



## E-WASTE FRAMEWORK FOR RESIDENTIAL E-WASTE-A CASE OF KOLKATA

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**Abstract :** Kolkata has emerged as an important destination/hub for the recycling of e-waste generated in West Bengal. Currently, e-waste recycling in Kolkata is completely undertaken by the unorganized sector. The process involved in e-waste recycling by the informal sector is highly polluting and is not only hazardous to the environment but also to the health of workers. Due to growing quantities and health and environmental hazards involved in e-waste recycling, immediate action from all concerned is required to curb the risk and improve the situation. This study is focused on estimating the quantities of e-waste generation in Kolkata municipal area, West Bengal. In addition to focusing on studying the current scenario of the e-waste recycling industry in the Kolkata municipal area.

**IndexTerms** –electronic waste(e-waste), Central pollution control board(cpcb), west bengal pollution control board(wbpcb), electrical and electronic gear (EEE)

### I. INTRODUCTION

The utilization of electrical and electronic gear (EEE) like PCs, TVs, and cell phones has expanded at a fast speed over the most recent twenty years on the planet. The finish-of-life removal of EEE creates electronic waste, which is considered a difficulty for ecological administration in the 21st century. E-waste contains more than 1,000 distinct substances, a considerable lot of which are harmful, and makes severe as contamination upon removal. These poisonous substances incorporate lead, cadmium, mercury, plastics, etc.

India has possibly the quickest developing business sector in the World for EEE. Perceiving the need to handle this tremendous measure of e-waste, the Government of India presented the E-Waste Management Rules which significantly affect first October 2016.

The E-Waste (Management) Rules, 2016 command CPCB to get ready rules on the execution of E-Waste Rules, which incorporate explicit guidelines for extended producer responsibility, channelization, collection centers, storage, transportation, environmentally sound dismantling and recycling, and restoration. Furthermore, India gathered simply 3% of e-waste produced in 2018 and 10% in 2019 according to the CPCB report.

The development pace of disposing of e- waste is high in India also. Over the most recent couple of years, India has arisen as an "IT" monster.

The buyer electronics market has likewise developed at a huge rate in India. Expanding market infiltration, huge substitution market, and high out-of-date quality rates make e-waste perhaps the quickest developing waste stream in India and numerous other nations.

### II. STUDY AREA

Kolkata remains on the Eastern Bank of River Ganga. In the last part of the waterway, Ganga streams by the side of Kolkata before it arrives at the Bay of Bengal around 180 Km. downstream from Kolkata. during the British period, it is called The Jewel of the East, and remained its capital till 1911, Kolkata is presently the capital of West Bengal a state of India.

Kolkata has an area of 1480 sqkm, with a population of 45,80,544 ( according to the 2011 evaluation) having a population density of 24,306. all out number of families is 1024928.

As Kolkata is one of the biggest city, as well as the capital of west Bengal, has a critical financial and managerial significance district. West Bengal contributes 9.8% of e-waste and Kolkata goes under the top ten urban areas that create e-squander

The central government amended the handling rule for E-Waste management in 2016, but it is not managed effectively anywhere in Kolkata yet.

### III. ISSUES IDENTIFIED

In Kolkata as of now no drive concerning electronic waste and no reusing office. There is a deficiency of assortment facility/dismantler unit and absence of mindfulness in Kolkata

A wide range of waste is gathered on the whole as city strong waste and is unloaded in the unloading yard which is an unfavorable effect on climate and human wellbeing because of electronic waste.

#### IV. METHODOLOGY

In the current review, essential information was gathered through a survey from 650 households in the Kolkata municipal region the information was gathered and examined for the satisfaction of the goal of the review.

