

# A Study of Public Awareness Concerned With E-Waste and Management Strategies

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**Abstract—** Today the living standards are gradually high, especially modern electronic goods will be essential in human daily life. Consumption patterns change along with rapidly emerging new technology and new types of waste materials come out. One of these new types of wastes is electronic wastes (E-Waste). E-waste is the latest trend in wastes, informal name for electronic products nearing the end of their useful life.

E-wastes are regarded dangerous, as certain parts of some electronic products consist of materials that are hazardous, depending on their condition and density. The hazardous components of these materials cause a threat to human health and environment. Many of these products can be reused, refurbished, reduce or recycled in an environmentally sound manner so that they are less harmful to the ecosystem. This paper assesses the public awareness regarding e-waste, highlights the hazards of e-wastes, and analyzes the management strategies to reduce e-waste.

## Abbreviation

EEE	Electrical and Electronic Equipment
EPR	Extended Producer Responsibilities
ICT	Information and Communication Technology
LCD	Liquid Crystal Display
YCDC	Yangon City Development Committee
WEEE	Waste of Electrical and Electronic Equipment

## INTRODUCTION

The global blast in technological development has impelled the worldwide electronic industry to turn into the biggest assembling industry on the world. With the enormous development found in the previous 25 years, the simultaneous quick

item out of date quality has brought about a sensational ascent of electronic waste (or e-waste) streams in industrialized nations. E-waste might be portrayed as waste electrical and electronic gear, in entire or to a limited extent from their assembling and fix process, which are planned for transfer (E-Waste Rules, 2011).

In addition to the fact that this creates a general waste management issue – because of the nearness of numerous materials and chemical compounds in electronic items, coming about waste can possibly seriously bargain human wellbeing and the earth. Dangerous chemical substances normally found in e-waste incorporate (however are not restricted to) different overwhelming metals – mercury, cadmium, and lead – brominated fire resistant plastics (BFRs) that can change over into dioxins and furans when consumed at high temperatures, and polychlorinated biphenyls (PCBs) (Wath et al., 2010).

Hence, the dangerous chemicals got from this buyer merchandise can have a high substantial gathering limit, are cancer-causing, or are profoundly negative to the sensory system, kidney, bones, and conceptive and endocrine frameworks. Without compelling government guideline of the transfer of electronic shopper merchandise, and without open attention to the intrinsic dangers, aggregation of such waste will have critical ramifications for the human populace.

Undoubtedly, building public awareness will be critical to dynamic and viable cooperation in e-waste frameworks. Awareness is likewise fundamental to be active customers who will request greater obligation from electronics producers and more activity from government bodies. Also, if producers become in charge of the finish of-life expenses of their items, an input circle will be made to urge item designers to decrease such expenses, by making their item not so much harmful but rather more amiable to material reusing.

So as to survey awareness, interviews and questionnaire will be directed with people to decide their utilization and disposal of household electronics; awareness in regards to government guideline of e-waste; and awareness in regards to the nearness of risky materials in electronics. Local and regional regulatory action will likewise be investigated to comprehend the structure of e-waste management systems, alongside the adequacy of endeavors from YCDC. Taken together, this investigation will assess the all-inclusive community's consciousness of e-waste risks and issues encompassing appropriate management, and along these lines shed light on potential victories and inadequacies in approach execution.

This study gives broad data about wellbeing and environmental results of e-waste. Be that as it may, there is restricted data on the public attention to the utilization of dangerous chemical compounds in these items, government arrangements with respect to e-waste the executives, and legitimate practices of disposal. Also, the all-inclusive community's view of unused gadgets – regardless of whether they believe it to be a type of waste – is as yet indistinct. An appraisal of open mindfulness at the dimension of the individual is imperative to understanding what is absent from the board procedures, and to understanding the open's conduct toward e-waste.

### Literature Review

#### Impacts on environmental and human health

E-waste legislation stems from growing concerns regarding the environmental impacts of this waste stream. Electrical equipment contains materials that can cause environmental problems if they are disposed of to landfill or incinerated. Hazardous substances are contained within components such as printed-circuit boards, cables, wiring, plastic casing containing flame retardants, display equipment, including cathode-ray tubes, batteries and accumulators, capacitors, resistors and relays, and connectors.

The landfilling of E-waste risks the leaching of heavy metals, including lead, cadmium and mercury, into ground water or the evaporation of mercury into the air. E-waste is highly complex to handle because of its composition. It is made up of multiple components some of which contain toxic substances that have an adverse impact on human health and environment if not handled properly that is if improper recycling and

disposal methods are deployed. So there is a need for appropriate technology for handling and disposal of these chemicals.

Basel Convention characterizes e-waste as hazardous when they contain and are contaminated with mercury, lead, cadmium, polychlorinated biphenyl etc. Wastes containing insulation or metal cables coated with plastics contaminated with or containing lead, coal tar, cadmium, Polychlorinated Biphenyl (PCB) etc are also characterized as hazardous wastes. Also precious metal ash from printed circuit boards, glass waste from cathode-ray tubes, LCD screens and other activated glasses are classified as hazardous wastes.

Effects of some of the prime hazardous components in of e- waste are mentioned below:

Sr.No	Hazardous components	Effect of Hazardous components of e-waste
1	Arsenic	Can affect skin and can decrease nerve conduction velocity. Chronic exposure to arsenic may cause lung cancer and sometimes be fetal.
2	Lead	May affect kidneys, reproductive systems, nervous connections. May cause blood and brain disorders, sometimes may be fetal.
3	Barium	Can affect heart muscle.
4	Chromium	Can damage liver, kidneys and may cause asthmatic bronchitis and lung cancer.
5	Beryllium	may cause lung diseases.
6	Mercury	Affects the central nervous system, kidneys and immune system, it impairs foetus growth. May cause brain or liver damage.
7	Cadmium	May cause severe pain in the joints and spine. It affects the kidneys and softens bones.
8	BFR (Brominated flame retardants)	Can harm reproductive and immune systems, may cause hormonal disorder.
9	Chlorofluorocarbon	May affect the ozone layer. It may cause skin cancer in human and genetic damage in organisms.
10	Polychlorinated Biphenyl (PCB)	May cause Cancer in animals, can affect the immune system, reproductive system, nervous system, endocrine system. PCBs persistently contaminate in the environment and cause severe damage.
11	Polyvinyl Chloride (PVC)	PVC contains upto 56% chlorine and when burnt, produces Hydrogen chloride gas which in turn produces hydrochloric acid that is dangerous to respiratory system.
12	Dioxin	These are highly toxic to animals and can lead to malfunction of foetus, decreased reproduction and growth rates, affect immune system.

