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E Waste : Recycling and Impacts

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ABSTRACT

E Waste is a quickly developing contamination issue on the planet, presence of this waste contains such a significant number of lethal substances which can pollute the earth and weaken the human health if these transfer articles are not precisely overseen. This paper gives a review about E Waste, problems related to environment and health due to careless management and management of E Waste.

Keywords: E Waste, Recycling, World Health Organization, VCR, Consumer Electronics Association

I. INTRODUCTION

The Information Technology (IT) has been the power place of the worldwide economy especially since easrly 1990s. Programming and equipment part of IT has touched a large portion of the parts of social, specialized, financial and common habitat. Exponentially expanding generation of PC equipment has postured significant difficulties of legitimate transfer of the waste (e-waste) delivered by this industry. Current investigation centers around the impact of use, dumping and reusing of the electronic waste on the common habitat [2].

Advances in the field of science and innovation realized modern transformation in the eighteenth Century which denoted another period in human development. In the twentieth Century, the data and correspondence conflict has gotten huge changes the way we arrange our lives, our economies, enterprises and foundations. These excellent improvements in current circumstances have without a doubt upgraded the nature of our lives. In the meantime, these have prompted complex issues including the issue of huge measure of unsafe waste and different wastes created from electric items. These unsafe and different wastes represent an incredible risk to the human health and condition. The issue of legitimate administration of wastes, in this manner, is basic to the security of occupation, health and condition. It constitutes a genuine test to the cutting edge social orders and requires composed endeavors to address it for accomplishing practical advancement [1].

Additionally, wastes are such items which people are required to discard, for example by law because of their hazardous properties. Our daily activities give rise to a large variety of different wastes arising from different sources. Thus, municipal waste is waste generated by households and consists of paper, organic waste, metals, etc. The wastes generated by production processes, households and commercial activities are hazardous waste[1].

What is 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.

Like other waste, the issue of e-waste has turned into a quick and long term worry as its unregulated collection and reusing can prompt major natural issues endangering human health. The data innovation has

changed the way we live, work and imparts conveying countless advantages and riches to every one of its clients. The making of inventive and new innovations and the globalization of the economy have made an entire scope of items accessible and moderate to the general population changing their ways of life fundamentally. New electronic items have turned into a basic piece of our day by day lives giving us more comfort, security, simple and quicker obtaining and trade of data. In any case, then again, it has additionally prompted over the top asset utilization and a disturbing waste age. Both developed nations and developing nations like India face the issue of e-waste management. It includes an entire scope of electrical and electronic things, for example, as refrigerators, washing machines, computers and printers, televisions, mobiles, i-pods, etc., many of which contain toxic materials. Many of the trends in consumption and production processes are unsustainable and pose serious challenge to environment and human health [1].

It is either discarded into the general waste stream or, perhaps, illegally exported to crude e-waste recycling hotspots which have been identified in Asian countries, such as China, India, and Pakistan, and in some African countries, such as Ghana and Nigeria. There is a lack of information on how much e-waste is generated and where, and on where it is moving to. This situation is made worse by the current system of gathering information, in which secondhand, used and waste products are, by and large, invisible to national statistics on production, sale and trade in goods [3].

II. An estimation of E-Waste

The exponential growth of internet users from 501 million in 2006 to over 1.3 billion at in 2011 in developing countries clearly indicates that the sale of computers and other terminals has grown at a lightning pace. In 2006, 44% of internet users were in developing countries whereas in 2011, 62%, were present in developing countries. Personal computer sales has significantly increased from 2000 to 2010, from about 170 million units sold globally in 2000 to about 370 million units sold in 2010. It is projected that sales in 2014 will reach an estimated 470 million units which is more than double in the last 10 years. In India, it is estimated that approximately 1.42 million PCs are getting obsolete every year. ITU data release of June 2012 indicates that total number of mobile cellular subscriptions reached almost 6 billion by the end of 2011, and in the developing countries, about 80% of the 660 million new mobile cellular subscriptions added in 2011were generated.

The report "Recycling - from E-Waste to Resources" issued at a meeting of the Basel Convention estimated that, by 2020 in China and South Africa, the e-waste from computers would increase between 200 and 400% over 2007 figures and 500% in India. It was also estimated that by 2020 in India the amount of e-waste from mobile phones would be 18 times higher than the 2007 figures and 7 times higher in China. Basel Action Network stated that 50- 80% of e-waste generated in USA is exported to India, China, Pakistan, Taiwan and African countries [4].

