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E-Waste Management Indian and Global Prospective

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Abstract: ***The electronic waste or e-waste is one of the fastest growing in the world. Major amount of e-waste is recycle and recovery by informal sector using basic methods such as open burning and acid strip method. The both method are destructive to the human and environmental. Central issue of the current study is electronic-waste (e-waste) which is emerging as a new environmental challenge for 21st century. The fast expansion of the electronic and IT industry, present consumer culture, increasing rates of consumption of electronic products have led to disastrous environmental consequences. E-waste, while recycling, may be hazardous because of toxicity of some of the substances it consists of Some of the waste has been proven to contain many cancers. Developed countries export this waste in the form of donation to developing countries. China and India, where environmental standards are low, are the biggest recipients of e-waste which, in most cases, is process illegally. The ecological burden of e-waste is born by people who live in developing countries, especially China and India, which processes the maximum amount of e-waste. Despite various laws and directives in developed countries, the e-waste management is unrestrained.***

I. INTRODUCTION

Globalization and information technology are being widely recognized as main drivers of the human civilization in the later part of twentieth century and the 21st century. The Information Technology (IT) has been the control house of the global economy particularly since early 1990s. Software and hardware part of IT has touched most of the parts of social, technical, economic and natural environment. Exponentially increasing production of computer hardware has posed major challenges of proper disposal of the waste (e-waste) produced by this industry.

II. NATIONAL SCENARIO

The growth of electronic waste is high in India, since it has emerged as an IT giant and due to modernization of lifestyle. However, there is no proper disposal system in our country that has led to enormous amount of electronic waste. There is a need to find a proper recycling and disposal technique, so that reduce the environmental pollution and health hazards. Estimated the total number of Personal Computers (PCs) emanating each year from business and individual households in India will be around 1.38 million, according to a report of confederation of Indian industries, the total waste generated by obsolete electronic and electrical equipment (EEE) in India has been estimated to be 146,000 tons per year. The results of field survey conducted in Chennai, metropolitan cities of India to assess the average usage and life of PC, Television (TV) and mobile phone shows that the average household usage of the PC ranges from 0.39 to 1.70 de-pending on their income. In case of TV, it varied from 1.07 to 1.78 and for mobile phones it varied from 0.88 to 1.70. the low income households use the PC for 5.94 years, TV for 8.16 years and the mobile phones for 2.34 years while, the upper class income uses the PC for 3.21 years, TV for 5.13 years and mobile phones for 1.63 years. Although the per-capita waste production in India is still relatively small, the total absolute

volume of waste generated will be huge. The growth rate of the mobile phones 80% is very high compared to PC 20% and TV 18%.

According to TRAI, India added 113.26 million new cellular customers in 2008, with an average of 9.5 million customers added every month. Cellular market grew from 168.11 million in 2003-04 to 261.97 million in 2007-08. Microwave ovens and air conditioners registered a growth about 25% and refrigerator sales amount-ed to 4.2 million in 2006-07. Washing machines have always seen poor growth and the penetration level of colored televisions are increased three times in 2006-07. Solid waste management, which is already a mammoth task in India[1], has become more complicated by the invasion of e-waste, particularly computer waste in India. The preliminary estimates suggest the total WEEE generation in India is approximately 146,180 tons per year and which is exceeded 800,000 tons in 2012.

Table 1: E-waste generation in top ten cities in India

City	WEEE, Tons per year
Mumbai	**11017.1**
Delhi	**9790.3**
Bangalore	**4648.4**
Chennai	**4132.2**
Kolkata	**4025.3**
Ahmedabad	**3287.5**
Hyderabad	**2833.5**
Pune	**2584.2**
Surat	**1836.5**
Nagpur	**1768.9**

III. FORMS OF E-WASTE

Electronic Waste (e-waste) is the term used to describe old, end-of-life electronic appliances such as computers, laptops, TVs, DVD players, mobile phones, mp3 players etc. which have been disposed of by their original users. Technically, electronic waste is only a subset of WEEE (Waste Electrical and Electronic Equipment). According to the OECD any appliance using an electric power supply that has reached its end-o f-life would come under WEEE. Acknowledging the benefits of IT revolution this section presents darker reality of information technology. Very speed of innovation that lies at the heart of computer manufacturer leads to the product obsolescence. The reality of computer life cycle reveals a hazardous life cycle. The dark side of high technological development of electronic industry, especially computer technology, is revealed in the form of polluted drinking water, waste discharges that cause harm to fish, birth defects, high rate of miscarriage and cancer among cluster workers. Rapid changes in computer technology and the emergence of new electronic goods, the growing dependence on information technology, increasing rates of consumption of electronic products have led to disastrous environmental consequences. This high tech benefits and boom in the market lead to extensive use of electronic goods, especially computers. All this is turning the face of the industry and collectively form a problem of electronic waste the percentage of waste that is technology-related is growing at an alarming rate. In a recent study researchers found that the volume of e-waste is increasing by 3 - 5% per year, which is almost three times faster than the municipal waste stream is growing generally[2]. The lifespan of a computer has shrunk from four or five years to about two years Electronics, the largest and fastest growing manufacturing industry in the world, aggressively promotes a culture of fast obsolescence and increased consumption. Large amounts of dangerous chemicals are present in computer and other electronic goods. The toxicity is due to lead, mercury, cadmium, hexavalent chromium (ChromiumVI), brominated flame retardants, plastic, PVC etc. A typical computer monitor may contain more than 6 percent lead by weight. In general, computer and electronic equipments are complicated assembly of more than 1000 materials, few of them are highly toxic such as chlorinated and brominated substances, toxic gases, photoactive and biological active materials acids plastics and plastic additives (Clean computer campaign). Each computer display contains an

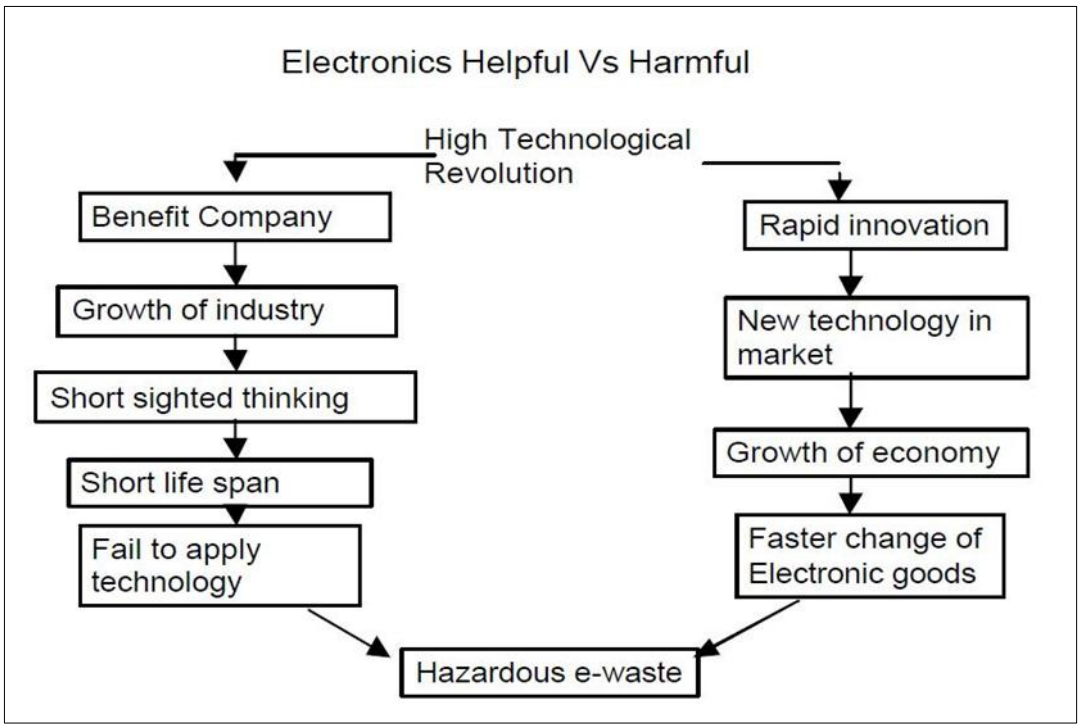
average of 4-8 pound of lead (MCC: 1996). Monitor glass contains about 20 percent lead by weight. When these components are illegally disposed and crushed in landfills, the lead is released into the environment, posing a hazardous legacy for current and future generations. About 70 percent of the heavy metals including mercury and cadmium, found in landfills come from electronic equipments discarded by the users. These heavy metals and other hazardous substances found in electronics items, contaminate ground water and pose environmental and public health risks, (Poison PC and Toxic TV) A single component of computer waste, Cathode Rays Tube (CRTs), has emerged as the leading edge of hazardous waste at the local, state, national and international level. CRTs are the glass Picture Tubes in computer monitors and other video display devices that amplify and focus high energy electrons beam to create the images, which we ultimately see in our screens. In order to protect consumers from radiation damages, the glass in CRTs contain lead compasses which is approximately 20 percent of each CRT. Lead is an example of heavy metal, a metallic element that is in pure form heavy[5]. Lead is extremely toxic, may be taken into the body, where they tend to combine with and inhibit the functioning of particular enzymes. A minute amount can have severe physiological or neurological effects . Lead tends to accumulate in the environment and has high acute and chronic effects on plants, animals and microorganisms. It causes damage to the central and peripheral nervous system, blood system, kidney and reproductive system in human. It also affects endocrine system and brain development among the children. (E-waste India Report, 2004).

Mercury used in switches, circuit boards and in flat panel displays is released into the environment when burned or smelted into the environment. Similarly Beryllium is used in every electronic assembly which is released into the environment through dust emission, during crushing, cutting and burning operations. Circuit board and plastic casing having brominated flame retardant are source of dioxins and furans.

Carbon black in printers and toner is class 2b carcinogen and beryllium, commonly used in mother boards and finger clips, is a health hazard. Beryllium has, recently, been classified as a human carcinogen as exposure to it causes lung cancer. (Exporting Harm, 2002) BFRs are among a group of bad actors specifically known as persistent organic pollutants[3]. Animal experiments have shown that a number of these chemicals affect thyroid function, have estrogenic effects, and act through the same receptor-mediated pathways as does dioxin, which is among the most potent animal carcinogens known. Further, environmentalists charge that electronics recyclers have not really come to grips with the special environmental problems that they say are inherent in the prolific use of BFRs in e-waste plastics. "There are presently no studies on the ultimate fate of BFRs when they are melted or burned in recycling or incineration environment more than the waste itself. Investigation conducted by several places found that the workers often used acid bath and other metals, washing the residue directly in to nearby rivers and other water bodies. Component that cannot be recycled are sent to landfills or burned in the open, releasing additional toxins in the environment.

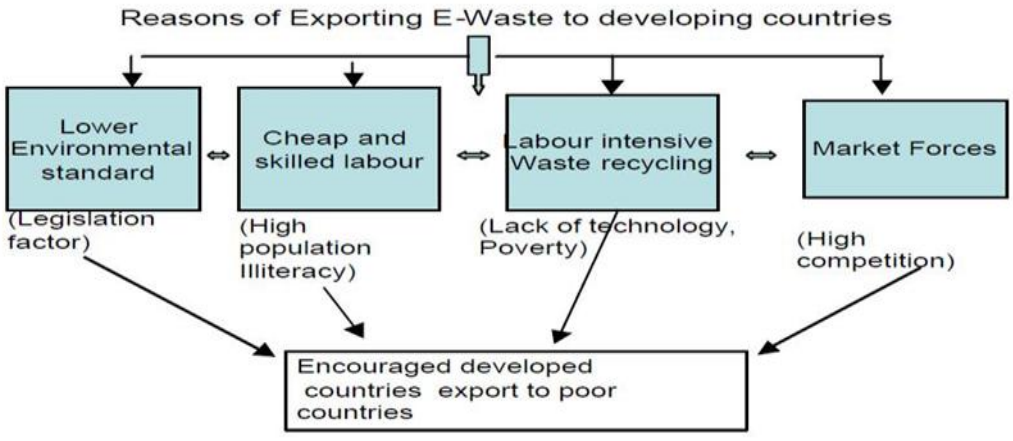
Extension of life span is the key strategy in managing the gamut of environment impact. Social and financial forces for computer waste management requires efficient partnership between public and private sectors as well as networked activities between scholars, business persons and policy makers around the world.

According to Xinhua News Agency, China has generated roughly 1.1 million tons of ewaste annually since 2003[5], including 5 million TV sets, 4 million refrigerators, 5 million washing machines, 5 million computers, and tens of millions of mobile phones and it will continue to pile up. Greenpeace estimates that by 2010, there will be 178 million new computer users in China alone



IV. Reasons Of The Flow Of E-Waste To Developing Countries

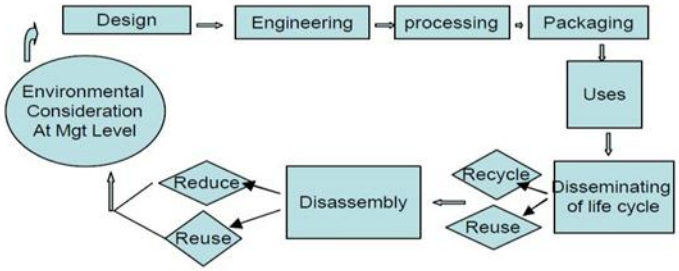
Due to lower environmental standards and working conditions in China and India, e-waste is being sent to these countries for processing – in most cases illegally. Uncontrolled burning and disposal are causing environmental problems due to the methods of processing the waste. The labor-intensive nature of electronic waste recycling, abundant, cheap and skilled labor force and generation of huge profits for local governments causes the authorities to turn a blind eye to this practice. Thus, they serve as passive encouragement to its spread[4]. It is more convenient and also economical to export e-waste to the third world countries like India, rather than managing and incurring high environmental and economic cost



V. Introducing Green Electronics

The most urgent challenge domestic manufacturer's face is to use "greener" design. The Legislative process embodies two considerations: one is to encourage the recycling and reuse of resources, and second the other is environmental protection, a clear principle is that sending e-waste to landfills or incinerators will be strictly prohibited.

Introducing Green Electronic



VI. New Initiatives

It is desirable to maximize reuse of equipment and economic development while minimizing environmental burdens and economic costs. Multi-stakeholder aspects are also important; the issue is politically contentious, both within and between nations. It is argued that, to the extent possible, effective research requires collaboration between different regions and societal sectors, and debate on solutions should be rigorous and take place in a neutral arena. Households, companies, and governmental organizations can encourage electronics manufacturers to design greener electronics by purchasing computers and other electronic goods with environmentally preferable attributes and by requesting take back options at the time of purchase.

VII. Conclusion

Most waste is inherently dangerous. It can degrade to produce, which may contaminate ground water, and create landfill gas, which is explosive. In addition, because of the dangers associated with landfill sites, there are now very strict requirements on the construction, operation and aftercare of such sites. Most planning authorities want a worked out quarry to be used for landscaping rather than a landfill site which no one wants in their „back yard". Product design must be employed to help to minimize not only the nature and amount of waste, but also to maximize end-of-life recycling. Manufacturers, retailers, users, and disposers should share responsibility for reducing the environmental impacts of products. Adopt product stewardship approach i.e. a product-centered approach should be adopted to preserve and protect environment.

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