

---

## Consumer Awareness about E-Waste in Rural and Urban Haryana

---

RAHUL DHULL<sup>\*1</sup>, DR. MANI SHRESHTHA<sup>2</sup>

<sup>1\*</sup>Research Scholar, Haryana School of Business, Guru Jambheshwar University of Science & Technology, Hisar, Haryana, India

<sup>2</sup>Assistant Professor, Haryana School of Business, Guru Jambheshwar University of Science & Technology, Hisar, Haryana, India

---

**Abstract:** The electronic industry is on the rise across the world and India is no exception to it. The consumer craving for newer and better electronic devices has led to faster rate of obsolescence of such electronic items. The obsolete electronic items, once they reach their end of life stage, need to be discarded and treated as Electronic Waste or E-Waste. E-Waste has surfaced as a major issue due to multifold increase in its quantity in last decade. Similar trends have been observed in India. The State of Haryana being a host to IT and ITes sector is also contributing in generation of larger quantities of E-Waste. The paper attempts to check the level of consumer awareness about E-Waste on five parameters namely: nomenclature, visual, conceptual, causal and general awareness. The study aimed at finding whether any variation exists in the awareness level of rural and urban consumers of Haryana regarding E-Waste. Data has been collected from rural and urban users of electronic products. Data has been analyzed using descriptive statistical tools. The study depicted that though the overall awareness of consumers of electronic items is on the lower side, the awareness of urban respondents is slightly better than the respondents from rural background. The paper also proposes ways and means for the policy makers and implementers to increase the awareness among users of electronic products in Haryana.

**Keywords:** Consumer awareness, E-Waste, Electronic waste, Stakeholders and Electronic items.

---

### INTRODUCTION

E-Waste is a common name for electronic waste. It is generated when the electronic items become useless or reach their end-of-life stage. Advancement in technology for electronic and electrical sector has considerably helped manufacturers to design innovative and upgraded products. Consumer usually gets attracted to these advancements in electronic products and tend to buy these items for utilization and hedonic purposes. Changing lifestyle and easy availability of finances has given an impetus to the consumption of electronic items. Such increase in sales of electronic items has led to the growth in economy of India and its counterparts. On the contrary, it has also led to rise in the volumes of E-Waste generated on an annual basis. India generates about 3.2 mt of E-Waste annually (Global E-Waste Monitor, 2020). Increased volume of E-Waste has become a threat to the health of people. Also, its management has become a challenge for almost all countries and especially for developing countries like India. Although, the state of Haryana is not the largest contributor of E-Waste in India but its geographical location makes it strategic to study in terms of E-Waste management. It shares boundaries with national capital Delhi and there is a great possibility of E-Waste being transported from in and around Delhi to Haryana. It is evident that the number of recycling companies operating in Haryana is quite high considering its area.

E-Waste is defined by researchers and organizations from different perspectives. E-Waste is a collective term, which is used for disposed of electronics and electrical equipment like computers, cellphones, T.V and refrigerators (Aggarwal, 2012). In India, the most acceptable definition of E-Waste is mentioned under E-Waste (Management and Handling) Rules, 2018. It states "E-Waste as waste electrical and electronic equipment, whole or in part or rejected from their manufacturing and repair process which are intended to be discarded". To simplify the understanding E-Waste it can be defined as "Any waste that is generated from electronic and electrical equipments when they reach their end of life stage".

E-Waste comprise of toxic substances like cadmium, mercury, lead and flame-retardants, that are fatal for human and environment (Kinnaman and Yokoo, 2011). E-Waste is considered as dangerous for humans as well as nature as it contains various deadly elements like lead, mercury, cadmium etc. So, these electronic items must be handled with care especially when they are no longer in use. Simply throwing useless electronic items in garbage may cause serious health issues as it can potentially contaminate soil, air and water. Burning of E-Waste to extract valuable materials like gold, silver etc. can cause contamination of air. Waste mobile phones are also considered as a hazard to human health (Singh et. al., 2020). Pregnant women and children are at higher risk of developing neurotoxicity due to E-Waste (Chen et. al., 2011). Places like India and China are facing serious threat as they have proved to be largest importers of E-Waste. Keeping in view negative impact of E-Waste on human beings and the natural environment, the issue needs an emergent attention.

