

Current Scenario of e-waste management in India: issues and strategies

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Abstract- Electronic waste or e-waste refers to unwanted, obsolete or unusable electronic and electrical products. Ever increasing usage of electronics and electrical equipments has resulted in piling up of e-waste. The current practices of e-waste management in India encounters many challenges like the difficulty in inventorization, ineffective regulations, pathetic and unsafe conditions of informal recycling, poor awareness of consumers and reluctance on part of the stakeholders to address the issues. As a result toxic materials enter the waste stream with no special precautions to avoid the known adverse impacts on the environment and human health as well resources are wasted when economically valuable materials are dumped. The purpose of this paper is to find out various issues related to e-waste and suggest strategies for effective e-waste management in India.

Index Terms- e-waste, environment, informal sector, recycling

I. INTRODUCTION

E-waste comprises of waste generated from used electronic devices and household appliances which are not fit for their original intended use and are destined for recovery, recycling or disposal. Such wastes encompasses wide range of electrical and electronic devices such as computers, hand held cellular phones, personal stereos, including large household appliances such as refrigerators, air conditioners etc. E-waste contain over 1000 different substances many of which are toxic and potentially hazardous to environment and human health, if these are not handled in an environmentally sound manner (MoEF, 2011). The last decade has seen a tremendous growth in the manufacturing

and consumption of electronic and electrical equipment all over the world. As a consequence of this, combined with rapid product obsolescence, and lower costs, discarded electronic and electrical equipment or 'E-waste' is now the most rapidly growing waste problem in the world. Most companies today design their products for planned or perceived obsolescence. This is reinforced through marketing and retailing practices, and affordability and convenience have taken over from product durability as primary drivers (Jennifer, 2005)

Life cycle of the E-waste

Figure below shows lifecycle of e-waste. Producers/manufacturers, retailers, consumers ,traders, exporters , scrapdealers, disassemblers/dismantlers, smelters and recyclers are major stakeholders in e-waste supply chain.E-waste, is an emerging problem as well as a business opportunity of increasing significance, given the volumes of E-waste being generated and the content of both toxic and valuable materials in them. The fraction including iron, copper, aluminum, gold and other metals in E-waste is over 60%, while pollutants comprise 2.70% (Widmer *et al.*, 2005). Therefore, recycling of E-waste is an important subject not only from the point of waste treatment but also from the recovery aspect of valuable materials. However the process of take-back and disposal of E-waste is very complex, which involves various kinds of products, many people and enterprises, extensive areas, and long time span (sometimes is even over ten years), it is a huge and complicated system

EEE=electrical and electronic equipment, WEEE=waste electrical and electronic equipment

