E-Waste Management – Accountability and Strategies

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Abstract

The electrical and electronic equipment (EEE) industry is the world’s largest and fastest growing manufacturing industry providing a role of a forceful leverage to the socio-economic and technological growth of a developing and developed society. These wastes have a major impact over the health of society. Tragedy at the Maya Puri Market (New Delhi, India) is one of the latest examples of this where approximately ten persons have died. After the interrogation it was found that this has occurred due to care less handling of e-waste. There are numerous examples like this. In this paper we analyze the responsibility and accountability of the society or manufacturer or seller or any other people responsible for generation of e-waste. The limitation of this paper is that due to non availability of sufficient data, we may only discuss the accountability and responsibility followed by suggestion of strategies based upon our experience.

Approach of the Study: The study has been carried on in two phases; the first phase was exploratory research and the second phase constructive research.

1. Introduction

The electrical and electronic equipment (EEE) industry is the world’s largest and fastest growing manufacturing industry providing a role of a forceful leverage to the socio-economic and technological growth of a developing and developed society. The various sections of the society which are accountable for the e-waste are manufacturers/sellers, users, and Government at large, in respect of dumping and reuse/recycling. As per the data from Toxics Links, an IT company based in Bangalore dumps around 30,000 computers per year without taking into account its impact on health and environment, and many other such companies are doing the same, resulting in the accumulation of the burden on earth. The problems, issues and the challenges emerging due the consequences of the consumer-oriented growth with rapid product obsolescence and technological advances, is the result of the insufficient awareness among the stakeholders and lack of sense of responsibility towards the environment. The society as a whole must work together upon the economic, environmental and social benefits costs of recovery approaches, and efficient e-waste management.

The unsustainability of discarded electronics and computer technology is another reason for the need to recycle/reuse. Not only to developing countries but even in developed countries recycling and disposal of e-waste may involve significant risk to workers and communities and great care must be taken to avoid unsafe exposure in recycling operations and leaching of material such as heavy metals from landfills and incinerator ashes. Scrap industry and USA EPA officials agree that materials should be managed with caution, and environmental dangers of unused electronics have not been exaggerated.

2. Concept of E-waste Management

Electronic waste, e-waste, e-scrap, or Waste Electrical and Electronic Equipment (WEEE) describe loosely discarded, surplus, obsolete, or broken electrical or electronic devices. Informal processing of electronic waste in developing and developed countries causes serious health and pollution problems. It includes the broad spectrum of electronic appliances, products, components, and accessories that - due to malfunction, exhaustion (batteries, light bulbs and fluorescent tubes), or obsolescence have been discarded. E-waste is the by-product of the technological revolution. When disposed off in a landfill, it
becomes a conglomeration of plastic and steel casings, circuit boards, glass tubes, wires, resistors, capacitors, fluorescent tubes, and other assorted parts and materials. E-waste contain substances like lead, cadmium, beryllium, mercury, polyvinyl chloride (PVC) and brominated flame retardants has immense potential to harm health and environment if discarded improperly and are valuable as a source of secondary raw material. In the below table, various types of e-waste and their impacts over the health and environment have been discussed in brief.

### Table – 1: E-waste – Impact on health and environment

<table>
<thead>
<tr>
<th>E-waste Source</th>
<th>Components</th>
<th>Effect on health and environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solder in printed circuit board glass panel</td>
<td>Lead</td>
<td>• Damage to Central Nervous System and Peripheral Nervous system blood system and kidney damage</td>
</tr>
<tr>
<td>and gasket in computer monitor</td>
<td></td>
<td>• Adverse effect on the brain development of the children harmful for circulatory system</td>
</tr>
<tr>
<td></td>
<td>Cadmium</td>
<td>• Toxic irreversible effect on health</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Accumulates in kidney and liver</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Causes Neural damage</td>
</tr>
<tr>
<td>Chip register and semi conductors</td>
<td>Mercury</td>
<td>• Chronic damage to the brain</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Respiratory and skin disorder due to bio accumulation on the body of fish</td>
</tr>
<tr>
<td>Relays and switches and printed circuit</td>
<td>Chromium</td>
<td>causes bronchitis</td>
</tr>
<tr>
<td>boards</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Galvanized steel plate and decorator or</td>
<td>Chromium</td>
<td></td>
</tr>
<tr>
<td>hardener for steel housing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cabling and computer housing</td>
<td>Plastic and PVC</td>
<td>Burning produces dioxins that causes reproductive and developmental problem</td>
</tr>
<tr>
<td>Electronic equipment and circuit board</td>
<td>Brominated flame retardants</td>
<td>Disrupt endocrine systems function</td>
</tr>
<tr>
<td>Front panel of CRTs</td>
<td>Barium, Phosphorous and heavy metals</td>
<td>Causes muscle weakness and damage to heart, liver and spleen</td>
</tr>
<tr>
<td>Copper wire printed circuit board</td>
<td>Copper</td>
<td>Stomach cramps, nausea, liver damage or Wilson disease</td>
</tr>
<tr>
<td>Nickel rechargeable Batteries</td>
<td>Cadmium</td>
<td>Allergy of the skin to nickel results in dermatitis while of the nickel to lungs result in Asthma</td>
</tr>
<tr>
<td>Lithium –ion batteries</td>
<td>Lithium</td>
<td>• Lithium can pass into breast and may harm a nursing baby</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Inhalation of substance may cause lung edema</td>
</tr>
<tr>
<td>Motherboard</td>
<td>Beryllium</td>
<td>• Carcinogenic(lung cancer)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Inhalation of fumes and dust cause chronic beryllium diseases</td>
</tr>
</tbody>
</table>

