

An Overview on Key Players of E-Waste and Available Treatment Options of E-Waste – a Review

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ABSTRACT

A variety of products having electric and electronic components are referred to as "e-waste." E-waste is a word used to describe outdated electrical and electronic equipment. Examples include computers, televisions, mobile phones, printers, and white electronic gadgets like refrigerators. Several toxic or harmful materials are known to be present in e-waste, and if they are released during processing, recycling, or disposal, they pose a serious threat to the environment and public health. The mechanisms in place for managing and collecting e-waste, as well as the processes and activities involved in collection, treatment, and disposal, are examined in this proposed research project.

Keywords : E-Waste , Electric products, Electronic products, Recycling, Disposal , Environment

I. INTRODUCTION

The term "e-waste," short for "electronic garbage," is used to characterise abandoned and out-of-date electrical equipment, such as computers, laptops, TVs, radios, and refrigerators. E-waste is made up of a variety of useful but potentially toxic materials that could impair people's health. If the proper procedures and safety precautions are not taken, recycling e-waste could be dangerous. E-waste is defined as electrical and electronic equipment that has been rejected during the production, refurbishment, or repair process and has been left behind as trash, in

whole or in part, by the consumer or a large consumer. All electrical and electronic equipment that has been dumped by its owner is referred to as "e-waste". The term "waste" in this case denotes that the product has reached the end of its useful life. E-waste includes both little things like electrical wires and big things like refrigerators—anything that is no longer in use. We can categorise e-waste into the following groups to give you a clear notion.

1.1 Sources of e-waste

The term "e-waste" refers to a variety of items that are electronic in nature, including toner, ink cartridges, batteries, rechargeable batteries, digital calculators and clocks, CRT monitors, electric solders, computer mother boards, keyboards, old cell phones, cameras, CD players, TVs, radios, drillers, fax machines, photocopiers, printers, fans, air conditioners, grinders, irons, and industrial and household electronic equipment.

1.2 E-waste HAZARD

E-waste is not necessarily dangerous. But, when e-waste is broken down and processed, the potentially dangerous parts make it harmful because only then do they endanger the environment and public health. Even while electronics and electrical equipment appear to be effective and ecologically benign, when they are turned into e-waste, they actually have hidden issues. Because of the hazardous materials they contain and the rapidity with which we replace out-of-date technology, electronics items constitute a significant threat to human health if they are not properly handled before disposal. Many poisons are found in electronic equipment like computers and cell phones. For instance, heavy metals like lead, barium, and cadmium, which can be exceedingly dangerous to human health if they enter the water system, are found in the cathode ray tubes (CRTs) in computer monitors. These substances may have an impact on a person's nervous and respiratory systems. Electronics enclosures made of flame-resistant polymer spew particles that are bad for endocrine systems in people. If unprocessed e-waste is disposed of in a landfill without first being recycled, these kinds of things may occur.

E waste toxins affecting body parts

COMPONENTS	CONSTITUENTS	AFFECTED BODY PARTS
Printed circuit boards	Lead and cadmium	Nervous system and kidney
Mother boards	Beryllium	Lung and skin
CRT Cathode ray tubes	Lead oxide , barium & cadmium	Heart, liver and muscles
Switches and flat screen monitors	Mercury	Brain and skin
Computer	Cadmium	Kidney, liver
Cable insulating	PVC Polyvinyl chloride	Immune system
Plastic housing	Bromine	Endocrine system

Table 1 . E-waste toxins affecting body parts.

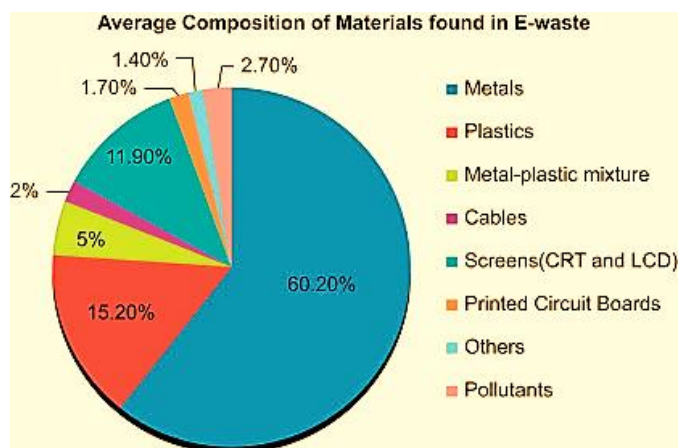


Figure 1 . Composition of Materials found in E-Waste

II. MARKET OVERVIEW

The global e-waste management market had a revenue holding of **USD 56.56 billion in 2021**. It is expected to reach **USD 189.8 billion by 2030**, growing

at a **CAGR of 14.4%** during the forecast period (2022-2030). Electronic garbage, sometimes known as "e-waste," refers to outdated electronics and electrical equipment. E-waste includes used electronics for recycling through material recovery, refurbishment, resale, reuse, or disposal. In industrialized and emerging nations, e-waste is one of the waste sources that is expanding quickly. Electrical, electronic, and consumer electronic equipment shorter lives are producing a lot of e-waste, increasing quickly every year.

