

A Case Study of Reducing Waste Electrical and Electronic Equipment Specific Focus on Rewa and Satna

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Abstract- The dramatic development in electronic waste (e-squander) including end-of-life electrical and electronic gear has arisen as a significant ecological concern. E-waste reusing, which includes an efficient assortment of e-waste and its treatment for reusing helpful materials, offers a significant apparatus to limit the raising pile of e-waste, supplement the lack of a few essential assets, and back the economy. A comprehensive methodology incorporating gotten to the next level item plan and reusing rate and insignificant emanation of dangerous e-waste toxins to the climate is required. In this research, we talk about the valuable open doors and requirements, and procedures for further developed e-waste on the board. Further, we feature the new worldwide pattern in the e-waste age and give an outline of the e-waste reusing process and the effect of e-waste toxins on human wellbeing. A couple of techniques that can be carried out to make e-waste reusing an effective and more secure interaction have been examined in Rewa and Satna city. For the data collection, the cycle interview strategy was coordinated. For the underlying three characterizations, 10 respondents were picked and observed results and concerns thought between people about e-waste management system and thoughts were gotten from these classes and taken conversed with from few mechanics and scrap merchants.

KEYWORDS: E-Waste, E-waste Management, Recycles, Sustainable e-waste management, WEEE,

1. INTRODUCTION

Fast progressions in science and innovation changed the fields of data and correspondence in the late 20th century, setting off emotional changes in the modern and financial landscape, those have gone on into the mid-21st century. Thusly, new Information Communication and Technology (ICT) items and other e-items are persistently being presented into the market, and more seasoned items quickly become out of date. The volume of e-waste is developing quickly. A new United Nations College (UNU) report assessed that 46.4 MT of e-waste is produced around the world consistently. The UNEP has anticipated that by 2021 — the amount of disposed of

PCs will increment multiple times over current levels, and that of disposed of cell phones, multiple times over the year 2007 levels, in India. Electrical and Electronic Equipment (EEE) put available in the area expanded by 10% — from 2.9 Mt in 2010 to 3.2 Mt in 2019. The ISRI has announced that, India produces roughly 2.7 million tons of e-waste yearly, and that 70% of the complete e-waste comes from 10 Indian states [7]. What's more, while the worldwide build yearly development rate (CAGR) of e-waste is expected to be 24.5% over these thirteen years, the rates for India for the time of 2015-2019 [8].

MOTIVATION OF THIS THESIS

The casual reusing of WEEE in India seriously affects the common territory and the well-being of unprotected employees in the waste administration area, as well as in regions promptly encompassing the e-waste handling area. Obviously, there is a basic requirement for manageable e-waste reusing. Indian administrations have given and authorized regulations also, guidelines forbidding the unlawful importation and casual reusing of WEEEs, and laid out assortment, taking care of, and treatment frameworks for naturally sound reusing. Few investigations on e-waste assessment, forecast, and the board have been completed in a couple of years; there have been relatively restricted examinations on WEEE in India. Along these lines, in this exploration, we primer assessed the administration of waste electronic and electrical equipment (WEEE) in India. For this hypothesis. It is to sort out how it starts, accumulated, and chose electronic waste to reuse and reuse in Rewa and Satna city, this proposition breaks down the influential factors, which incite how electronic waste changes are an electronic device to be reused.

EFFECTS OF E-WASTE ON ENVIRONMENT:

The harmful parts contained in waste management count on upon the kind of EEE. Also, the emanation of harmful parts and their subsidiaries into climate is reliant of the technique utilized for handling and reusing. Different metals and natural mixtures are added to the EEE in follow amounts for different purposes, for example, to

grant mechanical backing and strength, upgrade electrical and warm conductance, protection from fire and enduring circumstances, and other added benefits. Being implanted in EEE, these parts force negligible unfriendly impacts on human wellbeing when the EEE is unblemished. Nonetheless, upon outflow into the climate through reusing exercises, for example, destroying, size decrease, and consuming or warming these get delivered into the climate.

E-WASTE TOXICITY TO HUMAN BEINGS:

E-waste reusing without proper measures to restrict environmental contamination can change it up of natural and inorganic poisons like weighty metals, polycyclic fragrant hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), brominated fire retardants (BFRs), perfluoroalkyl and polyfluoroalkyl substances (PFASs), polychlorinated dibenzo-p-dioxins (PCDDs) into the environment which can unfavorably influence human wellbeing. This section talks about openness to e-waste poisons and the components of their poisonousness. Epidemiological discoveries featuring wellbeing results in e-waste laborers and populace occupying close by areas to destinations of e-waste reusing (generally in the casual environments) are likewise given.