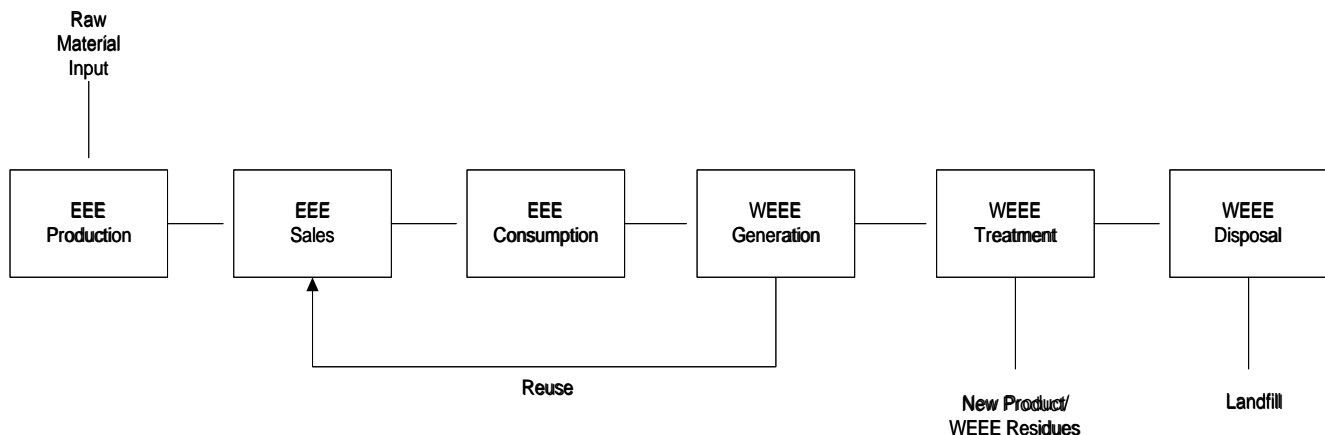


Figure 1. Life Cycle of E-waste

Source: (UNEP, DTIE, 2007)

II. RESEARCH METHODOLOGY

This paper follows an exploratory methodology based on a qualitative review of the environmental and social aspects in the area of e-waste sector. An exploratory methodology was adopted due to non-availability of ample information on e-waste. Data were collected through comprehensive analysis of qualitative data related to the topics that have been published in various sources mainly from various Government and NGOs' published reports, news articles, websites etc. This paper focus to limelight the issues related to e-waste management in India .

III. E-WASTE MANAGEMENT IN INDIA

India is the fifth biggest producer of e-waste in the world; discarding 1.7 million tonnes (Mt) of electronic and electrical equipment in 2014 (Economic Times, 2015). In India E-waste collection, transportation, segregation, dismantling, recycling and disposal is done manually by untrained labors in informal sector.

Due to low awareness and sensitization e-waste is thrown along with garbage which is collected and segregated by rag pickers. E-waste contains reusable and precious material. Rag pickers sell this E-waste to scrap dealers and run their livelihood. The scrap dealers supply the E-waste to recycling industries. The recyclers use old and hazardous technologies and equipment, to recycle/treat the e-waste (Gupta & Kumar, 2014). **India's produces nearly 12.5 lakh MTs of E-waste every year.** (ASSOCHAM, 2014).India ranks 155 out of 178 nations in Environmental Performance Index. It also ranks poorly in various indicators like 127 in Health Hazards, 174 in Air Quality, 124 in Water and Sanitization (EPI, 2014). Environmentally Sound Management (ESM) of e-waste will also improve ranking of India in these areas.

India is being used as dumping ground of e-waste by many developed nations. Figure shows % share of e-waste imports in India from different countries.

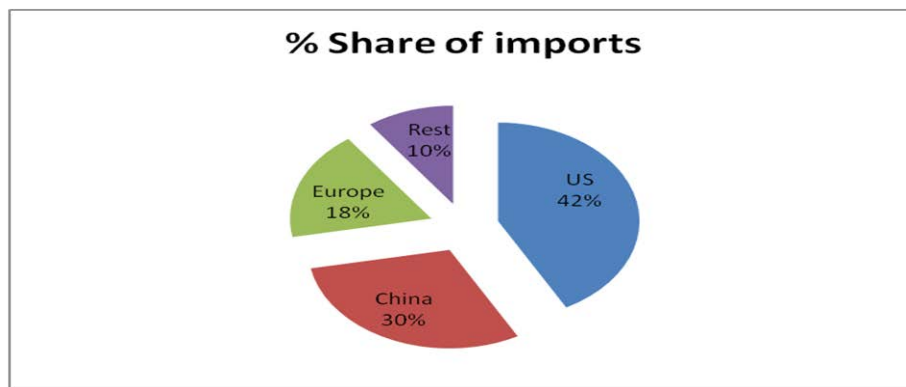


Figure 2- percentage share of e-waste imports

Source- (Economic Times, 2015)

Looking at the country-wise share in India's e-waste imports, US has a maximum share of around 42%, China at around 30% followed by Europe at around 18% and **rest 10% is from other countries like Taiwan, South Korea, Japan etc.** 10 States/UT contribute to 70% of the total e-waste generated in the

country. While 65 cities generate more than 60% of the total e-waste in India (Rajya Sabha, 2011). Table 1 shows top ten states producing e-waste in India. Figure 3 below shows top ten cities producing e-waste and quantum of e-waste produced by them.

