IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

# INVENTORIZATION OF E-WASTE AMONG ORGANIZATIONS IN KERALA

Athira S, Research Scholar
Institute of Management in Kerala, University of Kerala

**Abstract**

One of the solid waste categories with the fastest growth rates is electronic waste, which poses a severe environmental risk. Rapid advancement of technology has given rise to a significant environmental challenge: electronic waste (e-waste). It is composed of mixes of potentially dangerous inorganic and organic elements, including heavy metals, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, and flame retardants, as well as valuable metals like gold, silver, and platinum. Direct disposal of waste into landfills without any prior treatment endangers the environment because metals leach into water and soil. Inefficient waste recycling produces harmful and dangerous substances including dioxins, furans, and acids through methods like open burning and acid baths. E-waste management differs from that of regular solid wastes. The management of electronic trash requires advancements in addition to environmentally friendly technologies for its recycling and recovery of valuable and valuable resources. This paper focuses primarily on e-waste inventorization in organizations in Kerala. Statistical tools like percent, mean, median, standard deviation and t-test etc were used to analyse the data.

Keywords: EEE, E-waste, WEEE, Discrded EEE

## I. Introduction

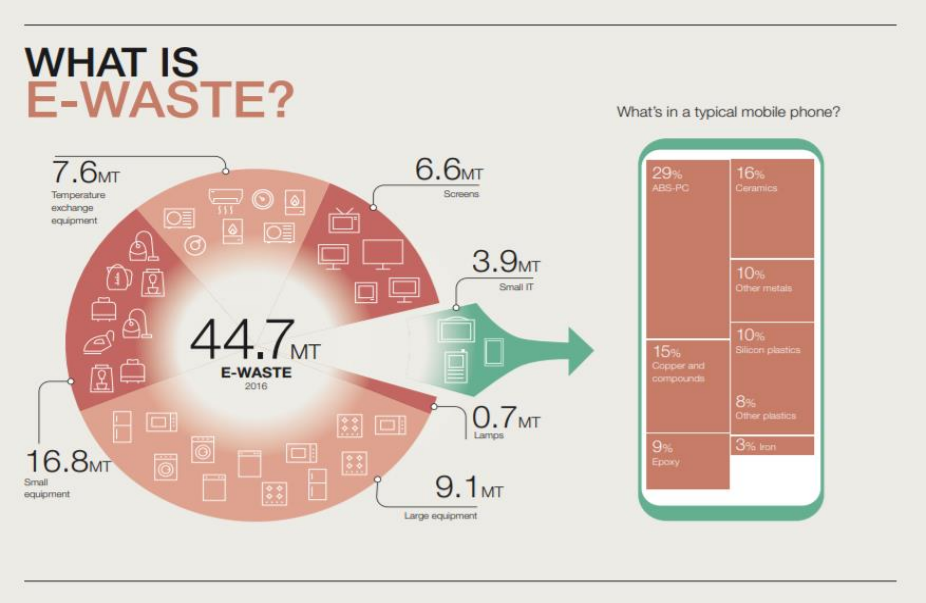
In the modern era, human beings are nothing without electricity. Uses of electricity covers almost all areas like, home uses, safety in community, medical uses, agricultural productivity, industrial purposes, social interaction, entertainment etc. Now a days, the market is flooded with ‘ease of do’ tools for various professions. Real-time monitoring and disease diagnosing became easy for the medical professionals since many advance paramedical and healthcare electronic equipments are available in the market. Several brands of cost-effective gadgets to check blood-sugar, blood-pressure etc. is available in homecare medical pharmacy. One can even order them online also. The electronics market is driven by customer demand, and customers are to be blamed. There are two sides to this: first, the customers' increased purchasing power as a result of economic growth, and second,

the industry's new and creative marketing gimmicks. The consumption of electronic products and rapid global economic development are directly related. In today's ever-evolving world, where the quality and version of electronics are used as a barometer of living conditions, they have evolved into a necessary commodity. The consumer mentality of "use and throw" could accelerate the obsolescence of electronic and electrical equipments (EEE)(Environment Protection Training and Research Institute (EPTRI), 2017).

