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Environmental Management strategy for controlling E-Waste

KEYWORDS: E-Waste, Extended Producer Responsibility(EPR), and Management

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ABSTRACT *Electrical and Electronic waste is on the increase both in terms of magnitude and deleterious effects. Scientific endeavors have been underway to regulate and abate the environmental menace. This paper essentially aims at taking stock of the problem at the national and international level and its impact of human health. Narration of a Swiss model as a strategy is outlined. Extended producer responsibility (EPR), scientifically evolved method for safe disposal of e-waste, EPR helps achieving 'win-win' situation on by means of controlling pollution on the one hand and ensuring producers to make profits on the other. The strategy proposed may be an eye opener for Indian policy makers to note of this model to be emulated in India.*

Introduction

Planet earth has been sustaining life for billions of years due to its equilibrium. Nothing comes into earth and nothing goes out, one element changes into another but remains on earth forever. Human civilization and development has altered this equilibrium by overuse of resources and dumping of waste indiscriminately. The natural assimilative capacity of earth is unable to cope up with the mounds of waste dumped, thereby leading to loss of equilibrium. Such a situation has lead to famine, floods, climate change, epidemics, water scarcity, polluted air and water, fallow lands and inequity among people. Development and environment are two sides of a coin, if one is welcomed other is lost. Still humanity proposes sustainable development, a method where environment is protected along with developmental activities, as the panacea for this. Despite this, equity among men remains unattainable; the poor are still getting poorer and the rich becoming richer. The basis of sustainable development is REDUCE, REUSE, RECYCLE, which can be true for any perishable goods manufactured on earth. Notwithstanding the existence of awareness about industrial, agricultural and commercial wastes, this paper deals with the magnitude of generation of e-waste in India and abroad and the institutional measures undertaken to overcome the problem based on the available information.

Problem

E-waste is '*any appliance using electrical power supply that has reached its end- of-life*' according to OECD (Organization for Economic and Co-operation Development) definition. Sinha *et al* defines '*any electrically powered appliance that no longer satisfies the current owner for its original purpose*'. To simplify e-waste comprises 'white goods' like refrigerators, air conditioners, washing machines, microwaves and 'brown goods' like televisions, radios, computers and cell phones. WEEE (Waste Electric and Electronic Equipments) also denotes e-waste and Basel convention which prevents trans-boundary movement of hazardous wastes has included WEEE in its list since 1992. Electrical and electronic gadgets have penetrated into every ones walk of life as a pretext of making life easier and simpler. The IIT Kanpur survey predicts that in India the number of mobile phone would outnumber the total human population down the line by 2022 (Ashish Chaturvedi, 2013). The negative externality caused due to improper disposal of e-waste is the problem. The available literature attributes to the attitude of consumers in frequently changing the electronic gadgets, buying new models of mobile phones etc. Essentially the problem lies in indiscriminate disposal of the consequential effects thereof. The problem of disposal of huge mounds of non-biodegradable materials causes improper, unsafe disposal practices get compounded due to unethical imports from developed nations to developing nations.

Magnitude

Annually world generates about 20-50 million tonnes of e waste, out of this India produces 4 lakh tones (2008). Rapid growth of information and communication sectors and globalization of markets will lead to more consumerism thereby generating more e-waste. Table 1, gives a list of materials used in a computer from plastics to silica. The quantum of toxins like cadmium, beryllium, antimony etc. seems to be so low but they cause severe damage to human health when exposed for a long period. The non bio-degradable waste would stay in the soil of dumping yard to slowly leach into aquifers turning underground water toxic.

Table 1: Materials used in a desktop computer

Name	Weight of the material (lbs)	Percentage of total weight (%)	Parts in the computer
Plastics	13.8	22.99	Main casing
Lead	3.8	6.298	Metal joining, CRT, PWB
Aluminum	8.5	14.173	Structure, conductors, CRT, PWB, connectors
Iron	12.3	20.471	Structure magnetivity, CRT, PWB
Tin	0.6	1.007	Metal joining CRT, PWB
Copper	4.2	6.928	Conductivity, CRT, connectors
Barium	<0.1	0.031	In vacuum tube/CRT
Nickel	o.51	0.850	Structure, magnetivity, CRT, PWB
Zinc	1.32	2.206	Battery, phosphor emitter
Beryllium	<0.1	0.015	Thermal conductivity, PWB, connectors
Gold	<0.1	0.001	Connectivity, PWB, conductors

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Cobalt	<0.1	0.015	Structure magnetivity, CRT, PWB
Manganese	<0.1	0.031	Structure, magnetivity, CTR, PWB
Silver	<0.1	0.018	Connectors, PWB
Antimony	<0.1	0.009	Diodes/housing CRT
Chromium	<0.1	0.009	Decorative, hardner(steel)
Cadmium	<0.1	0.009	Battery, glue green phosper emitter, rectifier
Selenium	0.009	1.0016	Rectifier PWB
Mercury	<0.1	0.002	Batteries, switches, PWB
Arsenic	<0.1	0.0013	Doping agent in transistors PWB
Silica	15	24.88	Glass, solid device, CRT, PWB