### Problems of E-waste Management in India

A large number of persons gathered from around the World to tackle the upcoming challenge which at present not seeming very significant from India’s perspective. Some of the following reasons show that our country is required to make plan and their execution relating to management of e-waste to avoid any disasters in future.

i. In the present era, India has emerged one of the leading countries in the field of IT and this industry uses, most of the time, new technologies that contain harmful components. However, these IT Companies do not have any proper planning for discarding of old computers and other electrical and electronics equipments used by them.
ii. E-waste is now the fastest growing at an unsustainable rate, and most toxic, component of municipal garbage.

iii. In India, due to high growth rate of population we do not have sufficient lands to store e-waste or dump such waste. Therefore, disposal of these without proper treatment can harm environment and human health.

iv. E-Waste is the products of the life cycle process that can have upstream environmental and resource depletion effect as it contain many costly and scarce metal and resources. The owner of wastes are unaware of opportunities to sell or give it away so they incorrectly believes disposal to be the least-cost option;

v. Most of the firms using high technologies in their working generate too much waste, or otherwise manage it poorly, as they do not have the information needed to manage waste well;

vi. While designing products, companies often do not consider environmental damage as a result E product that after a certain time period get converted into E-waste is incorrectly disposed off leading to contamination of recyclables or unsafe treatment of hazardous material. Undoubtedly, these things contribute to the growing generation of waste. However, the exact size and nature of this relationship in India is uncertain due to the lack of adequate time-series data on waste generation.

vii. Local governments are facing huge costs to handle e-waste, and even greater costs if they do not capture this toxic stream and handle it in an appropriate manner.

viii. The collection and recycling of E-Waste in India is being done by informal sector which results in adoption of malpractices. However, the government has taken the following steps to enhance awareness about environmentally sound management of electronic waste (CII,2006):

   a. Several workshops on the Electronic Waste Management are organized by the Central Pollution Control Board (CPCB) in collaboration with Toxics Link CII etc.
   b. Various actions have been initiated by CPCB for rapid assessment of the E-Waste generated in major cities of the country.
   c. A National working group have been constituted for formulating a strategy for E- Waste Management.
   d. A comprehensive technical guide on “Environmental Management for Information Technology Industry in India” have been published and circulated widely by the Department of Information technology (DIT), Ministry of Communication and Information Technology.
   e. Demonstration project has also been set up by the Indian Telephone Industries for recovery of copper from printed circuit board. Although awareness and readiness for implementing improvements is increasing rapidly, the major impediments of E-Waste management include:

ix. The lack of reliable data that poses a challenge to the policymakers wishing to design an e-waste management strategy and to an industry wishing to make rational investment decision.

x. Only a fraction of E-Waste (estimated 10%) finds its way to recyclers due to absence of an efficient take back scheme of consumers.

xi. The lack of a safe E-Waste recycling infrastructure in the formal sector and thus Reliance on the capacities of the informal sector poses severe risk to environment and human health.

xii. The existing E-Waste recycling system is purely business driven that come about without any business intervention.

xiii. There is a huge employment potential but because of the concerned business activities goes unchecked by the government, thus, results in the loss of track on turnover rate.