#### Management Strategies

There is no unique or ideal model for e-waste management in developing countries, each of which has its own specific environmental, social, technological, economic and cultural conditions. Environmentally sound management of WEEE recognizes three Rs i.e. reduce, reuse and recycle. The aim would be to **reduce** the generation of e-waste through smart manufacturing and

maintenance, **reuse** till functioning of electronic equipment by someone else and **recycle** those components that cannot be repaired.

A smart e-waste management system for developing countries have to assess the e-waste situation, recognize that e-wastes are a complex mixture of hazardous and nonhazardous substances and materials and need to define the integral e-waste management system taking into consideration the EEE market penetration, life cycle of ICT equipment, financing mechanisms etc.

The main aspects to be taken into account when framing ICT waste management guidelines for developing countries are:

- Policy and regulations covering import and export of EEE and WEEE in accordance with the rules of each country and with international legislation
- Defining responsibilities of prime stake holders at the level of government, supply chain, consumers of ICT equipment and entities for disposal of waste
- Extended producer responsibility (EPR) where the manufacturer's responsibility for its ICT equipment extends throughout the various stages of that equipment's life cycle with internalizing the cost of managing the equipment at end of life
- Responsible information system to have data on ICT equipment in market, disused EEE management and WEEE management and to have control on the monitoring and future planning
- Promoting employment and training for the informal sector engaged in recycling and recovery of the materials.

## Methods

### General Public Questionnaires:

Questionnaires with a short description of the current study and intended use of collected data were distributed to the respondents by explaining about it in person lived in Yangon Region. Questions focus on use of household electronics, and are structured in a systematic way in order to quantify and explain an individual's consumption habits, insight into perceptions on waste disposal, individual knowledge of e-waste hazards, and looks into public awareness e-waste management policies. In total, 300 sufficiently complete surveys were collected. Thus it will serve as a source of primary data on public awareness of the e-waste management issue.

**Government Interviews:** Interview will conduct Yangon City Development Committee-Pollution Control and Cleansing Department in person and ask the questions about the policies and perspectives concerned with e-waste management strategies.

## Findings

In this section, the data collected through questionnaire were categorized by house hold electronic usage and consumption pattern, household management strategies, individual perception, public knowledge and awareness of e-waste.

### Households Electronic Usage and Consumption Pattern

In total, 99% of questionnaire respondents reported that they use household electronics (again, defined in this study as mobile phones, personal computers, television, flat iron and kettle). The 92% of respondents indicated that they use mobile phones, over 70% used TV, flat iron and Kettle and only 32% used computers frequently. According to this survey data, most of the respondents have low touches in computers.

The last year, 35% of respondents purchased mobile phones, 5% in personal computers, 14% and 17% in flat iron and kettle and 6% bought others. According to this data, mobile phones were used more than other equipment. More than half of the respondents expect mobile phones 2 years lastly, about half-respondents expect more than 5 years in computer and TV, and over 30% expect more than 5 years in flat iron and 1 year in kettle. According to this data, computers, TV and flat iron have long lived in use and kettle has short time in use.

The electronic products purchased by last year have been repaired and reused 1 to 3 times by 48% respondents, 4 to 6 times by 6%, 7 to 9% by 1%, more than 10 times by 2% and 43% haven't repaired yet. Moreover, 63% of respondents repaired 1 to 3 electronic products in a year. According to this data, consumers also tried to repair at the repair services if something went wrong with the appliances. Mostly 35% of respondents spend 100000 to 200000 MMK on electronic products; lastly 5% spend more than 500000 MMK in a year.

Figure 1 to 7 of Appendix depicts the data collected for question 1-7 of the questionnaire to analyze the households' electronic usage and consumption pattern.

### **Households Electronic Management Strategies**

Over 40 % of respondents keep in home the electronic products that they no longer use, 26% give unused products to a friend, after that 17% respondents sale to secondhand shop and 7% take spare parts and lastly dispose as a trash. When electronic products were broken, mostly keep in home, the second disposed as a trash and then 14% give to a friend, 18% sell to secondhand shop and 8% take spare parts. According to this data, the unused or broken electronic products were kept mostly in home in order to give a friend, sell secondhand shop, take needed spare parts and finally when these become hopeless, and dispose to dump.

Figure 8 and 9 of Appendix3 depicts the data collected for question 8 and 9 of the questionnaire to analyze the households' electronic management strategies.

### **Individual Perception**

Data from Question 10 indicate that most people – approximately 67% – purchase new electronic items due to physical damage of existing ones, 24 % for essential for job, 4% for income increase, 3% for desire for latest technology and 2% for others. According to this data, the perceptions of respondents are even if the current item damage; buy new one and its good result to reduce e-waste. Only 3% follow newest technology that never ends and it's one of the reason to increase e-waste.

Data from Question 11 indicate that 39% of respondents' choice to repair an item because of the price of repair compared with replacing one. Availability of spare parts is one of the reasons to repair, 27% choice it and 17% choice the reason of warranty of product, 8% choice because of having knowledge of skills needed to repair and 9% choice others. According to this data, the respondents are mostly civil servant and so assessing the cost is one of the reasons to choice the repair.

Data from Question 12 indicate that 66% of respondents resold because of no ease to repair, 13% choice a cash reward by cause of initial cost of product and 21% choice for other factors. According to the data, firstly most choose to repair products and then resell them when not easy to repair. It's rare to dispose electronic products to dump even they are end of life.

Data from Question 13 indicate that 76% of respondents unaware of e waste collectors and

this idea seem to be a preliminary attitude to them and 24% of them considered that they notice for it if they are informed of collecting stations.

Figure 10 to 13 depicts the data collected for question 10 and 13 of the questionnaire to analyze the perception of individual on the factors of buying, repairing and reselling electronic products.

### **Public Knowledge and Awareness of E-Waste**

Data from Question 14 indicate that 38% know a bit the materials used in electronic products, 30% don't know much, 28% nothing to know, and 3% know quite a lot. According to this data, about 40% have knowledge of materials used in electronics products and other percent don't have knowledge about it.

