

E-waste management in India: Problems and Legislations

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Abstract- The electronic waste also known as e-waste is a dangerous waste consisting of unwanted electronic and electrical equipment. Developing countries are facing the problem of e-waste management enormously which is either internally generated or are imported from other countries. India is also facing the problem of e-waste management due to lack of awareness among people about dangerous effect of e-waste on environment and human being through informal e-waste collection and absence of implementation of rules for the process of e-waste in environment friendly manner. The paper discusses the condition of e-waste in India, the problem associated with e-waste, the method used for used for e-waste management and focuses light on the legislation work done regarding e-waste in India. As per the study it has been found that there is an instant need to address the issue related to e-waste in India in order to avoid its ill effect in future.

Keyword- E- waste, formal and informal sector, hazardous, WEEE

I. INTRODUCTION

The industrial revolution brought by science and technology in eighteenth century marked a new era in human civilization. The revolution brought by information and communication in twentieth century brought enormous changes in the way we organize our lives, our economies, industries and institutions. These changes have brought enormous development in modern time and enhanced the quality of our lives. The Indian information technology sector is also largely contributing to the global economy. At the same time, it is generating bulk of e-waste or Waste Electrical and Electronic Equipment (WEEE). The e-waste has become a matter of concerns in most of the developing countries like India, where in past not much emphasis given on it. In developing countries like India the e-waste has become a massive problem which is either locally generated or internationally imported, which causes serious hazard to human health and environment. The electrical and electronic equipment contain harmful component which are a reason to worry during the waste management process.

The major issue of concern is that there is no standard definition of WEEE/e-waste. The different countries have given their own definitions, interpretation and usage of the term "e-waste/WEEE". The most widely accepted definition and description of WEEE is as per the European Union directive. The directive 2002/96/EC of the European Parliament and of the council of 27 January 2003 on WEEE covers all electrical and electronic equipment used by consumer.[1] The definition according to this directive is:

1. 'electrical and electronic equipment' or 'EEE' means equipment which is dependent on electric currents or electromagnetic fields in order to work properly and equipment for the generation, transfer and measurement of such currents and fields falling under the categories set out in Annex IA and designed for use with a voltage rating not exceeding 1 000 Volt for alternating current and 1 500 Volt for direct current;[2]
2. 'Waste electrical and electronic equipment' or 'WEEE' means electrical or electronic equipment which is waste within the meaning of Article 1(a) of Directive 75/442/ EEC, including all components, subassemblies and consumables which are part of the product at the time of discarding.[2]

According to Basel action network the e-waste is defined as "E-waste includes a wide and developing range of electronic appliances ranging from large household appliances, such as refrigerators, air-conditioners, cell phones, stereo systems and consumable electronic items to computers discarded by their users".[3]

A. Composition of e-waste

E-waste consists of all waste from electrical and electronic equipments which have reached their end-of-life period or are not in useful condition and it should be either recycle or dispose. It includes computer and its accessories as monitors, printers, keyboards, central processing units; typewriters, mobile phones and chargers, remotes, compact discs, headphones, batteries, LCD/Plasma TVs, air conditioners, refrigerators and other household appliances. The e-waste has diverse compositions that are classified as 'hazardous' and 'non-hazardous' categories. Broadly, it consists of ferrous and non-ferrous metals, plastics, glass, wood and plywood, printed circuit boards, concrete, ceramics, rubber and other items. Iron and steel constitute about 50% of the waste, followed by plastics (21%), non-ferrous metals (13%) and other constituents. Non-ferrous metals consist of metals like copper, aluminium and precious metals like silver, gold, platinum, palladium and so on.[4] Due to the presence of elements like lead, mercury, arsenic, cadmium, selenium, hexavalent chromium, and flame retardants beyond threshold quantities e-waste become hazardous in nature. It contains over 1000 different substances, many of which are toxic, and creates serious pollution upon disposal. Obsolete computers pose the most

significant environmental danger and threat to human health among the e-wastes.[5]

II. RECYCLERS OF E-WASTE IN INDIA

A. Formal Sector

In this method the e-waste is collected and disposed by government authorised agency or company which do the e-waste management work in environment friendly way. These organizations perform the e-waste management by using proper equipment and also provide proper safety measures to the worker and on the recycling site.