4. E-waste Legislations in India

At present there is no specific Rules or Acts or Guidelines dealing with e-waste management in India. The Ministry of Environment & Forests (MoEF) of the Government of India is responsible for environmental legislation and its control. The Central Pollution Control Board (CPCB), an autonomous body under the MoEF, plays an important role in drafting guidelines and advising the MoEF on policy matters regarding environmental issues.
As per the Hazardous Waste Rules (1989), e-waste is not treated as hazardous unless proved to have higher concentration of certain substances. Though PCBs and CRTs would always exceed these parameters, there are several grey areas that need to be addressed, mainly on concerns of mercury, lead and cadmium. Basel Convention has waste electronic assemblies in A1180 and mirror entry in B1110. Electronic waste is included under List-A and List-B of Schedule-3 of the Hazardous Wastes (Management & Handling) Rules, 1989 as amended in 2000 & 2003. Therefore, the import of this waste requires specific permission of the Ministry of Environment and Forests.

In 2001, the German Technology Cooperation (GTZ) in cooperation with MoEF began work on hazardous waste management in India through the advisory services in environmental management. Subsequently, the global programme ‘Knowledge Partnerships in e-waste Recycling’ started implemented by Swiss Federal Laboratories for Material Testing and Research (EMPA). Combining the knowledge and technical expertise of EMPA on e-waste management, coupled with the field experience of the Indo-German projects in managing hazardous waste in India, the Indo-German-Swiss e-waste initiative was born in 2004.

5. Accountabilities and Responsibilities of Different Institution Regarding E-Waste

E-Waste management is new field in Indian perspective, first we need to assign who should be made accountable for E-Waste and its management. So that in future we need not to worry about the effect thereof on our environment and health as well as growth of this industry and our country should not be interrupted. After careful analysis we came to find a chain that should be managed aptly to foster growth and at the same time reduce the risk and uncertainties regarding E-Waste management. Based upon our analysis, we have categorised the following persons as accountable and responsible for generations and management of e-waste and the probable solutions.

5.1 Producer

The manufacturers of all the e-products are directly involved in the productions of these products. Hence they are primarily responsible for the production and management of e-waste. Further, they are also responsible for

a. Collection of any material that can be a source of damage to health and environment due to its constituents and forwarding it to safe way of recycling and reprocessing and disposal gateways. All electrical and electronic equipment should be given a unique serial number or identification code so that one can identify the responsible manufacturer.

b. E-waste should be collected “end of life” of their products in line with the principle of “Extended Producer Responsibility” (EPR), and to ensure that such e-wastes should be channelized to registered dismantler or recycler.

c. Producer should made arrangement were E-waste collected either individually or collectively for all electrical and electronic equipment at the end of their life.

d. The producer should provide contact details such as address, telephone numbers/helpline number and e-mail of dealers and authorized collection centers to consumer(s) or bulk consumer(s) so as to facilitate return of used electrical and electronic equipment.

e. The producer should create awareness through publications, advertisements, posters, or by any other means of communication and information booklets accompanying the equipment, with regard to information on hazardous constituents in product that has been purchased by consumers and later converted into e-waste, information on hazards of improper handling, accidental breakage, damage and/or improper recycling of e-waste.

5.2 Dealers

The dealers are responsible after the manufacturer as these are directly involved in the selling of products. The responsibilities of the dealers are discussed as follows.

a. Every dealer should be made responsible to collect the used electrical and electronic equipment (e-waste) by providing the consumer(s) a box, bin or a demarcated area to deposit e-waste.

b. Every dealer shall make an application in the prescribed form to the concerned State Pollution Control Boards or Pollution Control Committees for grant of one time registration. After filling the application for registration, if no objections are raised within
thirty days by the State Pollution Control Board, it shall be considered that dealer has been registered. Once the dealer is registered, he is required to submit details of e-waste collected to the concerned State Pollution Control Board or Pollution Control Committees on half yearly basis and registration would be liable for cancellation on failure to furnish these details to the State Pollution Control Boards or Pollution Control Committees.

c. Every dealer should made to ensure that the e-waste collected is safely transported back to the producer or to authorized collection centre as the case may be.

d. Every Dealer should be made to file annual returns in prescribed form to the concerned State Pollution Control Board or Pollution Control Committee, on or before the 30th day of June following to the financial year to which that return relates.

e. Every dealer is required to maintain records of the e-waste handled in prescribed format and such records should be available for scrutiny by the appropriate authority.