E Waste in India[5]

IT and telecom are two fastest growing industries in the country. India, by 2011, has achieved a PC penetration of 95 per 1000 from the 14 per 1000 in 2008. At present, India has 95 million one of the most threatening substances is lead, of which only 5 percent is recycled in India. Indians will not junk their mobiles, but pass them on to a new low-end user who will, in turn, junk them in the flea market from where the instruments make their way to the Kabadiwallas. Major issues related to Indian scenario are:

- India's hospitals to see patients with 10 times the expected level of lead in their blood.

- In India, a water sample revealed levels of lead 190 times as high as the drinking water standard set by the World Health Organization.
- Thousands of children throughout the India are attending schools that were built on or near toxic waste sites, with increased risk of developing asthma, cancer, learning disorders and other diseases linked to environmental pollutants.
- 1-20 kg per person/p.a and growing at 3 times faster than the municipal waste.
- Over 200 million current mobile users.
- Preliminary estimates suggest that total WEEE generation in India is approximately 1,46,000 tonnes per year.
- 20 million electronic household appliances including TV, washing machines, PCs etc) and 70 million cell phones reach end-of-life every year . Memory devices, MP3 players, iPods, ipads etc. are the newer additions.
- About 70% of the heavy metals (mercury and cadmium) and 40% lead, in landfills in India come from e-waste
- 22% of the yearly world consumption of mercury is used in electronics manufacture
- More of acid content flow into the land contaminating the soil and land value.
- About 70 percent, of heavy metals in India landfills comes from E-Waste.
- World's 80% population live in areas of cell phone reception
- Indians upgrade or exchange their cell phones every 18 months, meaning there are approximately 16 million unused mobile phones stashed away at home or in the office
- Average working life of a mobile phone is 7 years but worldwide the average consumer changes their mobile every 11 months.

III. Effects of e-waste on human health

E-Waste is highly complex to handle because of its composition. It is comprised of different parts some of which contain lethal substances that badly affect human wellbeing and condition if not took care of appropriately that is if improper recycling and disposal methods are deployed. So there is a requirement for proper innovation for dealing with and transfer of these chemicals [4].

It is obvious from a few examinations in China that the simple reusing strategies combined with the measures of e-waste prepared have just brought about opposed natural and human health impacts, including polluted soil and surface water. Medical issues have been accounted for over the most recent couple of years, including sicknesses and issues identified with the skin, stomach, respiratory tract and different organs.

Workers suffer high incidences of birth defects, infant mortality, tuberculosis, blood diseases, anomalies in the immune system, malfunctioning of the kidneys and respiratory system, lung cancer, underdevelopment of the brain in children and damage to the nervous and blood systems. However, long-term health studies of e-waste workers have yet to be conducted [3].

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.

IV. Management of e Waste

A. Recycling

Audiovisual components, televisions, VCRs, stereo equipment, mobile phones, other handheld devices, and computer components contain valuable elements and substances suitable for reclamation, including lead, copper, and gold. One of the major difficulties is reusing the printed circuit borada from the electronic wastes. The circuit boards contain such precious metals as gold, silver, platinum, etc. and such base metals as copper, iron, aluminum, etc. One way e-waste is processed is by melting circuit boards, burning cable sheathing to recover copper wire and open pit acid leaching for separating metals of value.[6] Conventional method employed is mechanical shredding and separation but the recycling efficiency is low. Alternative methods such as cryogenic decomposition have been studied for printed circuit board recycling,[7] and some As properly disposing of or reusing electronics can help prevent health problems, reduce greenhouse-gas emissions and create jobs,[8] there have been calls to reform "the methodology for e-waste disposal and re-use in developing countries" with reuse and refurbishing offering a more environmentally friendly and socially conscious alternative to downcycling processes.

Landfill disposal Regardless of the current worldwide move towards zero waste, the quantity of landfills has been expanding in both developed and developing nations. While the proprietors of present day landfills contend that as of late built landfills are able to do securely disconnecting from the condition the toxins found in gadgets, the presence of thousands of old landfills with no barrier and containing a blend of putrescible and e-waste is of much concern. There is sufficient evidence now to demonstrate that Landfills accepting electronic devices or old landfills containing e-wastes will cause groundwater contamination. Pollutants have the potential to migrate through soils and groundwater within and around landfill sites. Organic and putrescible material in landfills decomposes and percolates through soil as landfill leachate. Leachates can contain high concentrations of dissolved and suspended organic substances, inorganic compounds and heavy metals. However, the concentrations of toxic substances from leachate depend on the waste characteristics and stages of waste decomposition in a particular landfill[11].