Waste Electrical and Electronic Equipments (WEEE) are growing rapidly as a result of the enormous number of equipments being introduced into the market on a daily basis as a result of technological improvement. Taking a global and national perspective, we have evidence that massive amounts of e-waste end up in the waste stream every year and are not properly managed. Even advanced countries find it difficult to properly dispose of and recycle e-waste due to high labour costs, therefore they illegally send it to developing countries where labour costs are lower. In developing nations, the informal sector dominates and manages accumulated e-waste in an unsafe manner, causing threats to persons and the environment. This is evident in India, where informal workers employ dangerous ways to extract metals from e-waste components, and the wastes are burnt. Incineration and acid bath of discarded electronic components by the informal sector workers to extract precious metals such as gold, silver, palladium and other metals like copper, aluminium etc. without any safety procedures is detrimental to both human health as well as the environment. Toxic chemicals flow into the ground through these dangerous methods, hurting the soil and groundwater. Incineration releases poisonous gases into the atmosphere, resulting in air pollution. As a result, proper collection, and handling of e-waste generated is essential for avoiding undesirable consequences.

**EEE**

'Electrical and Electronic Equipment' means equipment which are dependent on electric current or electro-magnetic field in order to become functional. EEE refers to IT & Telecommunication equipments and Consumer electrical and electronics under Schedule1 of E-Waste (Management) Rules, 2016.




(*extracted from the report of World Economic Forum, Annual Meeting* on "The World's E-Waste Is a Huge Problem. It's a Golden Oppurtunity," 2019*)*

**E-Waste**

E-Waste or WEEE (Waste Electrical and Electronic Equipment) means electrical and electronic equipment, whole or part discarded as waste by the consumer or bulk consumer(organizations). "Used, obsolete, unserviceable, not working, irreparable, stored for considerable time, broken, not possible to utilize to its originally intended capability, equipment reached its end of life i.e., manufacturer planned obsolescence; such equipment which uses electricity for its function in otherwise called as Waste Electrical and Electronic Equipment (WEEE).

## II. Statement of the problem

In case of Kerala, the e-waste generated is collected (not completely) and sent-off to recyclers outside Kerala as there is no adequate facility to dismantle or recycle e-waste in the State. Due to the absence of apt e-waste collection and record-keeping, the quantity of e-waste generated from the household sector is unknown. The role of urbanization has a great impact on consumerism in Kerala.

Given the state of technology today, it is crucial to understand the impact of problems like e-waste, which are dangerous to the environment and society, and their management by identifying the issues it creates and challenges it poses when handled by public and private sector organizations in Kerala.

## III. Sample design

A sample design is the structural framework that guides the whole process of sample selection based on the needs of the study.

### 3.1 Population of the Study

Kerala's economy is unique in terms of consumer spending and modernization. The universe of the study consisted of all state-level public sector undertakings and private organizations using electrical and electronic equipments in Kerala. Public sector organizations cover all state level public sector undertakings (PSUs). There were 121 public sector undertakings in Kerala, as per the report of Comptroller and Auditor General (C&AG) of India as of March 31, 2018. There is no reliable source that states anything about the private sector enterprises in Kerala. So, to make the study reliable, private sector organizations were selected from 337,278 private sector undertakings registered under Kerala Shops and Commercial Establishment Act,1960. From the list of total private shops and business establishments, the researcher classified different forms of business organizations as sole-proprietorships, partnership firms, and company form of business in the state. And a total of 7696 private sector organizations were registered in Kerala as on March 31, 2019.

### 3.2 Sample Size

To arrive at the optimal sample size for faithful representation, adequacy, fairness, and reliability of the sampling units, Kukeran Formula has been applied at 5 per cent level of significance and as shown below.

**Sample size for Organizations**

**a. Sample Size of Public Sector Undertakings**

$Z = 1.96$

$p = 0.75$

$q = 0.25$

$d = 0.05$

$N = 121$

$$\frac{\frac{1.96^2 \times 0.75 \times 0.25}{0.05^2}}{1+\frac{1}{121}\left(\frac{1.96^2 \times 0.75 \times 0.25}{0.05^2}-1\right)} = 93$$

The recommended sample size = 93

As shown above, the minimum sample of 93 public sector undertakings has been arrived at 95% confidence level with 5% significance level.

