
E-Waste: Scourge of Technology Revolution

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ABSTRACT

The Rapid advancement in technology over the last two decades has drastically improved globally the quality of life, working and operating environment. The electronics industry is the world's largest and fastest growing manufacturing industry. This has been possible due to fast growing technology in this sector. Due to recent changes in policy in India, leading multinational companies have set up electronics manufacturing facilities and R&D centers for hardware and software. There is no doubt that the technological advancement helped Indian economy to grow faster and led to increase in the consumption of electronics products. There is a trend among consumers to replace their household electronics items with latest models. The effect is a higher rate of obsolescence which has been leading to growing piles of e-waste. Environmental challenges created through the process of consumption and obsolescence which, if not addressed, may escalate into a situation that would cause irreversible damage to the environment and ultimately human health. The aim of this research paper is to reveal the various issues involved in generation and management of e-waste, particularly from Indian perspective. The paper also discusses initiatives of some of MNCs in managing E-waste.

Keywords: *e-waste, electronic industry, rate of obsolescence, environmental challenges.*

Introduction

The Electronic waste which is popularly known as the E-waste, can be defined as electronic equipments, products connected with power plugs and batteries which have become obsolete. The E-waste also encompasses ever growing range of obsolete electronic devices such as computers, servers, main frames, monitors, TVs and display devices, telecommunication devices such as mobile phones, calculators, audio and video devices, printers, scanners, copiers and fax machines besides refrigerators, air conditioners, washing machines, and microwave ovens. The E-waste also covers obsolescence of recording devices such as DVDs, CDs, floppies, tapes, printing cartridges, military electronic

waste, automobile catalytic converters, electronic components such as chips, processors, mother boards, printed circuit boards, industrial electronics such as sensors, alarms, sirens and security devices. E-waste contains over 1000 different substances many of which are toxic and need to be handled in controlled and secure manner.

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The electronic waste is one of the rapidly growing environmental problems of the World. In India, the electronic waste management assumes greater significance not only for the generation of our own waste but also dumping of the E-waste particularly computer waste from the developed countries. The increasing "market penetration" in developing countries, "replacement market" in developed countries and "high obsolescence rate" make e-waste as one of the fastest growing waste streams.

Indian Scenario

In India, till now, none of the existing environmental laws have any direct reference to electronic waste or refer to its handling as hazardous in nature. However several provisions of these laws may apply to various aspects of electronic wastes. Since the e-waste or its constituents fall under the category of "hazardous" and "non hazardous waste", they shall be covered under the purview of "The Hazardous Waste Management Rules, 2003". The Hazardous Waste [Management & Handling] Rules, 1989 were amended in 2000 and 2003. These Rules regulate the generation, collection, storage, treatment, disposal, exports and imports of hazardous waste. According to these Rules, all hazardous wastes are required to be treated and disposed off in specially designed secured landfills. These Rules provide for the development of common hazardous waste treatment, storage and disposal facility thorough joint venture partnership. Composition of e-waste is very diverse and differs among products across different categories. Broadly, it consists of ferrous and non-ferrous metals, plastics, glass, wood & plywood, printed circuit boards, concrete and ceramics, rubber and other items. Iron and steel constitutes about 50% of the e-waste followed by plastics(21%), non ferrous metals (13%) and other constituents. Non-ferrous metals consist of metals like copper, aluminum and precious metals ex. silver, gold, platinum, palladium etc.

The presence of elements like lead, mercury, arsenic, cadmium, selenium and hexavalent chromium and flame retardants beyond threshold quantities in e-waste classifies them as hazardous waste. India, at present, generates about 400,000 tones of e-wastes annually of which only 19,000 tones are getting recycled according to recent data by hardware manufacturers association, Mait (Manufacturer's

Association of Information Technology). According to Mait, around 40 per cent of the unused and obsolete electronic products sit idle at homes, godowns and warehouses as one does not know what to do with it or there is no systematic mechanism to dispose it. Sixty-five cities in India generate more than 60% and ten states generate 70% of total e-waste. Among top ten cities generating e-waste, Mumbai ranks first followed by Delhi, Bangalore, Chennai, Kolkata, Ahmadabad, Hyderabad, Pune , Surat and Nagpur. The highly toxic chemicals found in the different components of electronic spare parts can contaminate soil, groundwater and air as well as affect workers of the unit and the community living around it. Moreover, workers in computer waste recycling operations may face dangerous working conditions where health and environmental conditions are compromised. Hence there is a clear reason to be concerned about trade and technology in practice and existing poor disposal practices of computer waste in India.