Table 1- Top Ten e-waste producing states/ UT in India

State	E-Waste (MTA)
Maharashtra	20270.59
Tamil Nadu	13486.24
Andhra Pradesh	12780.33
Uttar Pradesh	10381.11
West Bengal	10059.36

Delhi	9729.15
Karnataka	9118.74
Gujarat	8994.33
Madhya Pradesh	7800.62
Punjab	6958.46

Source - (Rajya Sabha, 2011)

Top ten cities

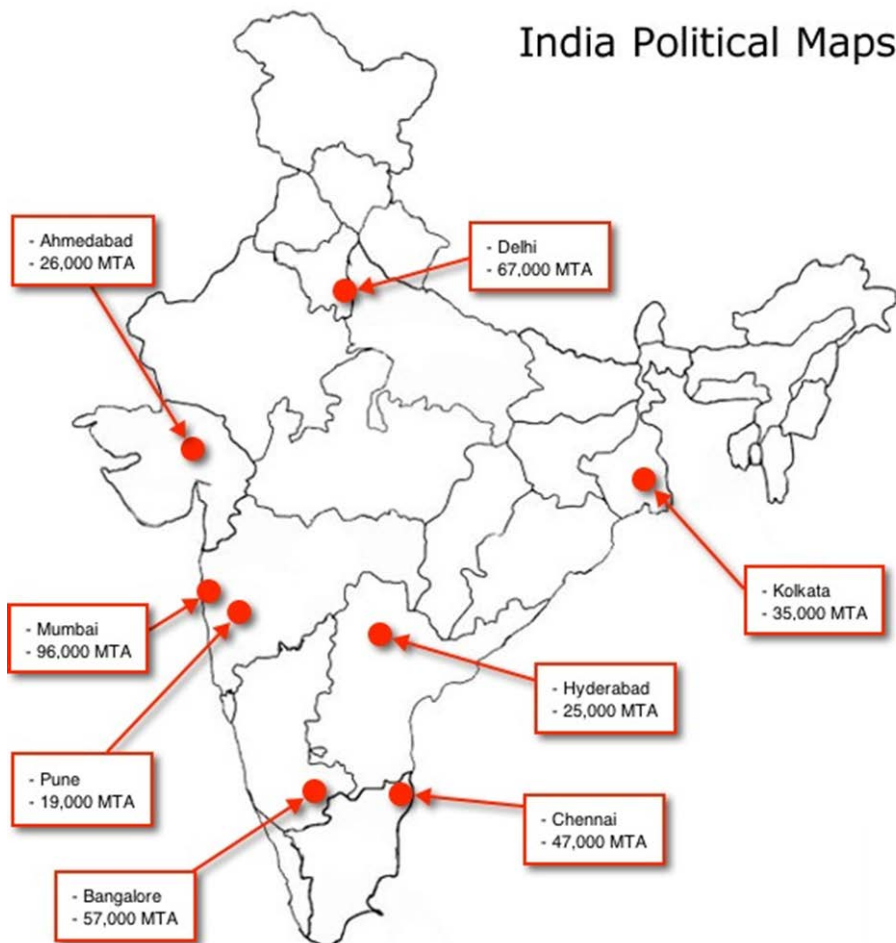


Figure 3- Map Showing top ten cities producing e-waste

The consequences of poor e-waste management practices are- (i) toxic materials enter the waste stream with no special precautions to avoid the known adverse effects on the environment and human health and (ii) resources are wasted when economically valuable materials are dumped or unhealthy conditions are developed during the informal recycling (Joseph, 2007) .Almost half of all unused and end-of-life electronic products lie idle in landfills, junkyards and warehouses.

