**IMPACT: International Journal of Research in Humanities, Arts and Literature (IMPACT: IJRHAL)**
**ISSN (P): 2347-4564; ISSN (E): 2321-8878**
**Vol. 6, Issue 6, Jun 2018, 581-590**


# A STUDY OF ENVIRONMENTAL IMPACT OF E-WASTE IN INDIA

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**Received: 14 Jun 2018** **Accepted: 19 Jun 2018** **Published: 30 Jun 2018**

## *ABSTRACT*

*E-Waste is not an industrial waste or chemical and physical substance but it includes valuable and hazardous supplies equally thus it requires a different method for recycling by which it will not harm environmental and also not to the human health. The process of re-use various components or base materials, that is made with metals called recycling. The problems of recycling includes are short of facilities, the high cost of labor, and strict environmental regulations resulting trend of not to recycle E-waste by some rich countries. Recycling has emerged as a new economic sector for trading, repairing and recuperating resources from unusable devices and converting it into a financially profitable economic activity. The current research paper used the data obtained from 140 citizens of India by using the convenient Sampling method to measure their awareness about e-waste management. Multiple regression tests were used and it was found that the citizens are aware of the e-waste and its management.*

***KEYWORDS:*** *E-Wastes, E-Wastes Management, India, Sustainability, Awareness*

## INTRODUCTION

There is no separate collection of e-waste in India. Hence, there is no clear data on the quantity generated and disposed of each year (Mundada, 2004). According to Secretariat, Rajya Sabha Report (2011) on e-waste, there is no confirmed figures available on how substantial are these trans-boundary e-waste streams. Central Pollution Control Board (CPCB) estimated India's e-waste at 1.47 lakh tonnes. It has further estimated that total 4.34 lakh tones of e-waste were generated in India till the end of the year 2009 (Kumar, 2009) and it will surpass the 8 lakh tonnes mark by 2012 (CPCB, 2010). In Indian scenario, the electronically sound 10 states are producing above 2/3 of the e-waste. And thus its management needs more efforts not from the side of the e-waste management agency but from the side of the citizens. Recycling is the main concern and gain importance due to the dumping of the e-waste by other countries for their disposal in India, which is the main cause of change in the environment degradation and now the time has come for improving environment and reducing the main cause of human health risks (Ha et al. 2009).

## OBJECTIVES

The aim of this study is to study the environmental impact of e-waste in India.

## REVIEWS OF LITERATURE

Lan Yi, Hywel R. Thomas. (2007) attempted to provide a review of the current state of the art of how e-business/ICT affects the environment. Their review found that the currently dominant approach is either a micro-level case study approach or a macro-level statistical approach. It is concluded that a more predictive and empirical model, which can be applied within a sector of society, should be more beneficial in the long term.

Jirang Cui, Lifeng Zhang. (2008) relieved that thermal processing provides a feasible approach for recovery of energy from electronic waste if a comprehensive emission control system is installed. In the last decade, attentions have been removed from hydrometallurgical process to hydrometallurgical process for recovery of metals from electronic waste. In order to develop an environmentally friendly technique for recovery of precious metals from electronic scrap, a critical comparison of main leaching methods is analyzed for both economic feasibility and environmental impact.

Erik Spalvins, Brajesh Dubey and Timothy Townsend (2008) revealed that lead is the element most likely to cause discarded electronic devices to be characterized as hazardous waste. Lead concentrations ranged from 7 to 66 μg/L in the columns containing electronic waste and ranged from <2 to 54 μg/L in the control columns. Although the mean lead concentrations in the columns containing electronic devices were greater than those in the controls, the difference was not found to be statistically significant when comparing the data sets over the entire monitoring period. Lead results from the excavated waste column suggest that lead concentrations in all columns will decrease as the pH increases toward more neutral methanogenic conditions.

Brett H. Robinson. (2009) revealed that the current global production of E-waste is estimated to be 20–25 million tonnes per year, with most E-waste being produced in Europe, the United States and Australasia. China, Eastern Europe, and Latin America will become major E-waste producers in the next ten years. Miniaturisation and the development of more efficient cloud computing networks, where computing services are delivered over the internet from remote locations, may offset the increase in E-waste production from global economic growth and the development of pervasive new technologies. Most E-waste is disposed of in landfills. Effective reprocessing technology, which recovers the valuable materials with minimal environmental impact, is expensive. E-waste workers suffer negative health effects through skin contact and inhalation, while the wider community is exposed to the contaminants through smoke, dust, drinking water and food. There is evidence that E-waste associated contaminants may be present in some agricultural or manufactured products for export.

