

Process and Control Management of Ever Increasing Generation of E-Waste

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ABSTRACT

Electronic and Electrical wastes specifically known as E-waste is growing at a very high rate throughout the world but especially in developing countries like India. It is predicted that India is likely to generate about 52 million tons of E-waste in 2020 which will be about 40% of the entire E-waste generated in the world at that time. The following article denotes the importance of this humongous growth, its effects on the environment and on us, the humans. The importance of various industrial methods and method of regulating the e-waste at a local governing level especially in India has also been suggested.

Keywords

PPPs, FDI, CRT, LCD

1. INTRODUCTION

Waste generation is one of the most difficult problem faced by us in the 21st century. The amount of waste generated, its recycling and disposal are some of the major issues faced by both developed as well as developing countries. E-waste stands for Electronic waste, the waste generated from electronics and its various components due to the advent of technological development. It is predicted that the worldwide E-waste generation will be about 65 million tons by 2017. According to a UN report published in 2014, India is the 5th biggest producer of E-waste generating 1.4 million tons of E-waste. Electronic waste (e-waste) now contribute about five percent of all municipal solid waste worldwide, nearly the same amount as all plastic packaging, but it is much more hazardous. Not only developed countries generate e-waste but most developing countries in Asia generate an estimated 12 million tons each year[9].

In 2005, more than 2 million tons of e-Waste was generated in the US alone (US EPA), but only 17 to 18 percent of that was collected for recycling. The rest, more than 80 percent, was disposed of, largely in local landfills [12]. The implications of ever increasing E-waste and its random disposal into developing nations by developed countries are discussed further into this paper. This paper will highlight the various problems created by increasing E-waste in India, the various government schemes and initiatives to solve it and its importance as a business commodity to like-minded people.

2. MAGNITUDE OF PROBLEMS CREATED BY E-WASTE IN INDIA

It is predicted according to a report presented by Rajya Sabha that there will be a 500% rise in Television created E-waste by 2020. Amounts of harmful or non-usable components generated in Computers, Mobile Phones and Mass manufactured electronic devices lead to a further increase in Cadmium, lead and other harmful waste causing harm to both nature and us. The major problems in India are lack of legal and Environmental acceptable recycling units or plants and

unclear laws and regulations on the production and recycling of E-waste in India. Most of the E-waste generated in India is obtained in metropolitan cities like Mumbai, Bangalore, and Delhi. Out of the total E-waste generated about 70% of the E-waste is being produced by about 10 states and 60% by 65 cities according to a Report published by Rajya Sabha in 2009[1].

It is estimated that around 95% of E-waste is being recycled through an informal sector which may or may not abide by the various government regulations in place[2].

According to report published in United Nations, out of the 3 containers leaving Europe, at least one container consists of illegal E-waste.(3). Although it is legal to export discarded goods to poor countries if they can be reused or refurbished, much is being sent to Africa or Asia under false pretences, says Interpol. Waste collection, transportation, processing and recycling is dominated by the informal sector. Most of the E-waste collected by various sources is dumped outside cities, towns which is then incinerated leading to an increase in pollution levels and smog. The sector is well networked and is unregulated. There are various issues regarding leakage of various toxins, poisonous substances into the environment affecting worker's safety as well as their health. It is of extreme importance that the informal and formal sector work together following various safety regulations, clinical and efficient management of waste so that minimum damage is caused to various sectors of society from developed countries[11].

Reasons For the export of E-waste into India are –

- 1) Cheap labor : Rates are approximately US - \$ 30/ computer ,India - \$ 2/ ,Computer Recycle Saving – \$ 28/ computer
- 2) Weak environmental laws
- 3) Excess dumping of CRT tubes due to the ramp walk of flat screen monitors
- 4) Driven by the potential for corporate profits

3. HARMFUL AND HAZARDOUS EFFECTS OF E-WASTE

The following table allows us to observe the various harmful effects caused by elements present in components of e-waste.

Table 1: Harmful effects of E-waste Related Components [4][7]

Elements	Components consisting the Element	Harmful effects
Lead	Bulbs, Television, Computer Monitors,	Impaired cognitive function,

	Control Boards	behavioral disturbances, attention deficits, affects nervous system of children
Cadmium	Batteries, Computer and Monitors, Resistance Boards, PCBs	Severe damage to lungs, also causes kidney related diseases
Mercury	Obtained in Thermostats, Flat screen monitors, Fluorescent tubes	Reduces growth and development ,reduces fertility and can cause muscle weakness
Sulphur	Found in Lead Acid Batteries	Kidney and Heart Damage, Causes eye irritation
Beryllium Oxides	Used in Heat Sinks for CPU and Power Transistors	Constant Exposure may lead to cause Lung cancer
Polychlorinated Bi-Phenyls	Motors ,Coolants, Capacitors	Thyroid Dysfunction
Copper	Wires, PCBs	Headaches, Eye Irritation, Throat Infections
Americium	Radioactive Source in Smoke Alarm	It is a Carcinogenic

The inappropriate disposal of E-waste without undergoing proper processes leads to saturation of various metals as well as non-metals such as lead, cadmium, nickel and others near urban dumping grounds. The abundance of these elements leads to a serious harm and causes illness among the local flora and fauna which includes us, the human beings[11].

