

Efficacy of Electronic Waste Management in the State of Uttarakhand: An Analysis

¹ Shuchita Agarwal,

Research Scholar, ICFAI Law School, ICFAI University, Dehradun

¹ Dr. Susanta Kumar Shadangi,

Associate Professor, ICFAI University, Dehradun

Abstract

Electronic equipment aimed at end users has evolved into a staple of daily life. Conventional approaches have undergone significant alteration, resulting in effective communication channel and quick information retrieval. Sales, storage, destruction, and then collection patterns have all changed as a result of the exponential growth in demand and output. This essay examines a variety of these practices in (electronic) waste management and suggests remedies including recycling management and other rules and regulations that must be adhered to. Authors have placed a strong emphasis on offering comprehensive information that might be helpful to the regulatory agencies in charge of waste management or the producers of different electronic devices, as well as the policy makers. Using a thorough examination of electronic waste, authors have highlighted three factors (sales, storage and its destruction). Electronic equipment geared towards end users has evolved into a staple of daily life. Conventional approaches have radically changed, resulting in effective behaviors for managing (electronic) waste and recommending remedies like recycling management, various directions, and laws that must be adhered to. Authors have placed a strong emphasis on offering comprehensive information that might be helpful to the regulatory agencies in charge of E- waste managing or the manufacturers of different electronic devices, as well as the policy makers.

Keywords: E- waste, E waste management, recycle, disposal

Introduction

The phrase "e-waste," which occasionally also appears as an enlarged form of "electrical and electronic waste," refers to all superfluous, broken, or obsolete electronic items that have been rendered unnecessary by their original owners. The production of e-waste worldwide is estimated by the UN to be between 50 and 60 million tonnes per year. The issue has only gotten worse as electronic goods have become less expensive. Technology is changing at high pace. Urge to buy latest technology has become a natural tendency in every society.

E-waste, on the other hand, is described by the OECD as "any appliance using an electric power supply that has reached its end-of-life." The Congressional Research Service of the United States similarly claims that "e-waste refers to obsolete, broken, or irreparable electronic devices." Solving the E-Waste Problem (StEP) has released the following definition of e-waste in a White Paper that is widely accepted:

"E-waste is a word used to describe all electrical and electronic equipment (EEE) and its components that have been thrown out as rubbish by their owner with no intention of being reused."

Also, the movement of electronic garbage, which had previously made its way into landfills, is now subject to strict regulations. Although international legal frameworks for managing e-waste have been established, the global e-waste problem has not yet been solved. We can see that dangerous e-waste has been processed by using crude technology in several towns.

Uttarakhand:

On November 9th, 2000, the state of Uttarakhand was separated from Uttar Pradesh. Most of Uttar Pradesh, particularly the western portion, became Uttarakhand. The "Land of Lord" or "Dev Bhumi" are other names for Uttarakhand. One of the most stunning regions, Uttarakhand draws visitors from both inside and outside of India. The Municipal Solid Waste (Management and Handling) Rules were established by the government in 2000 as a result of the large amount of tourist activities. The government wanted to preserve the area's natural beauty as much as possible. In order to handle the solid waste in key Uttarakhand cities including Dehradun, Rishikesh, Haridwar, Tehri, Haldwani, and Nainital, the government

started a number of projects, all of which are currently in various stages of completion.

The Himalayan regions have several environmental issues, which significantly affect the mountain ecosystem. For better living conditions and access to basic amenities, residents in mountainous areas are moving to urban areas. However, this has created a serious environmental concern in the form of e-waste creation, which disturbs the environment and endangers public health.

Current Status of E-Waste Management

For the recycling of e-waste, India heavily depends on the unorganized sector as only a handful of organized e-waste recycling facilities are available. Over 95% of the e-waste is treated and processed in the majority of urban slums of the country, where untrained workers carry out the dangerous procedures without personal protective equipment, which are detrimental not only to their health but also to the environment.

Recycling and treatment facilities require a high initial investment, particularly those fitted with technologically advanced equipments and processes. For the dismantling of one computer piece, these workers only get Rs. 5 or 10. For such a small amount, workers ruin their lives. Such “backyard recyclers” do not have wastewater treatment facilities, exhaust-waste gas treatment, and personal health protection equipment.

The hazardous nature of e-waste is one of the rapidly growing environmental problems of the world. The ever-increasing amount of e-waste associated with the lack of awareness and appropriate skill is deepening the problem. A large number of workers are involved in crude dismantling of these electronic items for their livelihood and their health is at risk; therefore, there is an urgent need to plan a preventive strategy in relation to health hazards of e-waste handling among these workers in India. Required information should be provided to these workers regarding safe handling of e-waste and personal protection. For e-waste management many technical solutions are available, but to be adopted in the management system, prerequisite conditions such as legislation, collection system, logistics, and manpower should be prepared. This may require operational research and evaluation studies.

