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Recycling Potential of E-Waste for Jammu City

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Abstract: - The fate of end-of-life electronics (e-wastes) is of increasing concern because of their toxicity and ever-increasing volumes. Addressing these concerns requires proper management plans and strategy which in turn requires reliable estimates of e-waste generation, consumer's disposal behaviour and awareness which are central to any successful E-waste management interventions without which no reuse/recycling efforts would be fully functional and satisfactory, no pollution abatement initiatives would be entirely successful, no policy instruments could be satisfactorily implemented. In this study the use and consumption model was used to estimate the generation of e-waste from the households. This model takes into account average lifespan and average weight of the selected electronic products. The data required for this model was obtained from field surveys with the help of questionnaires. The total generation of e-waste in the Jammu city comes equal to 7.745 tons per day (with per captia generation rate of 0.00675 kg per inhabitant per day) out of which the amount sold as scrap is equal to 0.825 tons.

Key Words — e-waste generation, waste treatment, recycling, e-waste management.

I. INTRODUCTION

Consumer electronics have been considered an important part of daily life. It revolutionized the way people communicate, entertain ourselves, and retrieve information. The rapid developments in the electronics sector over the past few decades achieved an unprecedented growth record in terms of sales, exports, innovative capacity, and spin-off potential for related activities. Accordingly, this development causes a constant stream of new products with decreasing short life span. Hence, the rate of disposal has been on the rise, more and more discarded devices are thrown away, and the volume of e-waste has significantly increased causing different dangerous problems. As technology grows quickly and electronics reach to the end of their life span faster, there is an urgent need for end-of-life management options (also known as e-waste management). Electronic wastes contain several metals, many of which are valuable, and some of which are hazardous. Thus, managing e-waste is imperative to recover the precious components and to reduce the environmental impact by handling the hazardous substance properly. Recovering processes include reusing, refurbishment, repairing, recycling, or disposal. Reuse, refurbishment, and repair are considered the most desirable methods for recovering as they help in extending the life span of the product. According to the difference in regulations of each country, it is normal that the trend of electronic manufacturers differs from one country to another. There are some electronics companies who do not stick to their responsibilities in the developing countries as they know that there are no penalties or extra taxes. On the other hand, they are committed to apply a strict e-waste process in developed countries by design electronics which have longer lifespans, use fewer and less-hazardous materials, and recycling the end of life products in a way which protects both the human health and the environment. The electronic waste management principle has been implemented by many countries as the most suitable approach to handle the e-waste problem. However, the Indian government and private sector can formulate a sustainable e-waste system based on the experience gained from the developed countries.

II. LITERATURE REVIEW

During the last 50 years, the world population has doubled, with over half of the population now lives in urban areas (Tansel 2017). Prospects of an urban life often involve the use of electrical and electronic equipment's (EEEs) to accomplish a variety of routine activities. Today, the electronic industry is one of the world's most important industries. From its steady growth during the recent decades to creating a large number of employment opportunities, promoting technological developments and eventually fueling an increasing generation of electronic waste (E-waste) through obsolete EEEs (Singh, Li et al. 2016), the industry asserts its significance in the present day context. Every EEE come with its own practical lifespan and become obsolete after a specific period of time contributing to the E-waste stream. Further, consumers are motivated to discard EEEs very much within their functional lifespan due to factors such as rapid economic growth, advancements in technology, increasing demand for information and communication technologies (ICT), urbanization processes, readily accessible and economical newer designs etc (Fraige, Al-khatib et al. 2012). As Echegaray (2016) argues, 'Deliberate curtailment of product lifespan and the symbolic devaluation of devices appear especially acute in the electronics segment, thus pushing up E-waste volumes'. Product obsolescence corresponds to a major sustainability challenge. Consequently, E-waste becomes a key global apprehension in terms of both environmental and resource recycling considerations (Zeng, Yang et al.2017). Addressing the E-waste issue is of great significance in the contemporary world. On one hand, E-waste is a source of toxic elements such as lead, cadmium, mercury, chromium and polybrominated biphenyls, while also being a source of valuable metals such as iron, copper, aluminum, gold, silver and other metals (Madrigal-Arias, Argumedo-Delira et al. 2015). E-waste, thus, is a rich stream of critical raw materials and it is imperative to recover those materials to achieve resource efficiency (Ongondo, Williams et al. 2015). However, this could only be ensured through a responsible E-waste disposal mechanism by consumer citizens of a country. While many studies on E-waste issues have been published in the last decade, only a few of them addresses publics' E-waste disposal behaviour and associated awareness (Borthakur and Govind 2017).

An electrical and electronic product can be classified as a product that contains a printed circuit board (PCB) and uses electricity. Much has been written about the e-waste problem, yet the definition of the term "electronic waste" is quite complex to define. Referring to scholarly literature on the topic, there is, as yet, no standard definition, as every country has its own definition of ewaste. The questions that arise, therefore is: What is to be called e-waste? Any electronic or electrical appliances, which are obsolete in terms of functionality? Products that are operationally discarded? Or is it both? The following are the different definitions of e-waste.

OECD (2001) defines e-waste as "Any appliance using an electric power supply that has reached its end-of-life". EU WEEE Directive (EU, 2002a) defines e-waste as "Electrical or electronic equipment which is waste including all components, sub-assemblies and consumables, which are part of the product at the time of discarding". Puckett and Smith (2002) defines e-waste as "e-waste encompasses a broad and growing range of electronic devices ranging from large household devices such as refrigerators, air conditioners, cell phones, personal stereos and consumer electronics to computers which have been discarded by their users".

