CHALLENGES AND OPPORTUNITIES IN ELECTRONIC WASTE SECTOR IN INDIA

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ABSTRACT:

In recent decades, the use of electronic and electrical devices has increased significantly, leading to rapidly rising amounts of waste electrical and electronic equipment (WEEE), called e-waste. Currently, around 20-50 million tones of E-waste are generated worldwide. The rate increases by as much as 3-5% each year, making e-waste one of the fastest-growing hazardous waste streams on a global level. The factors behind this development are the rapid obsolescence and replacement of electronic products caused by technological innovation and aggressive marketing. These aspects will contribute considerably to the dimension of e-waste quantities in the future. This research paper emphasis on some of the challenges and opportunities associated with Electronic waste sector in India.

KEY WORDS: Challenges, Development, Electronic – waste, Opportunities, Technology.

INTRODUCTION:

The rapid growth of technology, up gradation of technical innovations and a high rate of obsolescence in the electronics industry have led to one of the fastest growing waste streams in the world which consist of end of life electrical and electronic equipment products. It comprises a whole range of electrical and electronic items such 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. Optimal and efficient use of natural resources, minimization of waste, development of cleaner products and environmentally sustainable recycling and disposal of waste are some of the issues which need to be addressed by all concerned while ensuring the economic growth and enhancing the quality of life.

PROBLEM TO BE INVESTIGATED:

E-waste is a highly complex waste stream, as it contains both very scarce and valuable as well as highly toxic components. Electronic waste consists of more than 1000 different components, many of which contain toxic elements such as lead, cadmium or brominated flame retardants. When burned, these elements release toxic emissions. Many detrimental health effects are connected to the recycling and disposal of e-waste when performed without the necessary safety precautions. Electronic waste on one side developing enormous problems but also if biodraded properly also lead to different opportunities also. This research focuses on minimizing electronic waste by utilizing different opportunities associated with this sector.

SIGNIFICANCE OF THE STUDY:

Linking to electronic waste, over 100 % of Americans reported that they were in support of environmental protection and human health, and avoids purchasing products that are potentially harmful to the environment. Indian perspectives regarding electronic waste are also heading towards the same direction but more awareness and stricter action from government is being needed towards violation of environment. Therefore, the study undertaken is significant from the overall perspective. This research paper may be helpful in providing informational benefits to consumers and users of technology. Consumers will realize the importance of proper recycling efforts versus the illegal disposal of electronic goods.

OBJECTIVES OF RESEARCH:

1. To know thoroughly impact of electronic waste on human health and environment.
2. To study different challenges and opportunities associated with electronic waste.
3. To see the feasibility of converting challenges into opportunities.
4. To suggest some remedial measures in this regard.

REVIEW OF RELATED LITERATURE:

In 2003 the EPA found that E-waste was responsible for 1% of all the disposed solid waste in the United States. Although recycling continued to be encouraged, only 9% of computers were recycled with the majority disposed into landfills (Li, Richardson, & Walker, 2009). Additionally, large amounts of obsolete computers have remained in storage, awaiting disposal. In California, six million obsolete personal computers (PCs) and televisions were stored for disposal and the number has increased by 10,000 each day (Li, Richardson, & Walker, 2009).

The United States exported 50-80% of computer waste (Agoramoorthy, 2006). Millions of tons of scrap electronics each year have been shipped to developing countries for recycling. Cheap labor and low standards of environmental protection in India, China, Bangladesh, Pakistan, and Africa have attracted shipments of E-waste. Obsolete computers are dumped or burned, releasing hazardous substances into the environment. The 1989 United Nations Basel Convention restricted hazardous waste transfers and was ratified by all the developed countries.

With the increasing use of technology, e-waste was seen as a global problem, according to McConnell (2009). In the United States, the Natural Resources Defense Council reported 130,000 computers discarded each day (McConnell, 2009). Electronic equipment contained hazardous materials. The hazardous types of materials make recycling cost prohibitive. The breakdown and

separation of useful materials from electronics often was worth more than the salvaged materials' resale value (McConnell, 2009).

CHALLENGES ASSOCIATED WITH ELECTRONIC WASTE:

Electronic waste sector now a day is facing four major of challenges such as:

1. Increasing growth in the quantity and complexity of electronic waste
2. Increasing risk of damage to human health and environment
3. Economic unattractiveness of the 5Rs (Reduce, Reuse, Repair, Recovery & Recycle)
4. Electronic waste sector's contributing heavily to environment change.

