Policy Paper

on

E-Waste Management in Kashmir

by

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Entrepreneurship Development Cell (EDC)
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Sponsored by

Islamic University of Science &Technology(IUST)

Under

Minor Research Project (MRP)

Islamic University of Science & Technology(IUST)

Awantipora-Kashmir

J&K

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CERTIFICATE

This is to certify that Mr. **Parvez AhmadMir**has completed the minor research project entitled *"E-Waste Management in Kashmir"*sponsored by the Islamic University of Science & Technology, Awantipora Kashmir (J&K), thereby making it an intellectual property of the Islamic University of Science & Technology (IUST).

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Dated: 11/5/2019

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Acknowledgement

Praise to Almighty Allah, the most Gracious, mostMerciful by whose blessings the present study was accomplished.

At the outset, I wish to express my sincere thanks to all those who have made valuable contributions- directly or indirectly- in the successful completion of the present endeavour.

I am extremely grateful to theIUSTresearch team who sponsored this research project in order to develop a policy document on e-waste management for the state of Jammu & Kashmir.

I am thankful to honorable Vice Chancellor Prof. Mushtaq A. Siddiqe who has been instrumental in developing the zeal for research in the university. It is because of his vision, inspiration and encouragement that the university adopted researchorientation in the teaching-learning pedagogy in the last couple years and the present work is the outcome that only.

I shall be failing in my duties if I do not express my sincere thanks to all the stakeholders for their honest, sincere and cordial approach during my visit to their respective institutions for data collection.

I wish to express my deepest sense of gratitude to my worthy respondents from Islamic University of Science & Technology (IUST), Central University Kashmir (CUK), Cluster University Srinagar, Kashmir University, J&K Bank, HDFC Bank, IT-Companies – Rangreth, Srinagar Municipal Corporation, J&K State Pollution Control Board (JKPCB), CEO of Lelafe (Mr.Shameem A Shah) & STC company (Mr. Sheikh Parvez) and various families who have been sustained source of inspiration for collecting data from the respective organization.

I am also thankful to Prof. A.M Shah, Dean Academic Affairs (DDA)/Dean School of Business and Prof. Ayaz H. Moon, Dean School of Engineering & Technology IUST-Awantipora, Kashmir for their encouragement in completing this work at the final stage of the programme.

I am also thankful toDr Iqbal Khan, Department of Management Studies, IUST for giving valuable suggestions on e-waste Management.

I sincerely acknowledge the guidance of my colleagues at IUST with whom I have been fortunate in being able to constantly discuss and debate regarding various practices and concepts of e-waste Management. I am also thankful to all other members of teaching & non-teaching staff of the University for their help in one way or the other.

I am indebted to friends in and outside the University for their help in various ways.

Last, but not the least, I express my deepest sense of affection to my family members whose eternal love, inspiration, encouragement and support made mecomplete this endeavour successfully.

Dated: 11th May, 2019   **Parvez Ahmad Mir, PhD**

Contents

E-Waste Management in Kashmir

1.1: Introduction: Electronic waste (e-waste) or Waste Electrical and Electronic Equipment (WEEE) comprisesofa wide range of electronic appliances such as refrigerators, air-conditioners, stereo systems, computers, cell phones discarded by their users. However, e-waste has been defined as "any electronic and electrical equipment that has lost value to its owner" and has become obsolete for any functioning (Ongondo , et al, 2011). Innovations in the technological sector take place at a very high rate and it also translates into fast technological obsolesce. This leads to an alarming rate of the production of e-waste. This gives rise to both waste management issues and also throws up business opportunity for general public (Bhattacharya, 2018). In fact, e-waste include metals to the tune of approximately 60 percent like iron, copper, aluminum, gold; and plastic material accounts for about 30 percent and the hazardous pollutants about 10 percent of the total e-waste (Agarwal, 1998). The global level estimates report that 50 million tons of e-wastes are produced annually leading to a growing tsunami of e-waste pollution (Kiddee et al., 2013). Further, electronic industry is the world's largest innovative industry and tons of electronic items are produced annually, however, after their usage, they soon become a complex waste matter. The e-waste consists of 1000 different substances that can be categorized into hazardous and non-hazardous categories (Widmer, et al, 2005). This includes many hazardous heavy metals, acids, toxic chemicals and non-degradable plastics consequently creating serious environmental problems. Much of it is dumped, burnt or exported to recycler which produces smoke and dust particle containing carcinogens and other hazardous chemicals leading to severe inflammations and lesions including many respiratory and skin diseases. Moreover, these electronic circuits are burnt to extract the valuable metals such as gold, platinum, cadmium (Sreedhar, 2019). In addition, the wire coat of the electronic product consists of PVC (polyvinyl chloride) and PCB (Polychlorinated biphenyls), producessmoke, and carbon particles which are highly carcinogenic and may lead to severe lung, skin and other health diseases (Wikstrom, &Marklund, 2001; Wong et al, 2007).

In 2016, the e-waste generation at the global level was around 44.7 million metric tons (Mt), or 6.1 kg per inhabitant, and it was projected that the amount of e-waste is growing to touch 52.2 Mt in 2021, with an annual growth rate of 3 to 4 percent (Anonymous, 2016). Moreover, as per

the recent reports, 66 percent (67 countries) of the world population are covered under national legislation (Blade et al, 2017). Many countries in Asia are frontline contributors to the world as Hong Kong (21.5 kg/Inh), Singapore (19.6 Kg/Inh), Brunei (18.1 kg/Inh) respectively are on top of the list of countries with the highest e-waste contribution per inhabitant and are also emerging as "e-waste hotspot"; In addition, Bangladesh, Vietnam, Thailand are generating e-waste at faster rate even though they are laggards in technological adoption, moreover, Philippines is now emerging as the world capital of e-waste (Alam, 2016) and China, Japan and India are going to surpassin coming years. The irony is that only 7 percent of e-waste comes from mobile phones, personal computers and printers (Herat, &Agamuthu, 2015), however, a small fraction of e-waste enters into the recycling channel for value creation (Lundergren, 2012; Hotta& Kojima, 2012;Sreedhar, 2019). Even though there is growing international interest on e-waste but very little official statistics is available and only 41 countries in the world collect statistics on e-waste which is helpful for addressing the e-waste challenge. The International Telecommunication Union (ITU), set a target for member countries 2020 to reduce the e-waste volume by half so that shared vision of minimizing e-wastes for sustainable development can be achieved (Blade et al, 2015, 2018). In this direction, the Centre for Global Public Goods launched a $15 million mega project for setting up formal electronics recycling industry in Nigeria (Anonymous, 2019).