5.3 Refurbisher

The refurbishers are those persons who rectify the defected part of the disposed equipments. These persons make the parts resuable. Their responsibility are discussed below.

a. Every refurbisher should be made to collect e-waste generated during the process of refurbishing and channelized the waste to authorized collection centre.

b. Every refurbisher is required to file an application in the prescribed form to the concerned State Pollution Control Boards or Pollution Control Committees for grant of one time registration. After filling the application for registration, if no objection is raised within thirty days by the State Pollution Control Board, it shall be considered that refurbisher has been registered. Once the refurbisher is registered, he is required to submit details of e-waste collected to the concerned State Pollution Control Board or Pollution Control Committees on half yearly basis and registration would be liable for cancellation on failure to furnish these details to the State Pollution Control Boards or Pollution Control Committees. The refurbisher is required to maintains the relevant documents and shall file the half yearly and annual returns as the dealers are required.

c. Every refurbisher shall ensure that the e-waste thus collected is safely transported back to authorized collection centre or registered recyclers as the case may be.

5.4 Consumer or Bulk Consumer

Consumers are responsible for the following

a. Consumers using electrical and electronic equipment shall ensure that used electrical and electronic equipment (e-waste) which are not fit for the intended use are deposited with the dealer or authorized collection centres.

b. Bulk consumers using electrical and electronic equipment shall ensure that used electrical and electronic equipment (e-waste) which are not fit for the intended use are auctioned to, deposited with the dealer or authorized collection centers or refurbisher or registered dismantler or recyclers, avail the pick-up, or take back services provided by the producers.

5.5 Dismanteler

The dismanteler is that person which dismantle the electrical and electronic equipments which may or may not be available for reuse. The responsibilities of dismantelers are

a. ensure that that no damage is caused to the environment during storage and transportation of e-waste.

b. ensure that the dismantling processes do not have any adverse effect on the health and the environment;

c. Ensure that the facility and dismantling processes are in accordance with the standards or guidelines published by the Central Pollution Control Board from time to time; and ensure that dismantled e-waste are segregated and sent to the registered recycling facilities for recovery of materials.

d. Ensure that non-recyclable/non-recoverable components are sent to authorize treatment storage and disposal facilities.
e. The dismantler shall not process any e-waste for recovery or refining of materials, unless he is registered as recycler for refining and recovery of materials.

5.6 Recycler
The recycler has following responsibilities.

a. Ensure that the facility and recycling processes are in accordance with the standards laid down in the guidelines published by the Central Pollution Control Board from time to time.

b. Ensure that residue generated thereof is disposed of in a hazardous waste treatment storage disposal facility.

Recycling electronic waste is very difficult and can be very costly. While some equipment can be recycled with ease such as laptop computers, other pieces of equipment such as the cathode ray tube found in CRV monitors can be very expensive and very difficult to recycle. Often, even once all of the valuable parts of old electronics has been recycled, the rest of the equipment still ends up in the landfills with many toxic components.

6. E-Waste Management Strategies
E-wastes volume can be reduced by ensuring that the product is built for re-use, repair and/or upgradeability. Some of the suggested strategies for better management of e-waste management are as:

1. There is a need for modification/upgrading the Processing Techniques.

2. India urgently needs National E-waste policy: Promulgate an all-embracing national E-waste Management law and an all-encompassing policy there under, for substituting the existing Hazardous Waste (Management and Handling) Rules 2003, as the latter are not comprehensive enough to attain the aforesaid objectives. A wide range of market-based instruments may be utilized in e-waste management policy in India through landfill disposal levies, advance disposal and recycling fees and subsidy schemes on e-waste collection for recycling purpose.

3. While formulating the policy, Governments should leave the provision of e-waste-exchange services to private markets.

4. Consider gradual introduction of enhanced producer responsibility into Indian process, practices and procedures so that preventive accountability gains preponderance over polluter immunity.

5. The e-waste policy instruments should be established under Extended Producer Responsibility (EPR) and Product Stewardship (PS) schemes/policies such as:

   A. **Take-back requirements** — producers would be required to take their products back from final consumers for the purpose of resource recovery and/or disposal;

   B. **Product leases** — consumers lease the product and must eventually return it to the producer so that materials recovery and recycling can be undertaken;

   C. **Advance disposal or recycling fees** — a fee is levied on a new product to (at least partially) subsidize the cost of its future disposal or recycling;

   D. **Deposit refunds** — consumers pay a deposit when they buy a product and this is refunded when the product is returned to an approved dealer or specialized treatment facility;

   E. ** Tradable recycling credits** — producers must obtain a certain number of recycling credits for every product they supply, either by earning them through their own recycling efforts or by purchasing them from others who recycle;

