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Review Paper on Environmental e-waste Management

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ABSTRACT

In this paper the environmental problems related with the discarded electronic appliances, known as e-waste, are reviewed. Moreover, the current and the future production of e-waste, the potential environmental problems associated with their disposal and management practices are discussed whereas the existing e-waste management schemes in Greece and other countries (Japan, Switzerland) are also quoted. Electronic waste, commonly known as e-waste, comprises of discarded computers, televisions, microwaves and other such appliances. As managing e-waste becomes a priority, countries are evolving systems for the collection and environmentally sound disposal of this waste. India is only now experiencing the problems caused due to e-waste. Using descriptive case studies, this review explores the management of electronic waste in India, discussing its system flows and key issues suggesting the proposal for management of e-waste in India in an environment system management (ESM).

Keywords: e-waste management, environmental pollution, recycling.

INTRODUCTION

The technology boom of the 1990s gave us e-mail and e-commerce. The latest word to acquire the 'e' prefix has a more dubious distinction e- waste. Electronic Waste which is commonly referred to as 'e-waste' is the new by-product of the InfoTech society. And no, it does not describe junk e-mails, but a more real and physical waste in the form of old, discarded, end-of-life electronics. As electronics have become more reasonably priced, the volume of electronics in society has increased exponentially, as a larger section of the society is able to purchase them [1]. As affordability has increased, so has the replacement rate, with the speed of technological innovation offering more functionalities, smaller sizes and newer designs. Given the time lag between the purchase of the product and its end-of-life means that products purchased five, seven or even ten years ago, are being discarded now. Already, the quantities of electronic waste discarded annually has been creating disposal problems for municipalities, especially in the developed world for some time. India too is experiencing this problem. The technology boom of the 90s is being reflected in an e-waste boom now and even developing countries are waking up to the problem. E-waste management is more complex than household solid waste management for municipal waste systems because of the high concentration of toxic compounds prevalent in the electronic appliances. Their disposal requires special treatment to prevent the leakage and dissipation of toxins into the environment. The substantial expense involved as a result, is forcing the Indian government to look for solutions to manage e-waste more effectively in cost and environmental impact. As the spending power of the consumer in India has increased, their use of electrical and electronic products has also increased thus larger volumes of such products are finding their way into the waste stream. Managing this would be a challenge not only for the Indian municipal government, but producers and consumers as well, who would be forced to rethink about what happens to their products further down the stream

WHY IS IT IMPORTANT TO MANAGE E-WASTE

Old appliances which have reached their end of life may not be very useful to their owners; however they still need to be disposed off properly. E-waste has been put on the priority waste streams list, and is among the fastest growing waste streams [1]. Managing e-waste encompasses not just the disposal or recycling, but also the pre-disposal logistics involved in collecting and transporting the waste. It also includes strategies for reducing the total waste generated, in line with the 4R principle - 'Reduce, Recover, Reuse and Recycle' [3]. The importance to manage e-waste in the Indian context can be attributed to a number of reasons as summated below: (i) The growing volume of e-waste. With the growth of the electronics industry, the quantities of discarded electronics have also grown. Rising incomes and falling prices of electronic products have ensured that more people are able to afford electronics. Furthermore, rapid technological progress has resulted not only in a multitude of new electronic products but also reduced their lifespan, making products obsolete faster. In addition, substantial quantities of discarded electronic equipment which had been stored away in garages and basements for lack of better disposal options are being taken out. As per estimates, a total of 4.7 Lakh Tons of e-waste will be generated in India by 2011 and this figure is expected to double in the ensuing 03-05 years [6]. (ii) Resource depletion. Waste is regarded as a resource which should and could be reclaimed (Lindhqvist, 2000). Though disparate in their composition, electronic and electrical products contain valuable metals such as gold and silver as well of hundreds of other materials [3]. However, these can be broadly categorized as plastic, ferrous metal, non ferrous metals, precious

metals and glass. Studies in India show that e-waste generated herein consists of more than 50% various metals, plastics and plastic metal mixtures of 20%, CRT glass of 9% and the rest consisting of various other substances. (iii) Health and environment hazard. The main environmental concerns related to the management of electronic waste are the uncontrolled release of hazardous substances into the environment and the sub-optimal use of recyclable materials. Incorrect disposal can be extremely hazardous for the environment and health. Documented health hazards include various kinds of ailments from coming in contact with toxins such as cadmium, mercury, lead, dioxins and furans among others, emitted when land filled or incinerated [8]. Recycling e-waste is also dangerous and care needs to be taken to prevent emissions and effluents from the processing. In India over 90 % of e-waste is processed in unorganized sector which increases the health hazard potential of humans. (iv) Transboundary movement of e-waste. NGOs (BAN, Toxics Link) and newspaper reports (Time of India, Indian Express) have all found the alarming volume of e-wastes being shipped from one country to another, mainly from developed countries to developing countries. This is not only considered illegal in many countries – exporting as well as importing; it goes against the principal of environmental justice. This transboundary movement is particularly dangerous because the recipient countries often do not recycle and dispose the e-waste in an ESM, which is not compatible with the standards set in the country of export [9]. In India too there are many an e-waste recycling organizations where the author has visited, export e-waste.

