A STUDY ON E-WASTE MANAGEMENT PRACTICES IN DHAKA, BANGLADESH

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A thesis submitted to the Department of Civil Engineering, Daffodil International University in Partial Fulfillment of the Requirements for the Degree of **Bachelor of Science in Civil Engineering**

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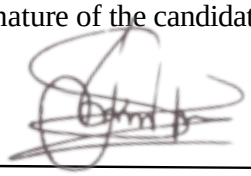

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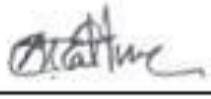

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DEDICATION

I would like to dedicate this work to my parents and beloved teachers, who raised and guided me in every single moment of my life.

ACKNOWLEDGEMENT

In the name of Allah, the Most Gracious, the Most Merciful,

We begin by expressing my deepest gratitude to Allah, the Most Compassionate, and the Most Merciful, for granting me the wisdom, strength, and perseverance to embark on this journey of knowledge and discovery. His boundless blessings and guidance have been my constant source of inspiration and fortitude throughout this endeavor.

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ABSTRACT

E-waste is now a significant issue affecting people in many different places. This country is highly affected as it isn't well managed, has unenforced laws and uses a lot of unofficial recycling. Information from ten repair shops and five vandal shops was studied to investigate how e-waste is managed in Bangladesh. The study confirmed that most e-waste is handled in an unofficial way, endangering people and the environment because of the use of lead, mercury and cadmium. A sustainable approach to managing e-waste in Bangladesh can protect the environment and benefit both the economy and people by mixing good practices found in Bangladesh with those from other countries. In comparison, an amount of 710 kg of waste is expected each month, consisting mainly of mobile phones (12%), laptops (13%), televisions (17%), refrigerators (15%), batteries (17%) and various electrical parts (26%). The problems are increased when recycling and disposal procedures are not followed properly. Of these findings, 73% chose to sell their e-waste to third parties that were not regulated and 27% simply threw it away in locations not closely monitored. Very few workers, only 27% and 13%, understand recycling and proper disposal methods, respectively.

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Chapter 1
INTRODUCTION

1.1 Background

A growing number of people and homes using mobile devices, computers and electronics is leading to a major concern about electronic waste across the globe (Needhidasan, Samuel & Chidambaram, 2014). The huge rise in demand for hardware and electronics has led to more demand for electronic goods. In 2017, the world used 72 million MT of electrical items (Forti et al., 2020). If e-waste is handled poorly, it can be dangerous to both people and the environment due to the poisons it contains (Needhidasan, Samuel & Chidambaram, 2014; Wath, Dutta & Chakrabarti, 2011; Vats & Singh, 2014). Ferrous material is the largest component (38%) of municipal waste, whereas non-ferrous material equals 28%, glass (4%), plastic (19%) and much less wood, rubber, ceramic and other materials (11%) (Needhidasan, Samuel & Chidambaram, 2014; Vats & Singh 2014). Out of the many dangerous substances, lead, nickel, cadmium, mercury, copper and chromium (VI) are heavy metals, while CFCs, PCBs, PBBs, BFRs and similar halogenated compounds are very dangerous as well (Wath, Dutta & Chakrabarti, 2011; Vats & Singh, 2014). These substances may result in dioxins and since dioxins put both the environment and people at risk, this is undesirable.

Recent studies show that, because it costs too much for recycling plants in developed countries to work at full capacity due to high costs, much e-waste is now exported to developing countries in Asia (Wath, Dutta & Chakrabarti, 2011; Vats & Singh, 2014). It has to tackle a serious issue as a consequence of the e-products industry growing fast and the rapid changes in electronics devices (Rahman & Mahboob, 2015; Alam & Bahauddin, 2015). Following Vision 2021, the Bangladeshi government hopes to use advanced technologies in fields like communication, education, health and reduce poverty (Alam & Bahauddin, 2015; Yousuf & Reza).