1.2. Global Status of e-Waste: Despite growing international interest, only a little official statistics related to e-waste is available which is substantiated by the fact that only 67 countries (66 percent of world population) are covered by National e-waste Management laws (Blade etal, 2017). However, some countries have developed a specific framework based on usage minimization, targets fore-waste collection and re-use of e-wastesin their respective areas (Ongondo et al., 2011). Below is mentioned the global scenario of e-waste.

1.2.1: AMERICA: In Americas, the total e-Waste generation was 11.3 million tons (MT) wherein only 1.9 Mt was collected and recycled, whereas the rest of the quantity entered the informal system. The e-waste distribution varies across the region wherein USA and Canada produce most e-waste per inhabitant i.e. around 20 kg/inh. The top producer of e-waste in American peninsula is the United States of America which produces 6.3(MT) Milliontons followed by Brazil, with 1.5 Mt, and the third is Mexico, with 1 Mt. However, some of the e-

waste quantity is exported to other third world countries particularly Asian and African countries in the name of charity or on discounted cost (Blade etal, 2017).

1.2.2: ASIA: In Asia, the total e-waste generation was 18.2 Million tons (MT) in 2016 wherein China generated(7.2 Mt), Japan generated 2.1 Mt, and India 2 Mt. The top four Asian economies that have the highest e-waste generation in relative quantities are: Cyprus (19.1 kg/inh), Hong Kong & China (19 kg/inh), Brunei and Singapore (around 18 kg/inh). United Arab Emirates (UAE), is considered to have one of the world's lowest life expectancy of electronics as it has a very high level of consumption, hence substantial amounts of electronic waste is produced annually (Blade etal , 2017).

1.2.3: OCEANIA: In Oceania, the total e-waste generation was 0.7 Mt in 2016 wherein Australia (0.57 Mt) is the highest producer of e-waste. Although Australia implemented its National Television and Computer Recycling Scheme in 2011 yet in 2016e-waste generation in Australia has been23.6 kg/inhwhereas in New Zealand it is 20.1 kg/inh. As per the review it was found that only 7.5 percent of the e-waste generated in Australia is collected and then recycled hence the rest is a precarious cause of concern. New Zealand is still in the process of developing a national scheme to deal with the e-waste issues. Where it is The e-waste is mostly land filled across the Pacific Island countries, and its management practices are predominantly informal. Currently, there is only one law on the management of e-waste in Oceania which is The National Television and Computer Recycling Scheme in Australia and it encourages Extended Producer Responsibility (EPR) schemes for managing e-waste. This scheme provides Australian households and small businesses with access to industry-funded collection and recycling services (Blade, 2017).

1.2.4: JAPAN: In the Japan, the withdrawal of electronic product is not free of charge, as consumers are supposed to pay an amount of money when they return used electronic products to the traders. Japan, so far, has established four types of e-waste withdrawal systems (air conditioners, televisions, refrigerators and washing machines) since 1998. The law specifies target rates and imposes strict penalties for non-compliance of law. Moreover, electronic companies have established their own collection centers and sometimes they operate collection centers in collaboration with other companies. The collected e-waste is transported to the intermediate e-waste collection points where the primary disassembly procedure of big parts

initially takes place and subsequently they handle the residues in a more proper way. Nevertheless, it may be noted that the success of e-waste recycling system in Japan is due to socially responsible, environmental-sensitive and the real discipline of its general public (Blade, 2017).

1.2.5: SWITZERLAND: Switzerland was the first official country where e-waste management system was established in 1990's, and, in fact, legislation related toe-waste management was introduced for the first time in 1998 through ORDEA law (Ordinance on The Return, the Taking Back and the Disposal of Electrical and Electronic Appliances). There are different e-waste recycling systems active in the country where one is run by The Swiss Association for Information, Communication and Organizational Technology (SWICO Recycling Guarantee) which manages the "brown" electronic equipment (e.g. computers, televisions, radios, etc.), while the other is run by S.E S.S (StiftungEntsorgungSchweiz System) which manages the "white" electrical equipment (e.g. washing machines, refrigerators, ovens, etc.). In Switzerland, consumers return the e-waste in a more convenient way, either through specialized collection centers or transporting the waste straight to the recycling spots. The materials are transported from the collection points to the disassembly facilitiesin order to disassemble and disinfect e-waste by removing the most toxic factors (Afroz et al., 2013). Thereafter most of the recycled materials is sent for the final material disassembly and recovery. The remaining materials that cannot be recovered are sent to incinerators for energy recovery and a smaller quantity (less than 2 percent) ends up to the landfills.

1.2.6: CHINA:E-waste issues in China were triggered by the environmental calamity because of the presence of heavy metals, inorganic and other hazardous substances in water, air, soil due to e-waste (Wong et al., 2007a, 2007b; Chan et al., 2007; Wong et al., 2006; Leung et al., 2008). As a result, the Government pressed for proper disposal of e-waste and as of now 18 percent of e-waste generated is recycled through formal mechanism in China.And now Extended Producer Responsibility (EPR)has also been introduced where manufacturers are themselves responsible for the recovery of waste electronic products as they are supposed to set up collection centers and ensure that waste is recycled in an environment-friendly manner based on cooperation rather than on competition (Agamuthu, & Victor 2011;   Osibanjo,   &Nnorom, 2007; Heart &Agamuthu, 2012; Aggarwal, 2012).