Table 1. Different Electrical and Electronic devices and produced waste

Sr.No.	Electrical and electronic devices	Produced waste
1	Computer	Circuit board (fiberglass, metals, and precious metals), plastic housing, small plastic components, screws, lead, clips, and small metal parts (ferrous and non-ferrous groups)
2	Mobile phones	Cadmium (Cd), arsenic, lead (Pb), palladium (Pd)
3	Television	Lead, mercury, circuit board, plastic, small metal parts, glass
4	Electric bulb	Highly concentrated lead and phosphorus, outline glass, low-pressure inert gas, tungsten filament, contact wires, insulation, and small metal parts
5	Electric motor	Metal parts (ferrous and non-ferrous), different wires, copper coil, lead, mercury, plastic
6	Laptop	Plastics, small metal parts, mercury, lead, circuit board, nickel, lithium, cadmium
7	Optical fibers	Fluorine (F), zirconium (Zr), yttrium (Y), lead (Pb), copper (Cu)
8	Rechargeable batteries	Nickel (Ni), cadmium (Cd), lithium (Li)
9	LCD screens	Lead (Pb), mercury (Hg)
10	Keyboard	Plastic, circuit board, small metal parts
11	Computer mouse	Circuit board, small metal parts, plastic

MAJOR CHALLENGES IN EFFECTIVE MANAGEMENT OF E-WASTE:

Electronic parts, for example, printed circuit sheets, realistic and memory cards, hard drives, and links and connector which are normally utilized in contraptions like PCs and cell phones have been the favored hotspots

for extraction of valuable and uncommon earth metals. In any case, of waste isn't just a wellspring of important materials, yet in addition of an assortment of harmful synthetics transmitted during its handling and reusing. For example, unsafe substances present in waste material (Pb, Hg, As, Cd, PCBs; essential discharge), or those delivered as side-effects during handling and reusing (dioxins and furans, PAHs; auxiliary outflow) are of incredible worry for climate as well as human wellbeing. A comprehensive methodology that incorporates assortment of all classifications of e-waste upon end of valuable life and reuse them altogether, so no materials get wasted, is expected for reasonable e-waste the board [9].

HEALTH CONSEQUENCES OF E-WASTE EXPOSURE

The well-being effect of e-waste openness on people has been mostly surveyed through assessing openness and impact biomarkers, and analysis of grimness design among uncovered and control populaces. A thorough record of the well-being complications of directness to different poisons related to e-waste reusing has been given by in a precise survey. Through evaluating levels of e-waste poisons and their subordinators in serum, blood, line blood, placenta, meconium, and so forth, it has been recommended that openness to e-waste poisons might influence thyroid capacity (as obvious by adjusted degrees of serum thyroid animating chemical, tri-iodothyronine furthermore, tetra-iodothyronine in the uncovered gathering (Grant et al., 2013).

Table 2. E-waste contents, its effect and sources

WASTE ELEMENT	EFFECT ON HUMAN BEING	SOURCES OF E - WASTE
Hexavalent chromium	Damage to DNA	Untreated steel plant
Barium	Brain swelling, muscle weakness, damage to heart, liver and spleen	Used in computer in front panel of a CRT
Lead	Central and peripheral nervous system, Blood system, Kidney and reproduction system	Glass panel, Gasket in computer monitors, solder in PCB and other component
Mercury	Brain, Kidney, Focus	Electrical and electronic equipment thermostats, sensors, switches, medical equipment, relays, lamps, mobile phone, flat panel display, batteries
Beryllium	Lung cancer, skin diseases	Motherboard, finger clips
Toners	Respiratory tract irritation	Plastic printer cartridge
Cadmium	Kidney	SMD chip registers, infra red detectors and semiconductor chips

Source: (Agrawal, A 2016).

E-WASTE RECYCLING METHODS

In the cutting-edge period of fast innovative advances, a lot of e-waste has been amassed from the expanded

creation of EEE that go to e-waste upon the finish of its valuable life. Powerful procedures are required both at the creation stage and after use for earth sound administration of the e-waste. Reusing is a significant device to control the rising stacks of e-waste; nonetheless, sub-par practices of reusing are adding to the increment in the degrees of poisonous contaminations in the environment. The ongoing worldwide pattern in waste the executives (casual handling of 82.6 % of worldwide e-waste in 2019) have become unsustainable and require a complex methodology for an all-encompassing arrangement. A better comprehension of the e-squander assortment and the reusing process is an important interface toward this path. This segment talks about in a word the proper techniques for e-waste assortment and formal recycling process for collection of significant metals from e-waste.

Table 3. E-waste contents, its effect and sources

Rank	Country and rank in e-waste generation	EEE placed on the market (Kg/capita)	E-waste generation (kg/capita)	E-waste collection rate (percent)
1	China	15.3	9.2	18
2	Germany	20.2	22.4	51
3	Japan	23.3	24.4	24
4	India	5.8	2.4	12
5	USA	25.3	21	15

Source: CSE 2020.