The study was designed to effectively gauge the E-Waste Recycling Motivations of the Denizens of Dehradun in the state of Uttarakhand with the aim and intention to explore what factors would motivate participants to recycle e-waste more frequently. Principally their “awareness” levels towards e-waste meaning and its usage was to be ascertained along with generation, actual usage, safe disposal and finally contribution towards ethical e-waste management and effective non-harmful recycling efforts.

The specific objectives of the study were :

- Gauge Environmental Concerns of the respondents with respect to e-waste consumption, usage and attitudes and their underlying consumption and disposal behaviours. Thus, the study ostensibly examined and assessed participants' general environmental concerns and how e-waste management relates to their environmental values and whether this causes any wilful discretion and indiscretion in consumption and disposal of e-waste generated and consumed individually by the respondents and the community as a whole.
- Recommendations and Suggestions as suggested by the respondents themselves since sustainable behaviours invariably come from within individual motivations before agglomerating at the household, community and societal levels. The idea was to ask for suggestions on how e-waste recycling programs or awareness can be improved from the participant respondents point of view so that the subsequent design of the intervention and programs can draw out meaningful conclusions from this study and make the resultant action planning more efficient and effective that in turn yields the desired behavioural changes sought to be conveyed. Besides, enquiring about their willingness to participate in future e-waste recycling initiatives either voluntarily or through incentives, rewards and motivations to bring about a change in “behavioural tendencies” with respect to responsible e-waste handlings at the individual and household levels first.
- Additional comments and verbatim suggestions were asked from the respondents so as to provide an open-ended section for participants to add any comments or insights not covered in the questionnaire and unearthing “mind maps and ways of thinking” especially when it comes to e-waste generation, consumption, usage and responsible disposal behaviours. Hence, the questionnaire was prepared for both buyers and seller of e-waste products so that any missing links and loopholes between the two can be unearthed and ways and means suggested to ameliorate the situations and on ground

activations.

Questionnaire Design : The questionnaire having questions covers 3 sections Part A for Demographic Profiling, Part B for gauging e-waste awareness and understanding levels and Part C for usage and attitude towards e-waste generation, consumption and disposal adopted by the respondents. Thus, Part A had 5 basic questions, Part B had 20 questions and Part C had 7 questions. The ideas sought to be captured were (a) e-waste awareness (b) e-waste management, (c) e-waste usage and attitude and (d) the opinion about the progressive use of e-waste management techniques and methods and what it takes to change behaviours. The questions are designed close-ended, wholly quantitative and measured on a 5-point Likert scale from Strongly Agree to Strongly Disagree to gauge the intensity, magnitude and direction of the feelings of the respondents. Further, the questionnaire distribution and data collection followed a demonstration of the current study and personal interaction with the selected population of Dehradun.

There has been a rapid increase in the education sector and Information Technology (IT) industries in megacities of India with the new found focus on “smartcities”. Dehradun is known as the education hub of North India. Dehradun is the capital of Uttarakhand, near the Himalayan foothills which is the 28th state of India. The IT industry and educational institutes are in the vicinity and surroundings of Dehradun. As per the official website of the state’s pollution control board, there is no dedicated database available after 2017. The state’s generated 3671 MT of hardware and 9860 MT of quantity sent to recyclers which contains hazardous substances.

The main objective of the study was to gather information about

- (1) Socio-economic status of the respondents and households who are the consumers and sellers of e-waste and the 8 recyclers who are the buyers and re-sellers after dismantling and salvaging the e-waste generated by the cities of Uttarakhand
- (2) E-waste responsiveness and education practices implemented by 400 respondents of Dehradun
- (3) EEE consumption by income groups and generated e-waste
- (4) E-waste generated by Dehradun
- (5) Hazardous substances generated by E-waste. The respondents are classified based on Kuppaswamy Socio-economic Status Scale.

This study was conducted in the month of July-August 2024 in the state of Uttarakhand. . Uttarakhand is the Himalayan state of India having a lot of mountain ranges and good number of people are also residing in the state which causes a lot of E- waste generation these days.

This study aims to assess and compare e-waste management awareness amongst the general public and the role of e-waste management practices in environmental sustainability. This work aims at studying the awareness of e-waste management among the Dehradun households.

The assessment strategy followed a certain order: Players and stakeholders of the E-waste recycling stream were identified including consumers, traders, repair shops, disassemblers, scrap dealers and dismantlers. Qualitative research involved semi-structured in-depth interviews with the formal E-waste recyclers present in Uttarakhand. One-to-one interviews were conducted to gather information with respect to following areas: Detailed understanding of each stage: Sourcing, Logistics, Processing of E-waste, Current handling capacities, Status of technology being used currently and challenges faced.