Data from Question 15 indicate that 62% of respondents don't perceive any hazards or risk of e-waste and 38% perceive about it. According to this data, it's a better result because some have knowledge that knowing e-waste as hazardous waste.

Figure 14 and 15 depicts the data collected for question 14 and 15 of the questionnaire to analyze the knowledge level on the impacts caused by e-waste.

Data collected for Question 16 show that 52% of respondents either do not perceive any health or environmental hazards to e-waste, or do not know of specific hazards and 48% notice about it. Finally, responses from Question 17 indicate that 91% of respondents either do not think there are any government policies in place to handle e-waste, or do not know of any pertinent policies or governing bodies.

Figure 16 and 17 depicts the data collected for question 16 and 17 of the questionnaire to analyze the public awareness impacts of e-waste on surrounding environment and policies on e-waste.

After that, according to the data collected through interview of government officer, YCDC, Myanmar being a developing country there are no unusable part worried with electronic parts (e-waste). Retail shop constantly kept the harm waste (parts) cautiously some place to be placed being used here and there some way or another. Consumers likewise endeavored to fix at the service centers if something turned out badly. At the point when these become absolutely miserable to fix they sold them back to the

second hand agents or to repair center. The repair service centers benefits likewise dealt with the great parts and reassembled them in second hand machines as essential. There are retail markets that have an electronic waste dump where all unusable electronic parts are being exchanged.

All these facts lead to the concept that in Myanmar electronic waste is not regarded as a waste. If a household disposes one there is always somebody ready to collect it. There are no wide spread educational papers, articles, and extension services etc. for electronic waste disposal in Myanmar. Only some news of electronic waste of other countries has been found. The main reason for this is disposal at dump sites are almost non-existing. The wholesome dumping of such items in urban dump sites is prohibited. However authorities say that no such disposal concerning electronic appliances happened yet.

Every one of these certainties led to the idea that in Myanmar electronic waste isn't viewed as waste. On the off chance that a family unit arranges one there is dependably someone prepared to gather it. There are no wide spread instructive papers, articles, and expansion administrations and so forth for electronic waste transfer in Myanmar. Just some updates on electronic misuse of different nations have been found. The fundamental explanation behind this is disposal at dump site are nearly non-existing. The household must call a municipal waste collecting truck to the house for dumping and pay a price for such service. Or dispose them on their own arrangement to the latest land fill sites of HteinPin and Dawei Chaung sites. The healthy dumping of such things in urban dump locales is restricted. Anyway authorities say that no such disposal concerning electronic appliances occurred in Yangon Region.

### **Conclusion**

Sometimes, we don't notice the fact that harmful our life and our environment because we have no knowledge about it. While the electrical and electronic appliances/items sector grows throughout the world and, the ratio of electronic wastes in garbage is increasing as well. At the present, there is no any critical effect and volume of e-waste yet but with the economy developing, the nation creating and the normal utilization of electronic gadgets rising step by step, Myanmar will before long need to manage an immense measure of electronic waste, which is a test for the earth. Without powerful government

guideline of the disposal of electronic consumer products, and without open attention to the characteristic dangers, amassing of such waste will have critical ramifications for the human populace. A legitimate structure and a lot of strategies which set out the nation's electronic waste management approach are essential.

### **Further Study Recommendation**

This paper has a few of restrictions and uncertain inquiries that ought to be tended to in future work. Given its attention on evaluating open mindfulness, the sample size estimate for the overall population poll is very little, and in this manner may not be completely illustrative of the general population's mindset and behavior toward e-waste in Yangon Region. In any case, past the sample size, the finding here might be appropriate to other extensive urban communities in Myanmar. Future examinations ought to likewise counsel electronic producers' delegates to comprehend their insight into and point of view on the EPR regime.

In particular, research should be done on the degree to which these companies use formal gathering and recycling services, for example, Golden Dowa, alongside discussion from clean innovation companies, for example, RecyGlo. Moreover, staff individuals from organization shops and showrooms should be met to decide if organizations give legitimate preparing in e-waste accumulation and the board to their representatives. To give a more profound examination of overview information, future work ought to decide if familiarity with e-waste perils and approaches really influence buying and disposal habits. Extending the degree past Yangon, it would be entirely significant to start relative studies between urban communities crosswise over Myanmar to comprehend varieties in open mindfulness on a national scale.

### **Acknowledgement**

It is a privilege to offer my sincere thanks to Dr. Tin Lei Lei Win, Principal of Co-operatvie College, Phaunggyi for giving me this opportunity and then deeply thanks to all my colleges from Co-operative College, Phaunggy . Without your support and encouragement, I can't accomplish my jobs.

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**Appendix I: Questions to be used for General Public Awareness.**

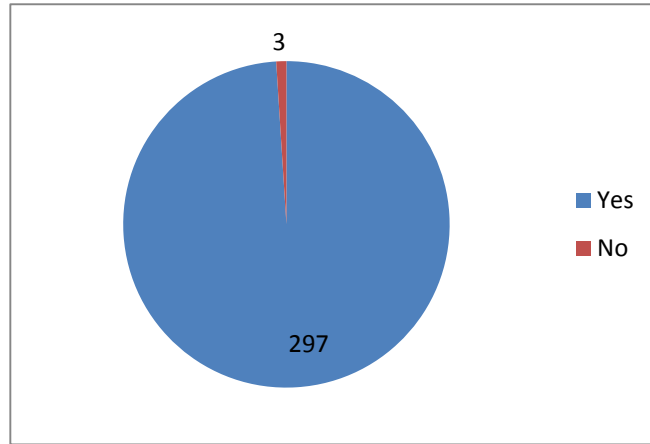
1. Do you use household electronic? If yes, which electronic products do you use frequently?
2. Of the household electronics that you use, how many of each type have you purchased/replaced in the last year?
3. How long do you expect the following electronic/electrical items to last?
4. How many times have you repaired electronic products purchased last year?
5. How many electronic/electrical products do you purchase a year?
6. How much do you spend on electronic/electrical products in a year?
7. On average, how many electronic/electrical products do you choose to repair in a year?
8. What have you done with the electronics that you no longer use?
9. What do you do with broken electronic/electrical products?
10. What was your reason for purchasing new electronic equipment?
11. Which factors would affect your choice whether to repair an object or not?
12. Which factors would affect you trading in your old products for a cash reward?
13. Do you know someone who can collect your unused electronic for recycling, or reselling?
14. How much do you know about the materials used in electronic/electrical products?
15. Do you perceive any hazards or risks in e-waste?
16. Do you notice any hazards caused by e-waste in your environment?
17. Do you know any waste management poliices and regulations implemented in Yangon Region?