## REVIEW OF LITERATURE

Considering the impact that E-Waste has on environment, various researchers have tried to study the problem and come up with few solutions. At global and domestic level, the thrust area of research on E-Waste is to study the health impact of E-Waste, its toxic components, formulation of rules and regulations for E-Waste management and trans-boundary movement of E-Waste. Scant literature is found to check the awareness level of consumer about E-Waste. Through the study, an attempt has been made to check the awareness of consumers of electronic products about E-Waste on different parameters.

E-Waste carries toxic elements such as Arsenic, Barium, Cadmium, Lead, Mercury and Nickel adversely affecting affect brain, liver, heart, kidney, nervous system and fetuses (Kiddee, et al., 2013). E-Waste can also cause genetic disorders and chromosomal dysfunction (Robinson, 2009). It has been found that high level of lead is present in the blood of native children of Guiyu when compared to some other States of China (Huo, Peng et. al., 2007).

Researchers have also focused on studying E-Waste management as a potential business sector to serve as new business opportunities. In some countries, government provide strategic support to corporate agencies by giving them relaxations in norms to function in unorganized sector to manage E-Waste (Grant, 2019). Many developing countries like India have taken the initiative to involve corporate sector in this domain to manage E-Waste and to provide employment opportunities (Reddy, 2013).

The government has taken few initiatives to tackle the problem of E-Waste management. One such initiative taken by Indian government is 3R: Reduce, Reuse and Recycle (Chakraborty, 2019). Organizations like Apple have also taken initiatives to manage E-Waste. Apple is using 100% recycled parts in power adapters of iPhones and LG has direct tie-up with authorized recycling companies to avoid practices like incineration, land filling and exportation of E-Waste to other countries (Report from Times of India, December, 2019). Trans-boundary movement of E-Waste from developed to developing nations for recycling and reuse causing rise in E-Waste in such nations. Lack of proper regulation and enforcement at national level is considered as a hurdle in E-Waste management effort. Basel Convention was an initiative taken to control the illegal movement of E-Waste from one country to the other. (Widmer et. al., 2005). Despite the health hazards, the movement of E-Waste to developing nations is noteworthy but its volume is still undetermined (Robinson, 2009).

Management of E-Waste through recycling has also been emphasized by the researchers. Gathering and transportation of E-Waste is a challenge and treated as one of the costliest step in the process of recycling (Lonn & Stuart, 2002). Companies have also established their own collection centers for their E-Waste management. Companies like Apple, Dell and HP collect not only their own E-Waste but also the related products of other manufacturers (Kanga & Schoeming, 2005).

Although debatable but the contribution of informal sector in managing E-Waste cannot be undermined. Some researchers have tried to identify the contribution of both formal and informal sectors in economy. Rag pickers as a part of informal sector contribute a lot to make recycling process viable. (Bridgens et. al., 2019). Such rag pickers and informal collectors in national capital territory contribute significantly in reducing the financial and physical burden of government in collecting electronic waste (Chi et al., 2011). It has also been found that recycling rates of informal sectors is very high in India, Pakistan and China (Bridgens et. al., 2019). Different countries have their own set of rules to curb such informal recycling practices.

Developed countries hardly import E-Waste from other countries whereas developing countries import it from developed countries. When it comes to take back policy for electronic products, India has dearth of such policies for items like T.V and washing machines. In countries like Japan Advanced Recycling Fees (ARF) is paid by the consumer whereas there is no such provision in India (Kaur & Goel, 2016). In India, E-Waste (Management and Handling) rules act as guideline to manage the problem. However there has not been much attempt to study the awareness level of consumers about E-Waste and its handling. This study explores whether the consumers are aware about the dimensions of E-Waste. Also, an attempt has been made to check the variation among consumers about E-Waste in context of residential background. Primarily, the study checks the awareness levels of rural and urban consumers about E-waste and its management in Haryana.

## RESEARCH METHODOLOGY

The research design for the study includes data collection, measurement and analysis of data. In this study, a combined approach including both exploratory and descriptive research (Malhotra and Dash, 2011) was adopted for analyzing the data and to find out the results. 10 statements were used on a five-point Likert scale to check the general awareness of consumers about E-Waste. To explore the variation in awareness levels of rural and urban respondents, 13 statements were further developed to study their frequency based nomenclature, conceptual, visual, and causal awareness.