Hong-Gang Ni and Eddy Y. Zeng (2009) revealed that with increasing frequency news and research articles in ES&T have reported on the environmental and health impacts of e-waste. Despite national and international legislation banning the trade of hazardous materials, a lucrative black market has inundated China with corpses of electronic appliances. Recycling e-waste to liberate raw materials exposes workers, often in substandard workplace conditions, to potentially harmful chemical species, including PBDEs and heavy metals—which then contaminate the environment. In this Viewpoint, Ni and Zeng summarize the challenges faced by China in the import and rendering of e-waste and offer suggestions on how to curtail the danger.

Kai Zhang, Jerald L. Schnoor, and Eddy Y. Zeng (2012) revealed that E-waste recycling has become a hotly debated global issue. This study, using China as a case study, analyzes the environmental, economic, and social implications of e-waste recycling in the developing world. More practical approaches, taking into account local economic and social conditions and the principles of Extended Producer Responsibility, are recommended to alleviate the increasing environmental disruption from improper e-waste disposal.

Qingbin Song, Jinhui Li.(2014) explained that as the world's leading manufacturing country, China has become the largest dumping ground for e-waste, resulting in serious pollution of heavy metals in China. This study reviews recent studies on environmental effects of heavy metals from the e-waste recycling sites in China, especially Taizhou, Guiyu, and Longtang. The exceedance of various national and international standards imposed negative effects on the environment, which made the local residents face with the serious heavy metal exposure. In order to protect the environment and human health, there is an urgent need to control and monitor the informal e-waste recycling operations

Rolf Widmer, Heidi Oswald-Krapf, Deepali Sinha-Khetriwal, Max Schnellmann, Heinz Böni. (2005) revealed that Electronic waste, or e-waste, is an emerging problem as well as a business opportunity of increasing significance, given the volumes of e-waste being generated and the content of both toxic and valuable materials in them. The Basel Ban, an amendment to the Basel Convention that has not yet come into force, would go one step further by prohibiting the export of e-waste from developed to industrializing countries.

Ramzy Kahhat, Junbeum Kim, Ming Xu, Braden Allenby, Eric Williams, Peng Zhang. (2008) explored issues relating to planning future e-waste regulation and management systems in the U.S. It begins by reviewing the existing U.S. recycling systems in the U.S. to establish the importance of developing public responses. Other countries and regions around the world have already legislated and implemented electronic takeback and recycling systems. To establish the context of existing experience, e-waste management systems in the European Union, Japan, South Korea and Taiwan are explored. The paper then discusses what specific conditions are expected to influence the acceptability and implementation in the U.S.

## RESEARCH METHODOLOGY

### Sources of Information

This research work is in the form of exploratory and its nature is also descriptive research Study. For conducting this research the information will be gathered from the Primary sources. The first-hand primary data was collected through questionnaires. For this purpose, the views of the respondents engaged in recycling industry form India was selected.

### Sample Design

**Sample Units:** Current study depends upon the citizens of India.

**Sampling Technique** – Convenient Sampling.

**Sample Size** – 140.

**Hypotheses**

**H1:** There is a significant difference in awareness about hazardous effects of electronic waste in India.

**Tools and Techniques of Research**

Since the data needed for this research is secondary data as well as primary data. the primary data will be collected by using a questionnaire while a some Secondary data will be taken from the annual report and other reports. To meet the research objective of research Questionnaire was used as an instrument for collecting primary data. Looking at the nature of study the questionaire will structure and mainly contained questions, which are closed ended? The response will be recorded and measured by using Nominal Scale and Liker Scale.

## DISCUSSIONS AND RESULT

The result of the data collection is shown as under:

**Table 1: Demographics**

| | Count | Percentage | | | |
|---|---|---|---|---|---|
| 15-24 | 67 | 59% | Student | 66 | 58% |
| 25-34 | 23 | 20% | Employed/service | 45 | 39% |
| 35-above | 24 | 21% | Business | 3 | 3% |
| Male | 75 | 66% | School Education | 14 | 12% |
| Female | 39 | 34% | Under Graduate | 47 | 41% |
| | | | Post Graduate | 53 | 46% |
| Single | 89 | 78% | | | |
| Married | 25 | 22% | | | |

It can be concluded from table and graph above that Majority of respondents are young belong to 15-25 year age group. Large proportions are male respondents (66 percent) and students studying in school and colleges in respective UG and PG courses. Hence the sample is composed of young generation student and employed community, therefore the results majorly reflect their perspective towards e-waste effects and its management.