**Appendix II. Questions for government officials**

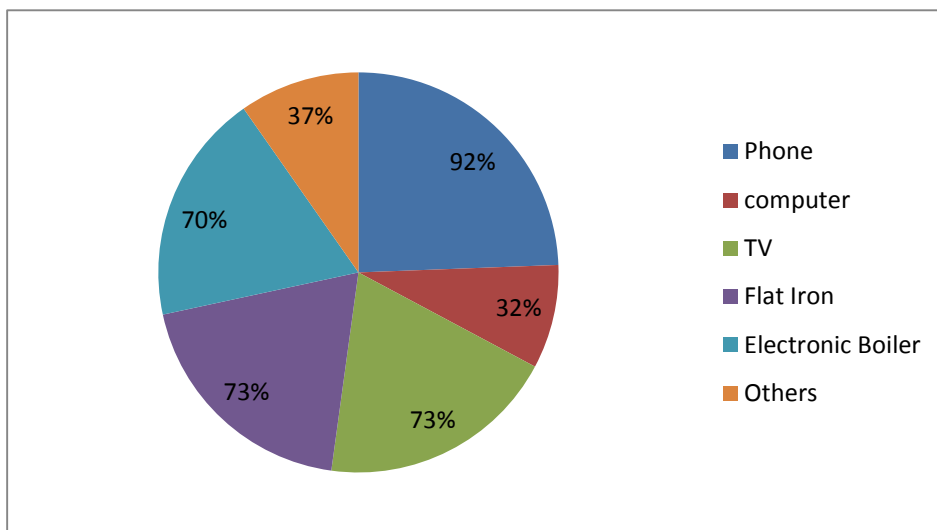
1. Is there any policies or regulation concerned with e-waste in Yangon ?
2. How to collect e-waste in Yangon Region?
3. Are there any private recycling companies for e-waste corporate with YCDC?
4. Currently, what are you carrying out to get awareness on e-waste by public?
5. Explain the current situation of e-waste volume in Yangon?
6. Are there any future plans to prevent the impact of e-waste?



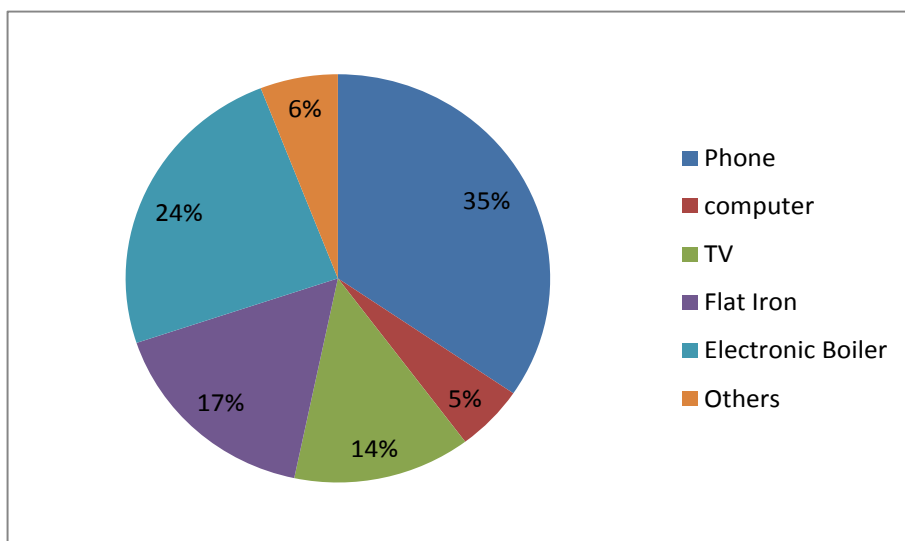
**Appendix III: Visual Representation of Survey Data**



**Figure 1 (a) depicts the data collected for question 1 of the questionnaire to analyze the households' electronic usage and consumption pattern.**



**Figure 1 (b) depicts the data collected for question 1 of the questionnaire to analyze the households' electronic usage and consumption pattern.**



**Figure 2 depicts the data collected for question 2 of the questionnaire to analyze the households' electronic usage and consumption pattern.**

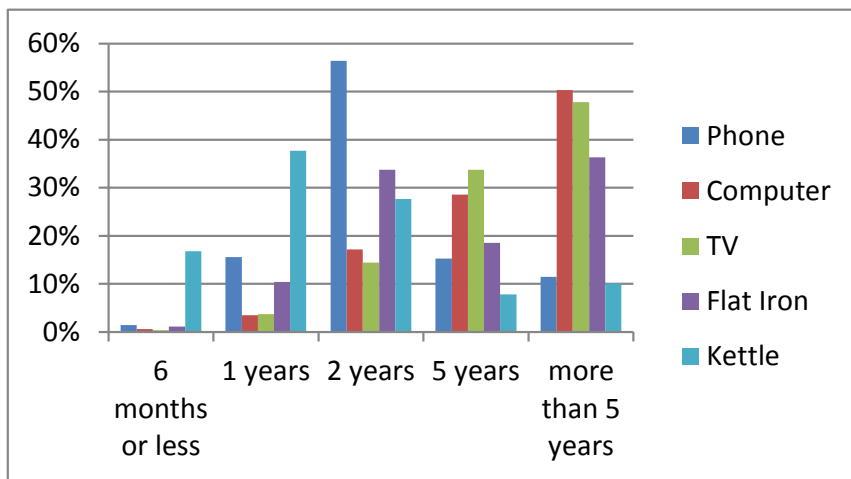


Figure 3 depicts the data collected for question 3 of the questionnaire to analyze the households' electronic usage and consumption pattern.