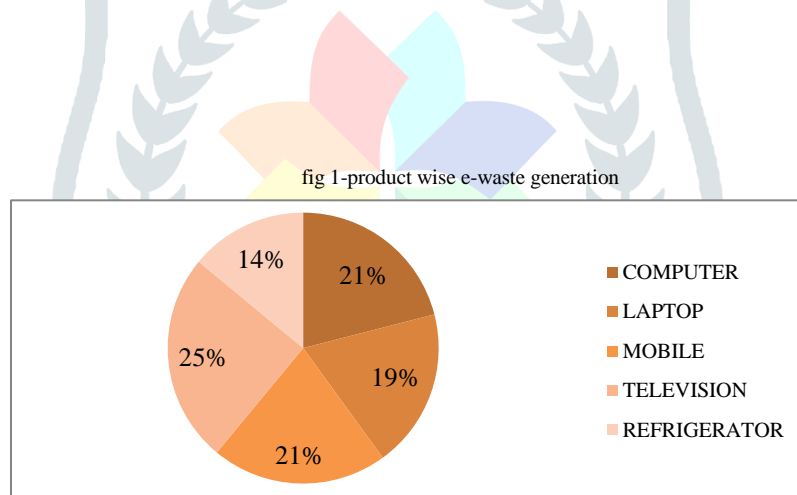
- Identifying the problem
- Aim of the study  
To propose a framework for assessment of E-Waste in Kolkata.
- Formulation of the objectives
  - a) To study and measure different sorts of e-waste produced in the Kolkata municipal area
  - b) To study and analyze the effects on humans and the environment
  - c) To get to the current arrangement of e-waste collection, storage, treatment, and removal process.
  - d) to set up a structure for the management of the effects of e-waste in the Kolkata municipal area
- Wellsprings of Data and Analysis
  - a) Primary Data  
The essential information is gathered by setting up a survey. A very much outlined survey is utilized for an assortment of information  
On how much e-waste is created.  
What is the course of assortment, Segregation, Transportation, removal, and treatment of electronic waste.
  - b) Secondary Data  
The secondary information was gathered from distributed sources, for example, research papers, published journals, and Guidelines from EWM rule 2016.
- Proposals and Recommendations

#### V. E-WASTE GENERATED

According to the West Bengal Pollution Control Board report, assessed E-Waste produced 144823 tones in 2020.

##### Residential e-waste category

- Desktop
- Laptop
- Mobile
- Printer
- Refrigerator
- Television



Residential e-waste category	Age in Months			
	Overall	SEC A	SEC B	SEC C
Desktop	81 (6.75)	83 (6.92)	81 (6.75)	79 (6.58)
Laptop	49 (4.08)	51 (4.25)	51 (4.25)	48 (4)
Mobile	33 (2.75)	37 (3.08)	35 (2.92)	28 (2.33)
Printer	58(4.83)	59 (4.92)	57 (4.75)	
Refrigerator	130 (10.83)	140 (11.67)	125 (10.42)	119 (9.92)
Television	102 (8.50)	99 (8.25)	111 (9.25)	104 (8.67)

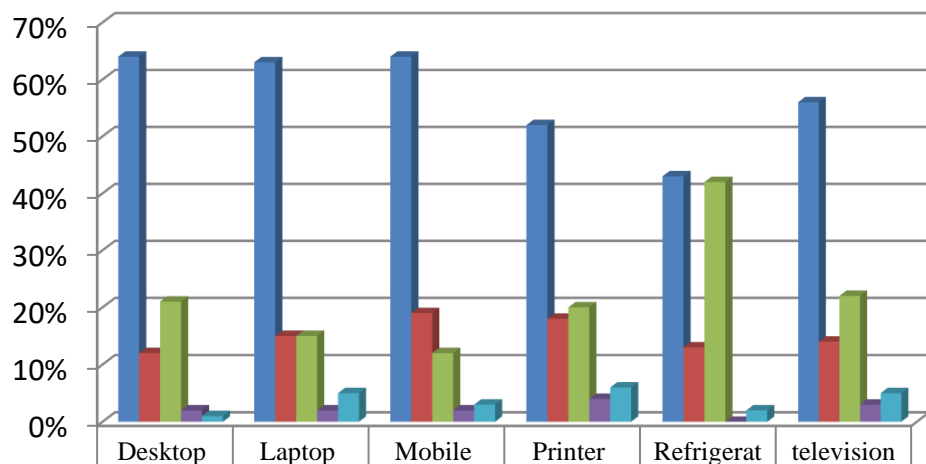
Table 1-age of residential e-waste

Residential e-waste category	Weight (KG)
Desktop	27.200
Laptop	3.410
Mobile	0.083
Printer	6.500
Refrigerator	35.000
Television	25.000