2011). Because of these needs, there are now more electronic and electrical gadgets in the country than ever before, causing an increase in e-waste. Right now, there is no proper system in Bangladesh to deal with e-waste. E-waste is a big problem since it holds different unsafe and toxic elements that may be risky to people and the environment (Rahman & Mahboob, 2015). The amount of e-waste produced in Bangladesh each year is said to be 0.4 million MT. Only a quarter or less of all this waste is recycled (Masud et al., 2018). Unhandled garbage is dumped in landfills, rivers, drains, lakes, canals, open spaces and municipal solid waste which places a greater risk of polluting the environment (Masud et al., 2018; Hossain et al., 2010; Alam & Bahauddin, 2015). Appropriate recycling methods enable extracting useful resources from e-

waste to produce new goods which in turn helps to reduce pollution, since this waste often has heavy metals and other metals (Masud et al., 2018; Alam & Bahauddin, 2015; Yousuf & Reza, 2011). But, the biggest difficulty in running an accurate e-waste management facility comes from increasing public awareness of the social, economic and environmental implications of e-waste among consumers, producers, dealers, legislators and retail sellers (Yousuf & Reza, 2011; Hossain et al., 2010).

1.2 **Study Area**

The area studied is Mirpur in Dhaka, Bangladesh, where there are many people and e-waste is now a major concern. One reason Mirpur is so important in Dhaka is that it features many residential areas and business spaces housing a lot of houses, shops and small-scale factories that make a lot of electronics, including mobile phones, computers, televisions and home appliances.

Informal businesses dealing with electronic waste are common in Mirpur. Activities involving lead, mercury and cadmium frequently let these substances into the environment, since protection or safety measures are not in place during these activities. Throwing e-waste out in the open and recycling it at home without proper measures has polluted the local land, water and air, risking the health of many and those who handle the waste.

Areas in Mirpur that consist of residential zones, markets and groups responsible for e-waste are covered by the study. The experts visited these locations to better understand the damage ewaste causes in Mirpur's ecosystem. The team focuses on this specific region with the aim of fully exploring the extent of the issue, its impacts on nature and solutions for better managing the situation.

1.3 **Objective**

1. To Observe the sources of electronic waste (e-waste) and classify it based on its origin, composition, and potential environmental impact.

Chapter 2
LITERATURE REVIEW

2.1 General

Improvements in technology, increases in electronic device prices and different preferences among consumers have led to electronic garbage, also known as e-waste, becoming one of the fastest-growing types of waste in the world. Due to these problems, electronic devices are becoming obsolete in just a short time which causes more items to be discarded without proper care. Experts project that the worldwide amount of e-waste will nearly double between 2014 and 2030, rising to 74 million metric tons (Forti et al., 2020).

Computers, TVs, refrigerators, cell phones and other appliances are examples of e-waste when they get thrown away. Even though these electronic products may have lead, mercury, cadmium, brominated flame retardants, they are also rich in gold, copper and silver. Should these dangerous materials not be disposed of properly, they can cause major problems for the land and people in the community (Needhidasan, Samuel, & Chidambaram, 2014).

In Bangladesh, a considerable amount of e-waste is produced in cities, similar to other parts of the world. More people moving to cities, a rise in internet usage and weak regulatory laws have worsened the problem. Most e-waste in Bangladesh ends up in the hands of recyclers who concentrate on acid stripping, fires and physical disassembling. As a result of these actions, resources are not managed well and nearby people and employees are exposed to harmful pollutants (Rahman & Mahboob, 2015).

A large majority of Dhaka's recycling and dismantling of e-waste takes place in Mirpur, as research on e-waste in Dhaka indicates. Although recovering materials is economically beneficial, it leads to many environmental problems, including poisoned soil and water, increased air pollution and the disappearance of different species in the affected areas (Masud et al., 2018).

E-waste influences the environment in numerous geographic regions, not only in one place. Both POPs and heavy metal wastes released into the environment can cause water and soil to become polluted, leading to decreased yields in both farming and water resources over time. Mercury and lead in old electronics may leak into the groundwater, leading to harm for creatures living in the water and for people. If plastics are not handled properly prior to burning in e-

waste, carcinogenic dioxins and furans can be released due to brominated flame retardants (Wath, Dutta & Chakrabarti, 2011).

Small but stable steps have been taken to deal with Bangladesh's problems related to e-waste. The Hazardous Waste Management Policy (2021) and the Environment Conservation Rules (1997) aim to manage the process and proper disposal of hazardous waste, including e-waste. But due to a lack of information, weak infrastructure and a lack of enforcement measures, these rules are not easy to implement in East Asia (Hossain et al., 2010).