**b. Sample Size of Private Sector Organizations**

$Z = 1.96$

$p = 0.75$

$q = 0.25$

$d = 0.05$

$N = 7696$

$$\frac{\frac{1.96^2 \times 0.75 \times 0.25}{0.05^2}}{1+\frac{1}{7696}\left(\frac{1.96^2 \times 0.75 \times 0.25}{0.05^2}-1\right)} = 366$$

The minimum recommended sample of 366 has been arrived at 95% confidence level with 5% significance level. The sample size of Private organizations is 366.

### 3.3 Sampling Method

The proportionate random sampling method is used for selecting the organizations. In the first stage, the entire state is divided into three geographical zones: northern, central, and southern. Then the list of public sector undertakings and private sector enterprises in different zones were collected and numbered. A whole list of 121 state-level PSUs was identified and listed by region. A representative sample of 93 was drawn proportionately from the list. Table 1 depicts the sample distribution of state PSUs. The appropriate sample units were drawn proportionately from a list of 7696 private organizations, as indicated in Table 2below. The respondent for data collection using the interview schedule was an employee or head of the department concerned (administration, human resources, IT departments, etc.) in PSUs and private organizations.

**Table 1**

**Sample distribution of Public Sector Organizations**

| Zones | Total number of Organizations | Required Sample |
|---|---|---|
| South | 89 | 69 |
| Central | 29 | 22 |
| North | 3 | 2 |
| **Total** | **121** | **93** |

*Source: primary data*

**Table 2**

**Sample distribution of Private Sector Organizations**

| Zones | Total number of Organizations | Required Sample |
|---|---|---|
| South Zone | 708 | 130 |
| Central Zone | 717 | 131 |
| North Zone | 573 | 105 |
| **Total** | **1998** | **366** |

*Source: primary data*

## IV. RESULTS AND DISCUSSIONS

### 4.1 Profile of Organizations

The sample consists of 459 organizational customers using Electrical and Electronic Equipments (EEE) selected at random from the state of Kerala. The study included State level Public Sector Undertakings (PSUs) and Private Sector Undertakings, that were chosen at random. Table 3 summarises the characteristics and profile of organizations in the study.

**Table 3**
**Distribution of Organization sample by their Characteristics**

| Characteristics of Sample | | n | % |
|---|---|---|---|
| Type of Organization | Public Sector Undertakings | 93 | 20 |
| | Private Sector Undertakings | 366 | 80 |
| Region of Organizations | North | 107 | 23 |
| | Central | 153 | 33 |
| | South | 199 | 44 |
| Category of Industry According to Pollution Potential | Red | 0 | 0 |
| | Orange | 0 | 0 |
| | Green | 236 | 51 |
| | Non- polluting | 223 | 49 |
| **Total** | | **459** | **100** |

*Primary data*

There were 93 public sector and 366 private sector organizations in the total sample of 459 organizations. Samples were taken from three geographical regions; 44 per cent of organizations were from south zone, 33 per cent from the central zone and 23 per cent organizations from the north zone. As shown in table, according to pollution potential, majority of organizations were under green category and 49 per cent organizations fall under non-polluting industry.

The quantity and usage period of various electrical and electronic equipments used in public and private organizations over the last 10 years (2012-2021) and the list of discarded EEE and the method of disposal were analyzed.

### 4.2 Quantity and period of usage of Electrical and Electronic Equipments

Here, the quantity and years of usage of Electrical and Electronic Equipments(EEE) over the last 10 years (2012-2021) in organizations were analysed. Table 4 shows Mean and Median values regarding quantity and the period of usage of EEE used in the Organizations.