Table 2-weight of residential e-waste

METHOD OF DISPOSAL	MOBILE	REFRIGERATOR	LAPTOP	TELEVISION	PRINTER	DESKTOP
Given to relatives/ friends	37%	11%	20%	24%	0	20%
Donated to driver/maid/other for charity	7%	0	0	1%	20%	0
Sold in second hand market	34%	19%	50%	31%	28%	50%
Sold to scrap dealer	3%	4%	2%	11%	20%	2%
Exchange for new products	13%	60%	27%	28%	30%	27%
Thrown in dustbin/municipal waste	6%	6%	1%	5%	2%	1%

Table 3- method of disposal



	Desktop	Laptop	Mobile	Printer	Refrigerator or television
Best Price	64%	63%	64%	52%	43%
Convenience	12%	15%	19%	18%	13%
Best Exchange Offer	21%	15%	12%	20%	42%
Credibility of Buyer	2%	2%	2%	4%	0%
Environmentally Friendly Disposal	1%	5%	3%	6%	2%

chart 1- reason for disposal

e-waste awareness-

From the data collected fifty-six percent of individuals know about issues connected with unloading e-waste in municipal waste and twenty five percent of individuals are uncertain about the adverse impact of e-waste and nineteen percent of individuals do not have some familiarity with the hurtful impact of e-waste.

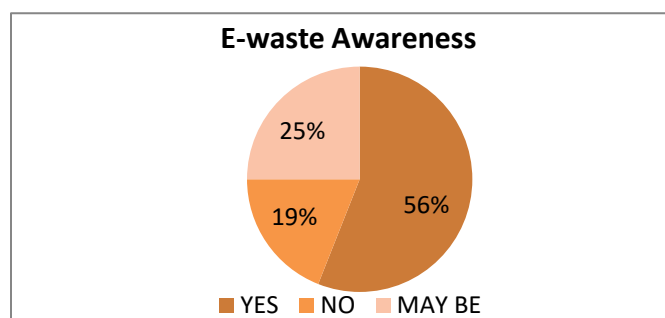


fig 2-e-waste awareness

## VI. QUANTIFICATION OF E-WASTE

year	desktop sold	mobile sold	refrigerator sold	printer sold	laptop sold	television sold
2011	102414	150638	55716	32450	238876	60451
2012	117776	180765	58501	33099	257986	62869
2013	135443	216918	61427	33760	278625	65384
2014	155759	260302	64498	34436	300915	67999
2015	179692	312363	67723	35125	324988	70719
2016	207147	374835	71109	35827	350987	73547
2017	238876	449802	74664	36544	379066	76489
2018	275785	539763	78397	37275	409391	79549
2019	314933	647716	82317	38020	442142	82731
2020	359638	777259	86433	38781	477514	86041
2021	410689		90755	39556	515715	89482

Table 4- electronic item sold

year	desktop	mobile	refrigerator	printer	laptop	television	total residential e-waste in tonns
2013	222.84	13.23	282.69	42.39	179.2	60.45	800.8
2014	674.12	16.87	480.2	106.52	437.91	138.42	1854.04
2015	1388.07	20.87	977.83	157.16	676.58	264.85	3485.36
2016	2432	25.05	1301.72	196.16	812.16	426.55	5193.64
2017	3299.44	30.06	1443.19	212.73	942.3	685.45	6613.17
2018	3992.76	36.07	1561.17	225.43	1058.41	1317.35	8191.19
2019	4598.59	43.28	1700.44	229.94	1143.08	1535.77	9251.1
2020	5301.06	51.94	1892.38	234.53	1234.53	1688.42	10403.36
2021	6106.56	62.53	2017.54	239.23	1333.29	1755.95	11455.07

Table 5- e-waste generated

## VII. ENVIRONMENT AND HEALTH IMPACT OF E-WASTE

COMPONENT	Electronics	POSSIBLE HAZARDOUS CONTENT
Cooling	Refrigerator	ODS
Plastic	Desktop, mobile, printer, laptop, television, refrigerator	Phthalate plasticize, BFR
Insulation	Refrigerator	Insulation ODS in foam, asbestos, refractory ceramic fiber
CRT	Desktop, Television	Lead, Antimony, Mercury, Phosphors
LCD	Desktop, laptop, mobile, Television	mercury
Rubber	Refrigerator	Phthalate plasticizer, BFR
Wiring/electrical	laptop, mobile, printer, Refrigerator, Television	Phthalate plasticizer, Lead, BFR
Circuit board	Desktop laptop, printer, Television	Lead, Beryllium, Antimony, BFR
Fluorescent lamp	laptop, mobile,	Mercury, Phosphorus, Flame Retardants
Thermostat	Refrigerator	Mercury
BFR-containing plastic	Refrigerator, Television	BFRs
Batteries	laptop, mobile,	Lead, Lithium, Cadmium, Mercury
External electric cables	Desktop laptop, printer, Refrigerator, Television	BFRs, plasticizers