1.3: **E-WASTE IN INDIA:**India now a BRICS economy is growing at a faster rate, and in the last two decades, the demand for electronic products has increased exponentially. Moreover, theIndian electronics industry is one of the fastest growing industry in the world (Venugopal, , et al, 2016), andas a result,the life span of electronic products is very short (Herat, &Agamuthu, 2015). India, contributed 2MT ofe-waste in the year 2016 but the irony is that 90 percent of e-waste is managed by the informal sectorby using unscientific methods that cause harm not only to the environment but also to the human health (Ramesh, et al, 2007). Consequently , the Electronic Waste (Management and Handling) Rules, 2011, came into existence in order to institutionalize e-waste management system in the country. These rules are based on Extended Producer Responsibility (EPR)-wherein the manufactures have to set up collection centers across the market and ensure that waste is recycled and disposed of in an environment-friendly manner. All the collection centers, dismantling units and recycling units are also supposed to register with State Pollution Control Boards and comply with their norms also. By shifting the burden of waste management onto the manufacturers, the EPR framework, in theory, creates incentives for more environment-friendly products, thereby minimizing e-waste andmaximizing value creation of electronic product. However, these rules were amended in2016 and now include collection targets; the producers have to implement a Deposit-Refund System (DRS) whereinupfront deposit is charged to the consumer at the time of purchase of the product and the deposit is refunded when the product is safely returned to the producer. This kind of instrument has been successful in some developed world (particularly in case of glassbottles), but its success rate also depends upon the implementation of law of the land(Awasthi et al, 2018; Anonymous, 2016; Kaur&Goel, 2016;;Turaga& Mark, 2008). Moreover, the e-waste collection centers are supposed to maintain a record of the e-waste collected, dismantled and sent to the recycler but unfortunately 90 percent of electronic waste in India is still managed by informal sector (Sreedhar, 2019).The Central Pollution Control Board (CPCB) reports that the maximum e-waste generation in India comes from ten states, which are Maharashtra, Tamil Nadu, Andhra Pradesh, Uttar Pradesh, West Bengal, Delhi, Karnataka, Gujarat, Madhya Pradesh and Punjab.

1.3.1:J&K State Scenario: The global e-waste Monitor-2017 report rightly warns about the "tsunami of e-waste" that is emerging in the coming years as it is going to cross 120 mt. (million metric tons) by 2050.Government in partnership with industry is supposed to craft the Environmentally Sound Management (ESM) practice to minimize the hazards of e-waste (Herat, &Agamuthu, 2012; Liang, & Sharp, 2016). In the currentscenario, e-waste is now becoming a serious issue in our state of Jammu & Kashmir (J&K-India),as the state is going to become the dumping yard for e-wastes. So, every individual and institution of the state is solely responsible for this mess. The state government has not designed any formal mechanism for the proper disposal of e-waste. As per the Report-2009-10 by J&K State Pollution Control Board, total e-waste generation was estimated to be approximately 492.32 tons with per capita generation of 0.054 kg in the State. The total annual e-waste for the year 2012-2013 has been found approximately 3260.4 tons with per capita generation of e-waste has been estimated to be approximately 0.26 kg for the year 2012-2013, which is approximately 5 times higher than previous data (Anonymous, 2016). After2013, no such survey was taken up by the organization.So, it is obvious that per capita generation e-waste in the state has increased tremendously so it is the duty of every individual to think about these issues before using these gadgets extensively.Moreover, the state government is supposed to design a comprehensive policy, wherein they are supposed to define electronic waste clearly while coming up with any integrated e-waste management policy and a regulatory regime for its implementation. In this scenario, the state is going to become, as already stated, a dumping yard for e-waste in the coming years. It is, ergo, also the responsibility of academic institutes to help the state administration in designing a research based comprehensive policy on e-waste Management.

1.4. Research Methodology:

The state of Jammu & Kashmir, once 'paradise on earth' is going to become a dumping yard for e-waste, having serious consequences on general public and environment. It is also a fact that no such research study on e-waste management has been conducted in the state as would underline and recommend a policy framework for the government of the state. This research study, therefore, hasexplored the basic variables related to e-waste management and hence the research study was exploratory cum conclusive in nature.

1.5: Objectives:

1. To study the perception of the stakeholders regarding the health and environmental hazards of e-waste in the sample study area.
2. To study the current disposal practices of e-waste in the sample study area.
3. To study the perception of customers regarding extra payments for management of e-wastes.
4. To give suggestions for policy implication of e-wastes Management in the J&K state.

1.6: Sample Inclusiveness:

The sample area for the research study was the summer capital city of Srinagar of theJammu& Kashmir state which has a huge demographic diversity particularly in the summer season (May to September) which is a must for increasing the representativeness of the Sample. In the sample inclusiveness plan, four major universities in Kashmr region namely Islamic University of Science & Technology (IUST), Central University of Kashmir (CUK), Cluster University of Kashmir (CUOK), Kashmir University (KU) were included . In the public sector, Srinagar Municipal Corporation (SMC), J&K State Pollution Control Board (JKPCB), and in the private sector, two IT-Companies (Lelafe& STC companies), two banks (J&K bank & HDFC Bank) were included in the sample plan . Moreover, the households were also included in the sample (table 1.1). These organizations were selected due to the extensive utilization of electronics products by these organizations, and they are, therefore, the major stakeholders of electronic wastes in the state. In order to collect primary data from the individual respondents from the respective organizations, we designed a comprehensive questionnaire comprising of the following major variables:

1. Customer Knowledge about e-waste.

2. Role of media in e-waste management

3. Health and Environmental Hazards of e-waste

4. Awareness about the Government Regulations

5. Implementation of the rules & Regulation in the state

6. Disposal Practices in the state

7. E-waste management based on Recycle, Reuse, Reduce, Repair, Reselling.

8. Life Cycle of the Product

9. Customer willingness to pay extra for e-waste management.

A well designed questionnaire was used for the collection of primary data (Appendix 1.1) and a total of 850 questionnaires were distributed among the respondents of the respective institutions. However, a total 430 questionnaires were received wherein 411 questionnaires were analyzed by using SPSS-19 software and 19 outliner's questionnaires were rejected.

Table 1.1: Sample Plan

S.No.	Name of Organization	Female	Male	Total
1	IUST	35	29	64
2	Cluster University Kashmir	37	30	67
3	Kashmir University	25	25	50
4	Central University of Kashmir	32	44	76
5	IT Companies(STC&Lelafe)	18	32	50
6	Srinagar Municipal Corporation (SMC)	7	7	14
7	JK State Pollution Control Board (SPCB)	8	8	16
8	Banks (J&K Bank &HDFC Bank)	21	17	38
9	Households	17	19	36
	Total	**200**	**211**	**411**

In order to makethe sample inclusive, the demographic variables male /female, rural/urban, education level, income, employment level were also incorporated proportionately in the sample plan. In the sample inclusiveness, on the basis gender, 51.8 percent male and 48.2 percent female respondents were included in the sample wherein 29.9 percent were married and 70.1 percent were unmarried . Moreover, in the age group, 73.2 percent respondents belong to the age group of 15-30 years and 22.9 percent belong to 31-45 years of age group, respectively. In the family the structure, 37.5 percent were having less than 5 five family members whereas 51.6 percent were having 5-8 members in the family. In the income group, 34.3 percent respondents belonged to below Rs 25,000/- income bracket and 36.3 percent belonged to Rs 26,000-50,000 income bracket whereas other belonged to higher income bracket. In the status segmentation, 44.3 percent belonged to employed class and 42.1 percent were students in the sample wherein 29.4

percent and 34.3 percent were graduates and post graduatesrespectively.In addition to elicit the information detailed Interview was conducted with various administrators of respective institutions mentioned in the sample plan. The normality test was accordingly conducted and the data found normal for the statistical analysis.