Dynamics of E-Waste Generation

India, with over 1 billion people, is the second most populous country in the world. Although penetration into Indian market for consumer durables is substantially lower than that of developed countries; the size of India's market in absolute terms is larger than that of many high-income countries. Moreover, India is one of the fastest growing economies of the world and the domestic demand for consumer durables in India has been skyrocketing. From 1998 to 2002, there was 53.1% increase in sales of both large and small domestic household appliances. The growth in PC ownership per capita in India was 604% between 1993 and 2000 compared to a world average of 181%. As a result, total PC base during this period has grown from 450,000 PCs to 4,200,000 PCs. Unfortunately, the indicators of economic growth and environmental protection are at odds with each other. India ranks an abysmal 123th on the 2010 Environmental Sustainability Index. Environmental concerns among manufacturers as well as awareness of consumers regarding environmental issues are not very high. While the government has passed several environmental protection laws, their enforcement remains questionable. However, there is increasing pressure both on the government as well as the private sector from strong environmental NGOs. While the environmental concerns take a back seat amid more

pressing problems, Indians culturally are loathe to waste and this ensures that electrical and electronic products often find second- and even third hand users down the income chain. Furthermore, recycling is a market-driven and growing industry in India, although driven by economic necessity associated with poverty.

A report by Toxics Link, a New Delhi based NGO on the computer waste, estimated that in India, business and individual households make approximately 1.38 million personal computers obsolete every year. The alarming rate of generation of E-waste in India and the unsafe methods of disposal in small and medium-scale units in the informal sector pose serious environmental and health risks. About 30,000 computers become obsolete every year from the InfoTech industry in Bangalore alone. The average life span of computers is three to five years and in case of mobile phones, it is only two to three years. The life cycles of products are shrinking due to fast innovation and promotional offers. Attractive market offers push the customer to buy new products rather than upgrading old ones. The customer who likes to replace their computers and mobiles as they see a new product with improved and innovative features, is known as early adopter of technology. They contribute to more e-waste generation. Indian people generally use pirated operating systems and software that result in crumb DVDs and CDs. The new computer is purchased sometimes not due to improper functioning but for upgrading system or software. Customers these days don't upgrade the computer; they prefer to replace it and very few customers like to send products for repair and servicing. Moreover, some of the new software present in the market can be run smoothly on new operating systems. They also require high Random Access Memory (RAM) as well as more space on hard disks. Therefore, new operating systems and changing software in computers are also a major reason for more e-waste generation. The components of the mobile and computers are so costly that customers prefer to buy new products. For example, the cost of battery in the case of mobiles and laptops, and cost of cartridge in the case of printers, etc. Customers don't think to replace the component and prefer to replace product with new ones. The electronic waste, if treated properly, is a valuable source for secondary raw materials while, if not treated properly, it is a major

source of toxins and carcinogens. Unsafe recycling methods not only expose those involved in the activity to serious health hazards but also pollute the surroundings. Therefore, there is a need to have an organized sector for recycling E-waste in a safe manner.

Impacts of E-Waste

Over years, the E-waste has become a global problem. The rapid technology change in the electronic devices coupled with low initial cost breeds obsolescence resulting in a growing e-waste environmental problem. What makes the matters worse for developing countries like India is that they have become the destination for developed nations for dumping their hazardous E-waste. The unsafe recycling of the electronic goods in the unorganized sector leading to a negative effect on the environment added to the problem. The effects of E-waste on human beings are too dangerous to be ignored. Electronic wastes can cause widespread environmental damage due to the use of toxic materials in the manufacturing 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. Land fillings with the E-wastes can cause leaching 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 the waste 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.

Some highly toxic substances found in E-waste and their ill effects on human beings are as follows –

- **Lead** – Lead is found in television and computer monitors on glass panels. Exposure to high levels of lead can result in vomiting, diarrhea, convulsions, coma or even death. Other symptoms are appetite loss, abdominal pain, constipation, fatigue, sleeplessness, irritability, and headaches. Lead damages the central and the peripheral nervous system, the circulatory system, the reproductive system and mental development of young children.
- **Cadmium** – It is used in making semiconductor chips and cathode ray tubes (CRTs). Inhalation of cadmium can cause severe damage to the lungs, kidneys and can even cause death.
- **Mercury** – The electronic goods industry consumes about 22 per cent of all the mercury produced in the world. Mercury is used in the manufacturing of circuit boards, cell phones, and batteries. Mercury is also used in flat screen displays in television and computer monitors. Mercury causes severe damage to organs such like the brain and the kidneys.
- **Barium** – Barium is used to protect people from radiation from the cathode ray tube (CRT) screen panels. It can cause the brain to swell, weaken muscles and cause severe damage to the heart, liver and spleen.
- **Beryllium** – Beryllium is used in the electronics industry because it is light, strong, a good conductor of electricity and non-magnetic. However it is extremely harmful if inhaled and can cause lung cancer.
- **Hexavalent chromium** – Chromium is used to prevent corrosion in steel and in steel housing. Chromium can enter the body and is absorbed by human cells. Once in the body, it has toxic effects. It can also damage DNA.
- **Poly-vinyl-chloride (PVC)** – Poly-vinyl-chloride or PVC makes up for the largest percentage of plastic used in electronic equipment. An average computer contains about 13.8 pound of plastic,

including PVC. The burning of PVC generates dioxins, a class of super-toxic chemicals that can damage the immune system and cause birth defects in children. PVC can also cause diseases such as brain and liver cancer.