To check the awareness 617 questionnaire were distributed all over Haryana in both rural and urban areas, out of which 578 were received. After scrutiny 38 responses were eliminated as a result of data cleaning and missing data. Finally 540 completely filled questionnaires were retained for further analysis. All the respondents were from science background. The sample size is unacceptable range as it should be 10 times of the variables (Hair et. al., 2014). This constituted a response rate of 87.52% which was quite higher than the adequate average response rate of 52.7% for an individual level response (Baruch and Holtom, 2008).

For the purpose of selecting the samples for the study, Non-Probability Convenient Sampling Technique was implemented. A pilot study on 100 qualified respondent was conducted. Cronbach's Alpha value of 0.7, establishes the reliability of all the items included under the study (Awang et al., 2016).

The respondents of the study are consumers from Haryana. The demographic information of consumer section included Residential Area of Haryana. Based on the residential area, respondents are divided into two categories such as rural and urban (285), 52.8 percent of respondents belong to the rural area and (255), 47.2 percent of respondents belong to the urban area of the total sample in the research study.

## ANALYSIS AND RESULTS

Four type of awareness like nomenclature, causal, visual and conceptual awareness were studied by the researcher to see the variation in response from rural and urban respondents. To examine nomenclature awareness the respondents were asked to express their familiarity with certain terms associated with E-Waste. Based on their responses, percentage for the familiarity with each term was noted. Table 1 shows the nomenclature awareness of consumers from rural and urban background about electronic waste

**Table 1: Nomenclature Awareness about E-Waste**

Term Associated with E-Waste	Rural %	Urban %
WEEE	7.4	9.4
Electronic Waste	72.6	76.5
E-Waste	80	87.1
"E-Waste Management and Handling Rules, 2018"	17.9	18.8
Waste Electronic and Electrical Equipments	35.8	30.6

Source: Primary Survey

Urban people are found more aware about the term WEEE than rural respondents. Respondents from urban background have heard about terms like (Electronic Waste, E-Waste and E-Waste Management and Handling Rules, 2018) more than respondents from rural background. So, it is evident from the results that urban people have more aware acceptability for the term E-Waste.

Researcher has tried to examine the awareness of rural and urban consumers about the concept of E-Waste. Respondents were asked about three statements and their agreement towards these statements were noted and analyzed. Response for each statement was noted on percentage basis.

**Table 2: Conceptual Awareness about E-Waste**

Understanding of the term E-Waste	Rural %	Urban %
Electronic and electrical items that can be recycled	45.3	52.9
Electronic and electrical items that cannot be recycled	47.4	37.6
Second hand electronic and electrical items	6.3	8.2

Source: Primary Survey

Table 2 shows that respondents from urban background are more aware about the concept of E-Waste. Urban respondents feel more towards agreement that electronic and electric items can be recycled while their counterparts are less aware to this fact. Rural respondents feel that E-Waste constitutes of electronic and electrical items that cannot be recycled. Urban respondents are more towards the agreement that E-Waste

constitute of second hand electronic and electrical items than rural respondents. Therefore from the above discussion it can be concluded that urban respondents are more aware about the concept of E-Waste.

Researcher also examined the awareness of the respondents based on their visual observation related to E-Waste. Respondents were asked about the hazardous symbol displayed on electronic items and their responses towards visual awareness were noted through two statements.

**Table 3: Visual Awareness about E-Waste**

Visual Awareness Statement	Rural %	Urban %
Noticed the Symbol on the packaging of Electronic Items	69.1	72.2
Not noticed the Symbol on the packaging of Electronic Items	30.9	27.8

Source: Primary Survey

Table 3 discuss about the awareness of rural and urban respondents about the visuals they see on electronic and electrical items. A high percentage of people from urban background notice the symbol made on the packaging of electronic items while the percentage to observe the same is low for rural people. So, the visual awareness about E-Waste is more in urban respondents.

E-Waste (Management and Handling) Rules, 2018 mentions all the electronic products that have been included in three different schedules. Schedule 1 includes items like personal computer, laptop, electronic notepad, answering machine and mobile phones. Schedule 2 includes television, microwave, washing machine, speaker and printer. Schedule 3 includes items like electronic toys, radio, digital camera, music system and video game system. The respondents were asked about the electronic products that were perceived by them as E-Waste generators. The responses were noted and their percentage was used for analysis.