**Table 4**
**Quantity and years of usage and their Mean values of Electrical and Electronic Equipment (2012-2021)**

| Items | Number of Items | | | Period of use | | | Number of organizations |
|---|---|---|---|---|---|---|---|
| | Total | Mean | Median | Total | Mean | Median | |
| Television sets (LCD and LED) | 394 | 1.66 | 1 | 1086 | 7.49 | 7 | 238 |
| Refrigerator | 180 | 1.38 | 1 | 592 | 7.40 | 7 | 131 |
| Air-Conditioners excluding Centralised air conditioning plants. | 12445 | 27.11 | 25 | 2232 | 7.97 | 7 | 459 |
| Fluorescent and other Mercury-Containing Lamps | 8299 | 19.62 | 20 | 2126 | 8.24 | 8 | 423 |
| Mainframes& Minicomputers | 8677 | 26.70 | 25 | 1510 | 7.63 | 7 | 325 |
| Personal computers (CPU with Input & Output devices) | 11274 | 26.47 | 21 | 2036 | 7.83 | 7 | 426 |
| Laptop computers (with CPU, Input & Output devices) | 4034 | 14.56 | 14 | 1025 | 6.07 | 6 | 277 |
| Notebook Computers /Notepad Computers | 27 | 2.67 | 2.5 | 33 | 5.50 | 5 | 10 |
| Printers including cartridges | 1500 | 3.39 | 2 | 1872 | 6.93 | 7 | 443 |
| Copying Equipment | 892 | 2.08 | 1 | 1765 | 6.74 | 7 | 429 |
| User terminals and systems | 4 | 2.00 | 2 | 6 | 6.00 | 6 | 2 |
| Facsimile Machines | 550 | 1.50 | 1 | 1488 | 6.67 | 7 | 366 |
| Telephones | 4435 | 9.73 | 5 | 3067 | 11.03 | 10 | 456 |
| Answering systems | 8153 | 25.64 | 25 | 2074 | 10.69 | 10 | 318 |

*Source: primary data*

The main items of Electrical and Electronic Equipments found in sample organizations in the study include, air conditioners (n= 12445), personal computers (n= 11274), mainframe computers (n= 8677), fluorescent and other mercury lamps (n= 8299) and answering system (n= 8153). The other electronic items that are most used in organizations include telephones, laptops, printers, copiers, facsimile machines, etc. Figure 5.1 below shows number of EEE used and their mean period of usage in organizations.

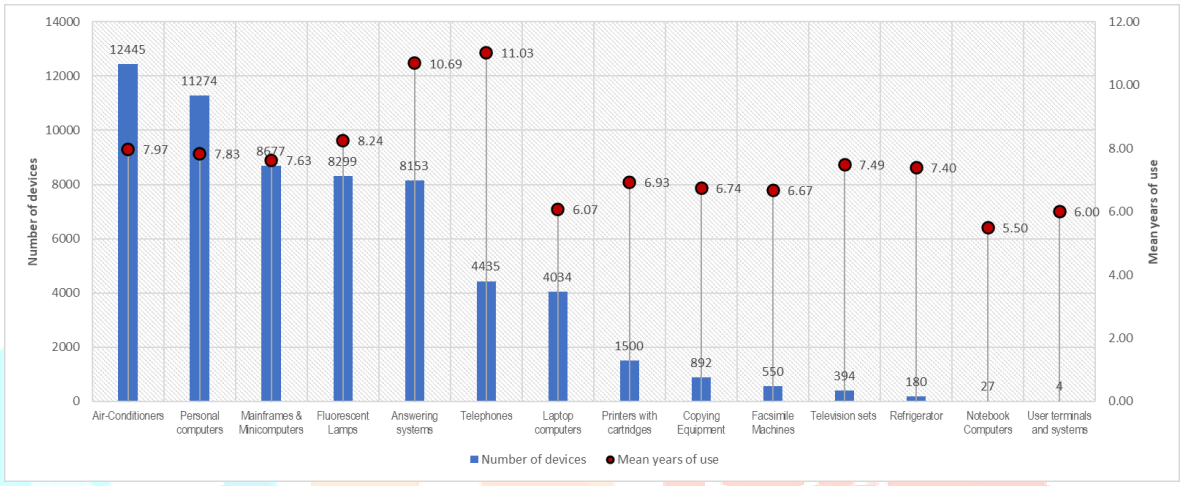



***Figure 1 :Number of EEE used and their Mean period of usage in Organizations***

In the current study, the mean period of usage for the most used EEEs such as air conditioners, personal computers, mainframe computers, fluorescent and other mercury lamps and answering systems was 7.97, 7.83, 7.63, 8.24 and 10.69 years respectively. From the table, it is evident that EEE item having a lower usage period is for notepad computers with 5.50 years and item having a longer period of usage is for telephones with 11.03 years.