3.1 Global E-Waste Management Market Restraints (High Recycling Cost)

E-waste recycling is problematic due to a lack of facilities for collecting it and the high cost of processing methods. Many outdated products are thrown away or stored in warehouses and storerooms since there is no framework in place to stop this. To address the issue, a system for routine e-waste collection must be created. The absence of waste pickup zones hinders recycling efforts. Moreover, waste is needlessly disposed of since consumers are uninformed of these drop-off locations, such as by using conventional techniques like burning. This leads to pollution and health problems.

3.2 Global E-Waste Management Market Opportunities (Initiatives by Electronic Manufacturers)

Today's manufacturers of electronic goods are well aware of the financial advantages of processing and recycling e-waste. Significant volumes of e-waste are generated throughout R&D and production operations, and businesses are taking steps to recover the vital components from this rubbish. Some of the valuable metals that can be retrieved from outdated cell phones include gold, silver, and palladium. Many of the largest cellphone producers have started their

own programmes to gather old phones from customers who want to upgrade their technology.

III. KEY PLAYERS OF E-WASTE

1. Waste Management Inc.
2. Capital Environmental Holdings Ltd.
3. Electronic Recyclers International, Inc.
4. Enviro-Hub Holdings Ltd.
5. Sembcorp Industries Ltd.
6. Veolia Environment SA.
7. Mri (Australia) Pty Ltd.
8. Tetronics (International) Limited
9. UMICORE SA and TES-AMM

2. Safe Treatment & Disposal of E-waste

1. *Secured land-filling*
 2. Insinuation
 3. Recycling
 4. Metal recovery by acid
 5. Reuse

5.1 Secured land-filling

The e-waste is built on flat land and the pits are pressed into the soil by putting the e-waste in it. Should be pressed.

5.2 Insinuation

In this technique, e-waste is heated to temperatures between 900 and 1000 degrees Celsius in a completely sealed chamber inside the insulator. As a result, both the volume of e-waste and the toxicity of the organic material it contains have been decreased. The Air Pollution Control System (APCS), which separates the various types of metals present in the smoke by chemical action, treats the gases together with the smoke and gas that escape the injector's chimney.

5.3 Recycling

Electronic garbage, including outdated computers, phones, keyboards, hard drives, Disc drives, fax

machines, printers, CPUs, picture tubes, modem cables, and other devices, can be recycled. This technique involves the autonomous destruction and preservation for reuse of various metals and polymers.



Figure 2. E-Waste Recycling

5.4 Metal recovery by acid

Electronic waste is separated from printed circuit boards, ferrous and non-ferrous metal, and other parts. Concentrates are used to recover all types of metals, including lead, copper, aluminium, silver, gold, and platinum. Waste plastic that can be recycled is discarded.

5.5 Reuse

Repaired and reused electrical equipment is available. Reusing products appropriately applies to computers, mobile phones, laptops, inkjet cartridges, inverters, LCD televisions, UPS systems, printers, and other devices. You may easily dispose of, recycle, and reuse your e-waste by using the five methods mentioned above. This not only enables recycling but also contributes to a healthy and safe environment.

IV. PROPOSED SOLUTIONS TO THE PROBLEM OF E WASTE

These e-waste importing gaps should be closed by domestic law.

- The need for secure rubbish disposal at home.
- The issue of imported E trash for recycling and reuse must be addressed by the Framework.

- Mix recycling and product return.
- Encourage financial investment in this industry.
- Ways to merge activities in the informal and formal sectors include developing proper ESM recycling technology
- Utilizing preventive measures, and adhering to the polluter pays principle.
- Make sure the company you choose has the ability to handle either sort of E-Scrap and insist on domestic processing.
- Establishing duties and responsibilities for recyclers
- Determining duties and responsibilities for recycling units
- Distributing recycling awareness programmes
- Training generators on how to handle e-waste
- Offering tax incentives to scrap dealers,
- Implementing reward and reprimand schemes for performance and non-compliance of e-waste management are all ways to promote recycling units.

V. CONCLUSION

The recycling process for electronic waste entails the tasks of collection, segregation, and disassembly. Large-scale upgrades and repairs, which are crucial for major electrical and electronic appliances, also contribute to the objects' longer lifespans. Little electronic waste equipment and non-metallic parts are frequently thrown away since recyclers don't care about them. To solve this problem, efforts may be made to find viable replacement uses for the non-metallic fractions, particularly plastics given their widespread availability.

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