3. SAMPLE SIZE AND TECHNIQUE

The sampling technique used was simple random sampling such that every household group (HIG, MIG and LIG) and respondents cutting across gender, age groups, educational profile, occupational profile in different categories had an equal chance for representation. Judgemental method was used in order to stop the survey count at 200 respondents for each of the sexes namely females and males. Ostensibly, this was done to capture richness of findings amongst both the sexes and eliminate any predominant gender divides or researcher biases.

1. METHODS IN ANALYSIS AND TOOLS USED

The research study makes use of t-tests for hypothesis testing, correlations, regression modelling and multidimensional scaling to examine hypothesis postulates directly and indirectly. The descriptive statistics document the dominant tendencies each question wise to show the intensity of feelings cumulative respondent wise. These are shown in frequency count and cumulative percentage basis followed by graphical representation for easier understanding and meaningful comprehension through better visualisation. The data analysis was analysed on IBM SPSS Version 20 that makes for statistical significance of data findings and enhanced visual control. Measures of central tendency like mean, median and mode do not inform the analysis though they were generated by SPSS because then the scope of the study would be too expansive and lengthy.

Demographic profile questions were asked in such a manner so as to ensure confidentiality of the respondents and giving them the assurance that this data will not be used for any commercial or marketing campaign purpose. Personal details were hence eliminated from the survey instrument using simple coding method of naming respondents sequentially and numerically from 1 to 400. No sensitive personal data like name, address or mobile number was recorded to ensure secrecy and privacy of the respondents.

The Cronbach's Alpha Score was (0.789) which is rather high and found to be acceptable in such phenomenon seeking research studies. This inter-rater reliability level is more than adequate for the research purpose as most questions were without inherent proxy measures and likert scaled. Reliability can be estimated using coefficients such as Cronbach's alpha. An alpha value of 0.70 is often considered as the criteria for establishing reliability. The Cronch's alpha was found to be 0.789, above the suggested value of 0.7.

Case Processing Summary

		N	%
Cases	Valid	400	100.0
	Excluded ^a	0	.0
	Total	400	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.789	53

These Statements were than Likert Scaled from Strongly Disagree, Disagree, Neither Agree Nor Disagree, Agree to Strongly Agree to gauge the respondents intensity of feelings towards that particular statement and the underpinning hypotheses under examination. The data thus collected was then subjected to a Paired Samples Tests Comparison popularly known a t – test. The results of the t-tests, thus, obtained have been reproduced below and its corresponding inference drawn has been showcased. Based on the t-test value and its 95% Confidence Interval of the Difference and its lower and upper limits, the Null Hypothesis is either Accepted or Rejected and the reasons for doing so have then been examined in each of the three Hypotheses. A plausible and reasonable justification and explanation has also been provided so that the correct perspective is brought out in the study irrespective whether we are accepting or rejecting the hypotheses and the reasons for doing so.

Hypothesis 1 : The current legal framework for electronic waste in India is insufficient and excessively lax.

Objective : Create more awareness towards ethical E waste recycling methods and participation of households.

STATEMENT 1. I feel Environment Protection Agencies should be responsible for ethical dumping of E Waste and its recycling methods and needs legislative and strictly enforceable laws in India now, that are binding on both individuals and waste disposal agencies whether government or private.

STATEMENT 2. I am aware of E waste and have fair knowledge of E waste Collection Centre near me that helps in disposing e waste ethically and correctly and I strongly feel that a legislative law and system of “Fines” on individuals and agencies alike needs to come into effect, if done incorrectly and irresponsibly.

The t-statistics is 8.027 which is greater than 0.54178 lower confidence interval limit and also greater than the upper confidence limit of .89322, hence the **Null Hypothesis is Accepted.**

This means that the current legal framework for electronic waste in India is insufficient and indeed excessively lax. The two statements namely Statement 1 and Statement 2 thus, stand validated and correctly reflect the respondents mindsets. In other words, it means environmental protection agencies should be made responsible for ethical dumping and recycling methods if needed through legislative actions and strictly enforceable laws in India now and these laws should be binding on both government and private agencies alike and also on individuals. A system of imposing “Fines” on both individuals and agencies should be compulsory if either are found to resorting to incorrect and irresponsible e-waste generation, its actual usage or its final disposal. The mean was .71750, standard deviation 1.78765, standard error of the mean .08938 at 399 degrees of freedom. The

Paired Samples Test

		Paired Differences				t	df	Sig. (2-tailed)	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower				Upper
Pair 1	I feel Environment Protection Agencies should be responsible for ethical dumping of E Waste and its recycling methods and needs legislative and strictly enforceable laws in India now, that are binding on both individuals and waste disposal agencies wheth - I am aware of E waste and have fair knowledge of E waste Collection Centre near me that helps in disposing e waste ethically and correctly and I strongly feel that a legislative law and system of "Fines" on individuals and agencies alike needs to come	.71750	1.78765	.08938	.54178	.89322	8.027	399	.000

2 tailed significance level was .000 and is valid criterion for measurement.