### 4.3 Mean Quantity of EEE used in Public and Private Organizations

The number of different items of Electrical and Electronic Equipments (EEE) used in public and private organizations were analyzed and presented in Table 5. Mean values and their standard deviation were taken for the number of each item of EEE and t-test was used to analyze whether there is any significant difference in the usage of EEE among organizations.

The table reveals that the average quantity of television sets used within public sector organizations stands at 1.84, while in private organizations, it is slightly lower at 1.45. The calculated significance level resulting from the t-test is 0.053, implying that there is no statistically significant difference in the number of television sets used across different types of organizations. Similarly, the mean quantity of refrigerators used in public sector

organizations is 1.52, whereas in private sector organizations, it is recorded as 1.13. The associated significance level obtained from the t-test is 0.34, indicating that there is no statistically significant difference in the utilization of refrigerators between the two sectors.

Air-conditioners used in public sector and private sector showed mean scores of 29.69 and 24.54 respectively. The result showed that, as the significance level of the t-test is less than 0.05, the usage of air conditioners is not the same for public and private sector organizations. The usage of air conditioners is significantly higher in Public Sector Organizations.

***Table 5***
***Mean score of Electrical and Electronic Equipments used in Public & Private Sector Organizations***

| Items | Public Sector Organizations | | Private Sector Organizations | | t | sig. |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | | |
| Television sets (LCD and LED ) | 1.84 | 1.29 | 1.45 | 1.12 | 1.953 | 0.053 |
| Refrigerators | 1.52 | 2.18 | 1.13 | 0.43 | 0.959 | 0.341 |
| Air-Conditioners excluding Centralised air conditioning plants. | 29.69 | 11.25 | 24.54 | 11.90 | 3.716 | 0.000 |
| Fluorescent and other Mercury Containing Lamps | 23.03 | 6.31 | 16.41 | 7.77 | 7.479 | 0.000 |
| Mainframes& Minicomputers | 29.18 | 26.21 | 23.18 | 9.79 | 1.976 | 0.050 |
| Personal computers (CPU with Input & Output devices) | 25.42 | 14.71 | 27.54 | 25.30 | -0.827 | 0.409 |
| Laptop computers (with CPU, Input & Output devices) | 16.94 | 9.39 | 12.15 | 5.98 | 3.947 | 0.000 |
| Notebook Computers /Notepad Computers | 2.33 | 2.31 | 3.00 | 1.73 | -0.400 | 0.710 |
| Copying Equipment | 2.56 | 2.38 | 1.55 | 1.35 | 4.171 | 0.000 |
| Facsimile Machines | 1.74 | 1.26 | 1.14 | 0.46 | 4.323 | 0.000 |
| Telephones | 12.40 | 19.11 | 7.05 | 6.85 | 3.108 | 0.002 |
| Answering systems | 30.60 | 11.72 | 21.44 | 10.70 | 5.687 | 0.000 |

*Source: primary data*

The Mean quantity of fluorescent and other mercury-containing lamps in the public sector and private organizations in the study were 23.03 and 16.41 respectively. The associated significance level obtained from the t-test is less than 0.05, indicating that there is a statistically significant difference in the utilization of refrigerators between the two sectors. Regarding mainframes and minicomputers, the mean score was 29.18 for the public sector and 23.18 for private sector organizations. The test result shows p value of 0.05 and therefore, there is no significant difference in the usage of computers in organizations. Regarding the usage of personal computers (CPU with Input and Output devices), the mean score obtained was 25.42 for the public sector and 27.54 for the private sector. The result of t-test was 0.409 which was higher than the significance level of 0.05 and can be said that there is no significant difference in the usage of personal computers among organizations.

The average quantity of laptop computers (with CPU, Input & Output devices) used in public sector organizations is 16.94 and that of the private sector is 12.15. The result showed that, as the significance level of the t-test is less than 0.05, the usage of laptops is not the same for public and private sector organizations. The Mean score obtained for public sector and private sector organizations regarding copier is 2.56 and 1.55 respectively. The result of t-test, i.e.., p value is 0.000, which is less than the significance level of 0.05 and therefore, there is difference in the quantity of copying equipment used in organizations. The average quantity of facsimile machines used in public sector and private sector organizations are 1.74 and 1.14 respectively. The test result showed, p-value less than 0.05 and there is difference in the number of facsimile machines used in organizations. The average quantity of answering systems in public sector organizations is 30.60 and that of private organizations is 21.44. The test result showed, p-value less than 0.05 and therefore, there is difference in the usage of answering systems in public and private organizations.

