations [22].

Uganda

One goal of Uganda's draft national IT policy is to address e-waste. The creation and implementation of an e-waste policy is indicated under Policy Priority area 2.7. Solid waste management in general is covered by the National Environmental Act, Cap. 153, which makes provisions for a sustainable environment [31]. Regarding e-waste, it is mute. Uganda is able to ratify international conventions pertaining to e-waste through the Ratification of Treaties Act 5/1998, which lays out the process for doing so in line with article 123 of the Constitution. This treaty allows Uganda to participate in international e-waste conventions. These include the Basel Convention on the Control of Transboundary Movements and Disposal of Hazardous Wastes, the Stockholm Convention on Persistent Organic Pollutants, and the World Charter for Nature [24].

Kenya

None of the current environmental legislation make a direct reference to the disposal of electronic or electrical waste [37]. However, measures enacted under the Environmental Management and Coordination (Waste Management Regulations) Regulations 2006 may apply to electronic waste that is classed as hazardous waste. Kenya has signed several environmental agreements and treaties. Kenya has ratified the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal and is a party to the Rio Declaration on Environment and Development (1992). Among other declarations and statements of principle, Kenya has supported the provisions of Agenda 21. The Environment Management and Coordination Act of 1999 is an Act of Parliament that enables the minister responsible for the environment to enact standards, regulations, and guidelines for the appropriate management, conservation, and protection of the environment [16]. .

Conclusion

The current legal frameworks for e-waste management that attempt to promote circular economy practices are admirable in their intent, but they are unable to adequately handle the complexity of the issue. Once again as earlier observed some Acts can be measured and compared it is evident that no support of the sectors and employment of economic instruments makes it difficult to implement numerous Acts, Regulations and Rules that may exist. It is a loss that may cause non-compliance to be constantly prevalent and put the country at the receiving end where the black market and informal segments reign supreme. To summarise, it is really significant to stress that its updating to the context of the present-day society is rather important to continuously preserve the environment, support the principles of eco-friendliness and sustainability, as well as provide the proper, clean, and safe environment for every person..

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