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Understanding e-waste: Concerns and Measures

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Abstract

Tremendous Growth in the ICT (Information and Communication Technology) sector has exponentially increased the usage of electronic goods and equipments all over the world. Although, subsequent up-gradation coupled with faster obsolescence of electronic products compel the user to discard them in a comparatively shorter time. This leads to piling of what is termed 'e-waste or electronic waste' into the waste stream. As per UN's Global E-Waste Monitor 2020, in 2019, record **53.6 million metric tonnes** (Mt) of electronic waste was generated worldwide, up 21% in just five years. In India the rate of growth has been estimated to be at 10% (Electronic Waste and India). But the issue does not only lie with the generation of e-waste. Lack of proper legislation, management and recycling are adding to the burden. This paper is an analytical research to understand the growing trend in e-waste along-with measures adopted globally as well as in India to control this menace.

Keywords: E-waste, Recycling, Environmental Sustainability, Pollutants

Introduction

All waste from electronic and electrical devices that have reached their end-of-life or are no longer suitable for their original intended use and are intended for recovery, recycling, or disposal is referred to as "e-waste." (E-WASTE IN INDIA RESEARCH UNIT (LARRDIS) RAJYA SABHA SECRETARIAT NEW DELHI, 2011). Regardless of economic and societal variables, waste management is posing a problem for both emerged and emerging economies. India is an emerging economy that boasts one of the world's largest markets for electronic goods. Even though these products have a longer lifespan in India than in industrialised countries, the country's size and population nonetheless contribute to a higher volume

of consumption and disposal. A new environmental concern has arisen as a result of the consumer-targeted growth strategy, quick product obsolescence, and technical advancements: the threat of "Waste Electrical or Electronic Equipment (WEEE)" or "e-waste," which is made up of outdated electronic products (Prasanna Bhat & Savale).

E-waste is generally misunderstood to be hazardous. While in fact e-waste is not hazardous if stocked following all safety procedures, transported in parts, recycled using scientific methods or properly handled in the formal sector at all stages of its lifespan. However, the e-waste, if recycled informally using crude techniques, can prove harmful to both physical and human environment. Several materials found in e-waste, including heavy metals, plastics, glass, etc., have the potential to be poisonous and dangerous to both human health and the environment if not disposed of in an environmentally responsible way. Recycling e-waste in the informal sector using crude techniques might harm the environment (Electronic Waste and India).

Pollutants in e-waste

Circuit boards, batteries, plastics, and LCDs tend to contain the highest concentrations of pollutants or toxins in e-waste (liquid crystal displays). The primary contaminants found in used electrical and electronic equipment are listed in the table below (E-WASTE IN INDIA RESEARCH UNIT (LARRDIS) RAJYA SABHA SECRETARIAT NEW DELHI, 2011):

Cadmium and lead in circuit boards, lead oxide and cadmium in CRT monitors, mercury in switches and flat-screen monitors, cadmium in computer batteries, polychlorinated biphenyls in older capacitors and transformers, and brominated flame retardants on printed circuit boards, plastic casings, cables, and PVC cable insulation that, when burned, release highly toxic dioxins and furans are just a few of the toxic materials found in electronic waste. Many of these chemicals are poisonous and cancer-causing (E-WASTE IN INDIA RESEARCH UNIT (LARRDIS) RAJYA SABHA SECRETARIAT NEW DELHI, 2011).

Table 1 Pollutants and their occurrence in waste electrical and electronic equipment (E-WASTE IN INDIA RESEARCH UNIT (LARRDIS) RAJYA SABHA SECRETARIAT NEW DELHI, 2011)

Pollutant	Occurrence
Arsenic	Semiconductors, diodes, microwaves, LEDs (Light-emitting diodes), solar cells
Barium	Electron tubes, filler for plastic and rubber, lubricant additives
Brominated flame-proofing agent	Casing, circuit boards (plastic), cables and PVC cables
Cadmium	Batteries, pigments, solder, alloys, circuit boards, computer batteries, monitor cathode ray tubes (CRTs)
Chrome	Dyes/pigments, switches, solar
Cobalt	Insulators
Copper	Conducted in cables, copper ribbons, coils, circuitry, pigments
Lead	Lead rechargeable batteries, solar, transistors, lithium batteries, PVC (polyvinyl chloride) stabilizers, lasers, LEDs, thermoelectric elements, circuit boards
Liquid crystal	Displays
Lithium	Mobile telephones, photographic equipment, video equipment (batteries)
Mercury	Components in copper machines and steam irons; batteries in clocks and pocket calculators, switches, LCDs
Nickel	Alloys, batteries, relays, semiconductors, pigments
PCBs (polychlorinated biphenyls)	Transformers, capacitors, softening agents for paint, glue, plastic
Selenium	Photoelectric cells, pigments, photocopiers, fax machines
Silver	Capacitors, switches (contacts), batteries, resistors
Zinc	Steel, brass, alloys, disposable and rechargeable batteries, luminous substances

India: e-waste Statistics

There is currently no factual data on the generation or import of e-waste in India. Several studies have been carried out by different entities to determine the amount of e-waste present/generated in the nation. Majority of these research are based on the model of electronic product obsolescence, which requires validation with actual field data (Electronic Waste and India). E-waste is growing in India at the rate of 10%. By 2015, the amount of e-waste will be close to 0.7 million metric tonnes, and by 2025, it will be 2 million MT (Electronic Waste and India).