**Table 4: Causal Awareness about E-Waste**

Schedule Listing	Electronic Item causing E- Waste	Rural %	Urban %
I	Personal Computer	84.4	91.8
	Laptop	89.5	89.4
	Electronic Notepads	81.1	85.9
	Answering Machine	72.6	76.5
	Mobile phones	86.3	87.1
II	Television	75.8	85.9
	Microwave	62.1	68.2
	Washing Machine	60	65.9
	Speaker	57.9	70.6
	Printer	57.9	57.6
III	Electronic Toys	52.6	65.9
	Radio	49.5	56.5
	Digital Camera	54.7	54.1
	Music System	45.3	56.5
	Video Game System	49.5	54.1

Source: Primary Survey

Table 4 discusses the awareness about electronic and electrical items which are perceived to generate E-Waste by the respondents from rural and urban background. The items are divided into three schedules as per E-Waste management rules, 2018. People from urban background have slightly higher percentage to perceive Schedule 1 items to generate E-Waste than respondents from rural background. Again the percentage of urban respondents is higher than rural respondents to consider Schedule 2 items as generators of E-Waste. Similarly, the percentage of urban respondents is higher to consider Schedule 3 items as generators of E-Waste. So, it is pertinent to mention that urban respondents are more aware on causal parameter as compared to their rural counterparts.

It is evident from the results that urban respondents are found to be more aware about nomenclature, conceptual, visual and causal awareness than the respondents from rural background. After assessing the awareness of respondents on these four parameters (nomenclature, conceptual, visual and causal), researcher has also tried to check the general awareness of consumers of electronic and electrical items to see if there exist any difference in their awareness level on the basis of residential background i.e rural and urban. To examine the awareness levels of rural and urban consumers about E-Waste management, t-test is applied. The variation in mean values of rural and urban consumers for the 10 statements about general awareness was noted and analyzed. The comparison of their views has been presented in table 5.

**Table 5: Comparison of Consumers' General Awareness about E-waste Management**

Statements	Residential Background	N	Mean	t-value	p-value	Mean Difference
E-Waste is just like any other waste	Rural	285	3.000	-1.465	.144	-.168
	Urban	255	3.168			
Stored E-Waste is harmful	Rural	285	3.301	-2.935*	.003	-.313
	Urban	255	3.615			
E-Waste is a threat to the environment	Rural	285	3.210	-3.454*	.001	-.416
	Urban	255	3.627			
I know the proper way to dispose of my E-Waste	Rural	285	3.287	-.1.259	.209	-.131
	Urban	255	3.419			
I have heard about E-Waste management rules	Rural	285	3.294	-.702	.483	-.073
	Urban	255	3.368			
At the time of purchase of electronic items, the retailer informs me about its disposal	Rural	285	2.761	-4.294*	.000	-.509
	Urban	255	3.270			
I always read the instructions regarding disposal on the pack of electronic items	Rural	285	3.221	1.448	.148	-.151
	Urban	255	3.372			
There are health problems due to E-Waste	Rural	285	3.371	-2.128*	.034	-.228
	Urban	255	3.600			
It is okay to mix E-Waste with other waste	Rural	285	2.550	-3.111*	.002	-.374
	Urban	255	2.925			
I know how to handle my E-Waste	Rural	285	3.203	-.559	.577	-.059
	Urban	255	3.262			
Overall awareness	Rural	285	3.094	-4.237*	.000	-.233
	Urban	255	3.327			

\* Significant at 0.05 level of significance

Source: Primary Survey

Table 5 shows the result of t-test regarding the consumer's awareness of E-Waste management on the basis of residential background of the respondents. From the table, it is evident that the overall awareness about E-Waste is slightly on the lower side. Respondents from both rural and urban background are not adequately aware about e-waste in Haryana. It is also visible from table 5 that the overall awareness of urban respondents is slightly better than rural respondents.

A significant difference ( $p < 0.05$ ) is found for five statements in the awareness level of respondents from rural and urban background. Urban respondents are more aware about harmful impacts of stored e-waste. The awareness level of urban respondents is better than rural respondents when it comes to considering stored e-waste as harmful. Respondents from urban background probably are more exposed to electronic items and perhaps their purchase frequency is also more than rural respondents and as such they might be witnessing more

events regarding e-waste and they consider storing E-Waste at home is harmful.

A significant variation in the level of awareness between rural and urban respondents has been found on the grounds of treating E-Waste as a threat to the environment. Expectedly, respondents from urban background are found more aware about this issue and again the possibly reason for this difference in awareness level of both groups could be the accessibility to awareness campaigns run by the government. Since most of these awareness seminars and events are conducted in urban set up, the urban respondents are found more aware about treating E-Waste as a threat to the environment.

