Global Status, Industrial Practices, Benchmarking, Recycling and Future of E-Waste Management: An Overview

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Electrical and electronic equipment production is one of the world's fastest growing industry. At the same time this also means that in the coming decades the amount of waste electrical and electronic equipment (WEEE) or collectively termed as e-waste will continue to increase. E-waste includes useful materials that have post recycled economic value. Unfortunately, in the unregulated informal sector, both illicit exports and improper donation of electronic equipment from developing countries, in particular computers, the bulk of e-waste is recycled and contributes to substantial risk of toxic contamination to recyclers, who are mainly women and adolescents. Formal recycling centers with adequate worker protection recycle as little as 25 percent of e-waste. The health consequences of both direct exposures during recycling and indirect exposures by contact with the environment are potentially severe but poorly studied. There are policy frameworks which aim to protect vulnerable populations but are not implemented effectively. The electrical and electronic equipment comprise items with either a battery or a power cord. The created e-waste from discarded equipment are broadly divided into six main categories: temperature exchange equipment, more commonly referred to as refrigeration and freezing equipment; screens or monitors, typical gadgets include televisions, monitors, laptops, notebooks and tablets; lamps which includes fluorescent lamps, high-intensity discharge lamps and LED lamps; large equipment in the form of washing machines, clothes dryers, electric stoves, large printing machines, copying equipment and photovoltaic panels, dish washing gadget; small appliances comprising of vacuum cleaners, microwaves, ventilation equipment, toasters, electric kettles, electric shavers, scales, calculators, radio sets, video cameras, electrical and electronic toys, small electrical and electronic tools, small medical devices, small monitoring and control instruments, DVD players, music players and sporting and entertaining equipment; IT and communication equipment and accessories which includes mobile phones, Global Positioning Systems (GPS), pocket calculators, routers, personal computers, printers, telephones, TVs, batteries lead condensers etc. Due to multiple factors the overall amount of e-waste generated is rising exponentially. High demand and a high rate of obsolescence trigger regular and excessive purchases, decreasing durability and short innovation cycles and low recycling rates help e-waste to grow rapidly.

Electronic equipment contains many hazardous metal contaminants, such as lead, cadmium and beryllium, and brominated flame retardant. The toxic heavy metal lead which is very common in e-waste, results in a number of health risks related to environmental contamination. Lead enters in living being via food, water, air, and soil. Mostly the kids especially vulnerable for lead poisoning. As kids absorbs more lead thus it gives problem to their nervous system and also the blood gets affected. The industrial practices of e-waste management include the sample selection and preparation, analysis, quality control and estimation of emissions of toxic substance.

The developing countries face the following problems in the field of e-waste management. There is a lack of resources to handle waste properly. Moreover, there is no regulation exclusively relating to e-waste. There is no end-of-life (EoL) system for the product take-back or extended producer responsibility (EPR) implementation in the developing countries. Good e-waste management in developing countries needs EPR implementation and growth of product reuse by re-manufacturing and effective execution.

In the name of second-hand appliances, developing countries would be expected to monitor the exports of electronic recyclables which will be standardized by proper global authority. Investigations by environmental agencies such as the Basel Action Network (BAN), Toxic Links show that substantial volumes of heavily polluting toxic electronic waste are still often illegally disposed of in developed countries and that domestic recycling activities are causing environmental damage.

Major environmental and health impacts occur during open burning of e-waste for recovery of precious metals which in turn generates employment. The recycling chain for e-waste consists of three main stages: collection, sorting/dismantling, and pre-processing and finishing. Developing countries undertake these three activities mainly by the informal sector of e-waste recycling. While the informal sector may take the first two of these measures without much impact on the environment, the last phase of end-processing, however, when performed by the informal recycling sector, may result in significant environmental impacts.

The Environmentally sound management (ESM) issue of e-waste is a global problem that arises from the cross-border movements between countries and regions, and therefore calls for global solutions are required. Some of the possible solutions are the design-for-the-environment (DfE) or eco design, lead-free soldering is one such example; proper handling of informal e-waste recycling sector; educating the public and government sector on the toxicity or dangerous aspects of e-waste; up gradation of technology for pre-processing and finishing in a cost effective way; safe handling of e-waste and personal protection; implementing an economic incentive based on the electronic bonus card system (EBCS).

Keywords: waste electrical and electronic equipment (WEEE); end-of-life (EoL); extended producer responsibility (EPR); Environmentally sound management (ESM); design-for-the-environment (DfE); electronic bonus card system (EBCS).

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