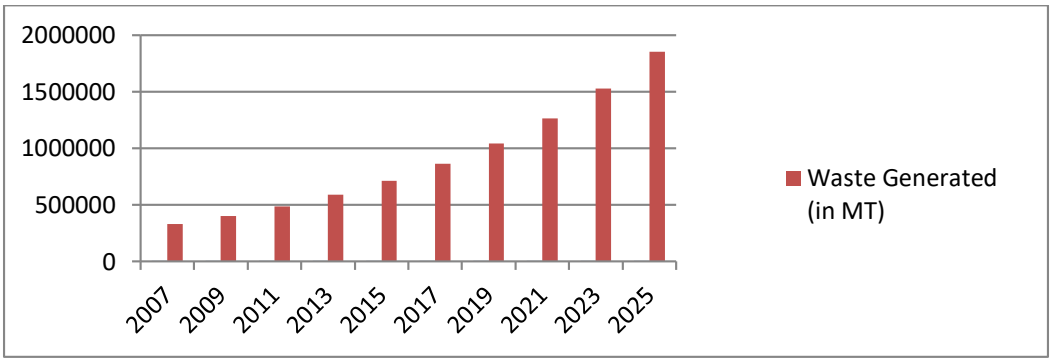

Figure 1 Growth of e-waste in India (Electronic Waste and India)

Among the top ten e-waste generating cities, Mumbai stands first followed by Delhi, Bengaluru , Chennai, Kolkata, Ahmedabad , Hyderabad , Pune, Surat and Nagpur . The authorities public and private sectors acting as primary sources of e-waste accounts for 70 % of e-waste, individual families make a contribution of around 15% and the balance 15% is produced by manufacturing industry (Prasanna Bhat & Savale)

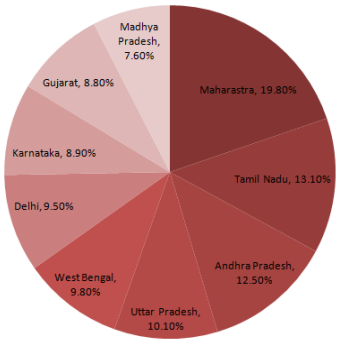

Figure 2 e-waste generation in India – State-wise (Electronic Waste and India)

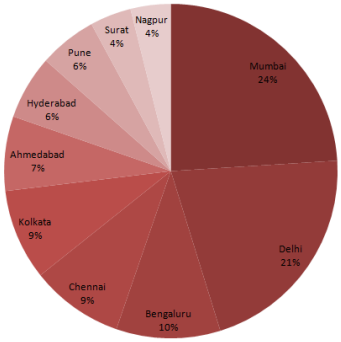

Figure 3 e-waste generation in India - City-wise (Electronic Waste and India)

Complex Management and Value Chain of e-waste

E-waste management is more complex than the household solid waste. Producers and manufactures have producing units as well as they also carry out research and development for new products. The product or parts may be imported. Similarly consumer either buys locally or imports own their own (Rode, 2012).

The percentage of imports is comparatively low. But companies may take returns in case of damage or non-functioning of products. Or they may exchange consumers old product for a newer one. Retailers occasionally only receive outdated merchandise. Secondary

markets, and especially computers, provide social advantages since they increase living standards by making commodities accessible to those with modest incomes. Low income in developing countries like India promotes creation of an informal sector due to economic constraints and demand. However, India's supply of new products and the market for its old ones are both restricted. It happens because goods are bought in one place and used in another. Second, transporting the commodity is expensive and the actual financial worth of used goods is poor. As a result, electronic devices are simply dumped in the trash (Rode, 2012).