Table 6- possible hazardous content

HAZARDOUS CONTENT	Environmental hazard	Health effect
ODS	Ozone depleting	Skin cancer, immune system damage
Phthalate plasticize	it to be toxic to aquatic organisms and may cause long-term adverse effects in aquatic environments.	can damage the liver, kidneys, lungs, and reproductive system
asbestos	It effect key microbial process and decrease the activity of soil microorganisms	Respiratory irritation
refractory ceramic fiber	Lungs fibrosis in animal	Category 2 carcinogens
Lead	Heavy metals leaching into ground water	Damage to neural system, blood system and kidney
Antimony	leaves thinner, smaller, less developed and the plants shorting	effects on the skin and eyes. Respiratory effects, such as inflammation of the lungs, chronic bronchitis, and chronic emphysema
mercury	Growth retardation in plants	If it enters blood stream and effect the

		brain
Phosphors	Heavy metals leaching into ground water	Damage to neural system, blood system and kidney
BFR		
Beryllium	In water chemicals will react to beryllium and causes it to become insoluble	Lungs disease, chronic beryllium disease, class a epa carcinogen
Flame Retardants		
Lithium	Reduces plant growth	Damage to nervous system, kidney
Cadmium	In water chemicals will react to beryllium and causes it to become insoluble	Lungs disease, chronic beryllium disease, class a epa carcinogen