INCREASING GROWTH IN THE QUANTITY AND COMPLEXITY OF ELECTRONIC WASTE GLOBALLY:

European Union:

In the European Union, e-waste has been targeted regarding the prevention of environmental pollution, for the exploitation of resources and the reduction of landfill use. The legislation developed by the European Parliament is based on three axes, the prevention, recycling and re-use of e-waste, so that the amount of the waste electrical and electronic equipment available is reduced.

Switzerland:

Switzerland was the first country in the world where an official e-waste management system was established and operated. The legislation regarding e-waste management was introduced for the first time in 1998 through ORDEA law (Ordinance on "The Return, the Taking Back and the Disposal of Electrical and Electronic Appliances"). Two different e-waste recycling systems are active in the country. One is run by SWICO Recycling Guarantee (The Swiss Association for Information, Communication and Organizational Technology) and manages the "brown" electronic equipment (e.g. computers, televisions, radios, etc.), while the other is run by S.E.N.S (Stiftung Entsorgung Schweiz System) and manages the "white" electrical equipment (e.g. washing machines, refrigerators, ovens, etc.).

Japan:

In the Japanese e-waste management system the withdrawal is not free of charge, but consumers pay an amount of money when they return used electronic products to the traders. Japan has established a withdrawal system for four types of e-waste (air conditioners, televisions, refrigerators and washing machines) since 1998. The law specifies target rates and imposes strict penalties for non-compliance. Until 2004 there were 41 e-waste recycling facilities in Japan,

partially financed by the ministries, municipalities or Japanese companies producing electronic products. Producers implement in their business strategy the e-waste management and have their own facilities or collaborate with other producers to create and operate such facilities.

China:

Chinese marketed estimated accumulation of EEE in households over time, as well as the amount of e-waste generated in China and the trans boundary flows of e-waste into China. Between 1995 and 2011, the sales of the five major types of home appliances increased exponentially. In 2011 alone, 56.6 million televisions, 58.1 million refrigerators, 53.0 million washing machines, 94.8 million air conditioners and 73.9 million computers were sold in the formal market of China, along with 250 million mobile phones. Also in 2011, an estimated 1.2 million tonnes of televisions, 0.44 million tonnes of refrigerators, 0.32 million tonnes of washing machines, 0.99 million tonnes of air conditioners and 0.67 million tonnes of computers were discarded. Collectively, these five types of discarded products amounted to 3.62 million tonnes of waste in 2011.

India:

The Indian electronic waste industry is booming at a very rapid alarming pace. It is expected to increase at a rate of 20% annually. With increasing per capita income, changing life styles and revolutions in information and communication technologies, India is the second largest electronic waste generator in Asia after China. A MoEF'2012 report says that Indian electronic waste output has jumped 8 times in the last seven years i.e. 8, 00,000 tones. The future projection of E-waste in India as per the Dept. Of Information Technology is shown India has majorly two types of electronic waste market called organized and unorganized market. 90% of the electronic waste generation in the country lands up in the unorganized market. Electronic waste accounts for 70% of the overall toxic wastes which are currently found in landfills which is posing toxic chemical contamination in soil and other natural resources. Indian PC industry is growing at a rate of 25% annually.

INCREASING RISK OF DAMAGE TO HUMAN HEALTH AND ENVIRONMENT:

It is estimated that 50 to 80 percent of e-waste collected in developed nations is exported to developing countries such as China, India and Pakistan due to cheap labor and lenient environmental regulations (StEP, 2009). These developing nations lack the health and safety infrastructure to process and dispose of materials safely, and consequently workers handle toxic metals without proper equipment. While there are operators in China who are licensed to process e-waste, the market is dominated by small-scale entities that are not authorized, nor properly