It is becoming necessary to unite formal and informal recycling methods in e-waste management due to how huge the issue has become. By cooperating, forming awareness movements and boosting advancements in recycling, e-waste can bring less harm to the environment and people. Moreover, Bangladesh can use and modify international guidelines for e-waste management, including Extended Producer Responsibility (EPR) rules, so they work well for its people (Masud et al., 2018).

E-waste management in Bangladesh is examined in the following sections based on a study of Dhaka, but primarily focusing on Mirpur.

2.2 **Sources of E-Waste**

The main sources of e-waste are considered to be both domestic and industrial. Since each type of electronic item creates its own unique waste, managing e-waste is very complicated.

Domestic Sources: The ready availability and low prices of electronics are leading households to produce a lot of e-waste today. Everyday types of e-waste can include mobile phones, laptops, TVs, air conditioners and washing machines. Due to a large number of residents and a tendency to throw away old devices and replace them with new models, urban centers in Bangladesh (such as Mirpur and Dhaka) majorly contribute to e-waste (Forti et al., 2020).

With an increased focus on innovation and short development cycles, manufacturers have accelerated the obsolescence of electronic devices in the economy. Recently, mobile phones need to be replaced after about two years due to compatibility problems or small signs of wear, while people kept them for nearly three or four years in the past (Rahman & Mahboob, 2015). People are abandoning more electronics due to a decrease in the common belief that repairing old equipment is worthwhile. These trends can best be seen among the families of Mirpur, an important area in Dhaka for residences and businesses. Studies have found that a lot of the e-

waste discarded at homes is made up of very small items such as cell phones and related gadgets. Televisions and refrigerators are difficult to control because people often choose to give them to unauthorized recyclers or keep them for a very long time (Masud et al.,2018). The lack of organized recycling and collection systems causes hazardous means of throwing away waste.

Industrial Sources: When companies no longer use computers, tools or equipment, the amount of e-waste goes up. In most cases, industrial e-waste is more dangerous than household e-waste since it holds greater levels of hazardous components. Workstations, servers, devices used in manufacturing and laboratory instruments are found in many companies. Since these gadgets hold metals like gold and copper, in addition to mercury and cadmium, they require special handling (Wath, Dutta & Chakrabarti, 2011). Most of Bangladesh's industrial e-waste is created in Dhaka, where the country's industry and economy are strongest. Businesses and workshops in Mirpur are adding to e-waste by throwing away old tools and equipment. Sewing machines and other tools are thrown away by clothing factories because of improvements in technology or faults. This waste is often handled by underground recyclers who use harmful practices that often do not protect the ground from contamination (Masud et al., 2018).

In addition, a large amount of useless electronics is being smuggled into Bangladesh which leads to more industrial e-waste. Imported equipment that gets discarded not long after use creates e-waste in the community since they are often coming to the end of their useful life. Since Mirpur has a lively waste recycling market, the environment there suffers from these abandoned items (Hossain et al., 2010).

2.3 **Classification of E-Waste**

Modern technology is making it necessary for people in all kinds of nations to rely on electrical products and appliances at home, at work and in factories. There is a rapid shift into new facilities because technology is improving at such a fast pace. Many tiny and big electronic devices are becoming e-waste and its amount is increasing as a result of this trend (Forti et al., 2020; Yousuf & Reza, 2011).

The European Union Directive 2002/96/EC has organized e-waste into ten main categories.

2.3.1 Large Household Appliances

This category also covers refrigerators, washing machines, air conditioners, electric fans, dishwashers, different kitchen appliances and heating devices. Since these items require

replacement due to faulty parts or new technology, the stream of electronic waste increases (Yousuf & Reza, 2011; Vats & Singh, 2014).

2.3.2 Small Household Appliances

Some small household appliances include hair dryers, toasters, fryers, electric shavers, clocks, water dispensers and sewing machines. Due to their short lifetimes, these items get dumped regularly and much more often than large items (Yousuf & Reza, 2011).

2.3.3 ICT and Telecommunications Equipment

Among the ICT equipment we find computers, laptops, mobile phones, networking devices, printers and scanners. Since they are updated quite often, these gadgets play an important role in today's digital world and create more e-waste (Yousuf & Reza, 2011).