Answering systems with a mean score of 30.60, an item of EEE used most in public sector organizations. Personal computers (CPU with Input and Output devices) are used most in private sector organizations.

**4.4 Discarded EEE and method of disposal in Organizations**

Table 6 shows, the list of discarded electrical and electronic equipments from organizations and their reasons and methods of disposal. Over ten years, fifty-seven air conditioners were discarded; out of them, the majority of ACs (n=24) were disposed of with authorised waste collection agency. A total of sixty-five desktop computers and three fluorescent bulbs were discarded as obsolete by the sample organization over the course of ten years. Around fifteen Copiers became waste, of which 10 were repaired, 4 items were stored as obsolete, and one damaged copier was sent to an authorised e-waste collection agency. A total of sixty-nine laptops, one hundred and twenty-one mobile phones, and forty-one refrigerators were discarded over the years 2012-21.

The table below shows that sixty-five telephones (not working) were disposed of with an authorised collection agency. Twenty-three (outdated) telephones were repaired, and twenty-one were exchanged. Five outdated, twenty-nine not-working, and unwanted items are being dumbed as obsolete in organizations themselves. A total of one hundred and forty-nine telephones (n = 149) were discarded over the years.

**Table 6**
**E-Waste in Organizations, reasons for discarding and method of disposal (2012-2021)**

| ITEMS (EEE) | Reason for discarding EEE | Authorised e-waste collection agency | Repaired | Exchanged | Removed as obsolete | Total |
|---|---|---|---|---|---|---|
| Air conditioner | Damaged | 7 | 3 | 1 | 3 | 14 |
| | Complaint | 13 | 4 | 8 | 7 | 32 |
| | Unserviceable | 4 | 2 | 2 | 3 | 11 |
| | **Total** | **24** | **9** | **11** | **13** | **57** |
| Desktop computer | Damaged | 4 | 5 | 5 | 15 | 29 |
| | Outdated | 5 | 6 | 7 | 10 | 28 |
| | Unserviceable | 1 | 6 | 1 | 0 | 8 |
| | **Total** | **10** | **17** | **13** | **25** | **65** |
| Fluorescent bulbs | Not Working | 0 | 0 | 0 | 3 | 3 |
| | **Total** | 0 | 0 | 0 | **3** | **3** |
| Copier | Complaint | 1 | 6 | 0 | 4 | 11 |
| | Damaged | 0 | 4 | 0 | | 4 |
| | **Total** | 1 | 10 | 0 | **4** | **15** |
| Laptop | Damaged | 6 | 26 | 0 | 4 | 36 |
| | Unserviceable | 1 | 3 | 0 | 2 | 6 |
| | Not working | 1 | 17 | 3 | 4 | 25 |
| | Outdated | 0 | 1 | 0 | 1 | 2 |
| | **Total** | **8** | **47** | **3** | **11** | **69** |
| Mobile phone | Damaged | 6 | 26 | 4 | 8 | 44 |
| | For buying new | 50 | 0 | 10 | 0 | 60 |
| | Not working | 11 | 0 | 3 | 3 | 17 |
| | **Total** | **67** | **26** | **18** | **11** | **121** |
| Notepad | Damaged | **1** | 0 | 0 | 0 | **1** |
| Refrigerator | Damaged | 7 | 0 | 0 | 0 | 7 |
| | For buying new | 1 | 0 | 0 | 0 | 1 |
| | Not working | 18 | 3 | 1 | 10 | 32 |
| | Outdated | 0 | 0 | 1 | 0 | 1 |
| | **Total** | **26** | **3** | **2** | **10** | **41** |
| Telephone | No use | 3 | 0 | 21 | 9 | 24 |
| | Not working | 62 | 0 | 6 | 20 | 68 |
| | Outdated | 0 | 23 | 0 | 5 | 28 |
| | **Total** | **65** | **23** | **27** | **34** | **149** |
| Printer | Complaint | 17 | 7 | 2 | 6 | **32** |
| | Damaged | 14 | 3 | 3 | 11 | **31** |
| | Not Working | 2 | 0 | 0 | 2 | **4** |
| | Unserviceable | 1 | 2 | 0 | 0 | **3** |
| | **Total** | **34** | **12** | **5** | **19** | **70** |
| Television | Damaged | 8 | 1 | 4 | 0 | **13** |
| | Unserviceable | 1 | 3 | 3 | 2 | **9** |
| | **Total** | **9** | **4** | **7** | **2** | **22** |
| Scanner | Complaint | 7 | 4 | 0 | 7 | **18** |
| | Irrepairable | 9 | 4 | 2 | 0 | **15** |
| | **Total** | **16** | **8** | **2** | **7** | **33** |
| Stabiliser | Unserviceable | **1** | **0** | **0** | **0** | **1** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **UPS** | **Damaged** | 4 | 1 | 3 | 1 | 9 |
| | **Unserviceable** | 2 | 0 | 0 | 3 | 5 |
| | **Total** | **6** | **1** | **3** | **4** | **14** |