B. Informal Sector

In this method the e-waste is collected and disposed by unauthorised people. They collect the e-waste from the household and market and then separate the useful and useless part by breaking the e-waste in improper way, this is very harmful to the environment because they keeps the useful part and either dump the remaining waste or burn it . They also do not use any safety measures which increase the risk to the health of the worker. They do this work in slum area of big metros and in metro cities either by making small workshop or from their home which pollute the surrounding of their living area.[6]

Some major sources of e-waste include

- Informal sector[7]
 - Dissembler/ Dismantler
 - Smelter
 - Recycler
- Formal sector[7]
 - Importer
 - Producer/Manufacture
 - Retailer (businesses/ government/ other)
 - Consumer (individual household, businesses, government)
 - Trader
 - Scrap dealer

III. HAZARDOUS EFFECT OF E-WASTE

Today a major amount of e-waste is generated by the old computer and its accessories. In the developed western and European countries, there is a new trend of donating their old computer and equipment to nearly third world countries. Because of it people feel good at having helped the under privileged. But it turns out to be a big problem as it passes downstream costs (waste removal) to under-developed countries, which most often do not have adequate environmental regulations. Poor countries simply accumulate the dangerous hazards of electronic waste. The “donations” end up not being recycled, but as hazardous waste.

E-waste constitutes the element used for the manufacture of electronic goods which are responsible for large environmental damage. It contain various dangerous materials such as lead, mercury, and hexavalent chromium which are constituent in cathode ray tubes(CRT), batteries, liquid crystal display(LCD).[5] Dangerous constituent of lead, brominates flame retardants are present in all electronics equipment which contain printed circuit board. Lead is reached into the ground water by the land filling of

e-waste. Toxic fumes emit into air if CRT is crushed and burned. No refined machinery or personal protective equipment is used for the extraction of different materials which have ill effect on human health [6]. The e-waste contain many toxics such as heavy metals, including lead, cadmium, mercury, Polychlorinated Biphenyls (PCB), Poly Vinyl Chloride (PVC) etc in some component.[8] The ill effect of these if disposed of in improper and non eco friendly manner is shown below[9]:

Table I
E-waste contents, its effect and sources[11]

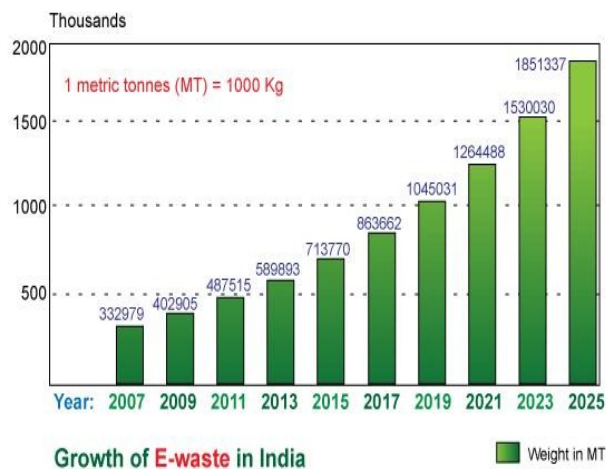
Waste Element	Effect on Human Being	Sources of E-waste
Lead	Central and peripheral nervous system, Blood system, kidney and reproduction system	Glass panel, Gasket in computer monitors, solder in PCB and other component
Cadmium	Kidney	SMD chip registers, infra red detectors and semiconductor chips
Mercury	Brain, Kidney, Foetus	Electrical and electronic equipment thermostats, sensors, relays, switches, medical equipment, lamps, mobile phone, batteries, flat panel display
Barium	Brain swelling, muscle weakness, damage to heart, liver and spleen	Used in computer in front panel of a CRT
Beryllium	Lung cancer, skin diseases	Motherboard, finger clips
Toners	Respiratory treat irritation	Plastic printer cartridge
Hexavalent chromium	Damage to DNA	Untreated steel plant

IV. STATUS OF E-WASTE IN INDIA

India is witnessing a major growth in electronic market. Due to rapid innovation in communication sector a large range of mobiles and communication equipment are available and it is developing rapidly. The computer and peripheral industry is also booming at very fast rate. All these thing leads to increase in e-waste generation in India. India is second largest electronic waste generator in Asia.[12] Ministry of Environment and Forest (MoEF) 2012 report tell that the e-waste output increases to eight times in last seven years i.e. 8,00,000 tones[12].