2.3.4 Consumer Equipment

Items found here are drilling machines, electric cutters and audio-visual equipment. Computers and phones are often found in homes and companies and tend to have metals that could be reused (Vats & Singh, 2014).

2.3.5 Lighting Equipment

Items found here are drilling machines, electric cutters and audio-visual equipment. Computers and phones are often found in homes and companies and tend to have metals that could be reused (Vats & Singh, 2014).

2.3.6 Electrical and Electronic Tools

Among the examples in this section are vacuum cleaners, routers, photocopy machines and generators. Houses, offices and places of work normally have machines and devices (Hossain et al., 2010).

2.3.7 Toys, Leisure, and Sports Equipment

Electric toys, gaming consoles, treadmills and music players are some of the products available here. As newer models become available, individuals often replace their old ones which creates e-waste (Ari, 2016).

2.3.8 Medical Devices

Among the medical equipment are X-ray machines, ECG monitors, dialysis machines and ventilators. Several hazardous parts are found in these devices, so they must be handled carefully when getting rid of them (Vats & Singh, 2014).

2.3.9 Monitoring and Control Instruments

Smoke detectors, thermostats and CCTV cameras, among others, are part of this group, as they monitor households and industry buildings (Huisa, 2008).

2.3.10 Automatic Dispensers

They are made up of water dispensers, vending machines and juice mixers. Electronics usually include metals, plastics and electronics, so it is necessary to manage their recycling properly (Yousuf & Reza, 2011).

2.3.11 Additional Components

Many of the used batteries in our devices add to e-waste. Batteries you can recharge such as lithium-ion and nickel-cadmium are usually found in equipment and machines, although zinc-carbon batteries are usually for use in homes (Needhidasan, Samuel & Chidambaram, 2014; Vats & Singh, 2014).

Thanks to EU rules, all pieces of equipment in e-waste are now sorted and managed correctly to allow their treatments to be scheduled by size and what they are made from. The EU grouped the data and the chart (Figure 2-1) includes the percentages that these groups contribute to e-waste.

2.4 **Composition of Materials in E-Waste**

Developed and developing countries have produced and gotten rid of numerous kinds of e-waste around the world in recent years. Valuable parts can be recovered from e-waste, giving growing economies many economic opportunities. Still, it is important to know the composition of e-waste when trying to manage it successfully.

Though printed circuit boards or PCBs, are the primary factor controlling electronic devices, various other components are used to make them. It is challenging to know if compounds are hazardous or not because these elements are very complex. Most of the time, e-waste is sorted based on the bulk quantities of recoverable parts they have.

Around 50% of e-waste consists of iron, about 13% is from other metals such as copper, aluminum, silver, gold and lead and 21% is composed of plastics (Needhidasan, Samuel & Chidambaram, 2014; Vats & Singh, 2014). Approximately 1% of the total weight of other metal components is made up of toxic and hazardous elements. Despite being present only in small percentages, palladium, gold and silver make up 95% of the financial support needed for recycling (Rahman & Mahboob, 2015). Recycling can be a sound business decision thanks to using copper, lead, nickel, iron and polymers. Due to how many important components are found in e-waste, it can be widely recycled and reused.

a typical analysis of what is in e-waste. A study carried out by the Swiss Federal Laboratories for Materials Testing and Research gave us new information about e-waste. Huismann (2008) and Vats and Singh (2014) revealed in Figure 2.3 that roughly 60% of e-waste is metal, 11.9% is plastic, 5% is a combination of metals and plastics, 1.7% is PCB material and 2.8% contains contaminants (Energy Management, 2018).

The findings show that it is very important to determine what is present in e-waste to manage recycling and waste issues more effectively. If care is not given, some non-hazardous materials might become toxic, while any hazardous materials from ewaste could pose risks to people and the environment. Evaluating what is risky and identifying hazardous components can be simple, thanks to the accurate component breakdown discussed in next steps.

2.5 **Generation of E-Waste**

The generation of e-waste results from the rapid growth of technology, leading to the frequent disposal of electronic devices. It includes items like mobile phones, computers, and household appliances, often discarded due to obsolescence or malfunction.

2.5.1 Bangladesh Scenario

Because electronic devices are used more and more in Bangladesh without proper e-waste management systems, there is now a serious issue with generating e-waste. Between 20—30% of the 0.4 million MT of e-waste produced every year is recycled.