***Source: primary data***

Table shows that a total of thirty-three scanners were discarded by organizational customers; out of those, eighteen were complaints. Among the compliant scanners, 7 were discarded by an authorised collection agency, 4 were repaired, and 7 were dumbed as obsolete items. Fifteen irreparable scanners were disposed of, of which nine were sent to the collection agency, four repaired, and two exchanged for new ones. One unserviceable stabiliser was disposed of by an authorised agency. Altogether, seventy printers became waste over the course of 10 years. Nineteen items of outdated printers were stored as obsolete in organizations, with 11 damaged, 6 complaints, and 2 not working. Five printers were damaged, and complaints were exchanged. Twelve printers were repaired; out of that, seven were complained about, 3 damaged and two were unserviceable.

Over the years, twenty-two television sets, thirty-three scanners, one stabilizer and fourteen UPS were other EEE items, discarded from sample organizations. by respondents. The reasons for and method of discarding all other electronic equipments are in the above table.

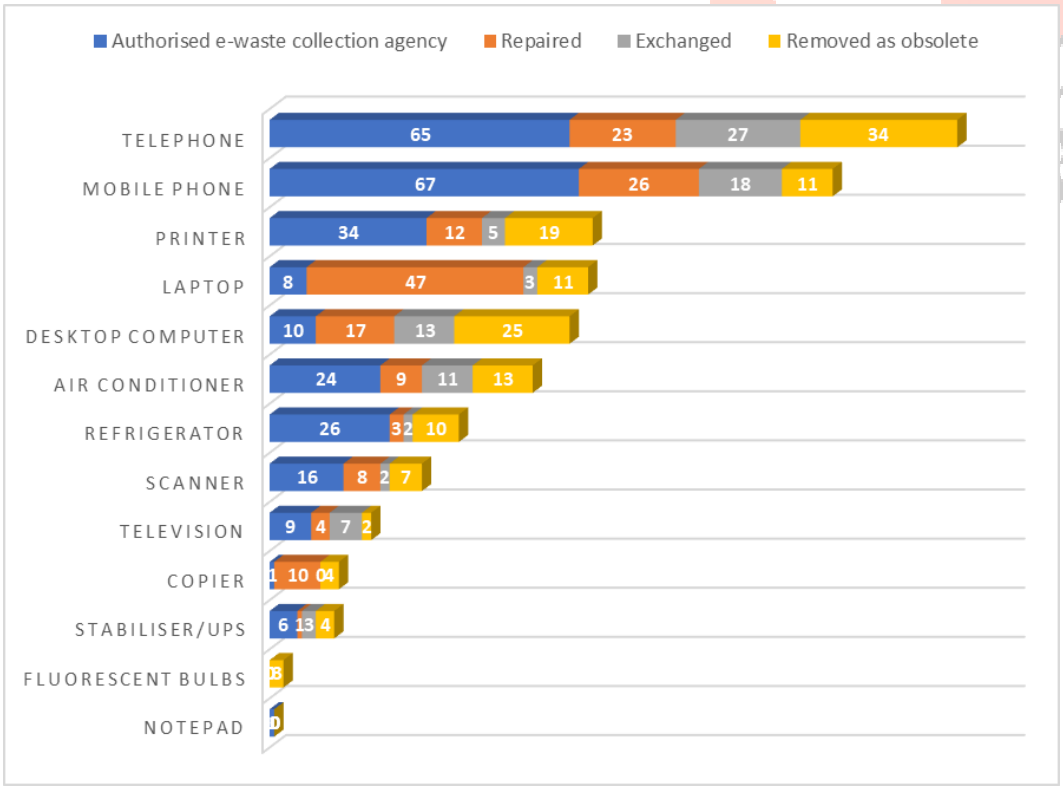



**Figure 2 Distribution of Discarded EEE and methods of disposal in Organizations**

Thus, most discarded e-waste from organizations were telephones (149), mobile phones (121 items), and then printers (70 items). Mostly organizations discard their e-wastes through authorised e-waste collection

agency. Figure 2 represents distribution of discarded electronic equipments and method of disposal from organizations in the study.

## V. Conclusion

It was found volumes of e-waste were not disposed of for years together and stored in government and public offices. Regarding the electrical and electronic equipments used, based on the availability of the working and obsolete equipment the data was recorded. In most of the organizations, there are staffs in departments for EEE support. Answering systems, with a mean score of 30.60, were the most used EEE item in public sector organisations. In the private sector, personal computers (CPUs with input and output devices) are most commonly utilised. Telephones (149 items), mobile phones (121 pieces), and printers (70 items) account for most of the wasted e-waste from businesses. Most e-waste is disposed of through an authorised e-waste collecting organisation. The challenges of handling e-waste vary significantly across public and private sector organisations.