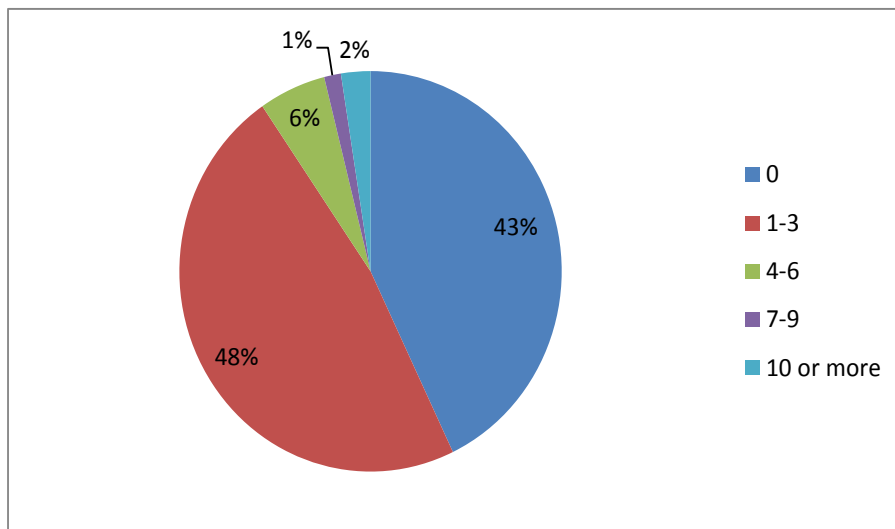


Figure 4 depicts the data collected for question 4 of the questionnaire to analyze the households' electronic usage and consumption pattern.

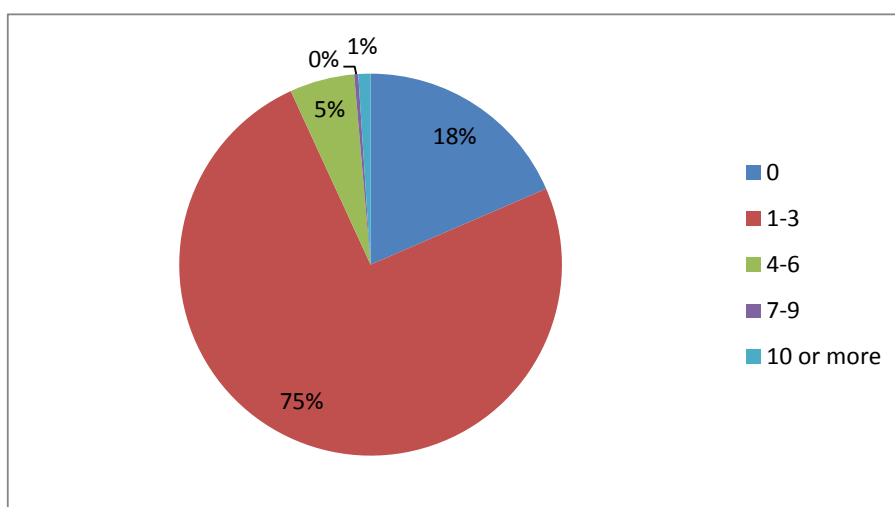


Figure 5 depicts the data collected for question 5 of the questionnaire to analyze the households' electronic usage and consumption pattern.

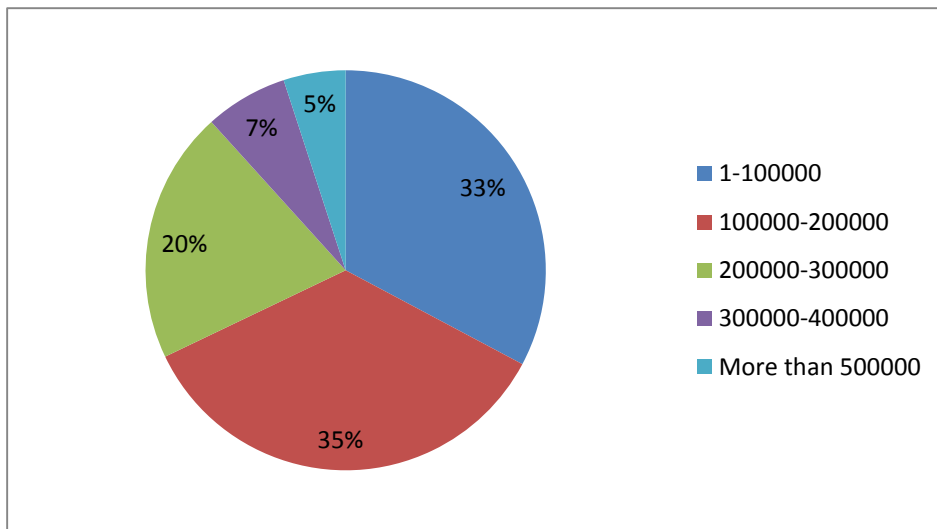


Figure 6 depicts the data collected for question 6 of the questionnaire to analyze the households' electronic usage and consumption pattern.

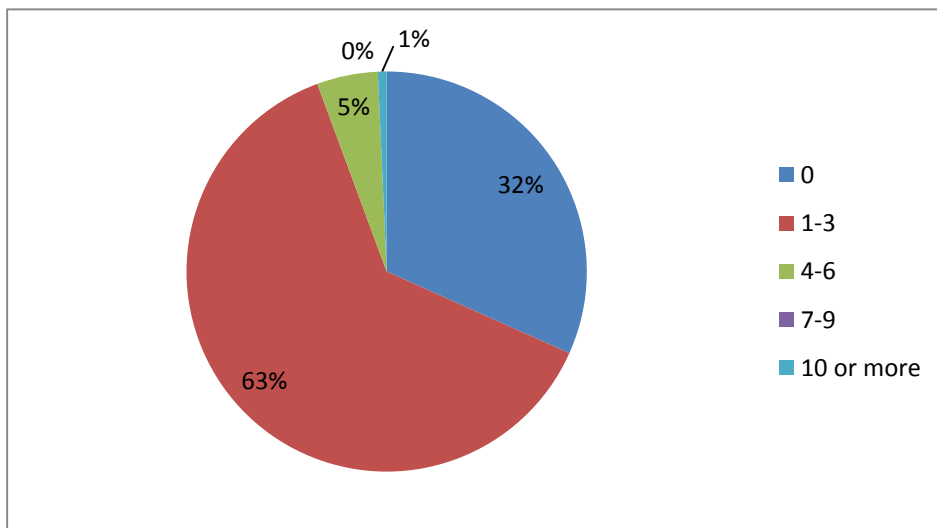


Figure 7 depicts the data collected for question 7 of the questionnaire to analyze the households' electronic usage and consumption pattern.