Table 7- impact on human and environment

VIII. E-WASTE PROCESSING IN KOLKATA

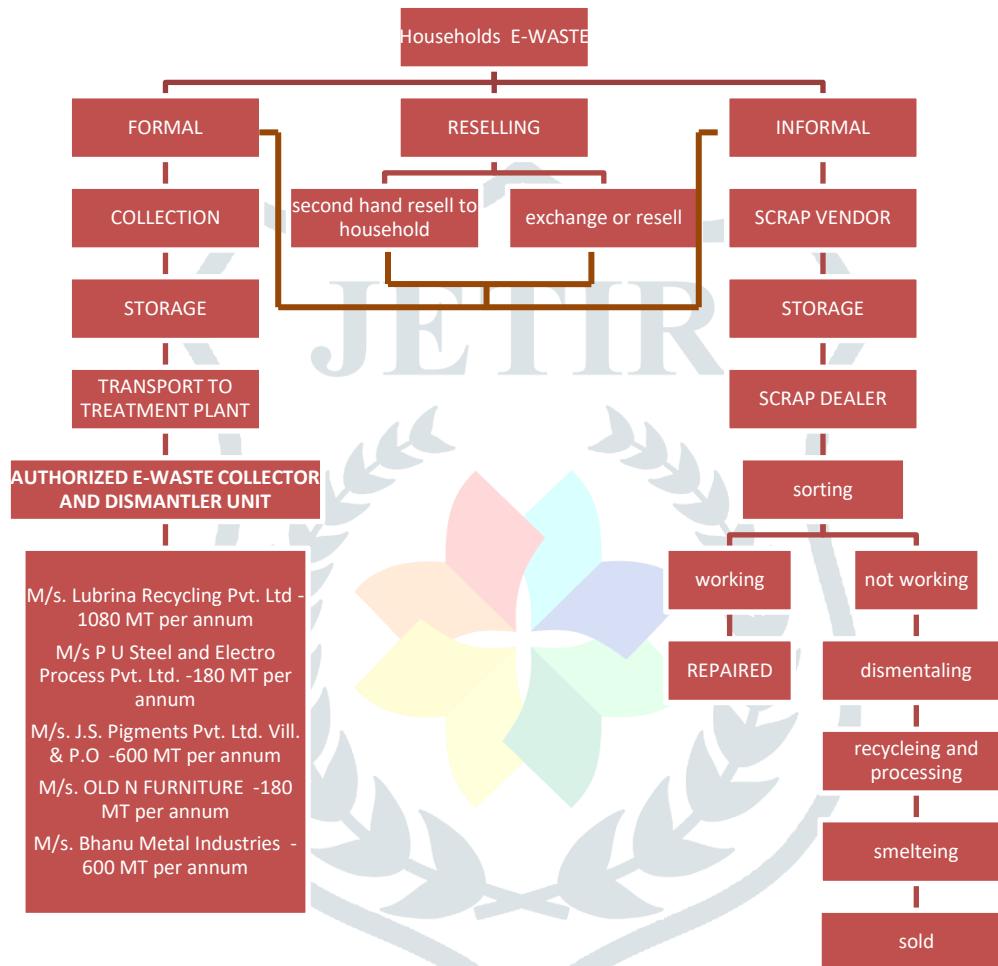


fig 3-existing e-waste processing in kolkata

AUTHORIZED E-WASTE COLLECTOR AND DISMANTLER UNIT

- M/s. Lubrina Recycling Pvt. Ltd -1080 MT per annum
- M/s P U Steel and Electro Process Pvt. Ltd. -180 MT per annum
- M/s. J.S. Pigments Pvt. Ltd. Vill. & P.O -600 MT per annum
- M/s. OLD N FURNITURE -180 MT per annum
- M/s. Bhanu Metal Industries -600 MT per annum

There are mainly 5 authorized e-waste collector and dismantler unit presented in kolkata. Total capacity of these dismantler 2640 MT/Annum.

In the unorganized sector, it was found the dismantling operations utilized devices like a hammer, chisel, and screwdriver including open consumption of wire to extricate valuable metals like copper, gold, Platinum, silver, and so forth.

A portion of the cycle includes the soaking of circuit sheets in an open corrosive bath followed by manual rejecting to remove copper and valuable materials which are followed by manual rejecting to extricate copper and valuable materials and the rest is thrown in an open channel.

Such interaction done without legitimate assurance to laborers is risky not exclusively to workers included yet in addition to climate

IX. RECOMMENDATIONS

E-waste is dealt with and discarded in a wasteful way which prompts damagingly affects human wellbeing and the climate. This is for the most part since e-waste involves dangerous constituents like lead, cadmium, chromium, brominated fire retardants, or polychlorinated biphenyls (PCBs) that debase soil, water, and furthermore human-impacted by different sicknesses because of the absence of mindfulness.

The absence of mindfulness is the primary purpose for the expansion of the electronic waste age which unfavorably affects the climate and well-being of humans thus, the government ought to concentrate to make mindfulness for naturally sound administration of E-Waste.

Different drives that can be taken in regards to this area-

- The Government ought to put resources into mindfulness creation for the end clients, featuring the potential dangers to the climate and individuals.
- Legitimate interchanges channels should be utilized and furthermore through NGO to make mindfulness among family and various associations.
- A severe boycott ought to be forced on open consuming and corrosive shower of PCBs must be upheld by specialists.
- The SPCB along with the police can do severe checking and make a disciplinary move against individuals who participated in these exercises.
- Security measures ought to be taken for laborers, particularly in casual areas who are engaged in destroying process.
- Giving gadgets for reuse, which broadens the existence of items and keeps them from being in the burn-through framework for a more drawn-out time frame.

Help the casual areas like piece sellers with formal preparation phases and information about e-squander handling and removal choices and furthermore on necessity under e-squander rules.

Coordinating a conventional reusing organization with the casual area for taking over risky reusing processes

Need to make mindfulness among different partners, overall population, and administrative power.

Ad lib existing casual assortment framework

A repurchase framework should be executed to urge the customers to give up their old electrical and electronic things.

Methods for e-squander reusing ought to be founded on 3R guidelines (reduce, recycle and recover) which would limit climate and wellbeing influences as well as would save assets.

Investigating existing and future e-squander patterns, there is a prerequisite of approved e-squander assortment focuses and reusing units for destroying, isolation, and reusing in a naturally sound way.

