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E-waste, Problems, Consequences and Disposal Practices in India: A Review

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ABSTRACT: The aim of the study was to generate the data base of the E waste and disposal practices among residents of smaller cities city. It was revealed that general, the consumer awareness in smaller cities city is very poor and are not aware of the collection centres, the E-waste rules, and correct disposal practices. Consumers either mix-up the E-waste generated along with municipal solid waste or keep them in their homes as such, thereby leading to unsustainable way of disposal practices. In India, Ministry of Environment and Forests (MoEF) has played a key role by formulating the E-waste policy, but the influence of this policy in smaller cities is nonexistent [9]. There is an urgent need to explore unlimited business opportunities and scope for developing sustainable models for E-waste management in smaller cities to deal with electronic waste.

Keywords: E-waste, consumers, awareness, disposal, management

I. INTRODUCTION

Electrical and electronic equipment, known as e-waste, is a rapidly growing global problem. However, E-waste contains precious materials that have an economic value if recycled properly. The majority of e-waste is recycled in the unregulated informal sector and results in significant risk for toxic exposures to the women and children as they are mostly recyclers in developing countries (Brune *et al.,* 2013) [1]. The 2012 UN report revealed that by 2017 global e-waste will increase a further 33% from 49.7 million to 65.4 million tons per annum (MIT, 2014) [8]. E-waste from cell phones is expected to increase 18-fold by 2020 in India (Schluep *et al.,* 2009) [11]. The total amount of e-waste produced is exponentially increasing due to multiple factors. Consumer demand and a high obsolescence rate lead to frequent and unnecessary purchases of EEE (Gagliardi and Mirabile, 2011) [4].

The per capita PC ownership between 1993 and 2000 has grown by 604% as against the world average of 181% during the same period in India (Sinha-Khetriwal *et al.,* 2005) [13]. The total PC base during this period has grown from an estimated 450,000 to 4,200,000 PCs (Sinha, 2004) [12]. However, Dwivedy and Mittal (2010) stated that contrary to the world average of 27 computers per 1000 people and over 500 computers per 1000 people in the US, India in the year 2004 had one of the lowest PC penetration rate at just 9 computers per 1000 people [3].

Nonetheless, the size of India's market in absolute terms is larger than most of the high income countries (Sinha-Khetriwal *et al.,* 2005) and hence although considered among the countries with lowest PC penetration rate, the generation of E-waste in the form of computer-waste could be significant [13]. For example, India had about 20 million computers in 2007 and 2.2 million computers had become obsolete in the same year (Chatterjee and Kumar, 2009) [2].

Ministry of Environment and Forest (2008) stated that ten states generate 70% of the total E-waste generated in India. Maharashtra ranks first in the list of E-waste generating states in India followed by Tamil Nadu, Andhra Pradesh, Uttar Pradesh, West Bengal, Delhi, Karnataka, Gujarat, Madhya Pradesh and Punjab. Moreover, it has been reported in the document that sixty-five cities in India generate more than 60% of the total E-waste generated in India. Further, it listed ten major E-waste generator cities in the country. Among them, Mumbai ranks first followed by Delhi, Bangalore, Chennai, Kolkata, Ahmedabad, Hyderabad, Pune, Surat and Nagpur. Complementing this, a study conducted by MPCB (2007) states that Mumbai and Pune fall under the top ten cities that are generating maximum quantities and Mumbai alone generates maximum among all the cities of India. The city of Smaller cities is under going rapid transition and has adopted the digital culture very quickly and as such the electronic gadgets have become the part and parcel of life in the city of Smaller cities [10].

However, Individual consumer's awareness in smaller cities is one of the major challenges in the e-waste management as it is not only sufficient to frame and implement the regulatory framework which defines clearly the roles of various stakeholders.

Lack in consumer awareness and basic civic sense among the smaller cities residents may cause hurdle to manage the E-waste. The people who are mostly ignorant about the management of E-waste are becoming the easy victims to the pollutants from the electronic gadgets. Hence, the main aim of the present research is to generate information about the E-waste and its challenges in smaller cities.