In 2005, the Central Pollution Control Board(CPCB) estimate India’s e-waste at 1.47 lacs tonnes or 0.573 MT per day. Major contribution of 60% of the total e-waste generated in India is made by sixty five cities. Seventy five percent of the total e-waste is generated by the top ten states which, includes Maharashtra, Tamil Nadu, Andhra Pradesh, Utter Pradesh, West Bengal, Delhi, Karnataka, Gujarat, Madhya Pradesh and Punjab. This increase in the amount of

e-waste generation is mainly due to increase in demand of product like PC, TV, and telephones in last 5-10 years.[5]. The Dept of Information technology project the future estimate of e-waste as shown in figure 1.



Source: Department of Information Technology Chart: CopperBridge Media

Fig. 1 Forecast of e-waste estimate in India[14]

An assessment conducted by the Manufacturers Association of Information Technology (MAIT) Indian hardware Trade Organization state that India produces almost 4, 00,000 tonnes of e-waste each year. Out of the country’s total e-waste only 5 percent is recycled and about 40 percent of obsolete and unused computers and electronic products decay in homes and warehouses. Due to faster rate of newer model of electronic entering in the market, the e-waste is growing in Indian market at an alarming rate.[5] Initially about 1, 46,000 tonne of electrical and electronic waste is generated in the country annually, over 80% from households most of which is recycled in non eco friendly manner. In 2007, India generate 3, 80,000 tonnes of e-waste. Only 3% of it recycled in authorised facilities. By 2012, the e-waste generation in the country is expected to cross the 8, 00,000 tonnes mark.[13]

Two billion PCs are expected to invade our homes and India’s mobile subscriber base is expected to touch 450 million by 2015.[13] The significance of e-waste management in India is greater not only due to its own waste but also due to the e-waste particularly computer waste dumped from the developed countries.

Due to the absence of any proper disposal system followed in our country, enormous amount of e-waste has been generated in last 60 years. This has leads to the requirement of a proper disposal and recycling system so that the environmental pollution and health hazard is get reduced.

According to the report of UNEP, by 2020, the e-waste from old computer would grow by up to 500% from 2007 levels in India while South Africa and China will witness a 200-400% rise in computer related waste.[13] Due to growth in mobile phone sector in India, the e-waste from discarded phone will grow by eighteen times from 2007 levels, whereas in China it is estimated to see a seven time rise in electronic waste from mobile phones. The status of e-waste in different states¹ is shown below.

Table II
WEE Generating top ten state[11]

State	WEE Tonnes
Maharashtra	20270.59
Tamil Nadu	13486.24
Andhra Pradesh	12780.33
Utter Pradesh	10381.11
West Bengal	10059.36
Delhi	9729.15
Karnataka	9118.74
Gujarat	8994.33
Madhya Pradesh	7800.62
Punjab	6958.46

Country level WEEE assessment study by the International Resource Group Systems South Asia Pvt. Ltd (IRGSSA), (m/s IRG Systems South Asia Pvt. Ltd), 2005.

V. E-WASTE LEGISLATION IN INDIA

In India, a lot of discussion and concern has now started regarding the e-waste management. A report of parliamentary standing committee on science and technology on the functioning of central pollution control board (CPCB) states that e-waste is going to be a big threat in future due to modern life style and increase in the living standards of people and rise of economic growth. The solid waste management process is defined in the Indian constitution under twelfth schedule and in municipal solid wastes (management & handling) rules, 2000 enacted by central government. These rule provide some guidelines for the management of the e-waste and can be used as a model in the e-waste recycling and disposal scheme such as house to house collection of waste, proper collection of waste from slums and squatters, hotels restaurants, office complexes and commercial areas, organizing awareness programmes for segregation of wastes; adopting suitable waste processing technologies; and restricting land filling of non-biodegradable inert waste. But there is no proper rule or regulation mainly for e-waste treatment. Some of the rules and regulation which are made related to e-waste are as follows.[5]

