

E-Waste Management: A Global Need

Archana Gokhale
Research Scholar,
Mewar University
Chittorgarh,Rajasthan,

Dharamveer Sharma
Assistant Professor
Deptt . Of Computer Science
Punjabi University,Patiala

“When we poison our environment, we poison our bodies, because our bodies are this environment, taken in as food, water and air. Environmental pollution becomes internal pollution.” -Udo Erasmus

Abstract

“Electronic waste” in general may be defined as all the discarded electronic machines, computers, office electronic equipments, electronic entertainment devices, mobile phones, microwave ovens, television sets, air conditioners, refrigerators, electronic toys, VCRs, stereos, fax machines, electric lamps, batteries etc. E-wastes are considered highly dangerous, as certain components of some electronic products contain materials such as heavy metals and non biodegradable materials that are hazardous, depending on their condition and density. The hazardous content of these materials pose a threat to human health and environment. Discarded electronic items if not disposed properly can leach lead, cadmium, mercury and other substances into soil and ground water resulting in soil air and water pollution. Many of these products can be reused, refurbished, or recycled in an environmentally sound manner so that they are less harmful to the ecosystem.

Over the years, E-waste has emerged as a global problem due to the problems of its high speed of accumulation and slow rate of disposal. The rapid advancement in the electronic devices and their low initial cost leads to the ever accumulation of e-waste resulting in ever growing environment problem due to threat to eco system. The problem has attained serious levels in the developing countries like india as developing countries have become a favorite destination for developed countries for the disposal and dumping of their hazardous e-waste in a easier manner in comparison to their own countries. Further the open disposal and unsafe recycling of the electronic items in the unorganized sector has increased the negative effect of electronic pollution at an alarming levels. At the same time the harmful effect of electronic waste pose a serious threat to the human health in the form of various ailments and diseases.

Electronic waste, or e-waste, is an emerging problem given the volume of e-waste being generated and the content of toxic and hazardous materials in them. The Basel Convention has identified e-waste as hazardous, and developed a framework for controls on trans-boundary movement of such waste. The Basel Ban, an amendment to the Basel Convention that has not yet come into force, would go one step further by prohibiting the export of e-waste from developed to industrializing countries.

This paper highlights the global e-waste problem and how it could be managed or reduced by means of proper recycling, reusing and disposal.

Keywords –E-waste, Environment, Hazardous Waste, e-waste management, recycling, Trans boundary movement

Introduction

We are living in an era of Information Technology. The IT revolution has not only brings the fruits of development but also the negative impacts on our environment and the health. The ever growing electronic industry is gradually leaving its by products and harmful waste components. The waste generated by the electronic industry has a huge quantum. The electronic waste is a new emerging issue of the IT Revolution. The quantity of e waste is increasing day by day as daily new electronic products are coming in the market due to the cut throat competition of the different industries manufacturing various electronic products viz. Computers, cell phones, LCD/LED ,TVs ,photocopier, fax machines etc.

As all we know electronic industry is the world's largest and fastest growing manufacturing industry. The electronic industry has provided the socio economic and technological growth to the society of developing countries. Due to the rapid technological advances in various electronic products such as computers, cell phones etc has made the previous versions of these products as obsolete in a very short period of time. All these electronic products contain toxic materials as their essential components and so they create a severe environmental problem of disposal of the toxic electronic waste which gradually enters the environment without its proper disposal or management at present.

All over the world the issue of e-waste has attained a serious level. In this regard fundamental aims of Basel Convention are the control and reduction of trans boundary movements of hazardous and other wastes including the prevention and minimization of their generation, the environmentally sound management of such wastes and the active promotion of the transfer and use of technologies.

The Basel Convention brought about a respite to the transboundary movement of hazardous waste. India and other countries have ratified the convention. However United States (US) is not a party to the ban and is responsible for disposing hazardous waste, such as, e-waste to Asian countries even today. Developed countries such as US should enforce stricter legislations in their own country for the prevention of this horrifying act.

