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E-waste Challenge for Developing Countries

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Abstract:

Electronic waste or 'E-waste' can include all electrical goods and electronic products that are no longer wanted or useful. Computers and computer equipment including printers, scanners, keyboards, mice and monitors as well as televisions are the most common form of E-waste. Other E-waste can include DVD and CD players, stereo and sound systems, photocopiers, faxes, digital cameras, game consoles and mobile phones. The hazardous content of these materials pose a threat to human health and environment. Discarded computers, televisions, VCRs, stereos, copiers, fax machines, electric lamps, cell phones, audio equipment and batteries if improperly disposed can leach lead and other substances into soil and groundwater. Many of these products can be reused, refurbished, or recycled in an environmentally sound manner so that they are less harmful to the ecosystem. This paper highlights the hazards of E-wastes, the need for its appropriate management and options that can be implemented.

Keywords: *Electronic or E-waste generation, recycle and management*

1. Introduction

The information technologies have revolutionized the way we live, work and communicate bringing countless benefits and wealth to all its users. The creation of innovative and new technologies and the globalization of the economy have made a whole range of products available and affordable to the people changing their lifestyles significantly. New electronic products have become an integral part of our daily lives providing us with more comfort, security, easy and faster acquisition and exchange of information. But on the other hand, it has also led to unrestrained resource consumption and an alarming waste generation. Both developed countries and developing countries like India face the problem of E-waste management. The rapid growth of technology, up gradation of technical innovations and a high rate of obsolescence in the electronics industry have led to one of the fastest growing waste streams in the world which consist of end of life electrical and electronic equipment products. It comprises a whole range of electrical and electronic items such as refrigerators, washing machines, computers and printers, televisions, mobiles, i-pods, etc., many of which contain toxic materials.

2. What is E-waste?

E-waste is a term used to cover all items of electrical and electronic equipment (EEE) and its parts that have been discarded by its owner as waste without the intent of re-use. It is also referred to as WEEE (Waste Electrical and Electronic Equipment), electronic waste or e-scrap in different regions. E-waste includes a wide range of products, almost any household or business item with circuitry or electrical components with power or battery supply. Electronic waste (E-waste) comprises waste electronics/electrical goods that are not fit for their originally intended use or have reached their end of life. This may include items such as computers, servers, mainframes, monitors, CDs, printers, scanners, copiers, calculators, fax machines, battery cells, cellular phones, transceivers, TVs, medical apparatus and electronic components besides white goods such as refrigerators and air-conditioners-waste contains valuable materials such as copper, silver, gold and platinum which could be processed for their recovery. E-waste is not hazardous per se. However, the hazardous constituents present in the E-waste render it hazardous when such wastes are dismantled and processed, since it is only at this stage that they pose hazard to health and environment. Electronics products like computers and cell phones contain a lot of different toxins. For example, cathode ray tubes (CRTs) of computer monitors contain heavy metals such as lead, barium and cadmium, which can be very harmful to health if they enter the water system. These materials can cause damage to the human nervous and respiratory systems (Table 1). Flame-retardant plastics, used in electronics casings, release particles that can damage human endocrine functions. These are the types of things that can happen when unprocessed E-waste is put directly in landfill. E-waste consists of all waste from electronic and electrical appliances which have reached their end- of- life period or are no longer fit for their original intended use and are destined for recovery, recycling or disposal. It includes computer and its accessories-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 composition of E-waste is diverse and falls under '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, aluminum and precious metals like silver, gold, platinum, palladium and so on. The presence of elements like lead, mercury, arsenic, cadmium, selenium, chromium, and flame retardants beyond threshold quantities make E-waste 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 and health hazard among the E-wastes. The countries of the European Union (EU) and other developed countries to an extent have addressed the issue of E-waste by taking policy initiatives and by adopting scientific methods of recycling and disposal of such waste. The EU defines this new waste stream as 'Waste Electrical and Electronic Equipment' (WEEE). As per its directive, the main features of the WEEE include definition of 'EEE', its classification into 10 categories and its extent as per voltage rating of 1000 volts for alternating current and 1500 volts for direct current. The EEE has been further classified into 'components', 'sub-assemblies' and 'consumables'.³ Since there is no definition of the WEEE in the environmental regulations in India, it is simply called 'E-waste'ⁱ.

3. Mapping Worldwide E-waste

World's E-waste to Grow 33% by 2017, Says Global Report By Tanya Lewis, Staff Writer | December 15, 2013, The interactive E-waste map shows data from 184 countries on the estimated amount of electrical and electronic equipment that hits the market and how much E-waste it ultimately generates. The world produced nearly 54 million tons (49 million metric tons) of used electrical and electronic products last year. That's an average of about 43 lbs. (20 kg), or the weight of eight bricks, for each of the 7 billion people on Earth. The StEP Initiative forecasts that by 2017, the world will produce about 33 percent more E-waste, or 72 million tons (65 million metric tons). That amount weighs about 11 times as much as the Great Pyramid of Giza. In Asia, the total E-waste generation was 16.0 Mt in 2014. China, India, Japan, Hong Kong, South Korea (Fig-1), Viet Nam, Bhutan, Cyprus and Turkey have national E-waste related laws. The Philippines and Jordan have regulations pending approval. The top three Asian countries with the highest E-waste generation in absolute quantities are China (6.0 Mt), Japan (2.2 Mt) and India (1.7 Mt). The top three Asian regions or countries having the highest E-waste generation in relative quantities are: Hong Kong (21.5 kg/inh.), Singapore (19.6 kg/inh.) and Brunei (18.1 kg/inh.)ⁱⁱ