Hypothesis 2 : E-waste generation and careless disposal causes untold and incalculable harm to humans and is the route cause of widespread environmental degradation in India.

Objective : Create sustainable and ethical recycling and ewaste disposal programs for the community with households and individual member participation.

STATEMENT 3. I have sufficient knowledge of E waste dumping process and its meaningful disposal and recycling to mitigate harmful effects on humans and environment alike.

STATEMENT 4. I have little knowledge of harmful contents present in E waste like lead, cadmium, mercury and the like which denigrate environment and contaminate food chain as well and I am unsure how these are extracted and recycled or disposed off.

The t-statistics is -21.149 which is lesser than -1.87442 lower confidence interval limit and also greater than the upper confidence limit of -1.55558, hence the **Null Hypothesis is Rejected.**

This means that E-waste generation alone and its careless disposal alone does not really cause untold and incalculable harm to human and is not the route cause of widespread environmental degradation in India and essentially this is the result of a combination of all other non e-waste pollutants interacting with each other and thereby causing detriment to environmental concerns in India. In a way this is true also since there is air, water and waste pollution that is causing more harm to nature than only e-waste when seen in isolation. E-waste thus does contribute to environmental degradation but to say that it is the only cause of such damage or the major cause of such damage would not be correct. Specific instances such as landfill dumpings instead of say hi-tech incineration can cause harm to the soil as e-waste mixes and leaches it and this enters the food chain through plants absorption. However, it needs to be pointed out that wherever e-waste is dumped, fruits and vegetables and plants in that area are not grown on such landfill sites but many miles away from it. Just like there is a biological oxygen demand for correcting water pollution levels, e-waste also used BOD and decomposition to reduce its contamination impacts on soil and environment. The respondents wholly justified the two statements namely statement 3 and 4 also in the research findings and thus this stands validated. The mean was -1.71500, standard deviation 1.62184, standard error of the mean .08109 at 399 degrees of freedom and significance level of .000 which is valid criterion for measurement.

Hypothesis 3 : The improper disposal of environmental waste causes detrimental environmental and health impacts.

Objective : To explore health and environmental hazards caused by E waste management.

STATEMENT 5. Ewaste is harmful for us and I try to reduce it and dispose it ethically in my own small way.

STATEMENT 6. I would like to get some monetary reward for ethical E waste generation and disposal such that it does not cause any harm to society and environment.

PAIRED SAMPLES T TESTS FOR HYPOTHESIS TESTING

The t-statistics is -2.331 which is lesser than -.25348 lower confidence interval limit and also greater than the upper confidence limit of -.02152, hence the **Null Hypothesis is Rejected.**

This implies that it is not the only improper disposal of environmental waste that causes detrimental environmental health impacts but there are other multiple causes to it as well. The Statement 5 shows that in spite of knowing that e-waste is harmful for us the respondents do not necessarily try to reduce it ethically in their own small ways even though they know they can. Likewise, Statement 6 presupposes that there should get some monetary reward for ethical e-waste generation and disposal such that it does not cause any harm to society and environment. E-waste thus is one of the many contributors detrimental environmental and health impacts along with many others. To label only e-waste as contributing to maximum damage to the environment may not be true or wholly correct. The mean was -.13750, standard deviation 1.17986, standard error of the mean .05899 at 399 degrees of freedom and significance level of .020 which is valid criterion for measurement.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Ewaste is harmful for us and I try to reduce it and dispose it ethically in my own small way. - I would like to get some monetary reward for ethical E waste generation and disposal such that it does not cause any harm to society and environment.	-.13750	1.17986	.05899	-.25348	-.02152	-2.331	399	.020

Paired Samples Test

		Paired Differences				t	df	Sig. (2-tailed)	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower				Upper
Pair 1	I have sufficient knowledge of E waste dumping process and its meaningful disposal and recycling to mitigate harmful effects on humans and environment alike. - I have little knowledgable of harmful contents present in E waste like lead, cadmium, mercury and the like which denigrate envoronment and contaminate food chain as well and I am unsure how these are extracted and recyled or disposed off.	-1.71500	1.62184	.08109	-1.87442	-1.55558	-21.149	399	.000

CORRELATIONS

In correlations, we find that statement 6 is correlated with Statement 1, Statement 3 and Statement 5. For easy identification these have been marked in bold black font and green cell colours. All other statements have either 2,1,2,0 and 2 correlations only as seen from the correlations table. This is the only statement that is correlated with 3 individual statements. To recapitulate, these statements are as follows :

STATEMENT 6. I would like to get some monetary reward for ethical E waste generation and disposal such that it does not cause any harm to society and environment.