Contributors to e-Waste

As it's an era of Information Technology the different electronic products have entered our day today life in one form or another. Most of the people whether importer, manufactures, consumers or end user of electronic products in developed as well as developing countries are contributing the various quantities of electronic waste in one form or another. The situation is worse in the developing countries as they serve as the dumping grounds for the obsolete electronic waste from the developed nations. Some of the example in this regard is as follows-

- **Importer:** About 50% of the products imported to India are from secondary markets and are re-assembled using old components. The remaining percentage is covered by international manufacturers and national brands which import electronic scrap to other countries.
- **Manufacturers:** Multinational manufacturers are major contributors of e-waste. E-waste includes motherboards, CRT's (cathode ray tube), IC chips and other electronic devices.
- **Consumer:** The main sources of the e-waste generation are business sectors such as the corporate sector, private or public sectors which accounts for a total of 78% of all the PC's installed in India. Sometimes charitable and educational institutes use old computers as well.
- **Scrap dealers:** Rag pickers and scrap dealers have found a new way to begin their business by adopting this new waste stream. They carry out the primary work of re-assembling obsolete computers, reuse the working components, assemble new computers and sell them in the secondary market.
- **Recyclers:** this sector of recycling is highly unorganized. For example Delhi has never been concerned about the e-waste spread. Areas like slums of Seelampur, Mundka in the west, Shastri Park and Geeta Colony are doing unorganized recycling of e-waste. They use bare hands, hammers and screwdrivers for recycling which is hazardous to the human health.

- **End users:** in today's world most of the people uses an electronic item in one form or another such as cell phones, Computers, LCD TVs, Photocopier Machines, FAX machines etc. knowingly or unknowingly most of the people are contributing to the electronic wastes. All these electronic items become old and obsolete very soon and hence become electronic waste.

Impact on Environment and Health

E-waste contains many hazardous substances and chemicals, many of which are toxic and are likely to cause adverse effects on the environment and human health.

Electronic wastes can cause widespread environmental damage due to the use of toxic materials in the manufacture of electronic goods. Hazardous materials such as lead, mercury and hexavalent chromium in one form or the other are present in such wastes primarily consisting of Cathode ray tubes (CRTs), Printed board assemblies, Capacitors, Mercury switches and relays, Batteries, Liquid crystal displays (LCDs), Cartridges from photocopying machines, Selenium drums (photocopier) and Electrolytes. Although it is hardly known, e-waste contains toxic substances such as Lead and Cadmium in circuit boards; lead oxide and Cadmium in monitor Cathode Ray Tubes (CRTs); Mercury in switches and flat screen monitors; Cadmium in computer batteries; polychlorinated biphenyls (PCBs) in older capacitors and transformers; and brominated flame retardants on printed circuit boards, plastic casings, cables and polyvinylchloride (PVC) cable insulation that releases highly toxic dioxins and furans when burned to retrieve Copper from the wires. All electronic equipments contain printed circuit boards which are hazardous because of their content of lead (in solder), brominated flame retardants (typically 5-10 % by weight) and antimony oxide, which is also present as a flame retardant (typically 1-2% by weight).

Land filling of e wastes can lead to the leaching of lead into the ground water. If the CRT is crushed and burned, it emits toxic fumes into the air. These products contain several rechargeable battery types, all of which contain toxic substances that can contaminate the environment when burned in incinerators or disposed of in landfills. The cadmium from one mobile phone battery is enough to pollute 600 m3 of water. The quantity of cadmium in landfill sites is significant, and considerable toxic contamination is caused by the inevitable medium and long-term effects of cadmium leaking into the surrounding soil. Because plastics are highly flammable, the printed wiring board and housings of electronic products contain brominated flame retardants, a number of which are clearly damaging to human health and the environment.

Industrial Policies for e-waste management

❖ TCS e-waste management strategy

Through its e waste management policy TCS reaffirms its commitment towards the environmental protection by ensuring proper e-waste management. E-waste in this context refers to electronic waste as per the WEEE (Waste Electric and Electronic Equipment) Directives formulated by the European Union.

TCS being an IT organization contributes majorly to the global e-waste scenario. This policy reflects TCS objectives and measures to manage e-waste in an environmentally manner. This policy affects the way TCS handles, disposes outdated electronic and electrical equipments and procures new ones. This policy works in conjunction with the environment policy and green procurement policy. Through its policy TCS seeks to-

- Procure computers/ hardwares from USEPA /similar energy star labeled vendors; who likely to take back e waste in future
- Minimize generation of e-waste by extending the useful life of computers/hardwares to 4-5 years
- Adhere to WEEE Directives for e-waste handling
- Achieve 100 % environmentally responsible of e-waste
- Adhere to applicable country specific e-waste regulations

- Carryout e-waste disposal only through handlers/recyclers authorised by the ministry of environment and forest/ central or state pollution control Boards in India or country specific regulatory agencies.

❖ **Nokia's e-waste management initiative**

Nokia takes environmental efficiency into account in all stages of product lifecycle. Nokia focus on substance management, energy efficiency, take back and recycling. This ensures minimal environmental impact from start to finish, beginning with the extraction of raw materials and ending with recycling, waste treatment, and the reintroduction of recovered materials into the economic system. In order for Nokia to carry out their own responsibilities they need others in the value chain like consumers and retailers, to commit to bring back obsolete mobile devices for responsible recycling. Such co-operation eventually leads to a situation where significant drivers for environmentally optimized product design enabling easier recycling would become commonplace, bringing further benefits for consumers, producers and the environment.