B. Consumer Awareness Efforts

The U.S. Environmental Protection Agency urges electronic recyclers to wind up noticeably ensured by exhibiting to a licensed, autonomous outsider inspector that they meet particular standards to securely reuse and oversee hardware. Clients are urged to pick confirmed certified recyclers. Responsible electronics recycling decreases, natural and human health impacts, expands the utilization of reusable and repaired equipment and lessens vitality utilize while monitoring restricted assets. Certified companies ensure they are meeting strict environmental standards which maximize reuse and recycling, minimize exposure to human health or the

environment, ensure safe management of materials and require destruction of all data used on electronics. Certified electronics recyclers have demonstrated through audits and other means that they continually meet specific high environmental standards and safely manage used electronics. Once certified, the recycler is held to the particular standard by continual oversight by the independent accredited certifying body. A certification board accredits and oversees certifying bodies to ensure that they meet specific responsibilities and are competent to audit and provide certification. In the US, the Consumer Electronics Association (CEA) urges consumers to dispose properly of end-of life electronics through its recycling locator at www. GreenerGadgets.org[9].

C. Processing Techniques

In many developed countries, electronic waste processing usually first involves dismantling the equipment into various parts (metal frames, power supplies, circuit boards, plastics), often by hand, but increasingly by automated shredding equipment. A typical example is the NADIN electronic waste processing plant in Novi Iskar, Bulgaria—the largest facility of its kind in Eastern Europe. The advantages of this process are the human's ability to recognize and save working and repairable parts, including chips, transistors, RAM, etc. The disadvantage is that the labor is cheapest in countries with the lowest health and safety standards. In an alternative bulk system, a hopper conveys material for shredding into an unsophisticated mechanical separator, with screening and granulating machines to separate constituent metal and plastic fractions, which are sold to smelters or plastics recyclers. Such recycling machinery is enclosed and employs a dust collection system. Some of the emissions are caught by scrubbers and screens. Magnets, eddy currents, and Trommel screens are employed to separate glass, plastic, and ferrous and nonferrous metals, which can then be further separated at a smelter. Leaded glass from CRTs is reused in car batteries, ammunition, and lead wheel weights, or sold to foundries as a fluxing agent in processing raw lead ore. Copper, gold, palladium, silver and tin are valuable metals sold to smelters for recycling. Hazardous smoke and gases are captured, contained and treated to mitigate environmental threat. These methods allow for safe reclamation of all valuable computer construction materials. HewlettPackard product recycling solutions manager Renee St. Denis describes its process as: "We move them through giant shredders about 30 feet tall and it shreds everything into pieces about the size of a quarter. Once your disk drive is shredded into pieces about this big, it's hard to get the data off".An ideal electronic waste recycling plant combines dismantling for component recovery with increased costeffective processing of bulk electronic waste. Reuse is an elective choice to reusing in light of the fact that it expands the life expectancy of a gadget. Gadgets still need possible reusing, yet by enabling others to buy utilized hardware, reusing can be put off and value gained from device use[10].

V. Strategies to manage E-Wastes[11]

There is as of now broad research into e-waste management with a specific end goal to moderate issues at both the national and global levels. Several tools have been developed and applied to e-waste management including: LCA, MFA, MCA and EPR. The management of e-waste in developed countries has taken a further step forward with the release of a waste electric and electronic equipment (WEEE) directive that is expected to reduce the disposal of such waste and improve the environmental quality. Research incorporates the division of parts that could be reused and the recovery of uncommon and valuable metals. This section summarizes the range of approaches that has been adopted, and points to future developments.

A. Life Cycle Assessment (LCA)

Life Cycle Assessment is a tool used to design environmentally friendly electronic devices and to minimise e-waste problems. Since the 1990s considerable research has been conducted on the LCA of electronic devices in terms of eco-design, product development and environmental impacts. The published reviews show the necessity of having more consideration in the design of electronic devices to take account of environmental and economic impacts. An environmentally friendly design is a better alternative product and it may in turn appeal to consumers. LCA is a powerful tool for identifying potential environmental impacts to develop eco-design products such as printers, desktop personal computers, heating and air conditioner devices, washing machines, and toys. It is also a systematic tool to define many environment impact categories such as carcinogens, climate change, ozone layer, ecotoxicity, acidification, eutrophication and land use, to improve the environmental performance of products.