STATEMENT 1. I feel Environment Protection Agencies should be responsible for ethical dumping of E Waste and its recycling methods and needs legislative and strictly enforceable laws in India now, that are binding on both individuals and waste disposal agencies whether government or private.

STATEMENT 3. I have sufficient knowledge of E waste dumping process and its meaningful disposal and recycling to mitigate harmful effects on humans and environment alike.

STATEMENT 5. Ewaste is harmful for us and I try to reduce it and dispose it ethically in my own small way.

Thus, Statement 6 is negatively correlated with Statement 1 at -.159. This implies that rewards for e-waste disposal at the individual level will result in better compliance of individuals to ethical e-waste dumping practices and there would be no need for an Environmental Protection Agency to monitor individuals then or through legislative and strictly enforceable laws in India. In other words incentivisation will definitely lead to ethical e-waste management practices without coercion of any kind like rules, regulations, laws or enforcing agency diktats.

Thus, Statement 6 is positively correlated with Statement 3 at .146. This implies incentivisation will lead to more education, awareness and compliance behaviour of individuals who will then in turn resort to ethical e-waste management, disposal and recycling measures that will reduce harmful effects on both environment and human beings alike.

Thus, Statement 6 is positively correlated with Statement 5 at .131. Thus, incentivisation will lead to reduction in e-waste and ethical disposal at the individual level. The other correlations have also been marked in bold in the figure and can be read easily to understand the interrelationships, if needed per se.

REGRESSION

Automatic Linear Regression Modelling was done using the dominant statement with maximum correlations ie., *STATEMENT 6. I would like to get some monetary reward for ethical E waste generation and disposal such that it does not cause any harm to society and environment.* The model selection method was forward stepwise and Gender was used as analysis weight so that both gender motivations come out clearly in a single model summary. The information criterion was -103.818 for all the variables under examination other than statement 6 and gender. The information criterion is used

to compare models. Models with smaller information criterion values fit better as can be seen by the negative score. Thus, this model had an accuracy level of 30.8% which is reasonably fair given the complexity that surrounds e-waste management and its disposal and recycling methods.

Correlations

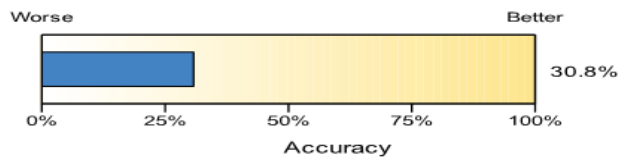
		I feel Environment Protection Agencies should be responsible for ethical dumping of E Waste and its recycling methods and needs legislative and strictly enforceable laws in India now, that are binding on both individuals and waste disposal agencies wheth	I am aware of E waste and have fair knowledge of E waste Collection Centre near me that helps in disposing e waste ethically and correctly and I strongly feel that a legislative law and system of "Fines" on individuals and agencies alike needs to come	I have sufficient knowledge of E waste dumping process and its meaningful disposal and recycling to mitigate harmful effects on humans and environment alike.	I have little knowledge of harmful contents present in E waste like lead, cadmium, mercury and the like which denigrate environment and contaminate food chain as well and I am unsure how these are extracted and recycled or disposed off.	Ewaste is harmful for us and I try to reduce it and dispose it ethically in my own small way.	I would like to get some monetary reward for ethical E waste generation and disposal such that it does not cause any harm to society and environment.	Are you willing to participate in future e-waste recycling initiatives?
I feel Environment Protection Agencies should be responsible for ethical dumping of E Waste and its recycling methods and needs legislative and strictly enforceable laws in India now, that are binding on both individuals and waste disposal agencies wheth	Pearson Correlation	1	-.074	.166**	.097	-.008	-.159**	-.049
	Sig. (2-tailed)		.140	.001	.053	.870	.001	.328
	N	400	400	400	400	400	400	400
I am aware of E waste and have fair knowledge of E waste Collection Centre near me that helps in disposing e waste ethically and correctly and I strongly feel that a legislative law and system of "Fines" on individuals and agencies alike needs to come	Pearson Correlation	-.074	1	.060	.021	.132**	.023	.003
	Sig. (2-tailed)	.140		.235	.670	.008	.646	.948
	N	400	400	400	400	400	400	400
I have sufficient knowledge of E waste dumping process and its meaningful disposal and recycling to mitigate harmful effects on humans and environment alike.	Pearson Correlation	.166**	.060	1	-.024	-.070	.146**	.063
	Sig. (2-tailed)	.001	.235		.631	.161	.003	.206
	N	400	400	400	400	400	400	400
I have little knowledge of harmful contents present in E waste like lead, cadmium, mercury and the like which denigrate environment and contaminate food chain as well and I am unsure how these are extracted and recycled or disposed off.	Pearson Correlation	.097	.021	-.024	1	.062	.041	-.097
	Sig. (2-tailed)	.053	.670	.631		.216	.412	.052
	N	400	400	400	400	400	400	400
Ewaste is harmful for us and I try to reduce it and dispose it ethically in my own small way.	Pearson Correlation	-.008	.132**	-.070	.062	1	.131**	.052
	Sig. (2-tailed)	.870	.008	.161	.216		.009	.304
	N	400	400	400	400	400	400	400
I would like to get some monetary reward for ethical E waste generation and disposal such that it does not cause any harm to society and environment.	Pearson Correlation	-.159**	.023	.146**	.041	.131**	1	.090
	Sig. (2-tailed)	.001	.646	.003	.412	.009		.074
	N	400	400	400	400	400	400	400
Are you willing to participate in future e-waste recycling initiatives?	Pearson Correlation	-.049	.003	.063	-.097	.052	.090	1
	Sig. (2-tailed)	.328	.948	.206	.052	.304	.074	
	N	400	400	400	400	400	400	400