In the research survey, both primary and secondary data were used. For thecollection of data from primary sources, efforts were made to elicit the opinions of almost all key personnel in the respective institutions through observation, personal interviews, questionnaires and schedules. The in-depth interview technique has also been used to increase the reliability of primary data. However, the deficiency of this survey was that we were not able to determine perception of customers from Jammu & Ladakh regions due to deficiency of resources and time.

1.7: Analysis of Data: In the research study, it was found that both rural as well as urban populationswere concerned about the environment as 93.9 percent respondents mentioned the environmental concern; however, a small marginal population 3.2 percent were not concerned. This reveals that it is goodto bring any government interventional based developmental change on environmental issues in the society. Further it was seen that 75.5 percent (urban) and 62.7 (rural) percent respondents were more concerned about their local environmental issues rather than state or central environmental problems,however a marginal proportion of (30 percent) respondents were least concerned about environmental issues which may be due to the lack of specific awareness about e-waste as it was found in the survey that only 17.7 percent (urban) and 19.4 percent (rural) respondents were having full knowledge about the e-wastes whereas 82.3 percent (urban) and 80.6 percent (rural) either haveno knowledge about e-waste or even if they have , they surely don't know how it impacts their environment or health.

Regarding the e-waste Regulations, it was found that 83.0 percent respondents mentioned lack of knowledge related to the Government regulations on e-waste which is a serious issue as 'law implementation' is directly proportional to 'law awareness'. Moreover, only 1.0 percent respondents claimed that Government regulation related to e-waste are properly implemented whereas 99.0 percent respondents claimed that these regulations are either not implemented at all or exists on paperonly. This put a strong question mark on the governance of Government Regulations on e-waste Management in the state. As the research study reveals, the knowledge about e-waste among the general public is abysmally poor; e-waste regulations either are poorly

or not implemented properly which needs an immediate strategic intervention from government for effective and efficient e-waste management in the state.

When respondents were asked as to why they do not recycle electronic products?, 39.9 percent respondents mentioned that they don't recycle because of non-availability of recycling facility in their vicinity whereas others mentioned that they lack information, time, space or it is useless to recycle the electronic products. In the survey, it was also found that the 28.5 percent respondents mentioned that they dispose the e-waste just like normal trash, whereas small marginal proportion of 10.9 percent respondents mentioned that they do segregation of e-waste before final disposal; In addition, 21.4 percent respondents prefer to donate e- products as charity.Moreover, among the respondents who prefer to segregate the e-waste, it was found that 53.0 use informal system for the final disposal without searching for formal mechanism or using recycling facility which is in consonance with Chinese study where approximately 60 percent of the generated e-wastes are sold to private individual collectors and passed into the informal recycling processes (Liu,   et al , 2006). Only 21.0 percent respondents mentioned that they use formal mechanism for disposal of e-waste, this proportion of respondents normally belongs to IT compannies. When the respondents were asked   whether they knew someone who'd collect e-waste product for recycling, reuse or reselling, 61.8 percent respondents mentioned that they don't have any knowledge about the person (s) or institution that could collect the e-waste for recycling, reuse or reselling whereas 38.2 percent respondents mentioned that they have knowledge about the e-waste collectors. As a result, the movement of e-waste into the informal sector from institutional and individual generators is significant, as a result the health and pollution hazards are significantly high. So, it is the responsibility of Government that they should design a formal mechanism forthe disposal of e- wastes and deep penetration of collection centers in the state.

It has been found thatboth rural and urban respondents perceive health risk while dealing with electronic products; however, it was also found that there is a huge variation between   rural (38.1 percent) and urban population (62.1 percent) in perceiving the health risks associated with wastes which may be be due to lack of awearness among the rural population. Moreover, 16.1 percent respondents mentioned that it's riskless to deal with electronic products which is due to the lack of information or awareness from different sources among the general masses in the state. Further, it was agreed by 78.8 percent respondents that theelectronic product contain toxic

component wherein 85.2 percent urban and 65.7 percent rural respondents are also of the same opinion, however, 21.6 percent, a good proportion of respondents are clueless about the toxicity of e-products. When the respondents were asked aboutthe special treatment for toxic or hazardous e-wastes, most of the respondents (69.8 percent) showed positive response whereas 31 percent respondents mentioned the lack of knowledge about the proper disposal of toxic material. It is further mentioned that 52.8 percent respondents mentioned that the negative impact on health is because of e-wastes, whereas 34.8 percent respondents lack knowledge about the same. So, government is supposed to provide awareness related to health hazards of e-wastes, and should also ensure thatthe producers of these electronic products design a sustained responsible framework.

When the respondents were asked about the management of e-waste in the state, both urban (63.2 percent) and rural (50.7 percent) respondents mentioned that the 'Recycling of e-waste' is the best strategy for reducing e-wastes in the state (Agamuthu, & Victor 2011), whereas 26.9 percent rural and 15.9 percent urban respondents mentioned about 'Reusing of old products' as an appropriate option for managing e-wastes. In addition, 12.8 percent and 8.7 percent respondents mentioned that donation and minimizing the use of e-products in daily life as the best fit for managing e-wastes in the state. Moreover, it was found in the survey that 53 percent respondents are willing to pay extra amount for proper disposal of e-waste which is in contrast to the study done in China, where more than 90 percent of Chinese citizens are reluctant to pay for the recycling of their e-waste as it is due to their traditional understanding that there remained value in these end-of-life products (Liu, et al , 2006). So, government in association with manufactures should design such a strategy where Extended Producers Responsibility (EPR) should neither become a burden for the manufactures nor should the customers feel price psychosis because of additional price .