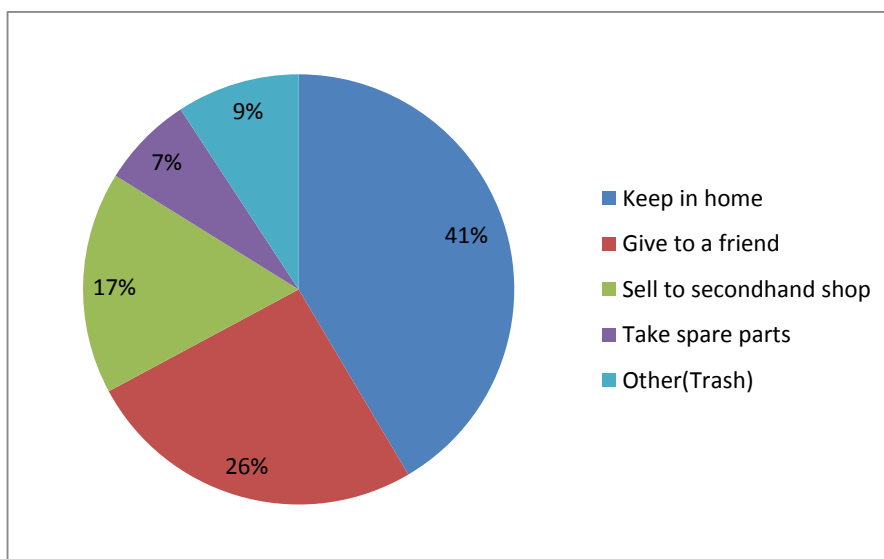


Figure 8 depicts the data collected for question 8 of the questionnaire to analyze the households' electronic management strategies.

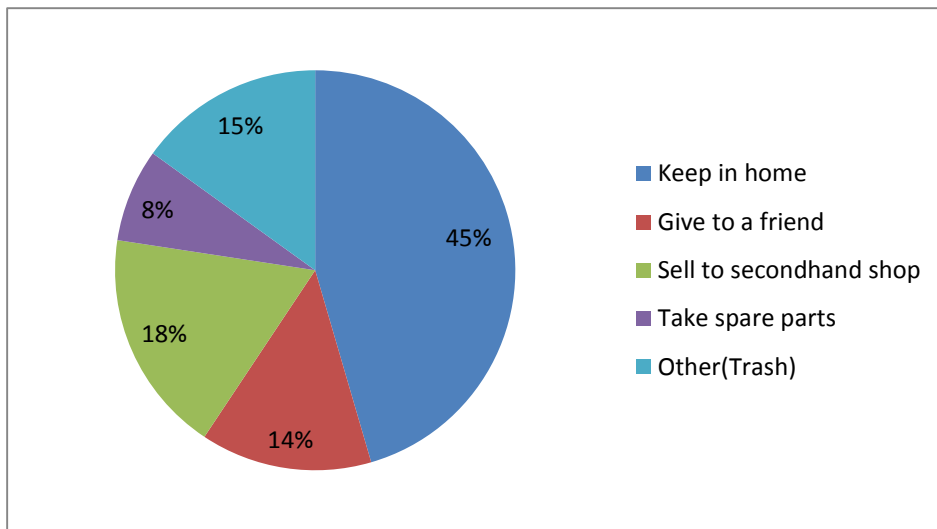


Figure 9 depicts the data collected for question 9 of the questionnaire to analyze the households' electronic management strategies.

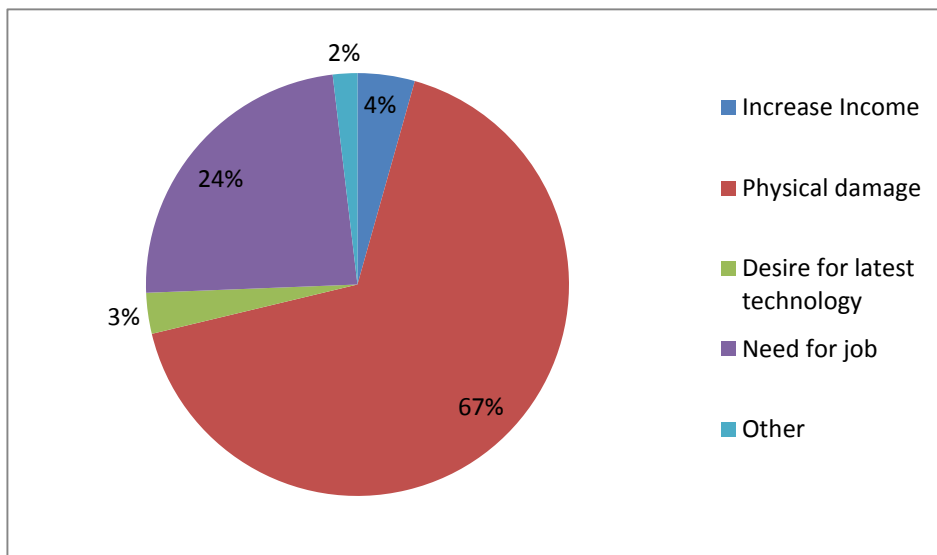


Figure 10 depicts the data collected for question 10 of the questionnaire to analyze the perception of individual on the factors of buying, repairing and reselling electronic products.

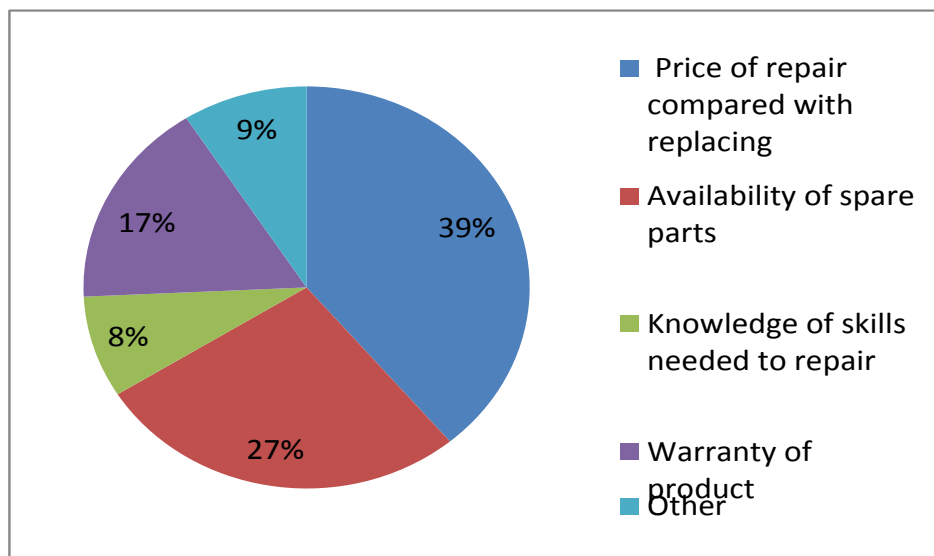


Figure 11 depicts the data collected for question 11 of the questionnaire to analyze the perception of individual on the factors of buying, repairing and reselling electronic products.