The formal sector accounts for less than 10 per cent of the recycling business, so there is huge scope for growth as the recyclers and suppliers are engaging with IT giants and other enterprises to dispose e-devices efficiently (ASSOCHAM,

2014).The informal E-waste sector is well networked but unregulated. The financial flow in the sector is highly organized and the huge network of collectors, traders and recyclers make financial gain through re-use, refurbishment and recycling. The low infrastructure set-up and operational costs enable them to make profit and dominate the market. The each player in the trade value chain makes at least a 10 per cent profit. The size of the informal sector continues to grow. Informal recycling centers have tended to move away from major cities such as Delhi, Mumbai, Bangalore, Chennai and Kolkata, and are quickly spreading into smaller peripheral towns (Sinha *et al.*, 2011).While the majority of Indian E-waste is generated

domestically, imports still account for a substantial, although decreasing, amount. About 80 per cent of E-waste is imported from the US and the remaining share comes from the EU. (Skinner *et al.*, 2010).

In India, the informal recycling sector employs mostly unskilled migrant labor and those from marginalized groups. Most migrants come from poorer Indian states such as Uttar Pradesh, Bihar, Orissa and West Bengal or are immigrants from neighboring countries such as Bangladesh. Women and children also constitute a significant proportion of the workforce. Most people involved in informal recycling are the urban poor with low literacy levels, and hence have very little awareness regarding the hazards of E-waste and the recycling processes (Sinha *et al.*, 2011) A large number of workers are involved in crude dismantling of these electronic items for their livelihood and their health is at risk; therefore, there is an urgent need to plan a preventive strategy in relation to health hazards of E-waste handling among these workers in India (Monika & Kishore, 2010).

Although E-waste Management and Handling Rules, 2011 are effective from May 2012 but scenario is still gloomy. Lax regulations and poor vigilance are main reasons for failure of the

rules. So management of E-waste is critical in India, owing to its exponential growth and the rudimentary recycling practices prevalent in the unorganized sector.

Complexity of E-waste flows in India

The e-waste is produced from different sources and various stakeholders involved in the value chain are also interlinked. Consequently, the E-waste does not follow one set path. The green areas and flows indicate the formal recycling sector, the red indicate the informal one, and the blue stakeholders and flows are semi-formal. The status of semi-formal stakeholders depends very much on their interaction with the other stakeholders. They represent the link between the formal sectors. Direct relations between the informal and formal sector occur as well, but are less common (Skinner *et al.*, 2010). Most of the E-waste ends up with scrap traders and dealers who, for economic reasons, commonly transfer it on to the informal sector. Figure 4 shows flow of e-waste in India