In the research analysis, as the data was following normal distribution pattern (Normality test), the p-value was 0.000, which is less than 0.05, (the assumed level of significance, 95 percent confidence), indicating the rejection of the hypothesis, which depicts that there is a relationship between e-waste management and general awareness level, Government regulation, disposal practices, Hazard level, paying extra amount for its disposal, hence the state policy to be designed accordingly (table:1.2). So, the Government in consultation with industries should

design a comprehensive policy mechanism for e-waste management to be adopted and implemented smoothly in the state.

S. No.	Dimensions	Sum of squares	Degree of freedom	Mean of Squares	F-Value	p-Value
Table1.2: ANOVA between E-waste Management and the different dimensions of e-waste Management						
1	Knowledge about Govt. Rules & Regulation	1.564	3	.521	2.661	.048
2.	Implementation of Rules & regulation	2.393	2	1.197	6.187	.002
3	Recycling of e-waste Products	17.405	2	2.861	36.195	.000
4	Specialization Knowledge about e-waste	14.664	4	3.666	22.335	.000
5	Presence of toxic components in e-waste	21.45	2	1.754	40.245	.000
6	Perceive any Hazard or Risk with e-waste	18.77	2	1.350	38.477	.000
7	Disposal Practices	35.178	5	7.036	61.771	.000
8	Paying extra amount for e-waste disposal	5.140	2	2.570	13.766	.000
9	Type of media used	2.203	5	.441	2.256	.048
10	Disposal methods for e-waste to be adopted	9.391	3	3.130	17.715	.000

Table:1.3: Perception of customers towards e-waste Management

S.No.	Dimensions	Agree	Disagree	Don't Know	Total
1	Knowledge of Govt. Regulations towards e-waste	70	230	111	411
		17.0%	56.0%	27.0%	100.0%
2	Implementation of e-waste Rules & Regulations	52	114	245	411
		12.7%	27.7%	59.6%	100.0%
3	Recycling of e-waste Products	73	310	28	411
		17.8%	75.4%	6.8%	100.0%
4	Knowledge about e-waste disposal centre	157	254	0	411
		38.2 %	61.8%	0	100.0%
5	Perceive any Hazard or Risk with e-waste	223	66	122	411
		54.3%	16.1%	29.7%	100.0%
6	Presence of toxic components in e-waste	324	30	57	411
		78.8%	7.3%	13.9%	100.0%
7	Special treatment for e-waste	287	47	77	411
		69.8%	11.4%	18.7%	100.0%
8	Negative impact on Health	217	51	143	411
		52.8%	12.4%	34.8%	100.0%
9	Pay extra amount for proper disposal	218	154	39	411
		53.0%	37.5%	9.5%	100.0%
10	Second hand Products for minimizing e-waste	107	304	0	411
		26.0%	74.0%	0	100.0%
11	PLC into consideration before purchasing	278	112	21	411
		67.6%	27.3%	5.1%	100.0%

This research highlights that the hazards of e-wastes needs appropriate Management and Regulations, and calls for clear policies, regulations, systems and institutions for effective management, monitoring and control as these have been found to be the weakest points in the e-waste management system currently in the state. Although the legislation for e-waste has been passed by the parliament, but its enforcement seems to be questionable. An analysis of the legislation and management system on e-waste in both industrialized and developing countries reveals that priority should be given to ameliorate the existing legislation system on e-waste management in the developing countries before the e-waste problem itself becomes so worst that itwould bevery difficult to control the same. Most of the research on e-waste management in the developing countries and in particular India has focused on the survey of environmental pollution, waste management problem and health hazards. This research also contributes to a new knowledge on the effective management of e-waste in the state of Jammu & Kashmir.

1.8: Suggestions for Policy Implications:

Based on the research conducted and the conclusions made thereof in case of the present study, the various suggestions are given hereunder and it is recommended that these may be incorporated in the formulation of the effective E-waste Management Policy mechanism in the J&K state:

1. Firstly, to make the e- waste Management a success in its true sense, the planning as well as its implementation should start from general public level planning. It should be followed by block level planning, district level planning and state level planning. Each unit should be managed according to the consumption pattern of the electronic products.

2. We need to create a general awareness about the e-wastes and their impact on health and environment in the state. In this regard, the attitude of the people in general has to be changed and a proper strategy to be formulated for this purpose. An effective media publicity pertaining to "Recycling, Reusing & Reducing" would be an important and a crucial part of this strategy. This is also important for bringing change not only at the societal level but our young generation willalsoget sensitized against this menace. This can be done by designing a communication policy in vernacular medium for mass media promotion in the state. It is also important that awareness campaigns, both in the rural and urban areas, should be undertaken with active participation of the self -help groups, NGO's, Academic Institutions etc. as the holistic policy of such nature, be it block level, district level or the state level, can become effective and efficient for the policy implementation in the state

3. In the research study it was found that E-waste is turning out to be a serious issue with huge implications that can create havoc for the future. The current practice for managing e-waste is only through informal services called locally as "*kabaddiwala*s" in the state. This is the most emerging topic nowadays because we use electronic gadgets at a larger pace and with the advent of new technology; we tend to buy more and more electronic goods. As a result of this, the old electronic gadgets remain lying with us without any use whatsoever and we often forget what effect it would have on the environment and/ or

health. The electronic goods are usually thrown out in the open areas. Besides, the components which are present in the electronic gadgets may contain heavy metals and potentially toxic materials like lead, mercury, cadmium and chromium that cause serious damage to the body. These materials mostly cause damage to the peripheral central nervous system. These also get accumulated in kidney/ liver and this could cause some serious carcinogenic diseases. Consequently, the state is obliged to design a formal mechanism for the collection of e-waste across the state where the public at large should also come on their own for the necessary disposal of the e-waste at these centers and be partners in this endeavour.