A variation is also observed in the awareness levels of rural and urban respondents in context of retailers. Significantly more respondents from urban background agreed to the fact that the retailer informs them about the disposal of purchased electronic items. The respondents from rural background are less informed by the retailer about the disposal of electronic items when they become useless. It could be the awareness amongst urban people that urges them to ask about the disposal of electronic items from the retailer. The retailer may also perceive urban people more receptive to the information provided regarding the disposal of electronic items that has been purchased from the outlet.

The awareness level of urban respondents is significantly more than rural respondents about the health problems arising from e-waste. Respondents from urban background agree more to the fact that e-waste causes a lot of health problems. The density of electronic product users is more in urban areas therefore it is expected that there awareness level about e-waste would always be better than their rural counterparts.

The awareness level of both rural and urban respondents is very low when asked about if it is fine to mix e-waste with other domestic waste. Even though the awareness is very low in both the groups but still urban people are better aware that e-waste should not be mixed with any other waste. Since the awareness about this statement is very low in both groups, government should take this issue seriously. The slightly better awareness of urban people could be attributed to the efforts made by municipal corporations while collecting domestic waste from homes. People are advised through loudspeaker not to put all kind of waste in one bin.

No significant difference in the awareness level of rural and urban respondent is found for considering e-waste as any other waste. No trend can be derived for their low awareness about identifying e-waste as any other waste on the basis of residential status. the awareness about considering e-waste as any other waste is on the lower side in both categories of respondents. When it comes to knowing the proper way to dispose of e-waste, no significant difference is found in respondents from rural and urban background. Awareness about proper disposal method of e-waste is on the lower side in both categories of respondents. This is an alarming issue as without knowing the proper disposal method, e-waste could end up being land filled which in turn will affect human health and environment. None of rural and urban respondents are aware about e-waste management rules in India. Their awareness level about e-waste management rules is almost same and is quite low. A non-significant variation in the awareness level of respondents from rural and urban background about e-waste management rules has been observed. There seems to be no efforts from government to make people aware about e-waste management rules. These rules are known to the manufacturers but the consumers are still unaware of these rules.

Lastly, respondents from rural and urban background are less aware about handling their e-waste. There is no significant difference in the awareness of both type of respondents about handling e-waste. Neither of them is highly aware about how to handle their e-waste. Again steps have to be taken to make them aware about carrying and handling their e-waste in an environment friendly way.

## **DISCUSSION AND MANAGERIAL IMPLICATIONS**

The present study shows that the overall awareness about e-waste in Haryana is slightly on the lower side. People from both urban and rural background are deficient in awareness about E-Waste and related issues. People are not even aware about rules and regulations related to E-Waste management and they consider E-Waste as any other waste. Their awareness about E-Waste is far behind optimum. However it can be said that respondents from urban background are slightly more aware about E-Waste and have a better nomenclature, conceptual, visual and causal awareness. The major reason for relatively higher awareness may be attributed to better education and higher information exposure.

From the present study it can easily be concluded that respondents from urban areas are more aware about E-Waste about its various effects whereas the rural respondents are less aware about the issue. However, the overall awareness about E-Waste is moderate in Haryana. To bridge the gap between awareness levels of rural and urban people more efforts should be focused on rural Haryana. The government should run more awareness campaigns in rural areas to make people aware about e-waste. Social media could be a better platform for spreading this awareness as people from rural areas has an increasing trend of using internet. Spreading awareness among school children in villages could possibly help in this matter. Various stakeholders should be encouraged to carry out their promotional activities along with awareness events in rural areas to aware people about e-waste and its management. From the study, it can also be concluded that separate awareness programs need to be run for urban and rural consumers of electronic items as more E-Waste is generated in urban areas

than their rural counterpart.

### FUTURE RESEARCH DIRECTION

The study restricted to the residents of only one state i.e. Haryana and do not represent the entire nation, so further research might be done on a larger geographical area. The awareness of people has been checked only on one demographic variable (rural/urban), but it could be extended to other variables like age, education and gender. The awareness about e-waste can be checked on multiple dimensions like intention etc., so there is always a scope of further research in this field.