Measure of WEEE and the wide assortment of materials they frequently contain (numerous possibly harmful to the two people and the climate) has zeroed in on how WEEE is dealt with and can be forestalled. The conceivable unfavorable wellbeing and natural outcomes of inappropriate treatment and activity of WEEE (e.g., in China, India, USA, and so forth) has further touchy conversation corresponding to the administration of WEEE. [10]

Table 4. Opportunities and Limitations of E-Waste Framework

Sl. No	Opportunities and benefits	Constraints
1	Rich wellspring of up to 60 significant and valuable metals including Au, Ag, Cu, Al and Fe	High volume and intricacy of e squander: e-garbage removal with the family squander contaminates the climate through filtering of e-squander poisons into soil and water, or emanation in air upon burning
2	Make unexpected tasks to help economy	Absence of ecological mindfulness and information on family e waste assortment
3	Gives ecologically sound the board of waste	Complex plan and smaller assembling of EEE
	Prevent environmental pollution by keeping the hazardous e-waste	Forestall ecological contamination by keeping the risky e-waste
5	Lessens gathering of e-waste by advancing assortment, reuse, and reuse	Inadequate execution of established guidelines and administrative system on e-waste the board

Source: (Kumar et al., 2017; Wang et al., 2017).

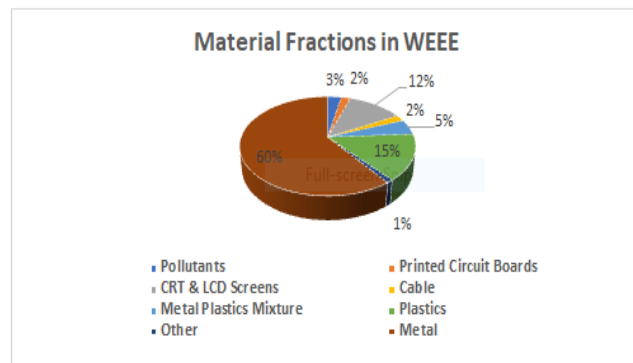


Figure 1: Material Fraction in WEEE

2. LITERATURE REVIEW

Zhang et al.2012: In this literature review author presents an audit of soil pollution coming about because of e-squander reusing exercises, with an extraordinary spotlight on China, where numerous pieces of information have been gathered for 10 years. Soils in the e-waste regions are in many cases debased by weighty metals and natural mixtures, fundamentally polycyclic sweet-smelling hydrocarbons (PAHs), polybrominated diphenyl ethers (PBDEs), polychlorinated and polybrominated biphenyls (PCBs and PBBs), dechlorane in addition to (DP), hexabromocyclododecanes (HBCDs), polychlorinated and polybrominated dibenzop-dioxins (PCDDs and PBDDs), and polychlorinated and polybrominated dibenzofurans (PCDFs and PBDFs), This audit features the dire requirements for 1) portrayal of contamination status in every one of the nations where e-waste are reused, 2) research on destiny and poisonousness of toxin combinations, and 3) advancement of consolidated procedures and techniques to remediate farming fields and problem areas of pollution.

Shashi and Sunil (2020). In this research author is portrayed the essential intercessions adjusting existing guidelines which are critical for a reasonable E-waste esteem chain, got assets, cultural prosperity, diminished natural effects and in general supportable turn of events. Besides, the purpose has made critical strides and drafted rules and regulations every once in a while, still an enormous piece of the populace in India knows nothing about the term E-waste and its administration.

Agarwal Vernika et al. (2020): In this paper, the writer has described that is vital to screen the advancement as well as the disappointments to guarantee all-around informed choices are carried out for e-squander the executives. Even though, there exist numerous stages exist to manage the e-waste issues, however, the idea of Artificial Intelligence can support quicker and more powerful e-waste executives. The idea of Artificial Intelligence is generally a more up to date idea which