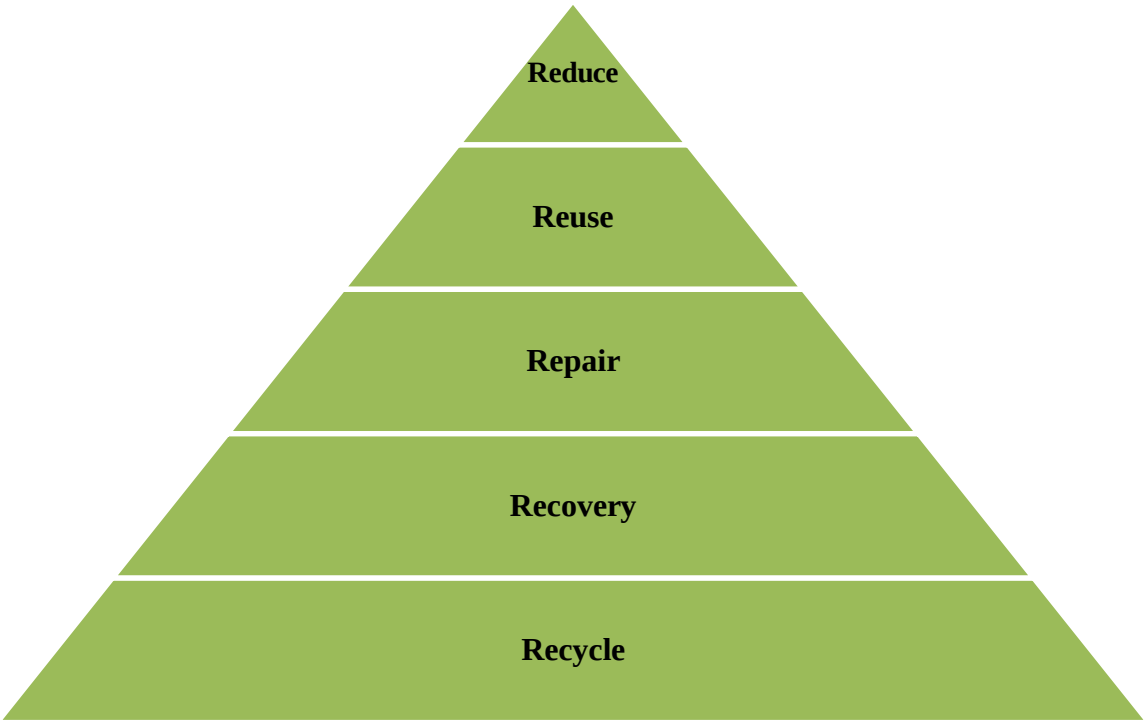
equipped to treat e-scrap. Common techniques for processing e-waste in developing nations include manual dismantling of hazardous materials and open-air burning, which generates significant accounts of dioxins and furans if performed without proper emission control systems. Cyanide leaching is also a prevalent technique for processing e-waste in developing countries, posing a significant concern to worker well-being if the spent leaching solution is not properly disposed.

The waste from electronic products include toxic substances such as cadmium and lead in the circuit boards; lead oxide and cadmium in monitor cathode ray tubes (CRTs); mercury in switches and flat screen monitors; cadmium in computer batteries; polychlorinated biphenyls in older capacitors and transformers; and brominated flame retardants on printed circuit boards, plastic casings, cables and PVC cable insulation that releases highly toxic dioxins and furans when burned to retrieve copper from the wires. Many of these substances are toxic and carcinogenic. The materials are complex and have been found to be difficult to recycle in an environmentally sustainable manner even in developed countries. Listed in the table below are the harmful elements in the compositions of electrical and electronic appliances that can be hazardous to health and environment.

Sr. No	Pollutant	Danger / Disease
01	Lead	Kidneys, reproductive system, mental development, respiratory problems.
02	Plastic	Reproductive and immune system, Water pollutant.
03	Chromium	Damage liver, kidneys and cause bronchial maladies including asthmatic bronchitis and lung cancer and DNA Damages.
04	Beryllium	It is carcinogenic and causes lung diseases. Causes damages to heart liver and spleen.
05	Cadmium	Causes severe pain in the joints and spine. It affects the kidneys, softens bones and neural damages. Cadmium is released into the environment as powder while crushing and milling of plastics, CRTs and circuit boards. Cadmium may be released with dust, entering surface water and groundwater.
06	Acid	Sulphuric and hydrochloric acids are used to separate metals from circuit boards. Fumes contain chlorine and sulphur dioxide, which cause respiratory problems. They are corrosive to the eye and skin.
07	Arsenic	Causes lungs cancer.
08	Bromine	Causes the problem of inhaling.
09	Cobalt	Problems to eyes and skin
10	Copper	Excessive use causes harm to immune system, stomach pain
11	Liquid crystal	Nausea irritant
12	Lithium	Damage nervous cells and system
13	Nickel	Nausea , irritant and sensation of vomiting
14	polychlorinated biphenyls	Causes respiratory problems
15	Selenium	Damage eyes and eyesight
16	Silver	Causes burning sensation in body
17	Zinc	Respiratory and lungs disorder.

(Source: Moef & StEP)

ECONOMIC UNATTRACTIVENESS OF THE 5 R (REDUCE, REUSE, REPAIR, RECOVERY & RECYCLE):



Electronic waste accumulation in the country if not disposed-off properly may become a serious challenge for the human health and environment in the coming future. From the Government side the enforcement of the laws needs to be stricter than ever with an intention to reduce this problem as soon as early before it becomes a threatening hazard for the country. This emphasize the immediate efforts on the part of Government ,corporate ,consumers, environmentalists to manage the Electronic waste through implementing a proactive and protective protocol for the agencies working in E waste reuse, recycle and disposal properly. Need is also felt to educate the general public about this critical issue which can become a major threat for the health of the public and the environment if not handle with care and consciousness.