** . Correlation is significant at the 0.01 level (2-tailed).

Model Summary

Target	I would like to get some monetary reward for ethical E waste generation and disposal such that it does not cause any harm to society and environment.
Automatic Data Preparation	On
Model Selection Method	Forward Stepwise
Information Criterion	-103.818

The information criterion is used to compare to models. Models with smaller information criterion values fit better.

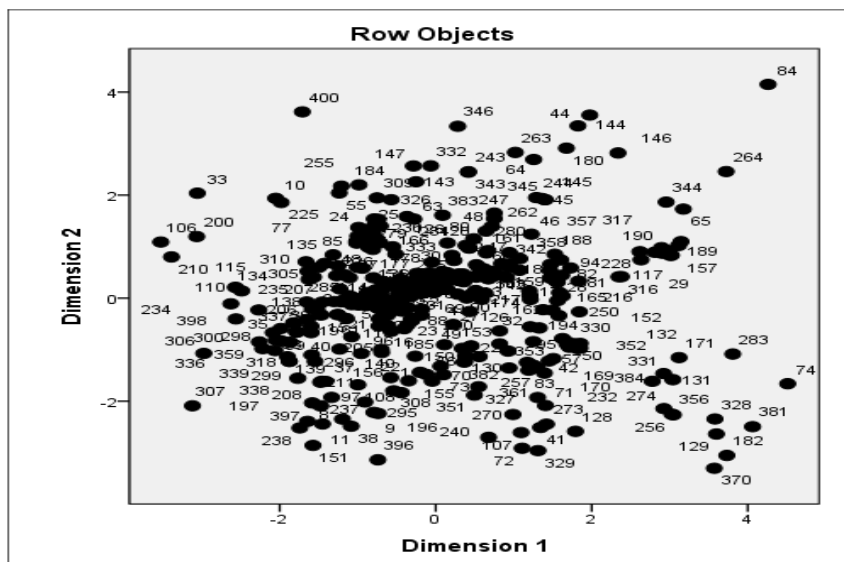


Case Processing Summary

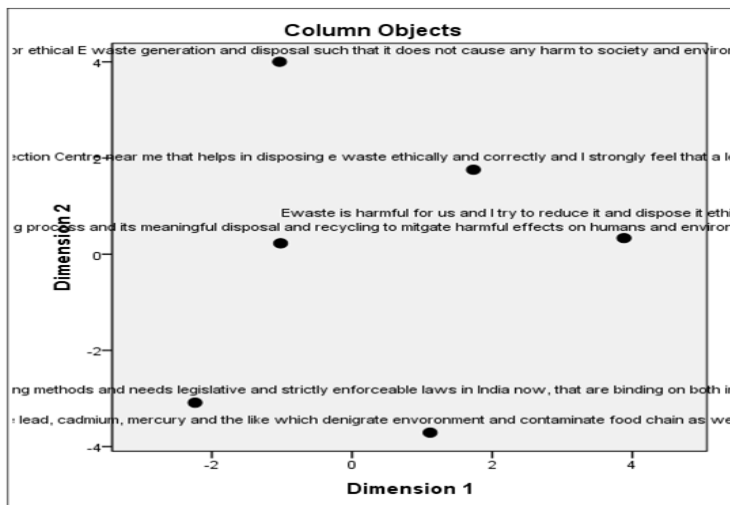
	N	Percent
Included	400	100.0%
Excluded	0	0.0%
Total	400	100.0%