A. The Hazardous Waste (management and handling) Rules, 2003

This rule categorized e-waste or its constituents under ‘hazardous’ and ‘non hazardous’ waste. As per the rules, “hazardous waste” is defined as any waste which by reason of any of its physical, chemical, reactive, toxic, flammable, explosive or corrosive characteristics causes danger or is likely to cause danger to health or environment, whether

alone or when in contact with other wastes or substances.[14]

B. The Hazardous waste (Management, Handling and Transboundary Movement) Rules, 2008

These rules provide the registration process of hazardous waste recycler. According to these rules, every person desirous of recycling or reprocessing hazardous waste including electronic and electrical waste is required to register with the central pollution control board (CPCB). The e-waste handler is required to register with the CPCB. The authorized recycler or re-processor or re-user should have environmentally sound facilities for recovery of metal and plastic and the waste should be sent to them. Under these rule the ministry of environment and forest is the nodal ministry to deal with the transboundary movement of the hazardous wastes and to grant permission for transit of the hazardous wastes through any part of India.[5] Part A of Schedule III (Basal No. 1180) consists of list of e-waste applicable for import with prior informed consent. Part B of schedule III (Basal No. 1110) deals with list of e-waste applicable for import and export not requiring prior informed consent. [15]

C. Guideline for Environmentally sound management of e-waste, 2008

The guideline are given by the government of India and approved by ministry of environment and forest and central pollution control board. The objective of these guideline is to provide guidance for identification of various sources of e-waste and the approach and methodology for handling and disposal of e-waste in an environment friendly manner. These Guidelines include details such as e-waste composition and recycle potential of items of economic value, identification of possible hazardous contents in e-waste, the recycle, re-use and recovery options, treatment and disposal options and the environmentally sound e-waste treatment technologies. The guideline also covers the concept of Extended Producer Responsibility [2]. After the approval of company's bill 2012 in the Rajya Sabha, it has become compulsory for the corporations to spend 2% of the net profits on Corporate Social Responsibility (CSR) activities. This will promote the equitable and sustainable growth in the country.[16]

D. The e-waste (Management and Handling) Rules, 2011

The primary objective of these rules is to channelize the e-waste generated in the country to make the recycling of the e-waste in environmentally sound manner. The concept of extended producer responsibility is introduced in these rules by placing the main responsibility of e-waste management on the producer of the electrical and electronic equipment. These rules had notified in May 2011 and get implemented from 01 May 2012. These rules are applicable to every producer, consumer involved in the manufacture, sales purchase, and processing of electrical and electronic equipment or components, collection centres, dismantlers and recyclers of e-waste comes under this law.[18] The is law is also applicable on the people involved in purchase and processing of electrical and electronic equipment or components.[2]

According to the newspaper (Business Standard, Dec 25, 2013) a study "e-waste management in India- Role of state agencies" done by Toxics Link reveal that most of the Indian states have failed to implement e-waste rules in the country which came into being in 2011[20]. The study also reveals that lack of efforts and action is made by most state pollution control board and committees. This shows that e-waste (management and handling) rules, 2011 are not properly implemented in the country.[21]

VI. FINDINGS AND CONCLUSION

Most of the developing countries, especially India faces a problem of continuous rise in the amount of e-waste due to the change in the lifestyle of the people which now more depends on electrical and electronic equipment in which continuous improvement has been made and the products are becoming obsolete rapidly especially in case of computer and its peripheral devices . This has arises a big challenge of managing the e-waste. A major amount of e-waste is managed through informal sector which done the e-waste management job in the way which has bed effect on the environment and very small amount of e-waste are managed by formal sector in environment friendly way. Unfortunately there is no large scale organised sector to do the recycling work and it is performed only by unorganised sector. Because of it the risk of damage to human health and natural environment increases as no precaution is taken while performing the recycling work and also the involvement of women and children has worsen the condition. The import of e-waste from other countries has ill-effect on environment. Due to lack of awareness among people about e-waste, the measures like ERP and Take back policy is very difficult. The legislation work regarding e-waste had been done lately in time and it is not performing well. Therefore the awareness of the people about e-waste need to be increase and the rules should be properly implemented to control the rise in e-waste in future.

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