Regulation for E-Waste Management in India

Putting the obligation 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. The e-waste (management and handling) Rules, 2011 would recognize the producers' liability for recycling and reducing e-waste in the country. The rules will come into effect from May 1, 2012. Personal Computer manufacturers, mobile handset makers and white goods makers will be required to come up with e-waste collection centers or introduce 'take back' systems. These rules will apply to every producer, consumer and bulk consumer involved in manufacture, sale, purchase and processing of electronic equipment or components," an environment ministry official said. The ministry is giving the producers of electrical and electronic equipment a breathing period of one year to set up their collection centers. The rules will come under the Environment Protection Act (EPA).

Under 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) the annual report (based on the data received by consumers) with regard to implementation of these rules, by September 30 of every year. On receiving reports for the State Pollution Board, the CPCB will

have to prepare a consolidated annual review on management of e-waste and forward it to the government along with its recommendations by December 30 of every year.

E-Waste Management: Corporate Initiatives

While the policymakers are yet to finalize laws to regulate e-waste management in the country, many multinational corporate houses have come forward voluntarily to help consumers dispose e-waste safely and thereby protect the environment. Some examples of corporate initiative are given below:

DELL

Since 2006, Dell India had set the trend by taking back the products manufactured by them once they became obsolete. DELL offered a system of free recycling for their consumers who could register online and the company would take back the obsolete products. Dell is a global industry leader in recycling. In 2006, it became the first technology company to offer free recycling of its products to consumers anywhere in the world with no exceptions. Recycling Discount Coupon is introduced by Dell to encourage PC recycling among its consumers. This coupon, offering a discount of Rs. 1000, may be used toward the purchase of any Dell system directly from Dell for any of its product lines. Available globally, Dell has now extended its free recycling program for consumers in India to accept computers from any vendor.

HCL

HCL Info systems Limited have announced an array of activities around e-waste disposal. The program will be rolled out across 505 'HCL Touch' centers spread over major metros and semi urban areas in India. Through this initiative, the company will enable its 'HCL Touch' centers across the country to accept the e-waste from its customers and put it in safe disposal process. Under this education campaign, HCL will also encourage people to dispose-off defunct IT equipments such as computers, keyboard, scanner, printers etc in an environmental friendly way.

NOKIA

Nokia India launched its 'Take Back' recycling initiative as a part of the nationwide rollout of the program over 25 cities since 2009. The program is aimed at creating consumer awareness on the benefits of recycling old phones, chargers and accessories. The initiative aims at inducing behavioral change among Indian mobile users to recycle their used handsets in an environmentally sustainable way."Nokia will plant a tree sapling for every handset dropped, irrespective of brand or model, into one of its recycling bins and also offer surprise gifts to the consumers. Globally, the Nokia Take-Back program has successfully been rolled out in over 85 countries with over 5000 recycling bins," Ambrish Bakaya, director corporate affairs, Nokia India Ltd said.

Conclusion

Solid waste management, which is already a mammoth task in India, is becoming more complicated by the invasion of e-waste. There exists an urgent need for a detailed assessment of the current and future scenario including quantification, characteristics, existing disposal practices, environmental impacts etc. Institutional infrastructures, including e-waste collection, transportation, treatment, storage, recovery and disposal, need to be established at national and/or regional levels for the environmentally sound management of e-wastes. Establishment of e-waste collection, exchange and recycling centers should be encouraged in partnership with private entrepreneurs and manufacturers. The problem of E-waste is growing in alarming proportions in India as also in the world. Although many developed countries have established well defined E-waste management systems, the systems in India have barriers from socioeconomic, infrastructural, and legal reasons. The E-waste recycling and recovery options practiced in India are very outdated and hazardous, causing severe environmental and occupational hazards. The establishment of E-waste Recycling & Treatment Facility shall be in line with the existing Guidelines/ best practices/requirements in India for establishing and operating "Recycling and Treatment and Disposal

Facilities" for hazardous wastes. Such facilities shall be set up in the organized sector. However, activities presently operating in the informal sector need to be upgraded to provide a support system for the integrated facility. This would enable to bring in the non-formal sector in the main stream of the activities and facilitate to ensure environmental compliances.

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