A. Management of e-waste: a Challenge

Solid waste management, which is already a mammoth task in India, is becoming more complicated by the invasion of e-waste, particularly computer waste. There exists an urgent need for a detailed assessment of the current and future scenario including quantification, characteristics, existing disposal practices, environmental impacts etc of e waste in Smaller cities. Institutional infrastructures, including e-waste collection, transportation, treatment, storage, recovery and disposal, need to be established, at national and/or regional levels for the environmentally sound management of e-wastes. Establishment of e-waste collection, exchange and recycling centers should is encouraged in partnership with private entrepreneurs and manufacturers.

The increase of electrical and electronic products consumption rates and higher obsolescence rate leads to higher generation of e-waste in Smaller cities. The increasing obsolescence rate of electronic products also adds to the huge import of used electronics products. Electrical and electronic waste (E-waste) is one of the fastest growing waste streams in the world. The increasing "market penetration" in developing countries, "replacement market" in developed countries and "high obsolescence rate" make e-waste one of the fastest growing waste streams in the world. The E-waste inventory based on the obsolescence rate in India for the year 2005 has been estimated to be 1, 46, 000 tonnes, which is expected to exceed 8, 00,000 tonnes by 2012.

Despite the fact that the E-Waste (Management & Handling) Rules were effective from 2012, there are still many challenges for environmentally Sound Management of e-waste in India, especially in small cities like smaller cities. There are several reasons for this including Government Apathy to implement rules, lack of authorized e-waste Recyclers, lack of awareness and inadequate implementation initiative. One of the major barriers in implementation legislation effectively is the consumer (both bulk and individual) awareness. Bulk consumers under the legislation are compelled to manage e-waste but the individual consumers are completely neglected. Few people in smaller cities store cell phones at home as they believe that personal information in mobile phone could not be discarded immediately. In the case of other electronic gadgets people think that it is better to purchase new as the repair shops generally do not give any guarantee for repaired electronic gadgets.

The observations at the study area and in depth interviews with stakeholders revealed that general consumer awareness about e waste is very poor in Smaller cities and the disposal practices are not implemented as it was seen that E Gadgets are mixed with solid waste. Further, they are not aware of the rules, correct disposal practices and fail to dispose it an environmental friendly way. The awareness of the consumer is of most importance in the entire supply chain of E-waste as it will generate awareness of reuse, repair and recycle for sustainable e-waste management to protect the livelihood, health and environment. This study has limitations but the sample size considered indicates the fact that there is a urgent requirement to handle the e-waste and hence control it's source of generation. The consumer awareness about the ill effects, benefits of reuse and recover approach may help to achieve the goals by develop a feelings to that precious metals can be obtained when recycled properly. This is the responsibility of every citizen by following Cradle to Grave approach. The Government needs to play its role as a regulatory agency by framing and implementing the rules that must be monitored very closely, especially in cities like smaller cities. The efficient collection of E waste is possible in smaller cities by the establishment of network system for collecting E-wastes with several collection agencies that must be built for adjoining producers, recycling companies, and local governments to exchange collecting E wastes information.

Beneficial recycling practice of E-Waste in Smaller cities can be improved by developing the recycling technologies. However, sustained efforts to develop the technologies to recycle E-wastes as secondary resources for recovering materials as well as to procure raw materials need to be developed and implemented in smaller cities.

B. E-waste scenario in India

Electronic waste or E-waste comprises of old, end-of-life electronic appliances such as computers, laptops, TVs, DVD players, refrigerators, freezers, mobile phones, MP3 players, etc., which have been disposed of by their original users. The growth in electrical and electronic equipment (EEE) production and consumption has been exponential in the last two decades. This has been as a result of the rapid changes in equipment features and capabilities, decrease in prices, and the growth in internet use. This creates a large volume of waste stream of obsolete electrical and electronic devices (e-waste) in developed countries.