B. Material Flow Analysis (MFA)

Before the Basel Convention came into force large volumes of E-Waste from developed countries were exported for reuse or recycling in developing countries especially China, India and South Africa. MFA is a tool used to study the route of material (e-waste) flowing into recycling sites, or disposal areas and stocks of materials, in space and time. It links sources, pathways, and the intermediate and final destinations of the material. Material Flow Analysis is a decision support tool for environmental and waste management. This tool can be applied to develop appropriate e-waste management. This includes a consideration of the flow of e-waste and its assessment it in terms of environmental, economic and social values. In addition, found that the proportion of personal computers sent for domestic disposal and recycling decreased to 37% in fiscal year 2004, while the proportion of domestic reuse and exports increased to 37% and 26%, respectively in Japan. Investigated e-waste generation using MFA.

C. Multi Criteria Analysis (MCA)

MCA is a decision-making tool developed for considering strategic decisions and solving complex multi-criteria problems that include qualitative/quantitative aspects of the problem. MCA models have been applied to environmental problems, including those of e-waste management, to provide optional E-Waste management strategies. For example, Hula et al. used MCA decision-making methodologies to determine the trade-offs between the environmental benefits and economic profit of the EoL processing of coffee makers. They analyzed a six-step methodology: definition of EoL scenarios, defined product

models, development of an EoL evaluation model, formulation of a multi objective problem, solutions for the Pareto set, and construction of EoL strategy graphs for the Pareto set of optimal EoL strategies that minimises environmental impacts and economic cost. There were 12 alternative management systems which were compared and ranked according to their performance and efficiency. The best option was partial disassembly and forwarding of recyclable materials to the local prevailing market with the remainder deposed at landfill sites.

D. Extended Producer Responsibility (EPR)

EPR is an environment policy approach that attributes responsibility to manufacturers in taking back products after use, and is based on polluter-pays principles. Leaders of EPR programs for e-waste management are the advanced nations, including the European Union (EU), Switzerland, Japan and some states or provinces of the United States and Canada. The Organization for Economic Cooperation and Development (OECD) has supported an environmentally friendly program and published a guidance manual for governments.

VI. CONCLUSION

E Waste is always inherently dangerous. It might hurt ground water, and make landfill gas, which is unstable. What's more, on account of the threats related with landfill destinations, there are exceptionally strict necessities on the development, activity and aftercare of such locations. Cautious management of this waste is very essential. Most arranging experts need a worked out quarry to be utilized for finishing as opposed to a landfill site which nobody needs in their back yard. Item designs must be utilized to limit the nature and measure of waste, as well as to boost end-of-life reusing. Manufacturers, retailers, clients, and disposers should share duty regarding diminishing the natural effects of items. Receive item stewardship approach i.e. a product-centered approach should be adopted to preserve and protect environment.

VII. REFERENCES

[1]. "E-Waste in India", Research Unit, Rajya Sabha Secretariat, New Delhi, June 2011.

[2]. " E-Waste: A New Environmental Challenge", Vijay N. Bhoi and Trupti Shah, International Journal of Advanced Research in Computer Science and Software Engineering , Volume 4, Issue 2, February 2014

[3]. "The global impact of e-waste Addressing the challenge", Programme on Safety and Health at Work and the Environment, International Labour Office, Geneva

[4]. Study Paper On e-waste management By Ram Krishna, DDG(FA), AEC , New Delhi & Ms.SampaSaha, Director (ER), RTEC, Kolkata

[5]. Proposed Solution of e-Waste Management

[6]. hagun, Ashwani Kush, and Anupam AroraInternational Journal of Future Computer and Communication, Vol. 2, No. 5, October 2013

[7]. Sthiannopkao S, Wong MH. (2012) Handling e-waste in developed and developing countries: Initiatives, practices, and consequences. Sci Total Environ.

[8]. Yuan, C., Zhang, H. C., McKenna, G., Korzeniewski, C., and Li, J. "Experimental Studies on Cryogenic Recycling of Printed Circuit Board", International Journal of Advanced Manufacturing Technology, Vol. 34, 2007, pp. 657–666

[9]. Fela, Jen (April 2010). "Developing countries face ewaste crisis". Frontiers in Ecology and the Environment 8 (3): 117. doi:10.1890/1540-9295-8.3.116. JSTOR 20696446.

[10]. "How to Find a Responsible Recycler". Electronics TakeBack Coalition.

[11]. "WEEE recycling resources". Simsrecycling.co.uk. Retrieved 6 January 2015.

[12]. Electronic waste management pproaches: An overview Peeranart Kiddee, Ravi Naidu, Ming H. Wong