Take back and recycling is one of the four focus areas in Nokia's environmental work. They cover three different aspects in their activities:

- The recycling of the materials used in Nokia's operations and facilities
- Designing products for recycling, and
- The take back and recycling of obsolete products.

In an effort to promote recycling of e-waste, Nokia India has initiated an operation where customers can drop their old mobile sets in the company's stores and win gifts or get concession on purchase of new handsets. This service started from Delhi in India where various recycling bins were set up across Nokia Care Centers. Customers can drop their used mobile handsets as well as other accessories like charger, battery, headphones, etc., in these bins. This whole operation was dubbed as 'Take Back' campaign. Company will also plant a tree for every handset dropped into the recycle bin. The company is planning to make an impact on the society by making its business go green. This practice started by Nokia, will serve as awareness campaign for other companies too and can prove a great help in reducing e-waste.

❖ **Dell's e-waste management strategy**

Dell is starting up a new service that will recycle old and unused electronics for small businesses. The program used to wash all the data from the hard drives will cost \$25 each of up to 10 pieces of hardware. Companies will also be able to resell their old valuable equipments to Dell. Dell's effort to save environment are being appreciated all over the world. Dell has been registered as one of the nation's 'responsible recyclers' by the Silicon Valley Toxics Coalition. This is because they do not transfer their electronic trash to the developing countries for hazardous dismantling rather they recycle it. Making green revolution as its theme and priority, Dell has also started making more energy efficient computers and is planning to plant trees to make up for the carbon emission done by its computers.

❖ **Toshiba steps up e-waste recycling to include copiers**

Toshiba is extending its recycling program to include copiers, imaging consumables and toner cartridges, etc. The company witnessed hike of 410% for electronic wastes recycled in 2010 when compared to 2009. The company has named this new campaign as 'Zero Waste to Landfill' recycling program. Aim is to provide an easy and efficient service to the businesses to recycle e-wastes. Since 2008, Toshiba works in collaboration with Close the Loop, the company which creates various recycled products like park benches, fences and garden boxes, etc., from recycled plastic.

❖ **Jidaw Systems Limited Electronic Waste Policy**

Jidaw Systems Limited is a company that basically deals in training, consulting and web content provision. Company totally discards the use of heavy electronics and generates very less electronic waste. The company has laid a few e-waste policy objectives and strategies. It includes minimum generation of e-waste and pollution control, dumping of e-waste with no harmful impact on the environment, maintenance of computers/hardware to increase their life, dejecting obsolete computers importation and disposing of electronic waste into Nigeria, encouraging use of recycled products, promoting e-waste recycling and imbibing it completely.

❖ **Coca-Cola's initiative for e-waste management**

The world around is going green and in this green race big companies are working hard to leave a positive impact on their customers and the society. Recently Coca-Cola announced \$3 million to achieve green upgrades to its headquarters located in Atlanta. The main aim of this green program is to reduce energy consumption in the building by 23% and water consumption by 15%. In this regard, energy efficient lights and air-conditioning equipments are being installed and provisions are being made to harvest rain water. Investment cost will be recovered quickly because company will save \$1 million annually by implementing this project. The project is expected to be complete in next one and half year and once operational it will be able to reduce carbon emission by 10,000 metric tons annually.

E-waste management strategy

Management of e-waste should begin at the time of generation. Minimization of waste and adapting replaceable techniques to manage e-waste can be helpful. The managing of e-waste includes:

1. Recovery and reuse
2. Volume Reduction
3. Production-process modification

It is high time the manufactures, consumers, regulators, municipal authorities, state governments, and policy makers take up the matter seriously. It is the need of the hour to have an “e waste-policy” and national regulatory frame work for promotion of such activities. An e Waste Policy is best created by those who understand the issues. So it is best for industry to initiate policy formation collectively, but with user involvement. Sustainability of e-waste management systems has to be ensured by improving the effectiveness of collection and recycling systems (e.g., public-private-partnerships in setting up buy-back or drop-off centers) and by designing-in additional funding e.g., advance recycling fees.

Role of Government

Generally government plays a welfare role for the people of the country. Governments should develop certain mechanisms to curtail the growing menace of electronic waste in a country. These mechanisms may be developed either by the public sector or in a “Public Private Partnership” (PPP) model for effective results. Governments should set up regulatory agencies in each district, which are vested with the responsibility of co-coordinating and consolidating the regulatory functions of the various government authorities regarding hazardous substances.