4. It is important that we do realize that we require a more stringent integrated and strategic e-waste prevention framework to effectively address the wastage-related issues. The government should come up with the e-waste regulations vis-a-viz the need per se and should update each Department about it. It should also keep a check on whether rules are implemented or not and should take corrective steps as and when required, to manage the e-waste so that our health and environment do not suffer. Indeed, it has been seen that as the state neither has a proper system nor a proper method of laws and regulations regarding e-waste management, it has become the most serious obstacle in the e-waste disposal mechanism. It, therefore, follows that both the Municipal Corporations (SMC) of the state & State pollution Control Board (SPCB) should play their proactive roles in this endeavor and should monitor the issues regarding e-waste management. It is incumbent on these bodies, therefore, to design a proper and sound monitoring system which would ensure the effective supervision and the enforcement of the rules and regulations. However, the regional economic differences may pose a problem to formulate a standardized regulation policy for economically backward areas as compared with the more advanced areas but then the policy itself should also include geographical/ income considerations. Moreover, constructing a monitoring system to supervise the enforcement of the regulations could be an effective way to control e-waste. It may be worthwhile to note that by identifying and aligning this function thereof with the administrative function of each department to implement e-waste management laws and regulations, we could achieve a major success in respect of the effective management of e-waste.

5. Integrated management system may improve the implementation of rules and regulation of e-waste management. In this regard, a single principal administrative department would be responsible for e-waste management whereas other departments should only be supportive so that the duplication of administrative functions among different government departments can be avoided. At the block level in the state, effective management of e-waste also needs the collaboration of different administrative departments. Therefore, by developing the state level e-waste management policy specific to the state, it would be quite possible to improve the enforcement of the laws and regulations.

6. It is a well-known fact that recycling, reusing and reducing are important dimensions of e-waste management system wherein the consumers can recycle their old electronics, reduce consumption of e-waste and reuse the older electronic product. For this purpose, however, we need to design a proper management system. Besides, we can improve the existing waste management system by introducing additional e-waste management system which can be operated under an additional department. Furthermore, introduction of a payment system as per nature and classification of the e-waste should be developed in the state. By doing so, the private entrepreneurs could easily enter into the business of e-wastes including PPP model (Public Private Partnership). Besides, they would be encouraged to enter into this sector for value addition or value creation at different level of supply chain in the e-waste management system.

7. Collection Centers at appropriate locations can be formed wherein segregation of e-waste can be done for further recycling, repair or reuse of second-hand products. Mobile Vans, or trucks for carrying e-waste from homes, offices, Banks, universities, colleges etc. to collection center can be operated initially by the government and then at a later stage; this activity can pass on to private players and government will only act as regulating-cum-monitoring agency for the benefit of the state. The transport facility should be specified and subsequently provided for according to the areas where the e-wastes are produced and consumed subsequently.

8. A sizable number of waste management units prevalent at the general public level can be run by self -help groups, youth groups or small entrepreneurs. This will help in making the program a self-supportive and sustainable with initial support of seed capital from the

financial institutions and/or the state. Moreover, it may not be a burden on the state as well. These groups will create not only awareness in the society but will also create new value to the e-waste if the strategy is based on "Recycle, Reuse, or Reduce" mantra.

9. The state government should pass an order pertaining to the strict e-waste guidelines to the institutions (both Private & Public) as also to the general public at large emphasizing therein the penalty to be imposed in case of the violations of guidelines/rules regulations. This can promote in right earnest the adoption of rules and regulations among the general masses as also with different institutions in the state. All the possible means should be used to make every individual aware of these rules along with the penalty which can be imposed in case of misinterpretation or violation of rules and regulations.

10. The Government should introduce "E-waste Audit" along with IT-audit on yearly basis. The 'E-waste Audit' should be based on three pillars of e-waste management i.e. Recycle, Re-use, or Reduce which will also promote green budgeting in the state.

11. In case of the electronic products which can be repaired with the use of new technology or can be upgraded easily (Reuse strategy), the Government should promote "Value Addition Facilitation Centers" in collaboration with the IT companies or technical institutions which can help in repairing or up-gradation of older electronic goods, as otherwise it will go waste and prove as a waste. Indeed,technical training at all levels (General public to state) forms the backbone of a successful e-waste management program.

12. The 'e-waste management 'can also promote employment generation in the state. This potential needs to be tapped as it is the most pressing problem prevailing in the state now-a-days. The youth possess a good deal of knowledge about the electronic goods especially mobile phones but they need the advancement of technical skills for the development of entrepreneurial ventures in the state. This can also prove to be an effective tool of management for sustainable development.

13. The academic and technical institutions in the state should develop and introduce new skill-based technical courses related to the electronic industry. These courses should also be introduced as open electives in the university / college education system which will help our pass-out degree holders to start the much-needed entrepreneurial ventures in the

state. The concept is also promoted by Choice Based Credit System (CBCS) under new curriculum of UGC and the AICTE.

14. It is proposed that an " e-waste management day" be announced in the state so that all the institutes/ departments and the public at large are involved to create mass awareness about this problem as also we could become the first state in the country to celebrate " e-waste management day" based on the concept of the three "R's" i.e. Recycle, Reuse, & Reduce. Moreover, the collection of e-waste for proper disposal on the same day will act as stimuli for changing the attitude of different stakeholders. The objective of e-waste day should inculcate innovative management practices -creating awareness, minimizing e-waste, recycling e-waste, repairing electronic products, reusing electronic products among the general public. It should be a community-based initiative, designed to raise awareness in respect of hazardous nature of electronic waste (e-waste), while offering an easy way for households and schools to dispose of old computers and mobile phones without causing any harm whatsoever to the environment. Indeed, we should make proper utilization of electronic goods and try to save the environment from their harmful effects.

15. The government should promote 'donation' as a value system in the society particularly with respect to the electronic product in social programs. It would be far better if we would donate or sell our product to somebody who can use it, if we feel that it is of no use to us and we do not want to keep it any longer. Besides, we can recycle only those components of the device that cannot be repaired. Electronics companies should be encouraged, if possible to manufacture the various components of the product to prolong the life span of electronic equipment. In fact, the Companies should manufacture sustainable products which have longer life. Any product that becomes obsolete for a particular segment of consumers could be donated and used by another segment of consumers.

16. Electronic companies should take the responsibility for the 'after-life' of their products. Extended Producer Responsibility (EPR), a popular framework across the world for e-waste management wherein the manufacturers of electronic products are responsible for the end-of-life management of their products and this should be followed in true spirit. The electronic products which are no longer viable should be sent to recycling

companies. Companies should initiate the policy of 'take back' or initiate return programs to encourage buyers to resell the products to the same companies they bought it from. In this regard, special guidelines could be issued by the state government to the respective manufacturers of electronic products. It would be much better for us that before we purchase a new gadget at a store, we can ascertain from them if they will buy back our old electronic product as the case is alreadypracticed with inverter batteries in the state.