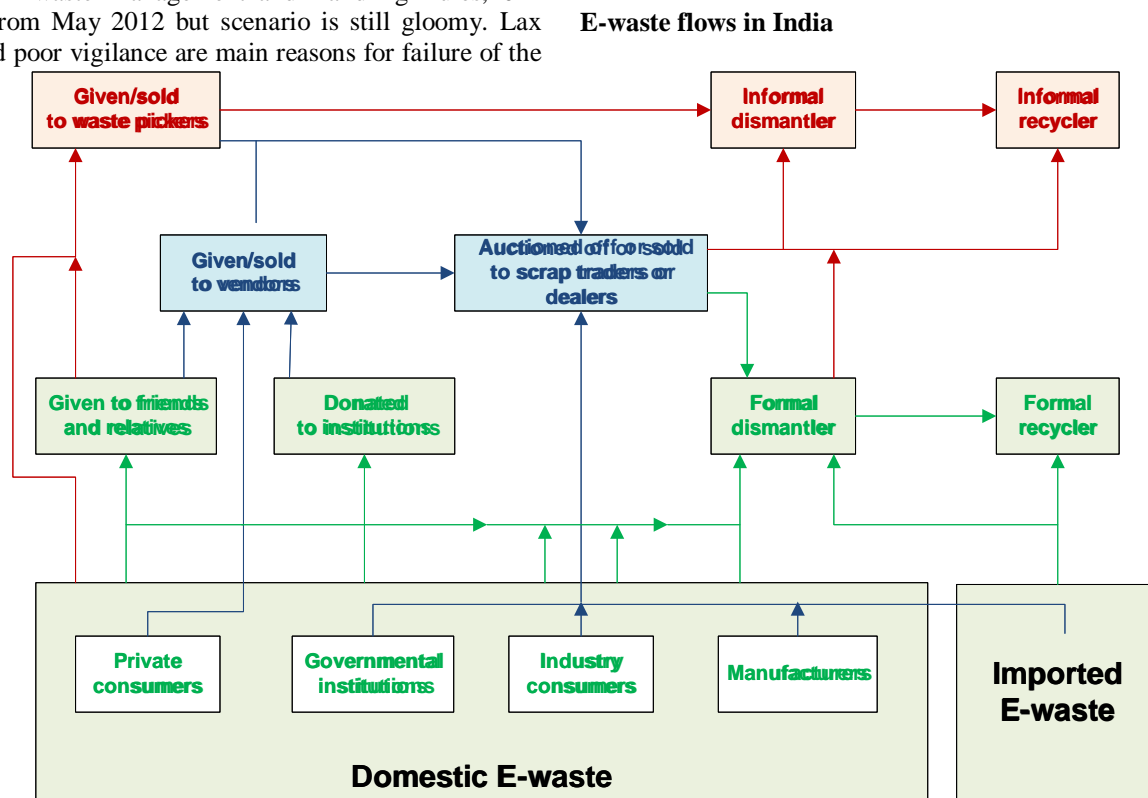


Figure 4. E-waste Flows in India
 Source: (Skinner *et al.*, 2010)

The flow of E-waste follows a path involving preliminary, secondary and tertiary stages. Preliminary-waste workers obtain E-waste from the formal organized market composed of manufacturers, importers, offices and so on. These stakeholders are mainly scrap dealers and dismantlers who have the ability to bid for and store large amounts of E-waste (Sinha *et al.*, 2011). As they have limited interest in dismantling the E-waste, it is segregated and dismantled by secondary E-waste workers, who have limited financial capacity. Finally, tertiary E-waste workers not only dismantle and segregate the E-waste but also try to

extract the valuable materials from it. While this situation describes the most common practice, there is a broad variety of other routes by which E-waste might travel. The E-waste may change hands among several of the above stakeholders and one stakeholder might be engaged with more than one activity (Skinner *et al.*, 2010). It is commonly found that actors at the top of the chain derive the highest profits whilst the tertiary workers subsist on less than a couple of US dollars a day (Kalra, 2004). It is obvious that the formalization of E-waste recycling would decrease environmental damage and increase worker welfare.

Issues related to E-waste in India

1. Volume of E-waste generated -

India stands fifth in e-waste generation producing around 1.7 lakhs metric tonnes per annum (Thomas Reuters, 2015)

2. Involvement of Child Labor-

In India, about 4.5 lakh child laborers in the age group of 10-14 are observed to be engaged in various E-waste activities and that too without adequate protection and safeguards in various yards and recycling workshops. So, there is a urgent need to bring out effective legislation to prevent entry of child labor into E-waste market- its collection, segregation and distribution. (ASSOCHAM, 2014)

3. Ineffective Legislation-

There is absence of any public information on most SPCBs/PCC websites. 15 of the 35 PCBs/PCC do not have any information related to E-waste on their websites, their key public interface point. Even the basic E-waste Rules and guidelines have not been uploaded. In absence of any information on their website, specially on details of recycle rs and collectors of E-waste, citizens and institutional generators of E- waste are totally at a loss to deal with their waste and do not know how to fulfill their responsibility. (Sinha & Rambha, 2013). So, there is failure in successful implementation of E-waste management and handling rules, 2012.

4. Lack of infrastructure-

There is huge gap between present recycling and collection facilities and quantum of E-waste that is being generated. No collection and take back mechanisms are in place. There is lack of recycling facilities.