CITY WISE E-WASTE IN INDIA

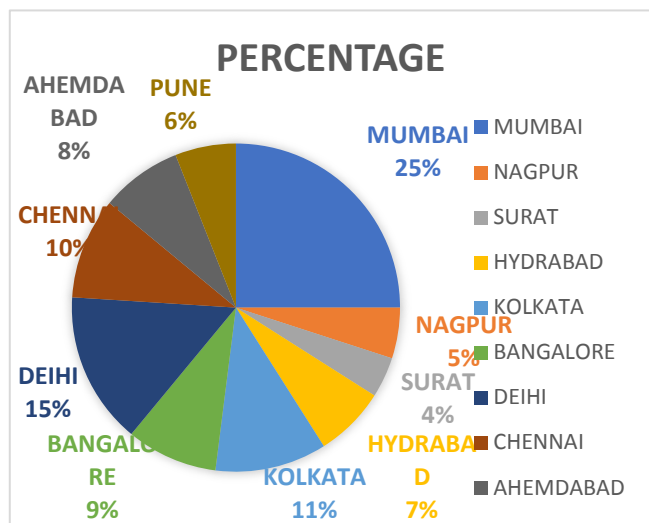


Figure 4: Percentage of City Wise E-Waste in India

3. RESEARCH METHODOLOGY

The standard of an examination is to evaluate how much electronic waste is produced in Rewa with the cooperation of the connected nearby piece merchants. Electrical and electronic waste is similarly an assorted expansion to the rising hazardous waste stream. Electrical and electronic waste is the deficiency of electrical and electronic hardware, which is respectably a flow expansion of destructive waste, is unite fast attention all through the world as the volume made is expanding rapidly. All electrical and electronic gear (EEE), toward the finish of its valuable life, adds to the flow of electronic waste. Yet, the current valuation of measure of EE, waste created in Rewa is a test to communicate a record of e-waste in the city regarding restricted and precluded piece retailers. Various techniques for the evaluation of waste have been determined. It has been seen that the real and predictable insights on electrical and electronic waste, the commodity of general and business data of e-waste at present isn't accessible in Rewa city. Scarcely any investigations need to expect to recognize the commitment of various nearby piece wholesalers of e-waste in the city. The review was led by the field visit and the assortment of rudimentary information in a few issues of the city and upheld by examination and auxiliary information. The device utilized for the study was open-finished questions, unapproved and casual inquiries, and conversations.

SURVEYING TECHNIQUE

To know the layout of the advancement and unloading of electrical and electronic waste, a study should be expected to done in "Rewa and Satna city" province of

Madhya Pradesh. The review procedure was acted in two stages given below.

1. Collection of secondary data
2. Primary data collection & analysis

SAMPLE SIZE ACCORDING TO CHANGED MARKET LOCATION

- PC and fringe display area owner/retailer.
- Electronic and Electrical item display area proprietor/retailer.
- Some piece seller/merchant of e-waste was additionally evaluated and discoveries are acquired
- Portable and embellishments display area proprietor/retailer.

For the investigation we recognized a sample size of 10 suppliers from following commercial group according to firm size, owner of showroom, marketplace like venders, retailer etc.

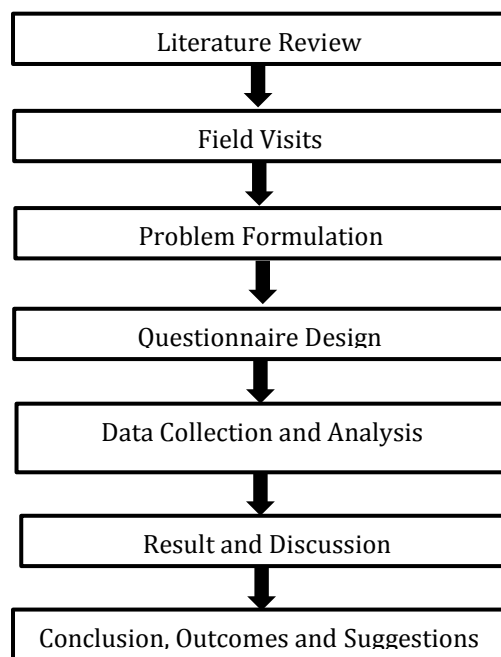


Figure 5: Research Methodology Flow Chart

SECONDARY DATA:

In this stage, we recognize the importance connected with electrical and electronic correspondence items in Jabalpur city and assess by the estimation with rate utilized domestic device, which is the primary component to the age of electronic waste. The level of the family that has these articles in Rewa is displayed below.

Table 5: Percentage of Household Possessing Different Products

District	Total Household	Total Percentage of Household having		
		Television	Computer/Laptop	Mobile phone
Rewa	8,15,029	60.2	18.4	46.7

Source: Census of India 2011

PRIMARY DATA:

The essential information was created by getting sorted out an overview, and likewise, demonstrate what is going on of e-waste in Rewa city. In the wake of obtaining the outcome from beneficiary examinations was finished. The review procedure begins through enthusiasm for various display area proprietors/retailers having a few items information. These all are arranged into three classes and out of every classification have eight display area proprietors/retailers were chosen and directed a meeting. The classes are given below as follows.

- Computer & Peripheral Seller
- Electrical & Electronic Goods Seller
- Mobile & Accessories Seller
- Scrap Dealer/ Vendor of E-Waste

DATA COLLECTION, ANALYSIS AND RESULTS:

The review conduct fundamentally has three focuses to be distinguished which are

- Responsiveness about electrical and electronic waste and its association among merchants.
- Usage of item gotten under replaced from purchaser.
- Idea/proposal about waste the board.
- The result from scrap providers or retailers.

Further a few unexpected results were gathered which are:

- Recycler of E-waste in Rewa and Satna.
- Results of survey conducted in an IT firm regarding e-waste management

Result showing models of e-waste management for Rewa and Satna city.