There is high level of trans-boundary movement of these devices as second and electronic equipment into developing countries in an attempt to bridge the 'digital divide'. E-waste contains many hazardous constituents that may negatively impact the environment and affect human health if not properly managed. An assortment of apparatuses is engaged with the disassembling procedure for expelling the parts and recuperation of reusable or important parts and materials. Essentially the mechanical/physical reusing forms honed include screening, shape partition, attractive division, electric conductivity-based detachment, thickness based division, and such different systems relying on the amount, sort, size and state of the material and part in E-waste (MPCB, 2007) [10]. Despite the fact that endeavors have been made to record E-waste reusing exercises in huge urban areas like Bangaluru, Chennai, Mumbai, New Delhi, and Pune by different natural associations, contamination control sheets, regions, and so on with a specific end goal to feature the genuine ramifications of casual reusing to the earth as well as human wellbeing, still parcel of ground to be canvassed in this issue. The greatest disadvantage of the present E-waste framework in India is the uncontrolled emanation of toxins that are going into the air, water what's more, soil, which are neither evaluated nor checked. The wellbeing perils from vapour, fiery debris and unsafe chemicals influence not just the laborers who come into contact with the E-waste, yet additionally other people who are presented to the E-waste condition. The aggregate E-waste administration framework is work concentrated and the majority of the reusing what's more, recuperation activities are done utilizing obsolete advances what's more, forms, that may prompt arrival of uncontrolled outflow of poisons (EU, 2000), (SVTC, 2006). Based on the investigation and examination of the present E-waste arrangement of India, the drivers are brought up, that can decidedly (named 'facilitators') or contrarily (named 'limitations') adjust an existing E-waste administration framework in India.

The first phase of economic liberalisation, the problems associated with E-waste in India has started manifesting since 1990. The initial estimates carried out by National WEEE task force in 2005 recommend that total Waste Electrical and Electronic Equipment (WEEE), generation in India is approximately 146,000 tonnes per year. The top states in order of highest contribution to WEEE include Maharashtra, Andhra Pradesh, Tamil Nadu, Uttar Pradesh, West Bengal, Delhi, Karnataka, Gujarat, Madhya Pradesh and Punjab. The ranked list of cities as WEEE generators are Mumbai, Delhi, Bangalore, Chennai, Kolkata, Ahmadabad, Hyderabad, Pune, Surat and Nagpur in the order (IRGSSA, 2005) [7]. A GTZ–MAIT Study in 2007, had put the approximation to 330,000 tonnes (GTZ-MAIT, 2007) [5] and in 2009 various sources including (Heimbuch, 2009) has put the figures to 420,000 tonnes [6].

While the current (of 2010) E-waste production equipment wise as per the estimates of UNEP report 2010, is over 100,000 tonnes from refrigerators, 275,000 tonnes from TVs, 56,300 tonnes from personal computers, 4700 tonnes from printers and 1700 tonnes from mobile phones. The data only includes equipment generated nationally but does not include waste imports (both legal and illegal) which are extensive in emerging economies like India and China (UNEP report, 2010) [15]. Whereas, a report by Toxics Link (2004) said that at recycling units in New Delhi (India) itself, 70% of the total electronic waste collected was actually exported or discarded by developed countries (Toxic Link, 2004) [14]. While the GTZ–MAIT Study in 2007 estimates that around 50,000 tonnes of WEEE were imported to India every single year (GTZMAIT, 2007). There is a vital need to decide a plan for E-waste problem in developing country like India, as the UNEP 2010 report predicts that by 2020, E-waste from old computers in India will jumped by 500%; from discarded mobile phones will be about 18 times high; from televisions will be 1.5 to 2 times higher; from discarded refrigerators will double or triple in future.

II. CONCLUSION

The paper proposed a national uniform E-waste administration framework for India in view of the present, social, temperate, word related and ecological situation, needs and prerequisites investigation in light of different effective practices, approaches followed in different nations. The proposed framework may prompt more formal and thorough control of the administrative specialist over the E-waste gatherers, merchants, recyclers, produces and importers– exporters of electronic machines. It might increase the E-waste gathering and prompt more proper utilization of assets including specialized aptitude and advances for better E-waste administration. The Indian E-waste framework requires a few changes for the naturally solid and directed logical handling of E -waste. Further, studies, contemplations and research are required for changing the strategies, council and laws identified with E-waste to suit the Indian situation. Additionally there exists a requirement for discovering the most ecological cordial reusing/transfer procedures and treatment choices for taking care of the E-waste containing the different poisonous and risky materials. Administration of E-waste, if appropriately completed, is an open door as it is regularly called as "urban mining." The part of open private organization (PPP) assumes a key part in creating and sorting out a sound E-waste administration procedure in India.

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