WHAT IS BEING DONE TO MANAGE E-WASTE IN INDIA

With the growing attention e-waste is generating both in the Indian as well as international context, the government has shown the urgency to adopt frameworks to regulate, monitor and control the disposal of e-waste. Several efforts, on international as well as national levels are underway to manage e-waste. To cite is the draft e-waste (management and handling) rules 2010 which was released by our honorable minister for environment and forest, Shri Jayram Ramesh on 14 May 2010 which principally lays focus on management and handling e-waste and the importance to manage them. Various efforts both at the International and the National level are being taken to manage the e-waste channel [1]. At the International level the Basal convention has been ratified which addresses the problems and challenges of management of e-waste. India too, keeping in stride with 'Better Late Than Never' approach is putting on an all out effort in safe and environmentally sound management of e-waste. A number of NGOs viz Toxic Links, E-Parisaraa etc are in the process of formulating ways and means to arrest the impact caused due to improper disposal of e-waste [6]. Moreover, India too wide Hazardous Waste (Management and Handling Rules) 1989 has banned export and import of hazardous waste which too is in continuation with steps towards safe management/disposal of e-waste in an environmentally sound manner.

EVALUATING THE SUCCESS OF A E-WASTE MANAGEMENT PROGRAMME.

An E-waste management program can only be successful if there are clear targets, financial incentives, neutrality to competition and consumer participations through knowledge of system, financial incentives and convenience to consumers. The following criteria can be used to evaluate the success of an e-waste management program.

(a) Whether it meets its environmental objectives. An e-waste management program can be termed as successful if the final disposal of the e-waste is environmentally friendly which environmental objective. is the ultimate

(b) Whether it is economically efficient. An e-waste management program if it is economically efficient and within the reach of everyone can be termed as a step towards being termed as successful.

(c) Whether it is simple to implement. An e-waste program which can easily be implemented in an organization without much of hassles/QRs can also be coined as successful.

(d) Whether it defines responsibilities clearly. Successful e-waste management programs are those which define clearly the responsibilities of all stakeholders involved in them i.e the responsibilities of producer, stockist and disposer/recycler of e-waste.

(e) Whether it is equitable. E-waste management policy measures are unlikely to succeed if they imply a disproportionate burden on a single actor. Thus the load on all actors is to be evenly distributed.

(f) Whether it promotes product changes. A successful e-waste management system would provide strong incentives for improvement of the life cycle impacts of the products during upstream stages of product design and development; reduce the quantities of toxic materials in products.

CONCLUSIONS

Electronic equipment and therefore e-waste are everywhere in our society. They are characterized by a complex chemical composition and difficulty in quantifying their flows at a local and international level. The pollution caused by irregular management substantially degraded the environment mostly in poorer countries, receiving them for recycling and recovery of their valuable metals. As forth e-consequences one co-systems, human health and environmental restoration of are as burdened by certain polluters generated by e-waste (e.g. Li and Sb), there are no sufficiently documented scientific studies. Motivated by the minimization of environmental effects caused by the generated e-waste, many technological changes have been effectuated. The following are indicated:

- The replacement of CRT screens with LCD screens (Pb elimination but Hg introduction),
- The introduction of optical fibres (Culmination from the cablings, but F, Pb,Y and Zr introduction),
- The introduction of rechargeable batteries (Ni, Cd reduction, but Li increase), etc.

Non-governmental organizations and citizens movements press for the elimination of hazardous substances in electronic appliances, resulting to manufacturers competing for a more "green" profile. Some indicative results of the above pressures are:

- The production of "halogen-free" appliances, not contributing to the production of PCB sand dioxins(but their production is more expensive environmentally),
- The replacement of bromide combustion retarders with more environment-friendly ones based on phosphorus, and
- The introduction of legislative restrictions (Pb, Hg, Cr, PBBs and PBDE up to 1000 mg/kg, Directive RoHS -Restriction on Hazardous Substances).

Summarizing the above, e-waste separation from the rest of solid waste and their recycling for the recovery of valuable raw materials and basic metals is essential. The management system has to be rationally designed so that the environmental benefits from the collection, transportation, management and the financial benefits from the recovery are not set-off by the required resources and energy consumptions for the system operation

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