There are 10 States that contribute to 70 per cent of the total E-waste generated in the country, while 65 cities generate more than 60 per cent of the total E-waste in India. Among the 10 largest E-wastes generating States, Maharashtra ranks first followed by Tamil Nadu, Andhra Pradesh, Uttar Pradesh, West Bengal, Delhi, Karnataka, Gujarat, Madhya Pradesh and Punjab. Among the top ten cities generating E-waste, Mumbai ranks first followed by Delhi, Bengaluru, Chennai, Kolkata, Ahmedabad, Hyderabad, Pune, Surat and Nagpur. The main sources of electronic waste in India are the government, public and private (industrial) sectors, which account for almost 70 per cent of total waste generation. The contribution of individual households is relatively small at about 15 per cent; the rest being contributed by manufacturers⁷

4. Recycling of E-waste

There are only few ways in which E-waste has been treated till date. But none has been found to be fully satisfactory. The most common one has been storing E-wastes in landfills, but it is replete with all the dangers of leaching described earlier. Another method commonly used has been to incinerate or burn the goods concerned, but this process releases heavy metals such as lead, cadmium and mercury into the atmosphere. Reusing and recycling are the other ways of dealing with E-wastes. They have been preferable because they increase the lifespan of the products and therefore imply less waste over time. The discard rate of Electronics Items also effect the recycling procedure (Table-2)

The urgent need to have a well coordinated mechanism on the collection, treatment and disposal of the E-waste .Proper control over the materials used in the manufacturing process is an important way to reduce waste generation. By reducing both the quantity of hazardous materials used in the process and the amount of excess raw materials in stock, the quantity of waste generated can be reduced. This can be done in two ways i.e. establishing material-purchase review and control procedures and inventory tracking system. Changes can be made in the production process, which will reduce waste generation. Hazardous materials used in either a product formulation or a production process may be replaced with a less hazardous or non-hazardous material.ⁱⁱⁱ Governments should set up regulatory agencies in each district, which are vested with the responsibility of coordinating and consolidating the regulatory functions of the various government authorities regarding hazardous substances. Governments should be responsible for providing an adequate system of laws, controls and administrative procedures for hazardous waste management 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.

Televisions and computers can be taken to recycling locations. Most other E-waste will also be accepted separately by commercial recyclers or local transfer stations. The cost of the recycling for transfer stations or commercial recyclers depends on the amount of recyclable material in the item. For example materials like copper and steel have a higher value than glass or plastic.

5. Impact of Hazardous Substances on Health and Environment

The waste from electronic products include toxic substances such as cadmium and lead in the 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 in older capacitors and transformers; and brominated flame retardants on printed circuit boards, plastic casings, cables and PVC cable insulation that releases highly toxic dioxins and furans when burned to retrieve copper from the wires. Many of these substances are toxic and carcinogenic.ⁱ

6. How Much waste is in 500 Million Computers?

Huge quantity of electronic waste presents an enormous environmental and health hazard to any community

Plastic	:	6.32 Billion Pounds
Lead	:	1.58 Billion Pounds
Cadmium	:	3 Million Pounds
Chromium	:	1.9 Million Pounds
Mercury	:	632,000 Pounds ⁱ

7. Conclusions

Effective E-waste management as we have seen internationally will need manufacturers to develop new capabilities and alliances. This can also be a powerful tool to demonstrate one's responsibility to the environment. It would be important for organizations to have a well directed strategy for E-waste management. Please don't dump your unwanted items in the street or local community areas such as parks, reserves and roadsides. E- Waste contains hazardous substances. Please don't attempt to recover any precious metals or recoverable materials from your unwanted equipment.

8. References

- i. http://rajyasabha.nic.in/rsnew/publication_electronic/E-waste_in_india.pdf
- ii. <http://www.globalewastemanagement.com>
- iii. <http://www.zerowaste.sa.gov.au/E-waste/E-waste-recycling>

Annexure

Components	Constituents	Affected body parts
Printed circuit boards	Lead and cadmium	Nervous system, kidney, lever
Motherboards	Berillium	Lungs, skin
Cathode ray tubes (CRTs)	Lead oxide, barium and cadmium	Heart, lever, muscles
Switches and flat-screen monitors	Mercury	Brain, skin
Computer batteries	Cadmium	Kidney, lever

Table 1: Components of computers and effect on human body:

Item	Discard/replace rate
Mobile telephone	1 to 3 years
PC	Every 2 years
Camera	3 to 5 years
Television	10-15 years
Refrigerator	10-15 years
Washing Machine	10-15 years
IT accessories	Very fast

Table 2: Discard Rate of electronics Items

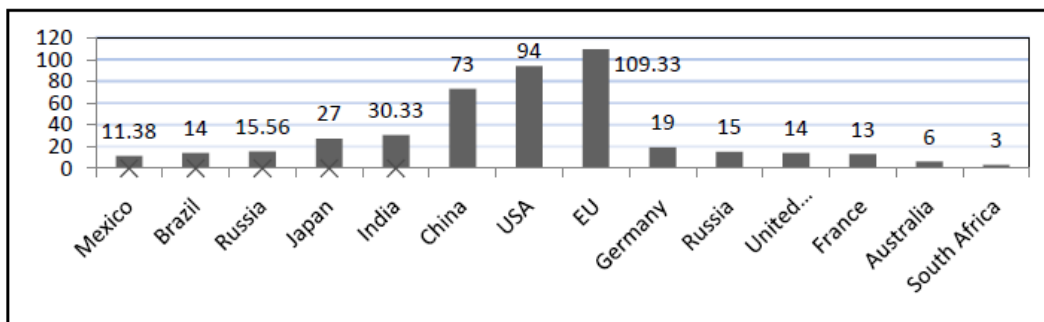


Figure 1: Comparison of E-waste generation

E-Waste Generation per year in 10⁵x tonnes in 2012 [StEP Initiative 2012]