5. Health hazards-

E-waste contains over 1,000 toxic materials, which contaminate soil and ground water. Exposure can cause headache, irritability, nausea, vomiting, and eye pain. Recyclers may suffer liver, kidney and neurological disorders. Due to lack of awareness, they are risking their health and the environment as well.

6. Lack of incentive schemes-

No clear guidelines are there for the unorganized sector to handle E-waste. Also no incentives are mentioned to lure people engaged to adopt formal path for handling E-waste. Working conditions in the informal recycling sector are only slightly worse than in the formal sector. (Skinner et al., 2010). No incentive schemes for producers who are doing something to handle e-waste. (Toxiclink, 2015)

7. Poor awareness and sensitization-

Limited reach out and awareness regarding disposal, after determining end of useful life. Also Only 2% of individuals think of the impact on environment while disposing off their old electrical and electronic equipment. (IRGSSA, 2010)

8. E-waste imports –

Cross-border flow of waste equipment into India- 80 percent of E-waste in developed countries meant for recycling is sent to developing countries such as India, China, Ghana and Nigeria. (Lundgren, 2012)

9. Reluctance of authorities' involved-

Lack of coordination between various authorities responsible for E-waste management and disposal including the non-involvement of municipalities (ASSOCHAM, 2014).

10. Security implications-

End of life computers often contain sensitive personal information and bank account details which, if not deleted leave opportunity for fraud.

11. High cost of sourcing e-waste-

The ELCINA conducted a study in 2009, where a sample calculation of capital, operating costs, revenues etc. for an e-waste recycling project indicates the cost of sourcing e-waste as the largest portion of the operating cost. (ELCINA, 2009).

12. High cost of setting up recycling facility-

In addition, the study also states that the advanced technology recycling projects (including metallurgy and refining of non ferrous metals) are at further economic disadvantage compared to basic process activities and are in general not economically viable. The formal recycling companies in India except some are only limited to pre-processing of the e-waste material, where the crushed e-waste with precious metals is sent to smelting refineries outside India. (Belgium, Singapore etc). Formal sector in India still has a long way to go in adopting state - of-art technologies for e-waste recycling due to problems in sourcing e-waste and partly due to difficulty in making it profitable with high end investment in such superior and costly technologies [(UNFCCC, 2013), (RINA, 2012)].

13. Lack of research-

Government must encourage research into the development and standards of hazardous waste management, environmental monitoring and the regulation of hazardous waste-disposal. (Karishma & Vrat, 2015)

IV. CONCLUSIONS AND RECOMMENDATIONS

There exist many hurdles to e-waste management in India. The major one is dominance of informal sector. So the steps should be taken to formalize the informal sector by strict implementation of rules and to levy heavy penalties on defaulters. The major challenges are to reduce E-waste through reuse, recycle, recovery and reduced use of toxic substances, to invent labor intensive intermediate technology to recycle / recover E-waste safely and to distribute the responsibility of managing E-waste on one or more stakeholders. Level of awareness should be increased using advertisements and e-waste issues should be included in curriculum. There is urgent need of an effective Reverse supply chain management of E-waste. In the reverse supply chain of E-waste would be collected from all kinds of resources, and it would be delivered to a processor that can recycle valuable parts from E-waste and dispose rest hazardous components in environmentally sound manner. The producer may buy those recycled valuable parts as raw material from the processor; therefore a close loop supply chain would be formed. In the process, companies can become more environmentally efficient through reusing and reducing the

amount of materials used. There is urgent need for a detailed assessment of the E-waste including quantification, characteristics, existing disposal practices, environmental impacts and the establishment of e-waste collection, exchange and recycling centers in partnership with private entrepreneurs and manufacturers. There is need of an effective take-back program providing incentives for producers to design products that are less wasteful, contain fewer toxic components, and are easier to disassemble, reuse, and recycle may help in reducing the wastes and deposit/refund schemes to encourage consumers to return electronic devices for collection and reuse/recycling. There is need of more recycling facilities and development of infrastructure to handle e-waste effectively. Each state should develop its own scrap yards in the respective cities to warehouse e-waste.

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