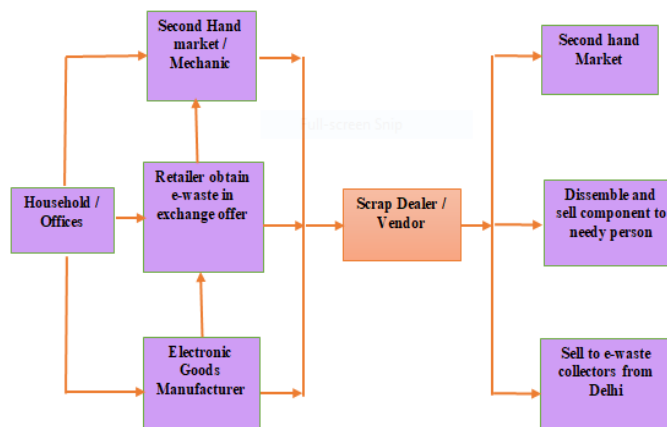


Figure 6: Current scenario of Flow of E-waste in Rewa and Satna City

In this model correction was made by introduction door to door collection of e-waste by government sanctioned activity and recycling of e-waste in government approved reutilizing Centre. In this approach household and retailer are forced to give the e-waste generated or collected by them to government authorized activities. This activity will recycle the e-waste in environment friendly manner. The scrap dealer is also following the same process as a retailer and the responsibility of government should also offer business support to scrap dealer for their survival.

ANALYSIS OF DATA:

The information worried about responsiveness from the various retailers interrogating in regards to risky impact concerning electrical and electronic waste and its association. As indicated by his responses we sorted three gathering retailers as having profound information, shallow information, and no information.

Table 6. Understanding & Knowledge among Businesses on e-waste management

Level of knowledge about-waste	Number of Computer & Peripheral	Number of Mobile & accessories Seller	Number of Electrical Electronic
Profound Information	3	2	2
Shallow Information	5	6	7
No Information	2	2	1

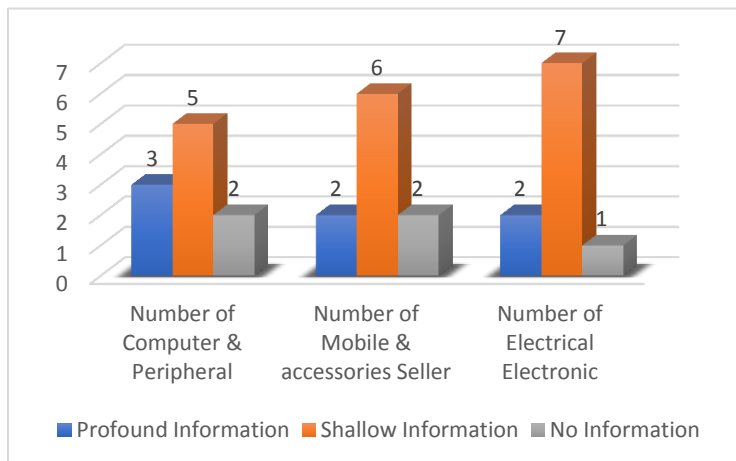


Figure 7: Knowledge Level of Different Seller about E-Waste

COMPUTER AND PERIPHERAL SELLERS:

The revelation got from the PC dealer and peripherals is summed up in the table and the outcome is introduced in the chart.

Table 7: Computer & peripheral showroom owner/retailer using different methods to manage e-waste

S No.	Code of showroom owner/retailer →	1	2	3	4	5	6	7	8	9	10
1	Offer to recycled Market/Technician	R	W	R	W	W	W	W	W	W	W
2	Offer to scrap Seller/Merchant	W	W	W	R	W	R	R	R	R	R
3	Whether exchange office accessible	W	W	W	R	W	W	R	W	W	W
4	Organization supports for reusing	R	W	R	R	W	R	R	R	R	R

R-Right, W -Wrong

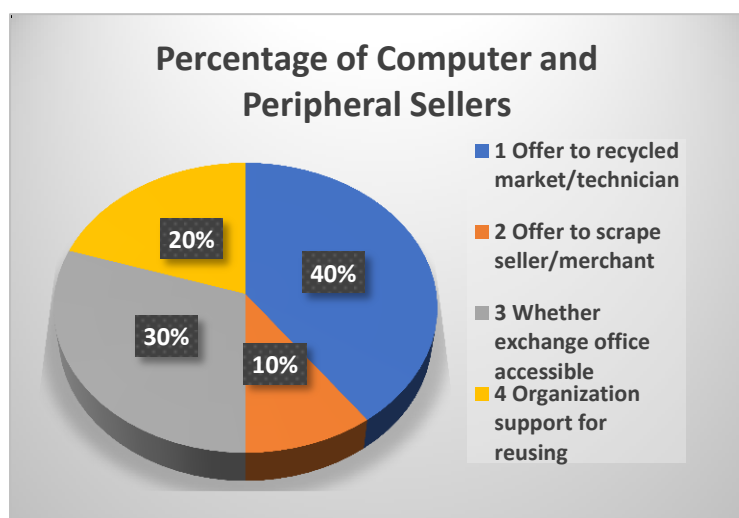


Figure 9: Percentage of Computer & Peripheral Sellers

ELECTRICAL & ELECTRONIC GOODS SELLER

The finding obtained from Electrical and Electronics supplier is summarized in table and result is shown in graph.