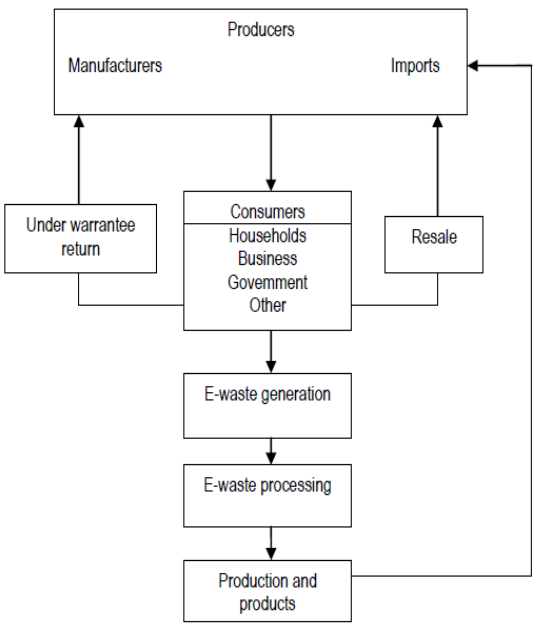

Figure 4 e-waste Value Chain (Rode, 2012)

This waste if segregated could become a mining treasure. However, technological limitation is present. Lack of legislation, awareness deficiency in relation to environment, social and economic aspect, among public, institutions, producers poses a challenge. The availability of skilled manpower for recycling and adequate technologies is limited in region (Rode, 2012).“E-waste is often a misunderstood black box. If recycled properly, it is an urban mining treasure” (E-waste Roadmap 2023 for India).

Management Agenda: World and India

The 2030 Agenda for Sustainable Development, adopted by all UN Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries developed and developing- in a global partnership ("Supporting the 2030 Agenda for Sustainable Development by enhancing UN system-wide collaboration and coherent responses on environmental matters" United Nations System-wide Response to Tackling E-waste, 2017).

India participated in the UNCHE 1972 and enacted the EPA 1986 for the protection and improvement of human environment. India is also a ratified member of the Rio Conference 1992. The management of e-waste is a step in line with fulfilling the SDGs ("Supporting the 2030 Agenda for Sustainable Development by enhancing UN system-wide collaboration and coherent responses on environmental

matters" United Nations System-wide Response to Tackling E-waste, 2017).

UN and Related Entities Active in E-waste Management by Sector:-

One of the fastest-growing waste sources in the world is electrical and electronic waste (e-waste). Reasons include rising "market penetration" in emerging nations, the "replacement market" in established nations, and the "high obsolescence rate." Numerous nations have introduced interventions as a result of environmental concerns and commerce related to e-waste at the local, trans-boundary, and international level (ENVIRONMENTAL STATUS OF BHOPAL CITY Central Pollution Control Board Ministry of Environment, Forests & Climate Change, Government of India). Various organizations around world have been established to control and for safe and sustainable management of e-waste.

- International Convention for the Prevention of Pollution from Ships (MARPOL);
- Montreal Protocol on Ozone Depleting Substances (1989);
- Organisation for Economic Cooperation and Development (OECD), Council Decision Waste Agreement (1992);
- United Nations Framework Convention on Climate Change (UNFCCC) (1994);
- Paris Climate Agreement (2015) under the United Nations Framework Convention on Climate Change;
- Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships (2009) ("Supporting the 2030 Agenda for Sustainable Development by enhancing UN system-wide collaboration and coherent responses on environmental matters" United Nations System-wide Response to Tackling E-waste, 2017).

India:-

E-Waste (Management & Handling) Rule was announced by the Ministry of Environment, Forests & Climate Change of the Government of India in 2011 and went into effect on May 1, 2012. This rule applies to all producers, consumers, and bulk consumers involved in the production, sale, purchase, and processing of electrical and electronic equipments or components listed in schedule-I, as well as collection centres, dismantlers, and recyclers of E-waste (ENVIRONMENTAL STATUS OF BHOPAL CITY Central Pollution Control Board Ministry of Environment, Forests & Climate Change, Government of India).

Additionally, the Indian government's Ministry of Environment, Forests, and Climate Change has announced the E-Waste (Management) Rules, 2016, which

will go into effect on October 1st, 2016. Each manufacturer, producer, consumer, bulk consumer, collection centre, dealer, e-retailer, refurbisher, dismantler, and recycler who is involved in the production, sale, transfer, purchase, collection, storage, or processing of e-waste or electrical and electronic equipment listed in Schedule-I, including their components, consumables, parts, or spares that make the product operational, shall be subject to these rules (ENVIRONMENTAL STATUS OF BHOPAL CITY Central Pollution Control Board Ministry of Environment, Forests & Climate Change, Government of India).

Other than this websites such as "GREEN" promote public awareness through social media, *Swachh Bharat Digital etc*., as public component in e-waste management plays a significant role. *Take-back' and Planet ke Rakhwale campaign* by Nokia began in 2009 wherein, drop boxes were setup across the country to take back used phones, chargers and accessories, irrespective of the brand, at Nokia Care Centres.

Conclusion

E-waste management has been difficult for a developing nation like India, but things are getting better. The government and the electrical and electronic industry have been working together to manage e-waste effectively, and the industry has undertaken a number of measures to handle e-waste ethically. Efficient management of e-waste can be accomplished in India if the Government, Producers, and Consumers all take responsibilities. Stringent legislation along with general public awareness, a sustainable environment free from e-waste can be achieved. Also the precious metals obtained through formal recycling of e-waste can help with the economics of the processing expenditure.

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