4. E-WASTE MANAGEMENT PROCESSES

Basel Convention, is an international treaty that was designed to reduce the movements of hazardous wastes between nations, and specifically to prevent transfer of hazardous waste from developed to lesser developed countries to reduce the ever increasing danger from industrial and E-wastes types of waste generation Many Asian counties including Taiwan, Japan and South Korea have agreed to reduce the waste generation by demanding the various manufacturers to recycle 75% of their annual production.

Modifications at the productions processes, recovery and reuse of products:

Certain changes can be made in production processes which can make a change in amount of E-waste generated[5].

- 1) Use of materials which are biodegradable instead of use of plastic and another materials in production of chips, micro-controllers etc.
- 2) Use of processes which will reduce the amount of waste generated during production such as stamping, powder metallurgy in the place of simple cutting and wastage of raw material.

- 3) Pre-planning of raw materials like lead, mercury so that lower amount of waste is created which reduces the damage to environment.
- 4) Chemicals which may include acids, caustics, cyanides etc are often a hazardous waste and must be properly managed. By reducing the number of parts that have to be manufactured, the quantity of waste obtained during the process can be significantly controlled.
- 5) In many cases, there are Smartphone or mobile recycling boxes placed outside the companies' offices or galleries where the consumers are allowed to throw their old, used phones for certain incentives. Such methods are highly useful as these phones are recycled, undergo various processes such as electrolytic recovery, condensation or osmosis where the base metal such as Copper, Gold is retrieved reducing the waste generation.
- 6) The following are some methods used for Reclamation of valuable components from the waste generated [6].

Table 2: Reclamation of Valuable Components

Components and Parts	Reclamation methods
Chips	Reclaimed during de-soldering process. Operational chips can be sold for re-use, or precious metals, including gold, silver and palladium, can be extracted from the chips.
Solder	Reclaimed during de-soldering process.
Gold	Reclaimed during gold leaching process and melted into gold bars or nuggets.
Bare Fiberglass Boards	Remain at the end of the process. Can either be sold and smelted to reclaim copper; or chopped and used as filler in various applications.

Motivated by the environmental effects caused by the generated e-waste, many technological changes have been effectuated[6]. The following are some of the examples:

- The replacement of CRT screens with LCD screens (Pb elimination but Hg introduction)
- The introduction of optical fibers (Cu elimination from the cablings, but F, Pb, Y and Zirconium introduction)
- The introduction of rechargeable batteries (Nickel , Cadmium reduction, but Li increase), etc.

5. WASTE-MANAGEMENT MODEL AT A LOCAL LEVEL IN INDIA

5.1 Many new government campaigns such as Swachh Bharat Abhiyan have been initiated by the Government of India to reduce the amount of waste disposal and proper management of E-waste, industrial waste and local type of wastages created at a local level of governance.

- 5.2** Various Government Bodies, NGO's should educate people in the methods of recycling of waste, waste bifurcation and reduction methods.
- 5.3** Local collection points in districts or Talukas can be created where the waste can be collected by recycling organizations and bodies. People (the citizens of that district or region) can be given certain incentives or monetary advantages depending upon the type of E-waste management ideas and services they provide.
- 5.4** The informal collectors or workers may collect these wastes by differentiating it into various types and then supply it to formal government appointed workers.

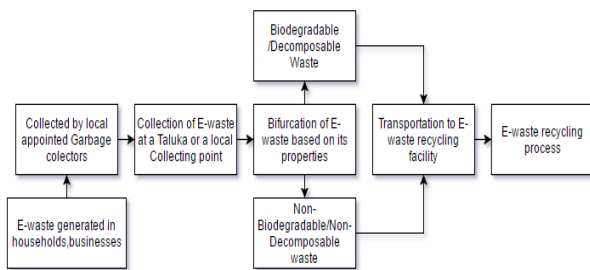


Fig 1: E-waste collection layout at a local governing level in India

A proper batch of skilled workers can be created to bifurcate and recycle the wastes depending on the process to be used, the materials and its usability which may lead to a higher employment and a planned and safe e-waste reduction.

To make a sound e-waste management process, a new working culture with new approaches suiting to the specified locality must be devised. It is a new field of profession and once people obtain exposure in its working and its advantages then it would certainly be a profit making and environment friendly local-scale occupation in the future [8].

6. CONCLUSION

The ESI (Environmental Sustainable Index) rank of India was 101 in 2005 and 66th in Environmental governance, which need further improvement by creating e-waste treatment infrastructure by PPPs(People, Private Partnership model in the country via Foreign Direct Investment(FDI) due to better technologies which western countries like United states, France, Germany have, which can be partnered with the cheap labor and manpower available in India which can collectively make the better e-waste treatment and techniques viable and economical. The recent government initiatives like Swachh Bharat Abhiyan and regulation to control E-waste and industrial waste generation must regulate the the ever

increasing rise of disposal and dangers of E-waste materials and harmful substances. The citizens of India and the government both have a responsibility to control and properly manage the problem of E-waste in India.

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