Table 8: Electrical and Electronics seller

S No.	Code of showroom owner/retailer →	1	2	3	4	5	6	7	8	9	10
1	Offer to recycled Market/Technician	R	W	R	W	W	W	W	W	W	W
2	Offer to scrap Seller/Merchant	W	W	W	R	W	R	R	R	R	R
3	Whether exchange office accessible	W	W	W	R	W	W	R	W	W	W
4	Organization supports for reusing	R	W	R	R	W	R	R	R	R	R

R-Right, W - Wrong

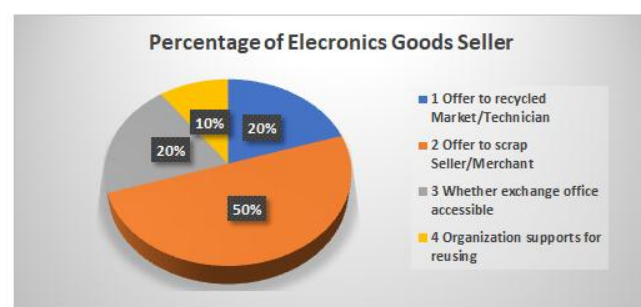


Figure 9: Percentage of Electronic Goods Seller

CELL PHONE & ACCESSORIES RETAILER

The end accomplished from Cell telephone and extras retailer is explained in table and result is displayed in diagram.

Table 9: Mobile & Accessories Seller

S No.	Code of showroom owner/retailer →	1	2	3	4	5	6	7	8	9	10
1	Offer to recycled market/technician	W	W	W	W	W	W	W	W	W	W
2	Offer to scrap seller/merchant	R	R	R	R	R	R	R	R	W	R
3	Whether exchange office accessible	W	R	R	R	R	W	R	R	R	R
4	Organization support for reusing	R	W	W	W	W	R	W	W	W	W

R-Right, W - Wrong

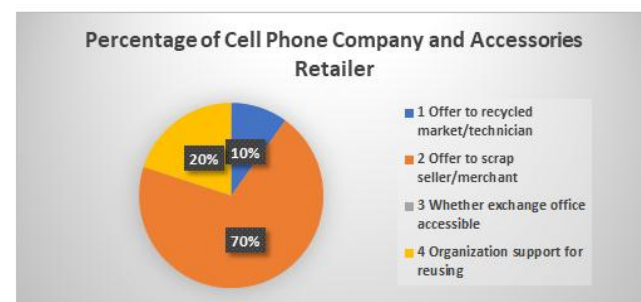


Figure 10: Percentage of Cell Phone Company and Accessories Retailer

RESULT ON THE BASIS OF SUGGESTION GIVEN BY DIFFERENT PRODUCT RETAILERS:

All through this study, different item retailers convey remarkable explanations and ideas laid out on their experience of e-squander. In light of the thoughts table containing not at all like proposals is planned as displayed beneath. As displayed given below.

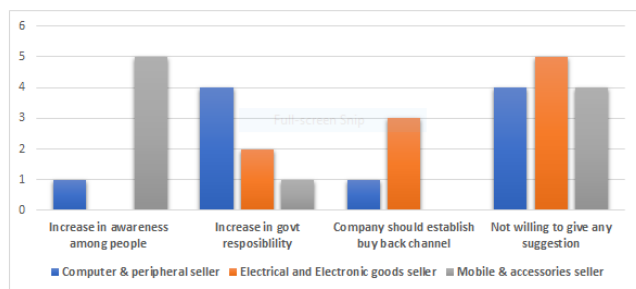


Figure 11: Rate Wise Conveyance of Vender as Indicated by Their Idea

4.CONCLUSION

The quick development and quicker change in modules of electrical and electronic gear are a significant issue that upgrades the measure of e-waste age. The risky idea of e-waste is one of the quickly developing climate issues of the world. The mass population of Rewa city spends their cash on buying various sorts of electrical and electronic things to keep up with their superficial point of interest. The essential information gathers from interviews with different monetary classes of families, and different classifications of business elements and foundations propose that the age of e-waste in Rewa city is going to expand step by step. The vast majority of the e-waste produced from business elements and organizations usually trade the waste creating things from the approved organizations which accept the things as such under repurchase conspire. Our analysis shows that the absence of familiarity with natural authority is the best limitation in the collection of waste followed by the absence of assortment framework, occupants' conduct, and cost. The most un-influencing component to the e-waste assortment is the distance among age and reusing units. The appropriate investigation further emphasizes that the amount also, kind of e-waste is a higher priority than the distance between their organization and the assortment point. The case concentrates on an organization that gets just 10% of e-waste as analyzed with their reusing limit. Moreover, the results show that data security is a crucial driver for enhancing e-waste collection. It also plays a critical role in building trust between e-waste collectors and waste holders. The case study validates it since they have regular customers of e-waste which are concerned about data security. The case study further reveals that the e-

waste units do not have adequate infrastructure facility for recycling, which in fact is the second driver of e-waste collection. The limitation of the research work is that the numbers of recyclers, gatherers, what's more, and dismantlers aren't uniform to draw powerful outcomes. Moreover, the review shows that landfill is the as they were chosen for scrap removal. The casual area rehearses outside burning. The further review should likewise be possible to decide how much e-squander is created, gathered, and reused, thinking about variety in the item lifetime and innovation, as anticipated in Quantifying the progressions of waste could help to work on the recuperation of auxiliary unrefined components.