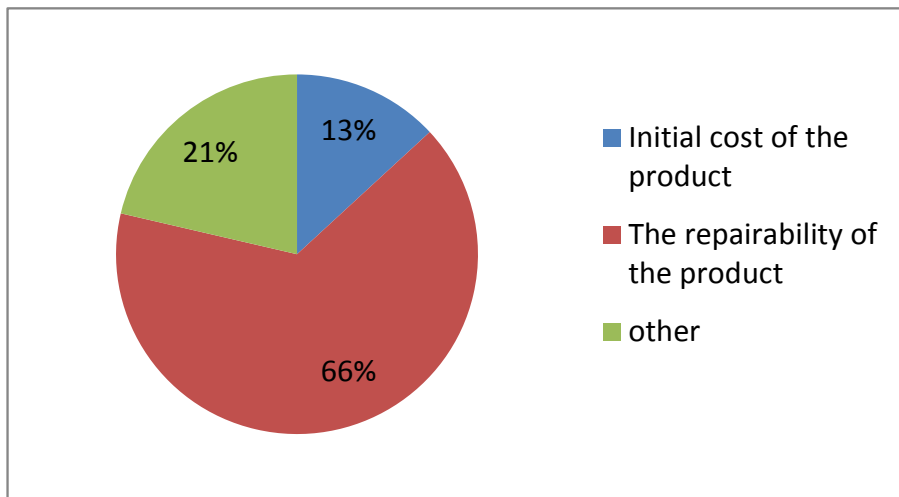


Figure 12 depicts the data collected for question 12 of the questionnaire to analyze the perception of individual on the factors of buying, repairing and reselling electronic products.

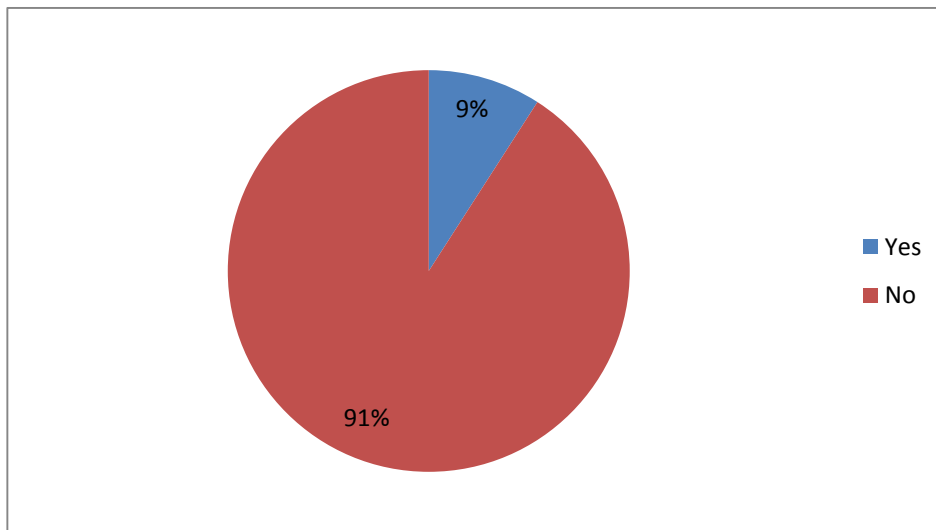


Figure 13 depicts the data collected for question 13 of the questionnaire to analyze the perception of individual on the factors of buying, repairing and reselling electronic products.

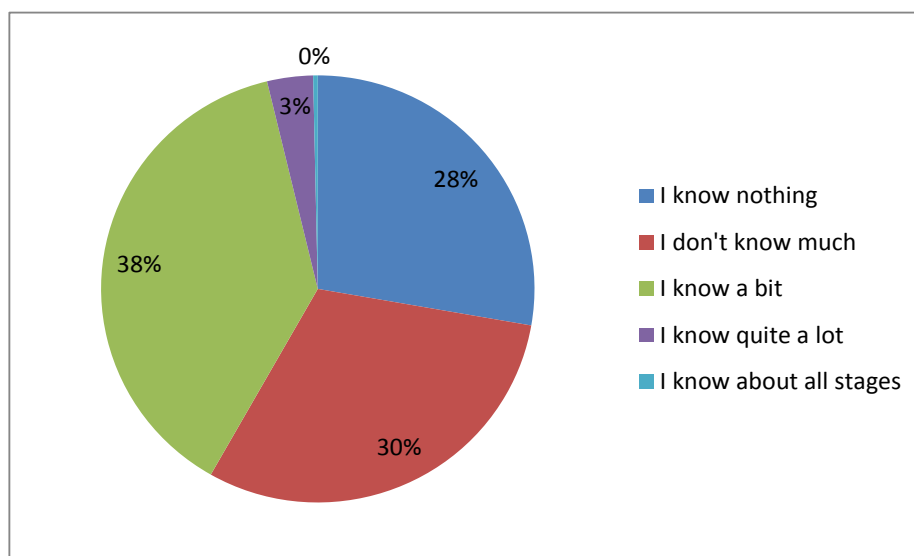


Figure 14 depicts the data collected for question 14 of the questionnaire to analyze the knowledge level on the impacts caused by e-waste.