#### X. PROPOSAL FOR INSTALLING RECYCLING PLANT

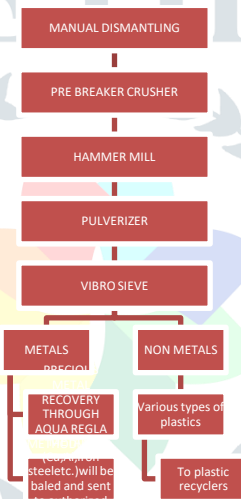


fig 4-flowchart of recycling plant

business -Handling of e-waste as per SPCB/CPCB guidelines

Project cost -Rs 2851.49 lakhs

Proposed caacity -6000MTPA

Proposed lacion -kolkata

services -Collection, storage, recycling, recovery and disposal of electronic waste as per CPCB guideline.

land -3-4 acers

Labor supply EMPLOYMENT OPPORTUNITIES

All out labor supply expected for offices will be as per the following

Qualified/proficient 15

Talented and incompetent works 35

(25% of the necessary labor supply will be taken present informal areas to offer them work chances).

## XI. FRAMEWORK FOR E-WASTE MANAGEMENT

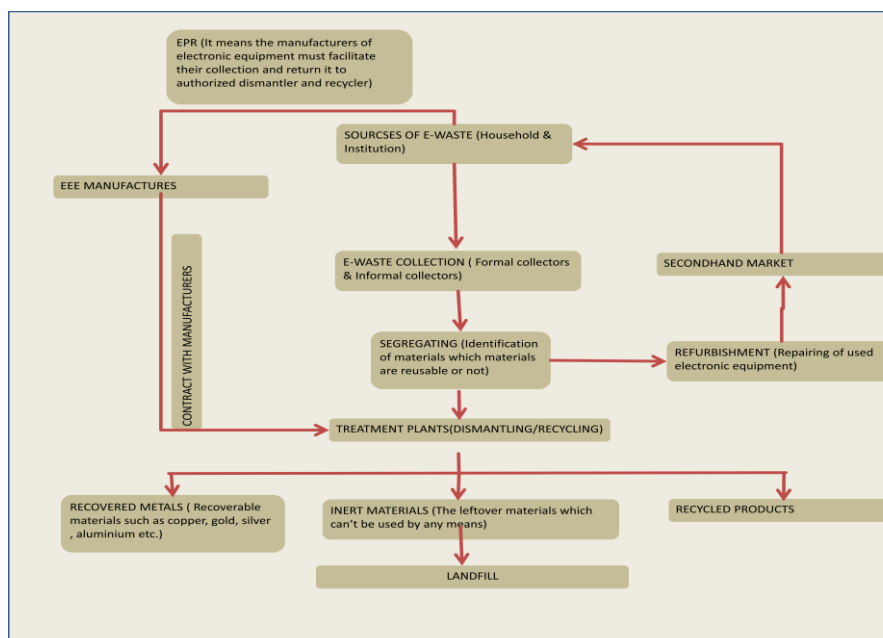


fig 5- framework for effective e-waste disposal

## XII. conclusion

economic development is significant however it ought not to be focused on the cost of damage to the climate if not the whole globe should confront its terrible outcome. It is challenging to successfully manage e-waste the board worldwide until a generally acknowledged e-waste definition is structured and acknowledged.

With nonstop progression in innovation and expanding agreeableness of various electronic items as essential necessities, the eventual fate of the electronic equipment industry looks encouraging especially in urban communities. The electronic market in Kolkata has been expanding because of part of business advancement and IT-created exercises. The assessed measure of e-waste produced in Kolkata is 7125 MT yearly and reused just 10-15% in the proper area rest sum is reused in the informal sector and stored in the stockroom. It is incredibly important to include the informal sector for fostering successful and capable e-waste the board framework yet their job should be limited to assortment and dismantling.

Electronic waste is perilous to climate yet it is likewise a significant asset for the extraction of important metals and different parts which is utilized during their production. since it is developing at a disturbing rate from one side of the planet to the other, a logical methodology should be taken to effectively address the difficulties

In India, we have appropriate lawful construction as referenced in the e-waste (management) rules 2008, 2011, and 2016 however the end clients don't follow it because of the absence of information, interest, training, and natural mindfulness.

Customers are the end clients and they likewise should be taught and made mindful of the issues and will assume a huge part in this situation

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