

ANALYSIS OF WEEE LEGISLATION WORLDWIDE

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Abstract: Improper handling of WEEE causes severe environmental pollution and adverse human health effects. This study investigates global environmental legislation and the proposal of innovative solutions to minimize the quantities of waste electronic and electrical equipment and highlight the illegal shipments of waste electronic and electrical equipment to developing countries. Policy formulation and implementation are often an integral part of the strategic framework that helps countries cope with domestic problems. It provides a systematic approach to addressing problems in a legally and nationally coherent manner. Only a third of this waste electronic and electrical equipment is currently subject to WEEE legislation, an important step in the elimination of WEEE. National laws on electronic waste are designed to address country-specific issues. In most cases, the law is not holistic and raises different administrative issues. Thus, a general law should be implemented with regard to waste electronic and electrical equipment, and it is also necessary to make regular changes to address the deficiencies identified by regular systematic reviews.

Keywords: legislation, waste electrical and electronic equipment, pollution, illegal transport, circular economy

1 INTRODUCTION

Technological advances have created enormous amounts of electronic and electronic waste. This amount is growing rapidly as the demand for a technology-dependent lifestyle increases. Consumers are also replacing their products more and more often, and the useful life of these devices is decreasing. Therefore, the number of electrical and electronic products thrown away every year is increasing, which

means that all these discarded products become waste, and their amount increases from year to year.

In order to tackle the environmental issues related to the control and administration of this type of waste electrical and electronic equipment, since the 80s/90s, the states belonging to the European Union have begun to develop international legislation specializing in the management of waste electrical and electronic equipment. As a result of these

arguments, European Directive 2002/96/EC was implemented, which in turn, due to the growth in considerable quantities of waste electrical and electronic equipment, was updated, with the result that Directive 2012/19/EU entered into force on 13 August 2012.

Unfortunately, both developed, and less developed countries have problems with the management, recycling and reuse of waste electrical and electronic equipment (Druta et al., 2021). Indeed, this is also because, in most developing countries, the e-waste collected includes electronic waste generated both locally and electronic waste imported illegally from developed countries (Widmer et al., 2005).

In order to better manage the environmental problems of WEEE in Europe, Directive 2012/19/EU requires a separate collection of waste electrical and electronic equipment, which, it is necessary to be ensured by convenient programs so that users can quickly dispose of this electrical equipment.

Thus, in order to solve the problem of increasing electronic waste and using it correctly, many countries have adopted laws on electronic waste.

According to the global report on the monitoring of electronic waste, it indicates that just 66% of the world's population, specifically 67 countries, have laws on electronic waste (Balde et al., 2017). In contrast, many African countries have no e-waste laws, yet Africa produces the least amount of e-waste (Balde et al., 2017). Against this background, however, illegal imports of e-waste for crude oil processing have become a problem in Asia and Africa.

The European Union has initiated regulatory guidelines on electronic waste for Member States to ensure the safest possible administration of electronic and electrical equipment waste.

2 E-WASTE LEGISLATION AROUND THE WORLD

Policy formulation and implementation is often an important part of the strategic framework that helps countries deal with domestic problems. It provides a systematic approach to solving a problem from both a country's legal and social point of view. In 2019, 54 million tons of electrical and electronic waste were accumulated (Forti et al., 2020), up by 45 tons compared to 2016 (Baldé et al., 2017), this corresponds to an overall medium of 7.3 kg/person/year. Sources say that this production will increase considerably by 75 tons per year by 2030. (Forti et al., 2020). Thus, it is attested that it is indeed an enormous challenge to develop strategies for the effective management of WEEE globally. All over the world, different methods and scenarios of WEEE management are emerging from one region to another.

2.1 *Legislation on electronic waste in Europe*

The European Union has implemented legislation on waste electrical and electronic equipment so that all Member States have as clear a record as possible of the importance of managing this waste as efficiently as possible and also, protecting the environment and people's health.

In Romania, the emergence and development of the waste management system for electrical and electronic equipment was driven by the need to comply with the Directives of the European Commission. This legislation is currently described in Directive 2012/19/EU. The fundamental objective of the directive is to decrease the generation of waste electrical and electronic equipment by promoting and improving environmental performance.