Organizations may choose to dispose of e-waste as hazardous waste, especially if the electronic items contain materials that are considered hazardous to the environment or human health. This method typically involves following specific regulations and guidelines for the proper disposal of hazardous materials. They may store e-waste on-site until they determine the best course of action for disposal. This method requires proper storage facilities to prevent environmental contamination and often involves keeping an inventory of obsolete or unwanted electronic items. Recycling is a common and environment friendly method of e-waste disposal. Organizations may choose to work with certified e-waste recycling facilities that can extract valuable materials from electronic devices while properly disposing of hazardous components. Some firms also sell or donate old but functional electronic equipments to individuals or charities.

E-waste management has become very important in order to ensure resource efficiency and material circularity(Biswajith, 2021). The COVID-19 has created a huge impact on the e-waste recycling industry. As more offices, both in government and private sectors are opting to work from home, there has been an increase in laptop and PC demand, which are potential future e-waste. At the same time, the desktop PCs and other IT equipment in office areas are no longer required. In 2020, nearly 29 percent of the desktop computers were abandoned and more than 23 percent of these computers were remained idle in 2021. In 2020, the estimated post-Covid e-waste management market was USD 47.5 billion which is expected to reach USD 119.94 billion by 2027. This estimation is higher than the pre-Covid scenario estimation (Nair 2021). The COVID-19 pandemic has not only disrupted the supply chains in major sectors but also affected the waste management industry. Proper collection of e-waste has been hampered due to lockdowns and unavailability of proper logistics. At the same time, logistics cost has increased while the copper price has been skyrocketing since the end of February 2021 (Paben, 2021). E-waste needs to be recycled with better efficiency and more sustainability. E-waste is a secondary source of resources as well which has enormous potential to enhance urban mining and help to establish a circular economy. Material recovered from e-waste could be a feedstock for several other

allied industries which can also bring up industrial symbiotic models. Hence, for the future to be greener the urban mining of e-waste is not an option, but rather a necessity (Biswajith, 2021).

## References

Biswajith, D. (2021). Towards Sustainable E-Waste Management Through Industrial Symbiosis. *Industrial Symbiosis for the Circular Economy*, 87–107.

Environment Protection Training and Research Institute (EPTRI). (2017). *E-waste Inventorisation in the State of Telangana*. https://tspcb.cgg.gov.in/CBIPMP/Consultancy Services/e-Waste/E-Waste-Report.pdf.

Importance of Electricity in modern life. (2020). *The Scientific World*. http://www.scientificworldinfo.com

Nair, A. (2021). *E-Waste Management Market Size, Share and Industry Analysis*. www.alliedmarketresearch.com/e-waste-management-market

Paben, J. (2021). Copper Price Climbs To Recent Record – E-Scrap News. *E-Scrap News*. https://resource-recycling.com/e-scrap/2021/02/25