The most common practices adopted for disposal of e-waste are acid baths, land filling and open air burning. When electronic equipments are burned, they release abundant fumes which are dangerous for environment way beyond our imagination and estimation. The principle of "Reduce, Reuse and Recycle" applies here. Reduce the generation of e-waste through smart procurement and good maintenance. Reuse still functioning electronic equipment by donating or selling it to someone who can still use it. Recycle those components that cannot be repaired. Public education and outreach may well be the most important component. That is because no matter what

infrastructure is available and developed, what the laws are, and what the option are, no one will be aware of it without public education.

ELECTRONIC WASTE SECTOR'S CONTRIBUTING HEAVILY TO ENVIRONMENT CHANGE:

In addition to recovering precious metals, recycling electronics also reduces the environmental impact associated with primary production of electronic products. The primary production of precious and special metals, including energy intensive stages such as mining and smelting, has a significant impact on carbon dioxide emissions. Reuse and recovery of electronics reduces the environmental impact of these products, as well as the impact from primary production of metals and fractions found in electronics.

OPPORTUNITIES ASSOCIATED WITH ELECTRONIC WASTE:

GREENING ELECTRONIC WASTE:

Greening electronic waste refers to a shift from less-preferred waste treatment and disposal methods such as incineration and different forms of land filing towards the five "R" Reduce, Reuse, Repair, Recovery and Recycle. The strategy is to move upstream in the waste management hierarchy, based on the internationally recognized approach of Integrated Solid Waste Management or ISWM. This strategic approach to manages all sources of waste; prioritizing waste, avoidance and minimization, practicing segregation, promoting "5 R" for implementing safe waste transportation, treatment, and disposal in an integrated manner, with an emphasis on maximizing resource-use efficiency.

FROM RECYCLING TO EMPLOYMENT:

Recycling is likely to grow steadily and form a vital component of greener waste management systems, which will provide decent employment. Recycling creates more jobs than it replaces. Recycling in all its forms employs 12 million people in the three countries - Brazil, China and United States. Sorting and processing recyclables alone sustain ten times more jobs than land filling or incineration on a per tonne basis. Estimations made in the context of this Report suggest that if an average of US$ 143 billion were invested in waste management over the period 2011-2030, a total employment of 20-23 million could be created in the waste sector by 2030, which represents 2-2.4 million jobs, more than the 23 million projected under a business as usual scenario.

IMPROVED ECONOMY:

Greening the waste sector includes, the minimization of waste. Where waste cannot be avoided, recovery of materials and energy from waste as well as remanufacturing and recycling waste into usable products should be the second option. The overall vision is to establish a global circular economy in which material use and waste generation is minimized, any unavoidable waste recycled or remanufactured, and any remaining waste treated in a manner least harmful to the environment and human health or even generating new value such as energy recovered from waste. Investing in greening the waste sector can generate multiple economic benefits. Recycling leads to substantial resource savings and helps in improving economy.

IMPROVED LABOR CONDITION AND HEALTH:

Improving labor conditions in the waste sector is imperative. The activities of collection, processing and redistribution of recyclables are usually done by workers with few possibilities outside the sector. Thus, despite the potentially significant contribution to employment creation, not all of the recycling and waste management related jobs can be considered green jobs. To be green jobs they also need to match the requirements of decent work, including the aspects of child labor, occupational health and safety, social protection and freedom of association.

APPLICATION OF NEW TECHNOLOGY:

The greening of the waste sector is also facilitated by significant breakthroughs in technologies required for collection, reprocessing and recycling waste, extracting energy from organic waste, and efficient gas capture from landfills. Recovering energy and other useful

products from waste has been enabled by considerable technological breakthroughs. Mechanical and biological treatment (MBT) and bio-methane have, for example, been recognized as suitable for processing electronic waste in developing countries.

CONCLUSION:

The increasing volume and complexity of waste is posing threats to ecosystems and human health, but opportunities do exist electronic waste sector. These opportunities come from the growing demand for improved waste management and for resource and energy recovery from waste. The waste recovery and recycling part of the waste explored to treatment chain probably holds the greatest potential in terms of contributions to a green economy.

SUGGESTIONS:

Impart training to generators on e-waste handling. Fix duties and responsibilities to recyclers and pickers. Government must introduce tax incentives for scrap dealers, reward and reprimand schemes for performance and non-compliance of e-waste management.

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