As this is a European Union directive, each Member State must draw up different programs and methods to comply with the recycling, collection and disposal targets set by the directive (Păcurariu et al., 2021). Thus, that directive contains 10 classes of electronic and electrical equipment and as follows:

1. IT and telecommunications equipment

Included in this category are components and accessories of computers such as laptops, mouse, processors, video payments, but also phones, whether they are mobile or not.

2. Small household appliances

This includes small appliances that are intended for personal care, such as clippers, shaving machines, epilators, hair dryers, toothbrushes, etc. They are also joined by cleaning appliances such as irons, vacuum cleaners, also a type of equipment that falls into the category of small appliances are the appliances used in the kitchen, for example coffee machines, toasters, fruit juicers, etc.

3. Large household appliances

The category is represented by large cooling equipment, such as refrigerators, freezers, refrigerated crates, including large appliances used for the refrigeration process, which are joined by washing machines and dishes, tumble dryers, electric hobs, microwave appliances, etc.

4. Monitoring and control tools

This category includes smoke detectors, thermostats, heating regulators such as other equipment for measurements such as scales.

5. Photovoltaic panels and consumer equipment

This cataclysm includes television equipment, radio equipment and other equipment which are used for reproducing or recording sound or image.

6. Instruments Electrical and electronic (excluding stationary industrial tools)

This category includes equipment for cutting, milling, polishing, welding equipment, spraying equipment, and also electrical equipment used in gardening.

7. Leisure equipment, sports equipment and toys

This category includes a lot of types of electrical and electronic sports equipment, video games, various electric toys such as cars, trains, etc.

8. Medical equipment (excluding infected and implanted products)

This includes all the electrical and electronic equipment used for medical procedures, from various branches. Some examples: parathitis used in cardiology, ventilators, radiotherapy or dialysis devices, along with other devices used to detect, analyze, treat various diseases or monitor patients.

9. Lighting equipment

This includes luminaires for fluorescent lamps, halogen lamps, or other devices for diffusing or directing light.

10. Automatic dispensers

Dispensers and vending machines of food, hot or cold drinks, soap, disinfectant, thus, the appliances that automatically deliver different products.

Directive 2002/96/EC is established on the principles of Extended Producer Responsibility (EPR). This principle constrains manufacturers (manufacturers, importers) of electronic and electric equipment to collect and dispose of this in an amicable way this type of e-waste.

Following this, the aim of 4 kg of WEEE collected per person/year was approved. The implementation of this directive has led to various significant conflicts between Member States in terms of the technical and legal basis for the treatment and collection of waste electronic

and electrical equipment. In order to solve these problems, the waste electrical and electronic equipment directive was revised in 2012. This amendment is intended to clarify the scope of concern and set new objective for the collection, recycling and reuse of electronic and electrical waste for each Member State (European Union, 2012). In parallel, the Directive initiated the objective of making each Member State bear 45% of the weight on electronic and electrical equipment launched on the market over the last three years (Yla-Mella et al., 2015).

As of 2019, the minimum collection limit is 65% of equipment that has entered the retail trade in the last 3 years or for each Member State a percentage of 85% of the waste electrical and electronic equipment generated. According to a recent study conducted by Eurostat (Eurostat, 2020), in 2019, a Romanian owned about 91 kg of WEEE, with an increase of about 20 kg compared to 2015, but less by a percentage of 50% compared to a person in Italy or France.

At the same time, for an environmentally sound processing, the directive can also observe the objective of treatment procedures for electronic and electrical electronic equipment and its components, as well as the storage space. At the same time, the directive supports extended producer responsibility, where producers can take responsibility for the recycling of end-of-life products they own.

Another extremely important thing that is found in Directive 2012/19/EU, is one in which there is talk about the reuse of products, that is to say, it is recognized that the re-use operation should be carried out and preparation for re-use should be more common in the management of waste electrical and electronic equipment. At the same time, the preparation for reuse of waste within the Waste Hierarchy is placed before the recycling procedure. As regards hazardous substances, Directive 2002/95/EC of 2004 mainly concerns the application of toxic substances and persistent organic pollutants e.g. lead, mercury and cadmium in the manufacture of products.