Adapted from SVTC, US

Table 2: Sources of Generation

S. No	Items	Weight (MT)
1	Domestic Generation	332979
2	Imports	50000
3	Total	382979
4	WEEE available for recycling	144143
5	WEEE actually recycled	19000

WEEE-Waste Electrical and Electronic Equipment
Source: MAIT, GTZ, 2007

In India, Mumbai stands first in e waste generation, while other cities like Delhi, Bangalore, Chennai and Kolkata follows. (Table 3) The total waste generation is 3.82 lakh metric tones (MAIT, 2007), with a domestic generation of 3.32 and imports about 50000 metric tonne. Of the 1.44 lakh metric tonnes of e-waste sent for recycling only 19000 tonne are actually recycled and the rest dumped along with municipal solid waste (Table 2). Rapid globalization tends to increase the amount of e-waste production in future that it is expected to double by 2013 from 2007 value (3.32 MT to 6.89MT). In state wise production Maharastra stands first and comparing the cities Mumbai produces maximum e-waste.

Table 3: WEE Generating top ten cities

State	WEE (Tonnes)
Ahmadabad	3287.5
Bangalore	4648.4
Chennai	4132.2
Delhi	4730.3
Hyderabad	2833.5
Kolkata	4025.3
Mumbai	11017.1
Nagpur	1768.9
Pune	2584.2
Surat	1836.5

Source: MAIT, GTZ, 2007

Institutional Measures and Management Strategies
The E-waste Management and Handling Rules of 2011 was introduced in India. The Pollution Control Board is the implementing agency. However the efficacy of these Rules leaves much to be desired. At the international level, the Basel Convention has been in vogue for more than a decade.

Extended Producer's Responsibility (EPRs)
In search for a solution that would not affect developmental activities or create health hazard for marginalized, the EPR (Extended Producer Responsibility) comes into play. '*The producer's responsibility for a product is extended to the post consumer stage of the products life-cycle'*. (OECD, 2001). Thomas Lindhqvist (2000) defines '*EPR is an environmental protection strategy that makes the manufacturer of the product responsible for the entire life cycle of the product and especially for the take back, recycling and the final disposal of the product'*. Switzerland has been the first to implement EPR in e -waste management in 1998 by an Ordinance on 'the Return, the Taking back and the Disposal of Electric and Electronic Equipments (ORDEE) but the actual collection and scientific disposal was carried out before the ordinance by voluntary initiatives taken by producer responsibility organizations. Taking Switzerland as the model for e waste management a methodology can be evolved for scientific and safe disposal of e waste. The main guidelines are the following four principles to achieve EPR, formulated by the OECD.

(i) Source reduction (natural resource conservation/materials conservation).
(ii) Waste prevention.
(iii) Design of more environmentally compatible products.
(iv) Closure of material loops to promote sustainable development.

a) Product take back which can be mandatory or voluntary
b) Regulatory approach where maintenance of product standard, ban usage of hazardous materials in the product and disposal bans
c) Voluntary industrial practices like voluntary codes among producers, public private partnership for servicing and disposal.
d) Economic instruments like deposit-refund scheme, advance recycling fee, fees on disposal, material tax and subsidies.

The responsibility of e-Waste management lies with the Government acting as a regulatory body and facilitator and manufacturers who need to follow safe production process, introduce advance recycling fee and get ready to accept e-waste. Next the retailers and distributors are responsible for take back of e- goods notwithstanding the fact that it was not sold by them. Consumers are to return the used products at designated collection centers and pay any fee for the same in the form of recycling fee paid during purchase of new product. Collection centers should accept any product free of cost and safely transport them to designated recycling points. Finally recyclers must take adequate safety measures during the process to ensure employers health and ensure safe disposal with the standards set by the Government.

The primary function is to set up an organization for EPR among the producers and importers with the Government as a partner or as a member. Problems faced in bringing in all the manufacturers into a single organization with their voluntary acceptance of EPR would be difficult but Government can play its hand here to bring all free riders into fold, with strict regulations. The next is fixing a recycling fee as it would only be the source of revenue for the maintenance of the project. The accepted fee for each article can be incorporated into its market rate open or hidden. This advance recycle fee to be collected should be mandatory since retailers may woo customers by waiving such money in order to increase sales.

Selection of multiple designated point of collection where all

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products (electrical and electronic) are taken back irrespective of their age, brand and status is the next step. People will have more incentive if they are able to dump all their waste in one place instead of various points of collection. Some retailers induce consumers to bring back used gadgets by offering exchange values but this can be done for articles of the same category- Mobile for mobile or TV for TV. The final site is the recycling centers where scientific and safe disposal practices are followed while dismantling, recovery of valuables, recycling, destruction of waste and finally dumping of end wastes. Government has to play a major role here to prevent individual recyclers who do not follow safety measures, they can be employed in the system thereby ensuring avoidance of health hazards. The recovered products should be brought back to the manufacturing stream so that recycling is carried out and in turn sustainable development ensues.