**Table 2: Process Adopted When Gadgets Damaged or Become Un-Repairable**

| Methods | Percentage |
|---|---|
| 1. Keep them at home | 17% |
| 2. Sell to recycler | 20% |
| 3. Handed over to waste collector | 18% |
| 4. Sell to second hand dealer | 24% |
| 5. Sell to scrap dealer | 9% |
| 6. Put on the street | 1% |
| 7. Donate to other | 11% |

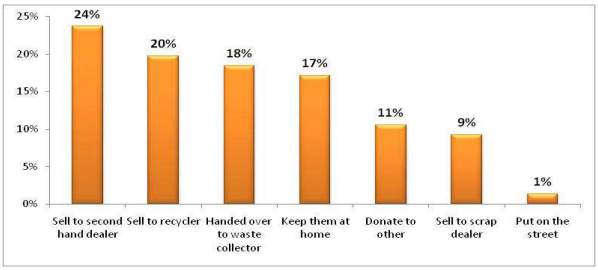


**Figure 1: Process Adopted for Recycling E-Waste**

Majority of respondents is selling their e-waste to near second-hand dealer, or hand it over to the local waste collector. Even a considerable percent of respondents keep their e-waste at their home. All these activities further enhance the improper disposal of e-waste in India.

**Table 3: Measuring Awareness on E-Waste**

| | Variable Name |
|---|---|
| What is e-waste | Aware1 |
| Awareness about hazardous effects | Aware2 |
| Waste pose a serious threat to the environment | Aware3 |
| Aware about volume of electronic waste we generate | Aware4 |
| Aware about national or international laws related to e- waste management | Aware5 |
| Know any e-waste trader or recycler (in Rajasthan / India) | Aware6 |
| Aware of local programs, projects or activities related to electronic waste management | Aware7 |
| Most of waste collectors are not aware of its negative effects | Aware8 |

**Table 4: T- Test Result**

| One-Sample Statistics | | | | |
|---|---|---|---|---|
| | N | Mean | Std. Deviation | Std. Error Mean |
| Aware1 | 140 | 1.0786 | .27003 | .02282 |
| Aware2 | 140 | 1.2071 | .40671 | .03437 |
| Aware3 | 140 | 1.0714 | .25846 | .02184 |
| Aware4 | 140 | 1.5643 | .49763 | .04206 |
| Aware5 | 140 | 1.7643 | .42597 | .03600 |
| Aware6 | 140 | 1.8357 | .37187 | .03143 |
| Aware7 | 140 | 1.8143 | .39027 | .03298 |
| Aware8 | 140 | 1.2071 | .40671 | .03437 |

| One-Sample Test | | | | | | |
|---|---|---|---|---|---|---|
| | Test Value = 1.5 | | | | | |
| | T | DF | Sig. (2-Tailed) | Mean Difference | 95% Confidence Interval of the Difference | |
| | | | | | Lower | Upper |
| Aware1 | -18.466 | 139 | .000 | -.42143 | -.4666 | -.3763 |
| Aware2 | -8.520 | 139 | .000 | -.29286 | -.3608 | -.2249 |
| Aware3 | -19.619 | 139 | .000 | -.42857 | -.4718 | -.3854 |
| Aware4 | 1.529 | 139 | .129 | .06429 | -.0189 | .1474 |
| Aware5 | 7.341 | 139 | .000 | .26429 | .1931 | .3355 |
| Aware6 | 10.682 | 139 | .000 | .33571 | .2736 | .3979 |
| Aware7 | 9.528 | 139 | .000 | .31429 | .2491 | .3795 |
| Aware8 | -8.520 | 139 | .000 | -.29286 | -.3608 | -.2249 |

A result of t-test confirms the finding that Majority of respondents are aware of e-waste, and there hazardous effects to health and environment. But they are not aware of the volume of e-waste generated by them, very few know about the national and international laws and regulation about e-waste management. Even they do not know any e-waste traders and recycler in their state or nearby. Respondent agreed that they are not aware of any local program, projects or activities related to electronic waste management and even their most waste collectors are not aware about its negative effects.