   F. ** Tradable landfill diversion credits** — producers must obtain a certain number of landfill diversion credits for every product they supply, either by earning them through their own efforts to divert waste from landfill or by purchasing credits from others who do so;

   G. **Education and awareness-raising** — information provision on how to dispose of a product or participate in a specific EPR or PS scheme;

   H. **Product Labeling** — an electronic product should be labeled so that consumers have information on its environmental performance and/or how it can be recycled or disposed of;

   I. **Targets** — producers must achieve specific outcomes, such as a minimum amount of recycled content per product; and/or
J. **Compliance measures** — such as penalties for non-compliance, bans on specific materials, and restrictions on disposal to landfill or a waste treatment facility.

6. The process for complete national level assessment, covering all the cities and all the sectors, should be initiated, which must envelope inventories, existing technical and policy measures required for emergence of national E-waste policy/strategy and action plan for eco-friendly, economic E-waste management, and also should culminate in identifying potentially harmful substances and testing them for adverse health and environmental effects for suggesting precautionary measures.

7. Voluntary industry initiative — firms should participate on a voluntary basis and there is no direct government involvement (albeit there is often some coercion or strong encouragement);

8. Creation of a public-private participatory forum of decision making, problem resolution in E-waste management, which could be a Working Group comprising Regulatory Agencies, NGOs, Industry Associations, experts etc. to keep pace with the temporal and spatial changes in structure and content of E-waste, and also this Working Group can be the feedback providing mechanism to the National Nodal Authority in the Government that will periodically review the existing rules, plans and strategies for E-waste management.

9. Voluntary industry–government agreement — both firms and governments are involved, but individual firms can choose not to participate;

10. Industry–government co-regulation — a combination of industry self regulation and supporting government regulation, with the latter being used to ensure, among other things, no firm can ‘free ride’ on the efforts of others;

11. Government provision of general information and education programs can improve waste management practices, provided the information is accurate and relevant, would not otherwise be supplied by private markets, and there is a reasonable prospect of the information producing net benefits to the community. Therefore, Government should take steps to promote Information, Education and Communication (IEC) activities in schools, colleges, industry etc. to enhance the knowledge base on E-waste management using the PPP mode.

12. Creation of database on best global practices and failure analyses for development and deployment of efficacious E-waste management and disposal practices within the country.


14. Community support for recycling should count. Support for recycling does not always extend to a willingness to purchase products with recycled content. More direct testing of people’s preferences and willingness to pay for recycling. Governments should provide better information on, and promote debate about, the costs and benefits of recycling and other waste management options. Community and policy makers able to make better informed waste management choices.

15. Formulate and regulate the occupational health safety norms for the E-waste recycling which is now mainly confined to the informal sector.

16. By preferring incarceration over monetary penalties for demonstrating deterrent impact government should insist on stringent enforcement against wanton infringement of Basel convention and E-waste dumping.

17. Announcement of incentives for the growth of E-waste disposal agencies so that remediation of environmental damage, threats of irreversible loss and lack of scientific knowledge do not anymore pose hazards to human health and environment. Simultaneously, as a proactive step, lest it becomes too late for their intervention municipal bodies must be involved in the disposal of e-waste.

18. The trade policy and Exim classification codes should be reviewed time to time to plug the loopholes which are often being misused for cross-border dumping of E-waste into India.

19. For policy makers, managers, controllers and operators, sustained capacity building for industrial E-waste handling should be mandated. Enhance consumer awareness regarding the
potential threat to public health and environment by electronic products caused due to improper disposal.

20. Any development in these sectors will have to be built on existing setup as the waste collection and pre-processing can be handled efficiently by the informal sector, at the same time offer numerous job opportunities.

21. State Governments should investigate moving waste disposal and resource recovery services to appropriately-constituted regional bodies. Collection of e-waste should also be managed through local government.

7. Conclusion

The problems, issues and the challenges emerging due the consequences of the consumer-oriented growth with rapid product obsolescence and technological advances make responsible and accountable all persons from manufacturer to end user including recyclers. The drafted E-waste Management Rules, 2010 is not yet passed and implemented. The said Rules are the only specific Rules on the management of E-waste. This rule can only bind the above-discussed persons because of consideration of Extended Producer Responsibility (EPR). The Government should focus on implementing such Rules as early as possible and should also take preventive actions against e-waste that is dumped by developed countries in developing countries in the form of donations or gifts.

References