Currently, European legislation on WEEE is divided as follows:

- European Directive 96 of 2002 on waste electrical and electronic equipment;
- WEEE Directive (2012/19/EU) on waste electrical and electronic equipment (WEEE);
- EP Directive 65 2011 on restrictions on the use of certain hazardous substances in electrical and electronic equipment;
- REGULATION (EU) NO 11032010 of the Commission on capacity for secondary (rechargeable) and automotive portable batteries and accumulators;
- Commission Implementing Regulation (EU) 2017/699 of 18 April 2017 establishing a standard methodology for calculating the weight of EEE and WEEE;
- Directive 2006_66_2007 on batteries and accumulators and waste batteries and accumulators.

The country that introduced for the first time in the world an official operating program of waste electronic and electrical equipment was Switzerland (Duygan & Meylan, 2015). Also known as the Swiss Foundation for Waste Disposal (SENS), it is the first Swiss electrical and electronic waste disposal system (EPR) that collects waste on behalf of manufacturers and distributors.

For starters, just collect refrigerators and freezers, then expanded for collecting a wider range of household electrical and electronic equipment (Ongondo et al., 2011).

In Germany, prescriptions were introduced by the Law on the placing on the market, return and environmental cancellation of electrical and electronic equipment through the program called 'ElektroG' (Walther et al., 2009). Manufacturers are also required to register with the Waste Electrical and Electronic Equipment Registry. (Rotter et al., 2011).

Prior to the existence of the WEEE Directive, Finland followed a producer responsibility

scheme for packaging waste, monitoring tires, and waste paper (Ylä-Mella et al., 2014). Thus, the WEEE Directive in Finland was harmonized with the legislation already existing in the country to provide a framework for the management of waste electrical and electronic equipment. The Amendment Act (Waste Law 452/2004) requires manufacturers to ease the release of WEEE entering their systems, including recycling and recovery and requires recovery activities, including recycling and disposal.

The smallest country generating waste electrical equipment in Europe, according to statistical data, is Albania, which generates 20 KT of waste electrical and electronic equipment annually, 0.6 kg per person per year (Baldé et al., 2017). And on the other hand, the country that generates the largest quantity of waste electronic and electrical equipment in Europe is Slovenia, it generates 33 KT annually with an average of 16.1 kg per person per year.

2.2 *Electronic and Electrical Equipment laws in Asia*

The Waste Electrical and Electronic Equipment Act came into effect in India in 2012. (Handling Rules and E-waste Management) (Turaga & Bhaskar, 2017). This focuses on the EPR principle. Their scheme requires producers to meet the collection targets set to to grow recycling and collection rates in countries where the WEEE sector is still largely informal (Turaga & Bhaskar, 2017). Thus, 95% of the recycling process takes place informally (Awasthi et al., 2016). The regulations require producers (even dismantlers and recyclers and) to enroll in environmental agencies that are administered at national level.

The regulatory bodies named under the name of the State Commissions for Pollution Control (SPCB) are answerable for issuing authorizations for the collection and treatment of waste electronic and electrical equipment. This regulation has also been amended, the

amendment consists of setting new similar objectives to those in the European Union Directive. This change has led to a growth in the number of plants for the treatment of waste electronic and electrical equipment.

Japan was a worldwide pioneer in introducing an EPR-based waste management structure for electronic and electrical equipment (Baldé et al., 2015; Sugimura & Murakami, 2016; Forti et al., 2020). At the same time, in 2021, the law on the recycling of waste electronic and electrical equipment renamed the law on recycling of household appliances (HARL) was implemented, which focuses on household appliances like washing machines, TVs and air conditioners which account for the largest share of electrical and electronic equipment in terms of volume and weight (Zhang & Kimura, 2006; Ongondo et al., 2009).

2.3 *Legislation on the management of waste electrical and electronic equipment in Africa*

In 2019, about 2.9 tons of WEEE appeared in Africa, the biggest amount coming from West Africa Forti et al., 2020). In addition, most developed countries export large quantities of WEEE from developed countries. Also, huge amounts of WEEE are exported because they are not functionally tested before being exported.

In many African countries there is no legislation specific to waste electrical and electronic equipment, or even if it exists it is not properly enforced, but various international agreements are found, as the Bamako Conventions and the Basel Convention, which focus more on controlling the transport of waste electronic and electrical equipment (Li et al., 2013; Snyman et al., 2015).