Basel Convention (Domestically Prohibited Goods): Dangerous products undesired at home are called Domestically Prohibited Goods (DPG). In international parlance, DGPs are defined as products that are either banned or severely restricted for sale in the country of origin but are allowed to be exported to other countries.

Developed countries follow double standards; they allow export of DGPs to developing countries but prohibit import of the same from these countries on the ground that they may contain toxic substances. India being the largest importer of Mercury, its consumption has increased five-fold over a period of seven years, from 346 tonnes in 1997-98 to 1386 tonnes in 2002-2003. Similarly e-waste has added to the list of DPG considering its deleterious effects on environment and human health. The Basel convention on the control of trans- boundary Movements of Hazardous Wastes and their Disposal was adopted in March 1989 and came into force on the 5th May 1999.

Article 8 of Decision VIII/2 on creating innovative solutions through the Basel Convention for the environmentally sound management of electrical and electronic wastes, in which the Conference of Parties "*taking into account the importance of waste minimization, product stewardship, extended producer responsibility, reduction of transboundary movements and the environmentally sound management of electrical and electronic waste (e-waste)*", encourages "*Parties to take a life-cycle approach and promote clean technology and green design for electronic and electrical products, including the phase-out of hazardous substances used in production and included in components*".

EPR has been recognized as a policy tool to minimize e-waste in the *Preamble part 3. Art 4 Par 3 and Art 10 of Basel convention.* Stringent laws already in force in developed countries have lead to export of e- waste to developing countries under the pretext of second hand electronic goods or scrap. The cost of safe disposal of the ever mounting e -waste in Developed countries is so high that they use third world countries as dumping grounds. In India and other Asian countries imported waste is being segregated manually by the informal sector for recovery of valuable items, plastic parts are burnt in their homes as fuel and the remaining dumped, which finds its way to municipal waste yard. These non biodegradable wastes contains many toxins like cadmium, lead, mercury, PVC, brominated flame retardants, chromium, beryllium and phthalates, which leach into the soil and water bodies thereby causing pollution. The workers follow no safety measures to avoid toxicity and mostly young children and female are employed in such units. Unsafe dismantling and recovery of reusable done by hands without any protection lead to damages to nervous system, kidney and bone diseases, deleterious effects on endocrine and reproductive system and cancers.

Conclusion

The most recent addition to polluting agents, e-waste, is an off shoot of rapid development of information technology. Our fragile environment already facing a myriad of pollutants is subjected to another threat in the form of e-waste that environmental protection becomes more difficult. A point to consider is, as usual the benefits of electronic goods are enjoyed by the high end society but the effects of pollution are inflicted upon the marginalized that constitute the maximum in our country. The onus of safe disposal of e-waste lies with the government, manufacturers, retailers and the consumers. All need to realize their responsibility and act consciously to reduce their usage and dispose it safely.

Government must be stringent in laws that prevent DPG (Domestically Prohibited Goods) entering inside, insist on EPR and monitor the process of safe disposal. Manufacturers can use alternate safe material for production, minimize wastage of resources, and manufacture goods that can be used for longer periods and follow EPR stringently. Retailers should be responsible to collect back all used items and safely send to recycling units, where scientific disposal practices are carried out. Consumers, the major players must realize their role in waste production and use the gadgets for longer duration, avoid changing products constantly and follow safe disposal practices.

REFERENCE

1. Ashish chaturvedi, Down to Earth, February 28, 2013. | | 2. Deepali Sinha Khetriwal , Philipp Kraeuchi , Rolf Widmer, 'Producer responsibility for e-waste management: Key issues for consideration e Learning from the Swiss experience', Journal of Environmental management, 2007 elsevier. | | 3. Greenpeace International, 'The need for Extended Producer Responsibility legislation in non-OECD countries', 20 August , 2007. | | 4. OECD, 2001. Extended Producer Responsibility: A Guidance Manual for Governments. OECD, Paris. | | 5. Plastic waste (management and handling) Amendment rules, Ministry of Environment and Forests, Government of India, 2011. | | 6. Ramapathi Kumar, 'Electronic trash' Survey of the Environment, 2008, pages 17-22. | | 7. Ravi Agarwal, 'electric trash', Survey of the environment, 2006, pages 53-57. | | 8. Sinha, D., Kraeuchi, P, Schwaninger, M., 2005. A comparison of electronic waste recycling in Switzerland and in India. Environmental Impact Assessment Review 25, 492-504. | | 9. Thomas Lindhqvist, Extended Producer Responsibility in Cleaner Production, (Doctoral Dissertation) LUND University, 2000.