17. The Companies should refrain from using hazardous materials; they should rather switch to green chemistry to re-invent the ways to make their electronic products and reduce e-waste thereof. If we use cleaner, smarter and state-of-the art methods/procedures to create our electronic products, the ill-effects of e-waste would decrease greatly. Instead of worrying about the problem after the products have been made, we should be creating the products which keeps its aftermath in mind. In certain cases of recycling, there may be products that cannot be recycled completely- PVC layers, for example, stay as such for ages and cannot be recycled. It would be better if the manufacturers use recyclable material so that the e-waste is converted into something that can be used again without harming the planet and its inhabitants. Incidentally, one of the major factors,while treating e-waste could be,to compel manufacturers to use green technology. Besides, government should issue guidelines not only on paper but to the respective companies; moreover, it should also implement the same at least in the government purchases.

18. The government should encourage companies to take Corporate Social Responsibility (CSR) in the e-waste sector in the state. Moreover, government should also promote among the customers to buy only from the companies which support "Extended Producer Responsibility (EPR)", "Recycling, Reuse, Reduce" strategy, and "Corporate Social Responsibility (CSR)",asfundamentaland core values of their organization.

19. The customers should be encouraged to buy environmental- friendly electronics and should look for products labeled as "Energy Star" or certified by "Electronic Product Environmental Assessment Tool (EPEAT)". The government should assist the electronic companies and encourage them to open up additional recycling and service centers in the state. In fact, by spending on them a meager amount, we can save thousands and it is indeed the best solution for making the full use of electronic goods.

20. We need to design communication strategy with the active collaboration of industries where promotion of 'Do'& 'Do not' of the electronic products should be the consideration for purchasing decision of the customer. This will enable the customer to use minimum products which are useful too. This indeed can define the true character of a welfare state.

21. It would be worthwhile that for the purpose of extending the life span of our electronic gadgets, it is better to buy a cover case as it helps to keep the device clean, saves it from damages and avoids overcharging of the battery etc. It would also help the customer to understand the importance of its value as well as the consumption pattern of the electronic goods.

22. Customer knowledge plays a key role and should be based on the number of things that have to be kept in mind. The consumer should always try to make as much use of the electronics that as he already has. It is better to be a need-based person rather than a want-based person. Though the modern rapid advancement of technology has driven many companies all over the world to come up with new products and thus create an excitement in the customers to buy such products but, nevertheless, one should always control his urge to buy the new electronics products.Infact, when a customer decides to buy an electronic device, he should make sure that he buys something that he really needs and the product comes closest to the specifications that heis looking for. Also, it is worthwhile to buy an electronic device that has the capacity of changing with the technology and is upgradable.

23. In terms of collaboration and in the interest of the good customer relationship, many companieswhich includes the big and renowned online companies as well,provide monetary rewards for customers who return their old devices when upgrading to a new one,as for example, giving them a certain amount off on their new product. It would go a long way in mitigating the e-waste production, if this practice is made more universal.

24. E-Waste management should be compulsorily introduced in school curriculum (from 8th standard to 12th standard) in the state, as it will help our young generation to become sensitive at an early age about the negative aspects of e-waste. Besides, e-waste has a

direct influence on the environment and hence it is an integral part of Environment Studies.

25. Even though all the electronic devices are usually accompanied with an InstructionManual which gives instructions as tohow to use the product and also gives easy fix-it-yourself guide, but unfortunately,most of the electronic products do not provide information about how to discard the electronic waste after use. In this regard,Government in consultation with the industries should make it mandatory for all the manufacturers/dealers to introduce e-waste Manualin order to ensure the proper disposal of e-waste.

26. The government needs to create public awareness in maintaining occupational and environmental health. Consumers can also be given more responsibility for e-waste disposal, if resources for proper recycling are made readily available to them.

27. Lastly, all the stakeholders involved in the E-waste Management could learn a lot from how this problem is managed so effectively in Japan, the western countries and other developed nations, who consider it as their top priority and adopt a highly advancedtechnology and various other means and methods in E-waste Management Strategy of-"Reduce, Reuse & Recycle".

1.9: Limitation of the Study:

The research project was conducted in only Kashmir region of the J&K state and hence the sample was fairly small as the project was sponsored under the minor research project scheme by the IUST. The study was exploratory-cum -conclusive in nature and that is the reason as to why the research was confined to the basic variable of customer perception related to e-waste management. However, there is enough scope for the future research which can be done on the basis of descriptive and experimental design. Moreover, customer behavior was not studied under individual category products of e-waste,which,in fact, is a broad area for the future research with regard to the value creation out of e-waste. Though the research study was conducted on 'systems model' but many dimensions of supply chain management were not included due to the paucity of financial resources and time. Nevertheless, future research can be under- taken whilst considering the different dimensions of supply chain management of e-waste.

1.10: Reference:

Afroz, R. Muhammad MehediMasud, Rulia Akhtar, &JaritaBtDuasa(2013), "Survey and analysis of public knowledge, awareness and willingness to pay in Kuala Lumpur, Malaysia: A Case study on household WEEE management", Journal of Cleaner Production, 52: 185–193.

Agamuthu, P. & Victor, D. (2011), 'Policy trends of extended producer responsibility in Malaysia', Waste Management & Research, 29(9), pp. 945–953. doi: 10.1177/0734242X11413332.

Agarwal R.(1998) India: the world's final dump yard!, January, Basel action news, vol. 1 at www.ban.org .

Agarwal, R (2012), "e-waste law: New Paradigm or business as usual", Economic & Political Weekly, vol 47 (25), 23, June.

Alam Z., (2016) "The Assessment of the e-waste Management Generated from Cellular Phones Laptops & Personal Computers in the Philippines", Manila Journal of Science 9: 27-42.

Anonymous, (2016) , "E-Waste Recycling Plant in J&K –Manufacturers & Suppliers", J&K State.

Anonymous, (2016), "J&K Pollution Control Board Ministry of Environment & Forest", J&K State.

Anonymous, (2016),"Report by J & K Environment Centre, Department of Ecology Environment Remote Sensing", J&K State

Anonymous, (2019), "Davos Conference on e-Waste Management in Nigeria", World Economic Forum, Davos.