### REFERENCES

1. Agarwal, R. (2012). E-waste law: New paradigm or business as usual?. *Economic and Political Weekly*, 14-16.
2. Awang, Z., Afthanorhan, A., & Mamat, M. (2016). The Likert scale analysis using parametric based Structural Equation Modeling (SEM). *Computational Methods in Social Sciences*, 4(1), 13-21. .
3. Baruch, Y., & Holtom, B. C. (2008). Survey response rate levels and trends in organizational research. *Human relations*, 61(8), 1139-1160.
4. Bridgens, B., Hobson, K., Lilley, D., Lee, J., Scott, J. L., & Wilson, G. T. (2019). Closing the loop on E-waste: A multidisciplinary perspective. *Journal of Industrial Ecology*, 23(1), 169-181.
5. Bridgens, B., Hobson, K., Lilley, D., Lee, J., Scott, J. L., & Wilson, G. T. (2019). Closing the loop on E-waste: A multidisciplinary perspective. *Journal of Industrial Ecology*, 23(1), 169-181.
6. Chakraborty, P., Sampath, S., Mukhopadhyay, M., Selvaraj, S., Bharat, G. K., & Nizzetto, L. (2019). Baseline investigation on plasticizers, bisphenol A, polycyclic aromatic hydrocarbons and heavy metals in the surface soil of the informal electronic waste recycling workshops and nearby open dumpsites in Indian metropolitan cities. *Environmental Pollution*, 248, 1036-1045.
7. Chen, A., Dietrich, K. N., Huo, X., & Ho, S. M. (2011). Developmental neurotoxicants in e-waste: an emerging health concern. *Environmental health perspectives*, 119(4), 431-438.
8. Chi, X., Streicher-Porte, M., Wang, M. Y., & Reuter, M. A. (2011). Informal electronic waste recycling: A sector review with special focus on China. *Waste management*, 31(4), 731-742.
9. Forti, V., Baldé, C. P., Kuehr, R., & Bel, G. (2020). The Global E-waste Monitor 2020. *United Nations University (UNU), International Telecommunication Union (ITU) & International Solid Waste Association (ISWA), Bonn/Geneva/Rotterdam*.
10. Grant, R. (2019). E-waste challenges in Cape Town: Opportunity for the green economy?. *Urbani izziv*, 30(Supp), 5-23.
11. Hair Jr, J. F., Sarstedt, M., Hopkins, L., & Kuppelwieser, V. G. (2014). Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research. *European business review*.
12. <https://timesofindia.indiatimes.com/business/india-business/how-cos-are-gearing-up-to-tackle-e-waste/articleshow/72499435.cms>
13. Huo, X., Peng, L., Xu, X., Zheng, L., Qiu, B., Qi, Z., ... & Piao, Z. (2007). Elevated blood lead levels of children in Guiyu, an electronic waste recycling town in China. *Environmental Health Perspectives*, 115(7), 1113-1117.
14. Kang, H. Y., & Schoenung, J. M. (2005). Electronic waste recycling: A review of US infrastructure and technology options. *Resources, Conservation and Recycling*, 45(4), 368-400.
15. Kaur, H., & Goel, S. (2016). E-waste Legislations in India—A Critical Review. *Management and Labour Studies*, 41(1), 63-69.
16. Kiddee, P., Naidu, R., & Wong, M. H. (2013). Electronic waste management approaches: An overview. *Waste management*, 33(5), 1237-1250.
17. Lonn, S. A., Stuart, J. A., & Losada, A. (2002, May). How collection methods and e-commerce impact product arrival rates to electronics return, reuse, and recycling centers. In *Conference Record 2002 IEEE International Symposium on Electronics and the Environment (Cat. No. 02CH37273)* (pp. 228-233). IEEE.
18. Malhotra, N. K., & Dash, S. (2011). *Marketing Research: An Applied Orientation* (pp. 552–582).
19. Reddy, R. N. (2013). Revitalising economies of disassembly: informal recyclers, development experts and e-waste reforms in Bangalore. *Economic and Political Weekly*, 48 (13), 62-70.
20. Robinson, B. H. (2009). E-waste: an assessment of global production and environmental impacts. *Science of the total environment*, 408(2), 183-191.
21. Singh, N., Duan, H., & Tang, Y. (2020). Toxicity evaluation of E-waste plastics and potential repercussions for human health. *Environment international*, 137, 105559.
22. Widmer, R., Oswald-Krapf, H., Sinha-Khetriwal, D., Schnellmann, M., & Böni, H. (2005). Global perspectives on e-waste. *Environmental impact assessment review*, 25(5), 436-458.