**Table 5: Multiple Regressions**

| Model Summary | | | | |
|---|---|---|---|---|
| **Model** | **R** | **R Square** | **Adjusted R Square** | **Std. Error of the Estimate** |
| 1 | .522[a] | .478 | .428 | .43515 |
| a. Predictors: (Constant), Aware8, Aware6, Aware4, Aware3, Aware1, Aware5, Aware2, Aware7 | | | | |

| ANOVA[b] | | | | | | |
|---|---|---|---|---|---|---|
| **Model** | | **Sum of Squares** | **DF** | **Mean Square** | **F** | **Sig.** |
| 1 | Regression | 5.365 | 8 | .671 | 3.542 | .001[a] |
| | Residual | 24.806 | 131 | .189 | | |
| | Total | 30.171 | 139 | | | |
| a. Predictors: (Constant), Aware8, Aware6, Aware4, Aware3, Aware1, Aware5, Aware2, Aware7<br>b. Dependent Variable: Awareness | | | | | | |

| Coefficients[a] | | | | | | |
|---|---|---|---|---|---|---|
| **Model** | | **Unstandardized Coefficients** | | **Standardized Coefficients** | **T** | **Sig.** |
| | | **B** | **Std. Error** | **Beta** | | |
| 1 | (Constant) | .852 | .348 | | 2.449 | .016 |
| | Aware1 | -.235 | .141 | -.136 | -1.670 | .097 |
| | Aware2 | -.080 | .110 | -.070 | -.727 | .468 |
| | Aware3 | .294 | .159 | .163 | 1.853 | .026 |
| | Aware4 | -.456 | .083 | .000 | -.001 | .655 |
| | Aware5 | .035 | .105 | .032 | .330 | .742 |
| | Aware6 | .428 | .109 | .341 | 3.923 | .000 |
| | Aware7 | .050 | .115 | .042 | .434 | .665 |
| | Aware8 | -.056 | .100 | -.049 | -.560 | .576 |
| a. Dependent Variable: Awareness | | | | | | |

From the above analysis we can conclude that variable aware3 and aware 6 explain about 40 percent of the variance in the overall awareness about the e-waste produced in the country. Citizens are aware of the threat from the waste but not aware of the e-waste traders and recyclers in the market to decompose the waste and also get benefited from the returns.

## CONCLUSIONS

Electronic waste has rapid growth in recent past in India that has become a major issue for global environmental and public health. The processing of Indian Waste Electrical and Electronic Equipment is majorly influenced by unorganized sector without proper recycling facilities. This Continuously growing waste is very complex in nature but also a rich source of metals such as gold, silver, and copper, and its recovery has made unorganized sector to work. Thus, in this paper, we have measured the awareness of the citizens regarding their e-waste management on their own ground. The responses were identified from the field survey and it has found that majority of respondents is selling their e-waste to near second-hand dealer, or hand it over to the local waste collector. Even a considerable percent of respondents

keep their e-waste at their home. Respondents seem to be aware of e-waste, and there hazardous effects to health and environment. But they are not aware of the volume of e-waste generated, national and international laws and regulation about e-waste management and even they do not know any e-waste traders and recycler.

Respondent agreed that they are not aware about any local program, projects or activities related to electronic waste management. People seldom isolate their e-waste from their household wastes. A large proportion of respondents agreed that they buy new electronic gadgets even the older ones are still working. But respondent seems to agree with the fact that they are willing to give out electronic waste to trusted e-waste collectors for free if they could ensure the environmentally safe disposal of waste. It can be easily inferred from the given field survey that lack of awareness among citizens and lack of collaboration and link between informal and formal recyclers.

**Following Suggestion Can Play an Important Role in Formulating a Community Based E-Waste Management Model**

- Informal community groups can be formed to conduct awareness programs at local society level to highlight benefits of e-waste management and its negative consequences for health
- Government guidelines on e-waste may be communicated to make recyclers and customers more responsible
- Facilitation and technical support for setting up formal recyclers units.
- Environmental Management Training should be carried out with the informal recycler
- Linking of the informal sector to formal recyclers for collection, segregation, and dismantling.
- Proper incentive plan can be formulated for collection and transport of e-waste to the formal recycler.

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