MULTIDIMENSIONAL SCALING

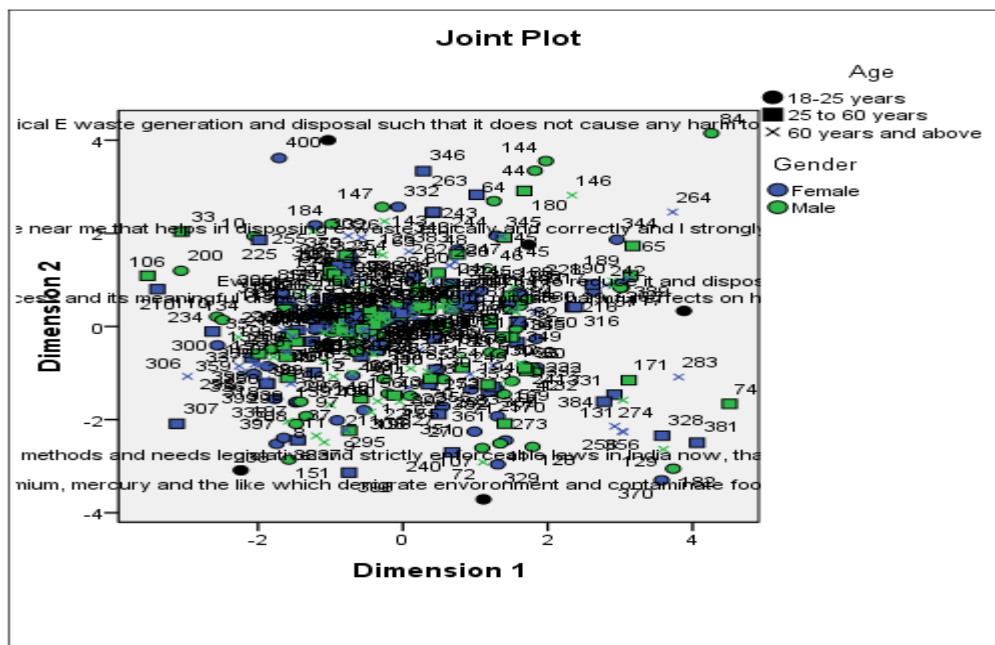
The first MDS plot shows all the 400 respondents and there euclidean distance on a 2 dimensional scale, X-axis is labelled as Dimension 1 and Y-axis as Dimension 2. Thus, all 400 respondents are marked on this plot based on the answers they gave for Statements 1 to 6 that tested the underlying 3 Hypotheses. These are the Row Objects.



The Column Objects show the location of the different statements on 2 Dimensions namely 1 and 2. By superimposing this column object plot onto the row object plot we can see which respondent is where on the distance from the 6 statements. For example, 400 th respondents is closest to statement ethical E waste generation and disposal such that it does not cause any harm to society and environment.



Finally the Joint Plot shows the gender differences between males and females along with their particular age groups. Thus, 400 th respondent is in 18-25 years age group and is female. This was cross verified with data file and it was absolutely correct. The plot is densest in centre and this justifies the e-waste is harmful for us and I try to reduce it and dispose it ethically in my own small way.



RESEARCH FINDINGS :

The detailed research findings have already been provided separately for consumers and for recyclers. The gist of the findings are again been restated here in a nutshell so that the study can be understood in proper perspective and comparatively since most recycler findings find their echo in consumer findings too.