5. OUTCOME AND SUGGESTIONS

In addition, the outcomes show that information security is an urgent driver for improving e-waste assortment. It additionally assumes a basic part in building trust between e-waste authorities and waste holders. The contextual investigation approves it since they have normal clients of e-waste who are worried about information security. The contextual investigation further uncovers that the e-waste units don't have sufficient foundation offices for reusing, which truth be told is the second driver of e-waste assortment. Moreover, the research work shows that a landfill is an option for scrap disposal. It is seen that the vast majority of the populace here doesn't know about e-waste and its unsafe effect on human well-being and climate. For example, the e-waste ought not to be found on our premises and we are not legitimately bothered about its disposal and it's the effect on the nearby open. The record of e waste age should be kept up with by the Municipal Corporation of the city and awareness-raising projects and exercises on issues connected with the ecologically strong administration (ESM), wellbeing and security parts of e-waste to support better administration practices ought to be executed for various objective gatherings and on mass premises.

The Indian government ought to in this manner take the drive to channelize e-waste to formal recyclers, as 95% of e-squander goes to the casual area. It will help recyclers to get an adequate amount of e-waste, which is basic to the reusing organization.

REFERENCES

1. S. L. Adigun. (2012) 'Humanitarian challenges and opportunities', IEEE Global humanitarian technology Conference, pp. 66-70.
2. D.S. Khatriwal, P. Kraeuchi, M. Schwinger. (2005) 'A comparison of electronic waste recycling in Switzerland and in India', Environmental Impact Assessment Review, Elsevier- Science Direct 25, pp. 492-504.

3. E-waste statistics - Guidelines on classification, reporting and indicators. (2015) 'United Nations University, IAS - SCYCLE, Bonn (Germany)', 51 pages (ISBN Print: 978-92-808-4553-2) (with C.P. Balde).
4. R. Widmer, H. Oswald-Krapf, D., Sinha-Khetriwal, M. Schnellmann and H. Böni. H. (2005) 'Global perspectives on e-waste,' Environmental Impact Assessment Review', vol. 25, pp. 436-458.
5. Wang Y Luo C, Li, J., H., Li, X., & Zhang, G. (2011) 'Characterization of PBDES in Soils and vegetation n site near an e-waste recycling site in China', Environmental Pollution, 159(10), 2443-2448.
6. UNEP. Sustainable Innovation and Technology Transfer Industrial Sector Studies Recycling from E-waste to Resources; 2009.(<https://unu.edu/media-relations/releases/un-publishes-first-regional-e-waste-report-for-commonwealth-of-independent-states-and-georgia.html>).
7. ISRI 2015. E-SCRAP BEAT, Your Source for ESCRAP Recycling news, updates & trends, Institute of Scrap Recycling Industries, Inc., (<http://www.isri.org/docs/default-source/electronics-recycling-newsletter/escrapbeat---winter-2015.pdf>).
8. Nandi J. Electronic companies and pollution boards flout e-waste rules: Report.1 July2014. <http://timesofindia.indiatimes.com/home/environment/pollution/ Electronic companies-and-pollution-boards-flout-e-waste-Report/articleshow/37584922.cms; 2014>.
9. Orlins, Sabrina; Guan, Dabo (2016). 'China's toxic informal e-waste recycling: local approaches to a global environmental problem',
10. Journal of Cleaner Production, Vol.114, p. 71-80.
11. Ongondo, F.O, Williams, I.D, Cherrett. T.J, Kidlington: Elsevier Ltd. (2011) 'Waste management (Elmsford)', Vol.31 (4), p.714-730.
12. Kai Zhang,, Jerald L., Schnoor Eddy Y. Zeng. (2012) 'E-Waste Recycling: Where Does It Go from Here?', American Chemical Society (ACS) 46, 10861-10867.
13. D de Oliveira,, José Francisco de Oliveira Neto. Maisa Mendonça Silva. (2020) 'E-Waste Mistakenly Disposed of as Recyclable Waste' A case study from Brazil.
14. Wang. Z. Zhang, B. Yin, J. Zhang, X. (2011) 'Willingness and behavior towards e-waste recycling for residents in Beijing city, China', Journal of Cleaner Production19 (9-10), 977-984.
15. Hua Zhong, (2014), 'Design for E-waste Recycling Deposit System and Expense Mechanism in China', Intech Europe.
16. Jian, Li. Shanshan, Z. (2010) 'Study e-waste management based on EPR System', International Conference on E-Business and E-Government.
17. Wang, Wenhua,Tian, Yihui,. Zhu, Qinghua,Zhong, Yongguang(2017). 'Barriers for household e-waste collection in China: Perspectives from formal collecting enterprises in Liaoning Province', Journal of cleaner production, 153(), 299-308.
18. Ackah. M. (2017) 'Informal E-waste recycling in developing countries: review of metal (loid)s pollution, environmental impacts and transport pathways' Environmental science and pollution research', 24(31),24092-24101.
19. Kumar. S. Singh, R. Singh, D. (2013) 'Electronics-waste Management' International Journal of Environmental Engineering and Management ISSN 2231-1319', Volume 4, Number 4, pp. 389-396.
20. Ghanshyam Singh, S, Biswas, A. (2020) 'E-waste Management in India: Challenges and Agenda, Centre for Science and Environment', (CSE).
21. Singh. A., Pancha. R., Naik. M. (2020) 'Circular economy potential of e-waste collectors, dismantlers, and recyclers of Maharashtra: a case study', Environmental Science and Pollution Research.
22. Tiwari. D. Dhawan. N. (2014) 'International Journal of Environmental Research and Development', ISSN 2249-3131 Volume 4, Number 3, pp. 253-260.
23. Singh,A, Gaurav,N, Verma,R, Garg,K (2016). 'Primary inventorization of electronic waste in Rewa Madhya Pradesh', Journal of medicinal plants studies,vol,4(5), p.86-91.