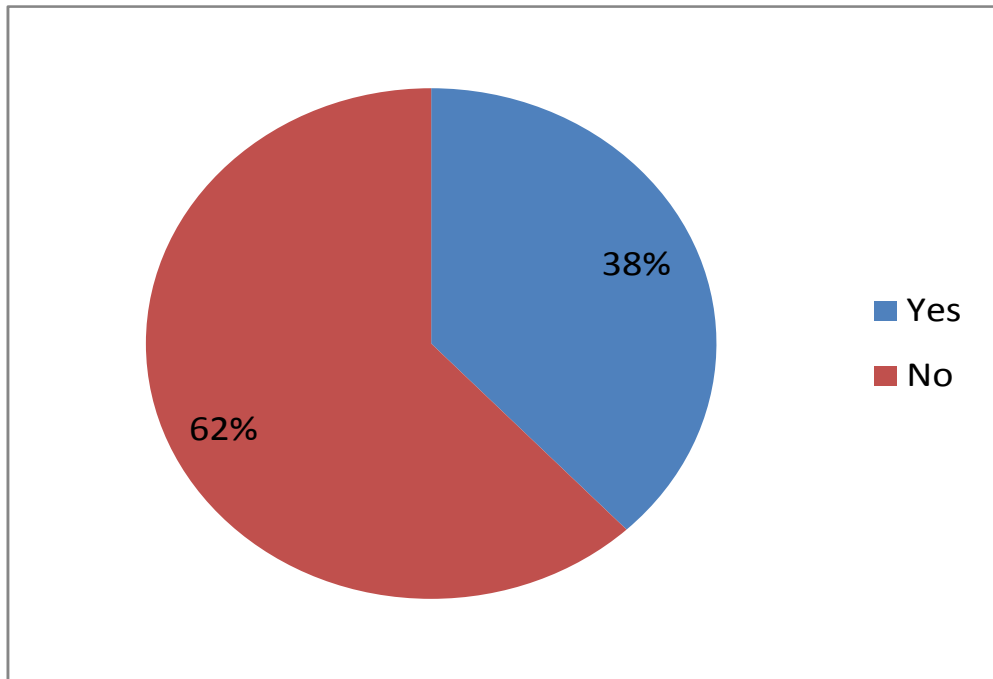


Figure 15 depicts the data collected for question 15 of the questionnaire to analyze the knowledge level on the impacts caused by e-waste.

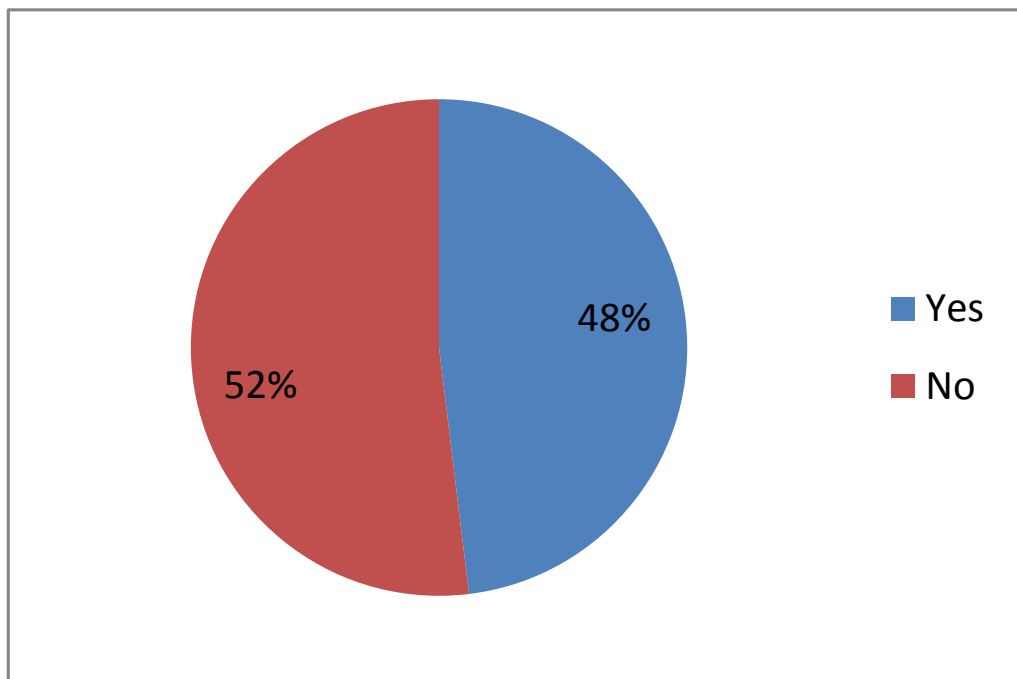
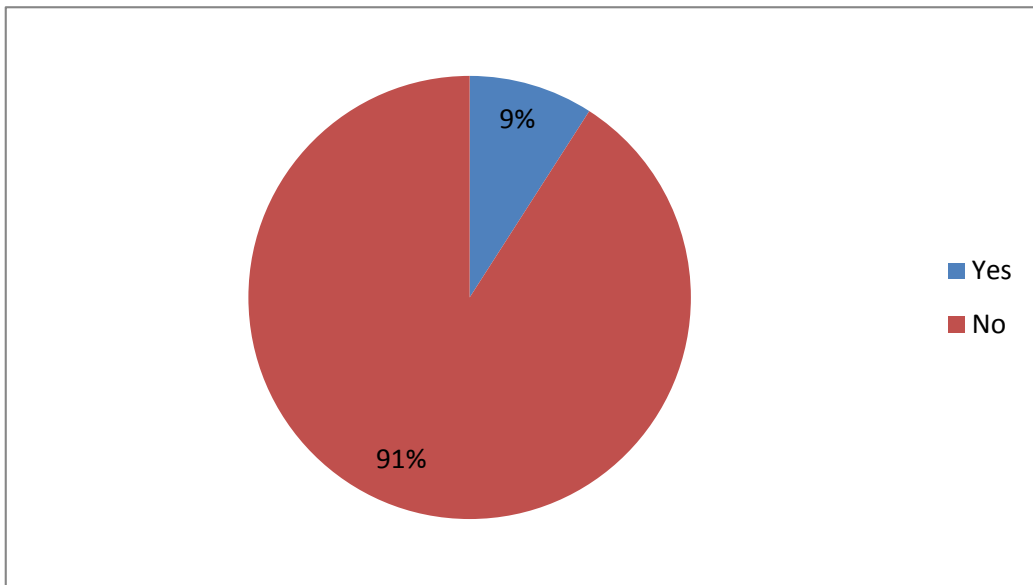


Figure16 depicts the data collected for question 16 of the questionnaire to analyze the public awareness impacts of e-waste on surrounding environment and policies on e-waste.



**Figure17 depicts the data collected for question 17 of the questionnaire to analyze the public awareness impacts of e-waste on surrounding environment and policies on e-waste.**