Algeria produces 252 KT of waste electrical and electronic equipment, an average of 6.2 kg/person per year, making it the principal emitter of waste electronic and electrical equipment in Africa (Campen & Enders, 2016;

Baldé et al., 2017). In addition, it does not have specific legislation for waste electronic and electrical equipment, nor does it register the collected waste. Instead Rwanda in 2012 drew up a policy on the administration of waste electronic and electrical equipment that is established on the EPR principle, but the development of the framework is still ongoing (Campen & Enders, 2016).

2.4 *Electrical and Electronic Equipment laws in America*

Canada does not have a federal WEEE law, they are managed under a control program called Electronic Product Stewardship Canada (EPSC), a program managed by private individuals (Baldé et al., 2017; Kumar & Holuszko, 2016). US WEEE disposals vary from state to state simply because there are no federal WEEE laws.

Since 2003, California has followed a management system, establishing and adopting a management system that provides for the financial responsibility of consumers of electronic and electrical equipment for the management of EoL (Li, 2011).

There are two certification programs in the U.S. on the recycling of waste electronic and electrical equipment, namely: the Responsible Recycling Standard for Electronic Recyclers (R2) which is managed by Sustainable Electronics Recycling International (SERI) and E-Stewards program which in turn is led by the Basel Action Network.

Also, in the US, there are various schemes regarding the management of waste electronic and electrical equipment, for example the National Strategy for Electronic Administration (NSES). This strategy aims to promote the EoL management of waste electrical and electronic equipment, reduce exports of waste electronic and electrical equipment to developing countries and stimulate environmentally friendly design in the manufacture of electronics (US-EPA, 2017).

3 DISCUSSIONS AND CONCLUSIONS

The administration of WEEE in Europe has evolved substantially since the European Union Directive on waste electronic and electrical equipment (WEEE) was transposed into member states' national legislation.

The introduction of this Directive has enabled Member States to introduce various instruments to eliminate electronic and electrical waste. The recast Directive 2012/19/EU on waste electronic and electrical equipment aims to increase recycling and reuse rates for electronic and electrical equipment launched in the market. According to the data analyzed, the frameworks determined in the Directive have made Europe the world's leading recycler of waste electrical and electronic equipment, with an average 42% of recycled waste (Forti et al., 2020). Around 5.1 tons were recovered out of a total of 12 tons generated in Europe in 2019. For example, European countries like Sweden and Finland are above the European average for the collection of waste electronic and electrical equipment, namely 55% and 69% respectively (Eurostat, 2017), although in Eastern Europe the collection rates are lower.

Unfortunately, we do not encounter a standard model containing uniform regulations for the elimination of WEEE in developed and developing countries, and scenarios vary from country to country. Thus, a general law should be implemented with regard to waste electronic and electrical equipment, and it is also necessary to make regular changes to address the deficiencies identified by regular systematic reviews. The most important rule of policy on waste electrical and electronic equipment should be to stop the import and export of waste electrical and electronic equipment, and impose harsh penalties for illegal shipments. In order to have an environmentally sound and effective management of waste electrical and electronic equipment depends to the greatest extent on the availability of data on electrical and electronic equipment placed on the market on

consumption, and on its generation. We suggest that more countries adopt and implement official data reporting on waste electrical and electrical equipment to ensure robust and efficient administration.

For each ton of e-waste that is properly recycled and collected 1.44 tons of CO₂ emissions are shunned, according to WorldLoop, which is committed to sustainably disposing of e-waste (WL, 2013).

Thus, we believe that manufacturers must implement the principles of the circular economy from the design to the end of service life of waste electrical and electronic equipment. A circular economy can reduce system-wide environmental degradation while increasing a new generation of value (Lakatos et al., 2018). This includes reusing, remanufacturing, reprocessing to extend product life and recovering old products as secondary raw materials (Stahel, 2016).

Studies also show that there is interest in how to manage waste electrical and electronic equipment. Also, the methods of treatment and disposal are constantly evolving and are also supported by the legislative framework so that the environmental objectives that have been proposed in the regulatory framework can be achieved. Studies also show that the European Union is making the greatest efforts to align itself with international standards and has provided the necessary legal framework for Member States implement waste management projects at the level of each signatory.

So the formulation and implementation of policies are often an integral part of the strategic framework that helps countries cope with internal problems. About 2/3 of the world's population is covered by laws on waste electrical and electronic equipment.

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