24. Kumar. R. Verma, A. Rajput, N. (2017) 'E-waste management in India formal vs. informal sectors', International Journal of Recent Advances in Multidisciplinary Research Vol. 04, Issue 08, pp.2720-2726.
25. Arya. S. Kumar, S. (2020) 'E-waste in India at a Glance: Current Trends, Regulations, Challenges and Management Strategies', Journal of Cleaner Production.
26. Wang W. Tian Y. Zhu Q. Zhong Y. (2017) 'Barriers for household e-waste collection in China: Perspectives from formal collecting enterprises in Liaoning Province', Journal of Cleaner Production, Ref: JCLP 9329.
27. Neha Garg. (2019) 'E-waste management in India: a study of current scenario', International Journal of Management, Technology and Engineering Volume 9, 2791-2803.
28. Maria Ceballos, D. and Dong. Z. (2016) 'The formal electronic recycling industry: Challenges and opportunities in occupational and environmental health research', Environment International, 95, 157-166.
29. Unger. N. Beigl. P. Höggerl. G. Salhofer. S. (2017) 'The greenhouse gas benefit of recycling waste electrical and electronic equipment above the legal minimum requirement', Journal of Cleaner Production, 164, 1635-1644.
30. A. Jayapradha. (2015) 'Scenario of E-waste in India and application of new recycling approaches for E-waste management', Journal of Chemical and Pharmaceutical Research, 7(3):232-238.
31. Central Pollution Control Board. List of Registered E-Waste Dismantler/Recycler in the country, Central Pollution Control Board, New Delhi; 2014. (http://cpcb.nic.in/List_of_E-waste_Recycler_as_on_29.12.2016.pdf). [Accessed 20 January 2017].
32. Anon (2018). 'Electrical & Electronics Manufacturing in India', NEC Technologies India Private Limited and Associated Chambers of Commerce of India (ASSOCHAM).
33. Agarwal, V. Goyal, S. Goel. S. (2020) 'Artificial Intelligence in Waste Electronic and Electrical Equipment Treatment: Opportunities and Challenges', International Conference on Intelligent Engineering and Management (ICIEM), 526-529.
34. UNEP. Sustainable Innovation and Technology Transfer Industrial Sector Studies Recycling from E-waste to Resources; 2009 (<https://unu.edu/media-relations/releases/un-publishes-first-regional-e-waste-report-for-commonwealth-of-independent-states-and-georgia.html>).
35. ISRI 2015. E-SCRAP BEAT, Your Source for ESCRAP Recycling news, updates & trends, Institute of Scrap Recycling Industries, Inc., (<http://www.isri.org/docs/default-source/electronics-recycling-newsletter/escrapbeat---winter-2015.pdf>).
36. Grant, Kristen; Goldizen, Fiona C; Peter D; Brune, Marie-Noel; Neira, Maria; van den Berg, Martin; Norman Rosana E (2013). 'Health consequences of exposure to e-waste: a systematic review', The Lancet Glob Health, 1(6), e350-e361.
37. Li J, Yu K, Liu L. (2009). 'Implementation of Progress of China WEEE', Asia Electrical and Electronic Green Society International Conference, Bangkok, Thailand, 20-25;
38. MAIT-GTZ E-Waste Assessment in India: Specific Focus on Delhi; 2007. (http://weeerecycle.in/publications/reports/GTZ_MAIT_ewaste_Assessment_Report.pdf) [Accessed 23 March 2015].