(i) Governments should be responsible for providing an adequate system of laws, controls and administrative procedures for hazardous waste management. Existing laws concerning e-waste disposal be reviewed and revamped. A comprehensive law that provides e-waste regulation and management and proper disposal of hazardous wastes is required. Such a law should empower the agency to control, supervise and regulate the relevant activities of government departments.

Under this law, the agency concerned should

- Collect basic information on the materials from manufacturers, processors and importers and to maintain an inventory of these materials. The information should include toxicity and potential harmful effects.
 - Identify potentially harmful substances and require the industry to test them for adverse health and environmental effects.
 - Control risks from manufacture, processing, distribution, use and disposal of electronic wastes.
 - Encourage beneficial reuse of "e-waste" and encouraging business activities that use waste". Set up programs so as to promote recycling among citizens and businesses.
 - Educate e-waste generators on reuse/recycling options
- I. Governments must encourage research into the development and standard of hazardous waste management, environmental monitoring and the regulation of hazardous waste-disposal.
 - II. Governments should enforce strict regulations against dumping e-waste in the country by outsiders. Where the laws are flouted, stringent penalties must be imposed. In particular, custodial sentences should be preferred to paltry fines, which these outsiders / foreign nationals can pay.
 - III. Governments should enforce strict regulations and heavy fines levied on industries, which do not practice waste prevention and recovery in the production facilities
 - IV. Polluter pays principle and extended producer responsibility should be adopted.
 - V. Governments should encourage and support NGOs and other organizations to involve actively in solving the nation's e-waste problems.
 - VI. Uncontrolled dumping is an unsatisfactory method for disposal of hazardous waste and should be phased out.
 - VII. Governments should explore opportunities to partner with manufacturers and retailers to provide recycling services.

Putting the onus of re-cycling of electronic wastes (e-waste) on the producers, the Ministry of Environment and Forest (MoEF) has for the first time notified e-waste management rules in India. The rules will come into effect from May 1, 2012. Under the new rules, producers will have to make consumers aware about the hazardous components present in the product. Also, instructions for consumers for handling the equipment after its use along with the do's and don'ts. They will also have to give information booklets to prevent e-waste from being dropped in garbage bins.

However, according to the rules, bulk consumers such as enterprises and government will be responsible for recycling of the e-wastes generated by them. The bulk users have to ensure that the e-waste generated by them is channelized to authorized collection centers or is taken back by the producers. They also have to maintain records of e-wastes generated by them and make such records available with State Pollution Control Boards or the Pollution Control Committees. The State Pollution Control Board will be required to prepare and submit to the Central Pollution Control Board (CPCB) an annual report (based on the data received by consumers) with regard to implementation of these rules, by September 30 of every year.

Responsibilities of the end user's

Waste prevention is perhaps more preferred to any other waste management option including recycling. Donating electronics for reuse extends the lives of valuable products and keeps them out of the waste management system for a longer time. But care should be taken while donating such items i.e. the items should be in working condition.

Reuse, in addition to being an environmentally preferable alternative, also benefits society. By donating used electronics, schools, non-profit organizations, and lower-income families can afford to use equipment that they otherwise could not afford.

E-wastes should never be disposed with garbage and other household wastes. This should be segregated at the site and sold or donated to various organizations.

While buying electronic products opt for those that:

- are made with fewer toxic constituents
- use recycled content
- are energy efficient
- are designed for easy upgrading or disassembly
- utilize minimal packaging
- offer leasing or take back options
- Have been certified by regulatory authorities. Customers should opt for upgrading their computers or other electronic items to the latest versions rather than buying new equipments.

References

1. Kurian Joseph (2007)- Electronic Waste Management in India-Issues and Strategies.
2. Devi B.S, Shobha S. V, Kamble R. K. (2004). E-Waste: The Hidden harm of Technological Revolution, Journal IAEM, Vol.31, pp.196-205
3. Trick J. (2002). A mobile is not just for Christmas, Tuesday, 24th December 2002 <http://news.bbc.co.uk>.
4. Envocare (2001). Mobile Phone Recycling at www.envocare.co.uk
5. Ramachandra T.V and Saira V. K. (2004). Environmentally sound options for waste management, Envis Journal of Human Settlements, March 2004.
6. Piyali Mandal(2011)- India gets first e-waste management rules.
7. http://www.step-initiative.org/actors/featured_member.php?id=7
8. Shallu Sharma: <http://www.waste-management-world.com/index/from-the-wires/wire-news-display/1500590852.html>.
9. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal.