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Managing Garbage of The Digital World

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It is a concrete fact that with the huge increase in usage of Information & Communication Technology (ICT) devices to eliminate the digital divide, there is also an threatening growth of digital waste world-wide. There is a urgent requirement for e-waste management since e-waste constituents might lead to severe environmental damage and health risks , when crude, unprofessionalmethods are applied for the retrieval of important components. It is also required to encourage recycling of all important and valuable material from e-wastes to preserve the natural resources.

Keywords: Digital, Information and Communication Technology (ICT), e-governance, India, Information Technology, Government, E-Waste, Electronic, Risks

INTRODUCTION

E-waste is defined as "waste electrical and electronic equipment, whole or in part or rejects from their manufacturing and repair process, which are intended to be discarded" whereas electrical and electronic equipment has been defined as 'equipment which is dependent on electrical currents or electro-magnetic fields to be fully functional'. Today, most of the developing countries are suffering with the problem of rapidly increasing e-waste and they have to have new and effective e-waste management systems for end of life Information and Communication Technology (ICT) products to avoid the threat on the environment and the mankind.

The rapid growth of Information and Communication Technology (ICT), the technological changes and frequent innovations are resulting in shorter life span of Information and Communication Technology (ICT) product and equipment. Moreover in the developing countries the amount of imported unused Electrical and Electronic equipment (EEE) is uncontrolled. Therefore, the volume of e-waste has drastically increased in developing as well as the developed nations. At the same time, it is encouraging that every country, along with going for the development in the Information and Communication Technology (ICT) sector, is also working for 'Going Green' by taking care of issues such as efficient use of natural resources, sustainable recycling of e-waste, minimization of e-waste, and development of products with minimum use of hazardous substances.

Electrical and electronic equipment (EEE) are developed from valuable as well as hazardous materials and if at end of life of EEE, these hazardous materials are not disposed of scientifically it may cause severe damage to the environment and public health. The presence of heavy metals (like: Arsenic, Lead, Cadmium, Barium, Nickel, Zinc Sulphide, Lithium, Mercury, etc.) and other toxic substances like Polychlorinated biphenyls (PCB) etc. may cause extreme harm to the environment, if not disposed of in an environment friendly manner.

International Telecommunication Union (ITU) has accepted the fact that the regulations in many developing countries to cover the areas of Waste Electrical and Electronic Equipment (WEEE) are inadequate as they exclude key topics and key stakeholders like the informal sector. The collection, recycling, recovery and associated activities of e-waste management by the informal sector having little or no knowledge about techniques, precautions etc, cause more damage to their health and environment.

Environmental sustainability can be defined as " the ability to maintain the qualities that are valued in the

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physical environment by the use of design for environment principles, efficient use of non - renewable resources, efficient and environmentally sound recycling and use of renewable resources as much as possible", in order to have a sustainable policy to handle e-waste in an environment friendly manner, it is thus extremely important that the policy of e-waste disposal and the regulatory aspects should be stringent as well as rational.

EFFECTS OF E-WASTE ON HUMAN HEALTH AND ENVIRONMENT

E-waste is highly complex to handle because of its composition. It is made up of multiple components some of which contain toxic substances that have an adverse impact on human health and environment if not handled properly that is if improper recycling and disposal methods are deployed. Therefore, there is a need for appropriate technology for handling and disposal of these chemicals.

Basel Convention characterizes e-waste as hazardous when they contain and are contaminated with mercury, lead, cadmium, polychlorinated biphenyl etc. Wastes containing insulation or metal cables coated with plastics contaminated with or containing lead, coal tar, cadmium, Polychlorinated Biphenyl (PCB) etc. are also characterized as hazardous wastes.

Precious metal ash from printed circuit boards, glass waste from cathode-ray tubes, LCD screens and other activated glasses are also categorized as hazardous wastes. Effects of some of the prime hazardous components in of e-waste are mentioned below:

MANAGEMENT OF E-WASTE

There is no unique or ideal model for e-waste management in developing countries, each of which has its own specific environmental, social, technological, economic and cultural conditions.

Environmentally sound management of WEEE recognizes three Rs, which are,reuse, recycle and reduce. The objective would be toreuse till functioning of electronic equipment by someone else,recycle those components that cannot be repaired and reduce the generation of e-waste through smart manufacturing and maintenance.

A smart e-waste management system for developing countries have to assess the e-waste situation, recognize that e-wastes are a complex mixture of hazardous and non-hazardous substances and materials and need to define the integral e-waste management system taking into consideration the EEE market penetration , life cycle of ICT equipment, financing mechanisms etc.

S.No.	Hazardous components	Effect of Hazardous components of e-waste
1	Arsenic	Can affect skin and can decrease nerve conduction velocity.
		Chronic exposure to arsenic may cause lung cancer and sometimes be fatal.
2	Lead	May affect kidneys, reproductive systems, nervous connections.
		May cause blood and brain disorders, sometimes may be fatal.
3	Barium	Can affect heart muscle.
4	Chromium	Candamage liver, kidneys and may cause asthmatic bronchitis and lung cancer.
5	Beryllium	May cause lung diseases.
6	Mercury	Affects the central nervous system, kidneys and immune system, it impairs foetus growth. May cause brain or liver damage
7	Cadmium	May cause severe pain in the joints and spine. It affects the kidneys and softens bones.
8	BFR (Brominates flame retardants)	Can harm reproductive and immune systems, may cause hormonal disorder.
9	Chlorofluorocarbon (CFC)	May affect the ozone layer. It may cause skin cancer in human and genetic damage in organisms.
10	Polychlorinated Biphenyl (PCB)	May cause cancer in animals, can affect the immune system, reproductive system, nervous system, endocrine system . PCBs persistently contaminate in the environment and cause severe damage .
11	Polyvinyl Chloride (PVC)	PVC contains upto 56% chlorine and when burnt, produces Hydrogen chloride gas which in turn produces hydrochloric acid that is dangerous to respiratory system.
12	Dioxin	These are highly toxic to animals and can lead to malfunction of foetus, decreased reproduction and growth rates, affect immune system.

The main aspects to be taken into account when framing ICT waste management guidelines for developing countries are:

- Policy and regulations covering import and export of EEE and WEEE in accordance with the rules of each country and with international legislation
- Responsible information system to have data on ICT equipment in market, disused EEE management and WEEE management and to have control on the monitoring and future planning
- Defining responsibilities of prime stake holders at the level of government, supply chain, consumers of ICT equipment and entities for disposal of waste
- Promoting employment and training for the informal sector engaged in recycling and recovery of the materials.
- Extended producer responsibility (EPR) where the manufacturer's responsibility for its ICT equipment extends throughout the various stages of that equipment's life cycle with internalizing the cost of managing the equipment at the end of life

INDIAN SCENARIO FOR E-WASTE MANAGEMENT

Last few years India has emerged as one major IT hub and the consumer electronic market has grown in an exponential rate. According to Manufacturers Association of Information Technology (MAIT) the Indian PC industry is growing by 25% compound annual growth rate. Study reports that in 2007, 2.2 million computers were made obsolete and 14 million mobile handsets replaced.

The e-waste generated was estimated to be 332,979 tonnes out of which 144,000 tonnes was recyclable and actually e-waste recycled was 19,000, tonnes. The e-waste processed contained 7000 tonnes of TV and 12000 tonnes of computers. It was also estimated that around 50,000 tonnes of e-waste was generated through import besides 332,000 tonnes generated domestically.

Developed countries find it profitable to send e-waste for reuse/ recycling to developing nations because of economic disparities e.g. cost of recycling of a computer in US is $20 whereas in India it is $2. So the import of e-waste to India has got enough chance to jump high. In India, there are 10 states that contribute to 70% of the total e-waste generated in the country, whereas 65 cities generate more than 60% of the total e-waste.

In India, Ministry of Environment and forests (MoEF) is responsible for environmental legislation and its control. The main bodies active in e-waste management in India are CPCB, SPCBs, Gtz and industry associations such as MAIT. These organizations are working under the guidance of MoEF. CPCB (Central Pollution Control Board) had set up a task force in 2007 to analyze the different aspects of e-waste covered in various environmental legislations in India and had drafted measures for environmentally sound management of e-waste.

In the beginning of 2008, the CPCB released measures for environmentally sound management of e-waste, which apply to all those who handle e-waste. These guidelines are first policy framework dealing specifically with prevention, management, treatment, recycling, and disposal of e-waste in India. The policies framed, provide guidelines for manufacturers, customers, generators, collectors, recyclers, transporters, dismantlers, and enforcement agencies and prescribe procedures for handling e-waste in an environmentally efficient manner. Apart from adoption of environmentally sound technologies, they include international standards and practices like restriction on hazardous substances (RoHS) in EEE

Concerns/ Challenges in e -waste management

Following are the some of the major issues that need attention while handling e-waste:

- The data for information on e-waste is estimation and there is a problem in finding information on imports of e-waste. Most studies have concentrated on devices like mobile, computer and TVs while the domestic appliances also contribute to a considerable proportion of e-waste. There is a need to have credible data covering wide range of products across sectors.

- Waste collection, transportation, processing and recycling is dominated by the informal sector. The sector is well networked and unregulated. There are serious issues regarding leakage of toxins into the environment hampering workers' safety/ health.
- There is a requirement for establishment of collection channels for e-waste from the generator to the recycler. Presently as the standards are not followed by the collectors (mainly the informal sector), the environmental, health and safety norms are hampered. The formal sector having large infrastructure and high operational cost finds difficulty in competing with the informal sector.
- The informal sector needs specific attention to be handled properly considering the socio economic condition so that the solutions for environment friendly management of e-waste are found to be rational for the stake holders
- There is a lack of fund and capacity in Government for monitoring and enforcement of the regulations
- Awareness regarding the hazards of e-waste is low because of structural deficiency in implementation of policies, poor literacy and poverty of an important major stake holder (informal sector)
- The e-waste management system is mostly manual and low tech and the 'take back' by producers is limited to few IT equipment and few formal collection centres. There is lack of effort from producers that results in limited implementation of EPR. In absence of accountability and penalty criteria in the regulation, it is difficult to monitor the EPR activities.

CONCLUSION

ITU has agreed to the way that there is no unique or ideal model for e-waste management in developing countries, each of which is characterized by its own specific environmental, social, technological, economic and social conditions.

With a view to bridge the computerized divide, there is exponential development in the use of Electrical and electronic equipment(EEE) thus there is disturbing effect on environment and human health when the ICT wastes are not disposed of scientifically. There is an emergent need to implement the existing policies and guidelines in line with the international principles and practices for a healthy e-waste management system.

Government policies ought to encourage the reuse of EEE planning to minimize and recycle Waste Electrical and Electronic Equipment (WEEE). The Extended Producer Responsibility(EPR)do need to have clear regulations to mandate the 'take back' movement of companies entirely.

There is a clear need to have proper data system through standardized mechanisms. Eco-design can have a positive effect in reducing the rate of WEEE generation, encouraging the management of e-waste and recovery of materials, achieving cost reductions.

In Indian context, Ministry of Environment and Forests in the E-waste (Management and Handling-Rules, 2011) has clarified about the Reduction in the use of dangerous substances (RoHS) in the manufacture of electrical and electronic equipment where attempt is made to get ensured that new electrical and electronic equipment does notcontain Lead, Mercury, Cadmium, Hexavalent Chromium, poly-brominated biphenyls (PBB) or poly-brominateddiphenyl ethers (PBDE) which is to be achieved inside a period of three years from the date of commencement of these rules.

MoEF is likewise advancing the 3R Concept (Reduce, Reuse and Recycle) for Hazardous Waste ManagementMoEF has additionally defined the responsibilities of Central Pollution Control Board(CPCB)and State Pollution Control Board(SPCB) who are going about as checking authorities in respect of management of e-waste in India. Briefly the principle elements of CPCB are:

- Coordination with State Pollution Control Boards.
- Preparation of Guidelines for Environmentally Sound Management of e-waste.
- Conduct assessment of e-waste generation and processing.
- Recommend gauges and specifications for processing and recycling e-waste.
- Documentation and assemblage of information on e-waste.
- Conducting preparing and awareness program.
- Enforcement of reduction being used of dangerous substances (RoHS).

- Incentives and certification for green design/items.

The collection, storage, transportation, segregation, refurbishment, disassembling recycling and transfer of e-waste is likewise defined by the guidelines issued by the Central Pollution Control.

The DoT guidelines in the direction "to develop a hearty and secure state-of-the-workmanship telecommunication network giving seamless coverage special concentrate on provincial and remote areas for crossing over the advanced divide" have likewise specific regulations for the environmental and health issues emerging from the telecom network. The remuneration for reception of green approach and incentive for use of renewable energy sources can be one functional and sustainable method for overseeing e-waste in Indian socio social environment. By advancing the use of energy efficient equipment and renewable energy technologies, and furthermore receiving measures for reduction of carbon impression, the concern for e-waste is additionally addressed in direction of long haul maintainability.

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