III. Generation Of E-Waste In India

Since 2000s, waste electrical and electronic equipment (WEEE or ewaste) has become a global concern in terms of environmental improvement and resource recycling (Breivik et al., 2016), which is the fastest-growing waste steam with the 43.8 million tons (Mt) global quantity in 2015 and growing to 49.8 Mt in 2018 (Baldé et al., 2015). The growth of population in urban India from 11.4% in 1901 to 31.16% in 2011 contributed to an alarmingly increasing amount of waste production (Yadav, Karmakar et al. 2016). Further, the second half of twentieth century witnessed the rise of a consumption-based economy around the globe (Aras, Korugan et al. 2015). As one of the largest and the most flourishing segment of this growth story, electronics industry (Zeng and Li 2016) results in a massive volume of EEEs being produced, used and consumed worldwide since the 1980s (Sing, Li et al. 2016). According to the Confederation of Indian Industries (CII 2011), Indian electronics industry has a market size of approximately USD 65 billion and is expected to reach USD 400 billion by the year 2020 (Agrawal, Singh et al. 2014). The outcome is the large quantity of E-waste produced in the country. Emerging economies like India has the fastest growing markets for EEEs and thus, are large generators of E-waste (Widmer, OswaldKrapf et al. 2005).

IV. Research Methodology

The Inventorization initiative, which is first of its kind in the State of J&K aims at generating data on the E-waste generation and management in the capital cities and towns of the State. For accomplishing the objectives of the research field survey was conducted at different areas within the study area. The first step in applying any approach and methodology is to establish the geographical boundaries of the study area.

Study Area: The study area decided for conducting the field survey is Jammu city of Jammu and Kashmir State with the GPS location as 32º44´59´´N latitudes and 74º49´59´´E longitudes.

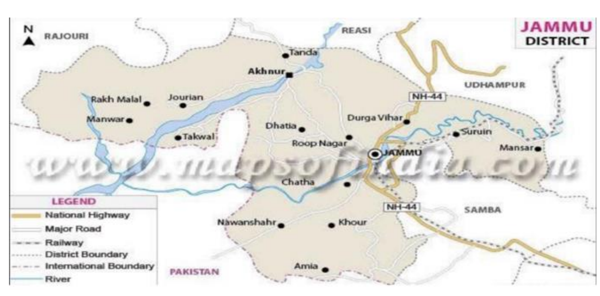

Fig.1. Shows the area under investigation

V. Results And Discussion

A survey was conducted in Jammu city to make an assessment of e-waste generation and understand public knowledge and awareness related to e-waste management in the city. A limited random survey was conducted with a sample size of 400 individuals in Jammu belonging to different educational backgrounds and professions. Personal interview method was used to collect indepth information related to the issues of e-waste and its management. A questionnaire was developed which contained questions on basic socioeconomic information and three other parts. The socioeconomic information included questions regarding sex, age, education level, and monthly income. The first of the three additional survey parts uncovered consumers' behaviours and attitudes on recycling and disposal of e-waste. The second part aimed to investigate the consumers' environmental awareness related to the hazards posed by e-waste. The third part surveyed the consumers' willingness to pay for recycling and treatment. The questionnaire consisted of both open-ended and close-ended questions. Most of the questions had multiple choice options, which made it easy for the respondents to answer them appropriately. The open-ended question gave the respondents ample time and space to express their views. The open-ended questions besides strengthening the close-ended questions provided a lot of qualitative information and made the study interesting. Apart from just interviewing, informal interactions were also used as a tool for data collection. During the course of the study, informal interactions were done with respondents to familiarize them with the objectives of the present study, their role and benefits to them from the study. A total of 400 personal interviews were administered in 2019 at respondents' homes; the sample effective response rate through the face-to-face interviews was 99.75%. Table 4.1 reports the descriptive statistics for the main socioeconomic characteristics of the respondents. The mean age of the respondents was 36.67 years. Around seventy-two percent of respondents were male, the average number of household members was 4.77 that is close to 5, and the average educational level was between high school and college level, but somewhat closer to college level. Specifically, 28.57% respondents had finished high school and 36.84% had completed a college education.

VI. Conclusions And Future Scope

Changes in lifestyle of people, technological development, and low-cost availability of electronic gadgets have led to increased consumption rates of electronic products. Consequently, the global quantities of WEEE are on an upward trend across the globe. In this study, we estimated the quantities of WEEE generated from some e-products in Jammu using "use and consumption" method. Based on survey analyses, the total amount of WEEE generated was estimated to be 10.32 tons per day in Jammu City with per captia generation rate of 0.00675 kg per person per day. Due to increased generation of WEEE and the lack of proper managing systems for this type of waste in the city, it is predicted that such waste would have some adverse effects on the health of Jammu citizens and the environment as well. Therefore, it is necessary that the municipality along with the source separation programs also do field surveys on the quality and the quantity of e-waste generated to provide necessary infrastructures for separation, collection, recycling, and management of such waste. For the purpose of developing new policies, the results of this study can be useful for understanding the status of the issue, residents' attitudes, and WTP for e-waste disposal, for the policy makers and managers, and can be used to promote the recycling of e-waste in Jammu.

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