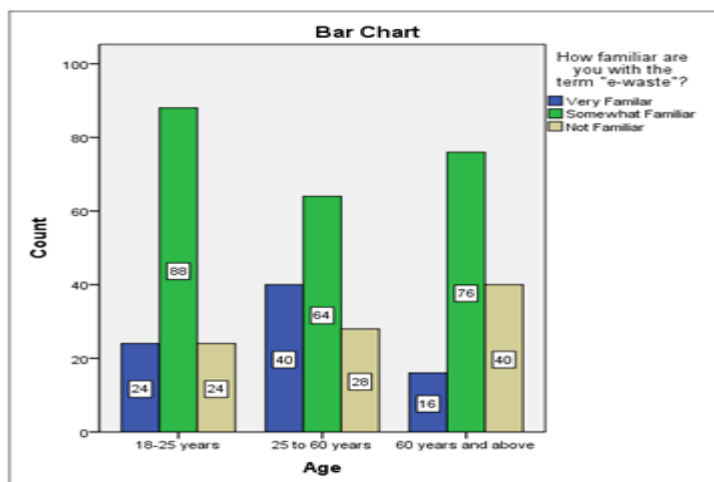
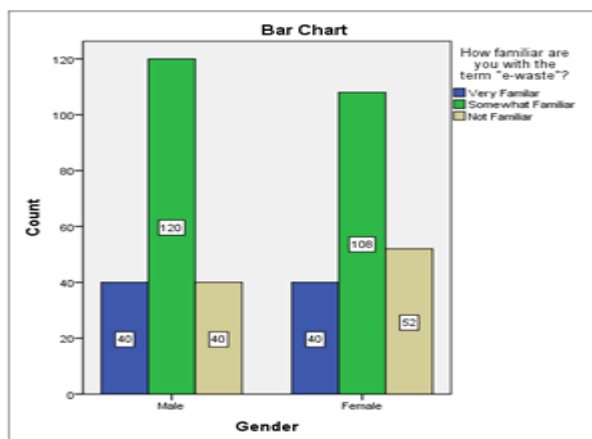
1. Awareness both unaided and aided continues to remain low amongst the respondents and this is a cause for concern and this cuts across gender. Somewhat familiar and not familiar together make 320 respondents. The cross tabulation

gender wise – agewise is provided below.

Gender * How familiar are you with the term "e-waste"? Crosstabulation

Count

		How familiar are you with the term "e-waste"?			Total
		Very Familiar	Somewhat Familiar	Not Familiar	
Gender	Male	40	120	40	200
	Female	40	108	52	200
Total		80	228	92	400



2. There 53% to 47% for and against knowing what constitutes e-waste and what doesn't.
3. A majority of 62% of the respondents consider electrical and white goods as e-waste.
4. Majority of the respondents 53% replace their electronic devices within three years.
5. A huge 80% of the respondents have not used a recycling program.
6. A vast majority - 76% of the respondents believe that e-waste is a significant problem in Dehradun even as 75% believe that it is important to recycle electronic devices.
7. A majority $61\%+35\%=96\%$ are aware that contamination results when e-waste is not properly disposed off.

8. Again 70% of the respondents say that they have not used a formal recycling program.
9. Although 17% believe that lack of information is the primary reason for not recycling e-waste and 44% agree that it is due to a combination of multiple factors.
10. A huge 47% would like financial incentives to motivate them to recycle more of e-waste.
11. A majority 60% of the respondents favour home collection of e-waste for improving e-waste management in their community.
12. 75% are unaware of any local initiatives or programs for e-waste management in Dehradun.
13. A mammoth 87% are unaware of any e-waste legislation (local or national e-waste laws and regulations for disposal.)
14. For 36% of the respondents only electrical goods make up e-waste.
15. 56% believe that proper e-waste disposal is very important for the environment with 85% of the respondents believing that improper disposal can actually harm human health.
16. A massive 79% of the respondents are not willing to pay a small fee for proper e-waste disposal even though 68% want stricter regulations on e-waste disposal.
17. Electrical items at 27% of the respondents dominate across households in terms of inventories.
18. The three predominant methods of e-waste disposal remain selling to raddiwala-kabadiwala, selling to second hand consumer, dealer or online buyer even as e-waste disposal in community dhalao and dustbins remains the least preferred option by vast majority of the respondents across different category of electronic products.
19. The average useful life of electrical goods is least with 44% saying its between 1 or 2 years. The average useful life of white and brown goods is much higher between 10 to 15 years on an average.
20. Consumer awareness public service campaigns, Free e-waste collection from homes, anti dumping laws with prohibition and fines for violations at 16% of the respondents each is the preferred mode to motivate participants to recycle e-waste more frequently.
21. Celebrity endorsements to motivate ethical e-waste practices was agreed to by 17% of the respondents.

REFERENCES

1. E-waste management in India: A mini-review by Abhishek Kumar Awasthi, School of Environment, Tsinghua University, China in 2018
2. Electronic Waste and India by Dr S. Chatterjee in 2011
3. Sahu, G. (2013). Environmental Regulatory Authorities in India: An Assessment of State Pollution Control Boards. Centre for Science, Technology & Society School of Habitat Studies
4. Nautiyal, Navtika Singh, Agarwal Shuchita: E-Waste Management: An Empirical Study On Retiring And Disposal Of Retiring Gadgets, IAEME Publication, Scopus Indexed Volume 11, Issue 12, December 2020, pp.2901-2910
5. Kumar, A., Holuszko, M., & Espinosa, D. C. R. (2017). E-waste: an overview on generation, collection, legislation and recycling practices. Resources, Conservation and Recycling, 122, 32-42.