Awasthi, A. K., Wang, M., Wang, Z., Awasthi, M. K., & Li, J. (2018), 'E-waste management in India: A mini-review', Waste *Management & Research*, *36*(5), 408–414. https://doi.org/10.1177/0734242X18767038.

Bhattacharya, S.(2018), "The Afterlife of Things in Delhi Junkyard", Economic & Political Weekly, vol.53(46), 24.Nov.

Blade C.P, Wang F .Kuehr, &Huisman J (2015), "The Global e-waste Monitor 2014",United Nations University , IAS-SCYCLE, Bonn, Germany.

Blade C.P., Fortis, V., Gray V., Kuehr, R., &Stegmann, P. (2017), " The Global e-Waste Moniter-2017", United Nations University, Bonn, ITU, ISWA.

Chan JK, Xing GH, Xu Y, Liang Y, Chen LX, Wu SC, Wong CK, Leung CK, &Wong MH.(2007), "Body loadings and health risk assessment of polychlorinated dibenzop-dioxins and dibenzofurans at an intensive electronic waste recycling site in China. Environ Science Technology,. 41(22): p. 7668-74.

Herat, S. & Agamuthu, P. (2012) 'E-waste: a problem or an opportunity? Review of issues, challenges and solutions in Asian countries', Waste *Management & Research*, 30(11), pp. 1113–1129. doi: 10.1177/0734242X12453378.

Herat, S. & Agamuthu, P. (2015), 'Hidden dilemma in household e-waste management', Waste Management & Research, Vol. 33(6) 497 –498

Hotta Y, Kojima S, (2012), "Policy Framework for International Collaboration towards Sustainable Resource Circulation and Management in Asia", in IGES(ed), IGES White Paper IV-2012 Greening Governance in Asia-Pacific , Haryana : IGES, Japan, pp157-186.

Kaur, H. & Goel, S. (2016), 'E-waste Legislations in India— A Critical Review', Management and Labour Studies, 41(1), pp. 63–69. doi: 10.1177/0258042X16649466.

Kiddee P, Naidu R & Wong MH (2013), "Electronic waste management approaches: An overview", Waste Management 33: 1237–1250.

Lakshmi Raghupathy , MAIT-GTZ Mrs Christine Krüger, Adelphi, Ashish Chaturvedi, GTZ-ASEM, Rachna Arora, GTZ-ASEM, Mikael P. &Henzler, adelphil, (2015), "E-waste recycling in India – bridging the gap between the informal and formal sector, www:iswa.org.

Leung, A O. W., Nurdans.,Duzgoren-aydin, K.C. Cheung, & Ming H. Wong , (2008), "Heavy metals concentrations of surface dust from e-waste recycling and its human health implications in southeast China", Environment Science Technology,. 42(7): p. 2674-80.

Leung, A.O., Zeheng J., Chik Kim Yu, Wing Keung Lie, Chris K.C Wong, ZongweiCai, Ming H. Wong, (2011), "Polybrominateddiphenyl ethers and polychlorinated dibenzo-

p-dioxins and dibenzofurans in surface dust at an e-waste processing site in Southeast China", Environment Science Technology. 45(13): p. 5775-82.

Liang, L., & Sharp, A. (2016). Determination of the knowledge of e-waste disposal impacts on the environment among different gender and age groups in China, Laos, and Thailand. Waste Management & Research, 34(4), 388–395. https://doi.org/10.1177/0734242X16628978

Liu, X., Tanaka, M. & Matsui, Y. (2006), 'Electrical and electronic waste management in China: progress and the barriers to overcome', *Waste Management & Research*, 24(1), pp. 92–101. doi: 10.1177/0734242X06062499.

Lundergren K (2012), "The global impact of e-waste Addressing the challenge", International labour organization (ILO) publication , Geneva.

Ongondo F. O, Williams I. D, &Cherrett T.J., (2011), "How are WEEE doing? A global review of the management of electrical and electronic wastes", Waste Management; 31:714-30 .

Osibanjo, O. &Nnorom, I. C. (2007) 'The challenge of electronic waste (e-waste) management in developing countries', *Waste Management & Research*, 25(6), pp. 489–501. doi: 10.1177/0734242X07082028.

Ramesh, B., Kuber, A. & Ahmed, C. (2007) 'Electrical and electronic waste: a global environmental problem', *Waste Management & Research*, 25(4), pp. 307–318. doi: 10.1177/0734242X07076941.

Sreedhar, Nitin, (2019), "A second Life for Digital Debris", The Mint, 30th March.

Turaga, U.T. & Mark Borsuk (2008), "Designing environmental risk indicators to motivate sustainable behavior" , Annual Meeting of the Society for Risk Analysis, Boston, MA, 7-10 Dec , Waste Management 2010; 30(12): 2592-60

Venugopal, P., Halog, A. &Dubey, B. K. (2016) 'Editorial Special Issue on E-waste Management: E-waste: An Urgent Need to Act', Management and Labour Studies, 41(1), pp. vii–ix..

Widmer, Rolf, Oswald-Krapf, Heidi, Sinha-Khetriwal, Deepali, Schnellmann, Max, & Boeni, Heinz (2005), "Global perspectives on e-waste", Environmental Impact Assessment Review 25: 436–458.

Wikstrom, E. &Marklund, S. (2001), "The influence of level and chlorine source on the formation of mono- to octa-chlorinated dibenzo-p-dioxins, di-benzofurans and coplanar polychlorinated biphenyls during combustion of an artificial municipal waste. (cited in Kevin et al., 2008) Chemosphere 43(2): 227-234.

Wong, C. S., Wu, S. C., Duzgoren-Aydin, N. S., Aydin, A., & Wong, M. H. (2006), "Sources and trends of environmental mercury emissions in Asia", Science of the Total Environment, 368: p. 649-662.

Wong, C. S., Wu, S. C., Duzgoren-Aydin, N. S., Aydin, A., & Wong, M. H. (2007a). Trace metal contamination of sediments in an e-waste processing village in China. *Environmental Pollution, 145*, 434–442.

Wong, C. S., Duzgoren-Aydin, N. S., Aydin, A., & Wong, M. H. (2007b). Evidence of excessive releases of metals from primitive e-waste processing in Guiyu, China. *Environmental Pollution, 148*, 62–72.

Notes