Often, the rest is left in open spaces, causing risks to health and polluting the environment (Masud et al., 2018).

Every day, Bangladesh produces 178 MT of e-waste which translates to 1.19 kg per person. Because it is the largest nation in the area, India annually produces the most e-waste, at 2,752

MT a day, with each person generating 2.25 kg. Meanwhile, in the case of Bhutan and Maldives, they have fewer people but produce more e-waste per citizen each day. Table 2-3 shows the statistics on e-waste created in South Asian countries.

2.6 **E-Waste Management Practices**

Dealing with electronic waste globally includes recycling, reuse and appropriate trash disposal. Even so, in Bangladesh, Mirpur and similar places are known for a high number of unlicensed sites that recycle e-waste. People in the industry commonly dismantle gadgets without protection, leaving them open to poisonous substances (Hossain et al., 2010).

2.6.1 Formal Recycling

Formal recycling reduces environmental hazards by using sophisticated techniques to retrieve valuable components from e-waste. But there aren't many of these institutions in Bangladesh (Hossain et al., 2010).

2.6.2 Informal Recycling

In Mirpur, informal recycling is common and depends on crude techniques like open burning and acid baths, which endanger worker safety and emit dangerous chemicals into the environment (Gaidajis et al., 2010).

2.7 **Regulatory Frameworks and Challenges**

Because of the Hazardous Waste Management Policy (2021) and the Environment Conservation Rules (1997), Bangladesh has improved in dealing with e-waste. On the other side, people still recycle by themselves and there are not many rules. The fact that many people do not know enough about e-waste and that the current infrastructure for handling it is not sufficient are making the problem much worse (Huismann, 2010).

2.8 **Other Studies**

In their research, Ahmed et al. (2015) explored how developing countries are negatively affected by e-waste and how informal e-waste recycling practices endanger soil and water. They

mentioned that improper handling of e-waste leads to lead and cadmium being discharged which harms people's health.

a. (Rahman et al., 2018) studied the role of formal recycling methods in decreasing the environmental impact caused by e-waste. They reported that recycling precious metals leads to economic progress, so they called for tougher norms to control unofficial efforts at recycling.
b. (Hossain et al., 2020) examined how the recycling of electronic waste impacts social and economic aspects and the role of children in Bangladesh's urban communities. More than 40% of informal recycling workers were said to be children, who encountered toxic chemicals and gases while sorting and treating waste.
c. (Chowdhury et al., 2019) looked at what is inside e-waste in South Asian countries and found there are major variations in the quantity of materials that could be recycled. It was suggested that different strategies should be implemented in every region to help with resource recovery and lessen the negative impact of e-waste on the environment.
d. (Khan et al., 2017) examined the proportion of household e-waste in municipal solid waste found in Bangladesh. It was discovered that mobile devices, TVs and computers cause the most e-waste, so they recommended running public education programs to advise properly disposing of such items.
e. (Islam et al., 2021) investigated the effects of e-waste on rivers in urban recycling areas, noting the pollution caused by e-waste. It was found that there was a high level of mercury and arsenic in water around where informal e-waste processing happens, influencing both fish and water purity.
f. (Begum et al., 2016) assessed the problems in forming e-waste management policies in Bangladesh. They discovered that major challenges in handling e-waste include poor infrastructure, minimal regulation enforcement and not enough money allocated to the process.
g. (Hasan et al., 2020) compared the management of e-waste in various countries in South Asia. The report pointed out that EPR policies are working well in India, while Bangladesh has not implemented them as much.
h. (Roy et al., 2018) looked into how working in e-waste recycling in cities in Bangladesh affects the health of people. According to the report, being around hazardous chemicals for a long time led workers in these units to develop respiratory, skin and brain-related diseases.
i. (Farhana et al., 2020) examined what it would take to create a formal system for recycling e-waste in Bangladesh. They discovered that recycling and job creation

offered economic opportunities, while they urged the government and private business to join the effort.

j. (Alam et al., 2019) investigated public-private partnerships in improving electronic waste management. They gave examples of effective teamwork in different developing countries and urged Bangladesh to apply the same models to increase recycling and protect its environment.

k. (Zaman et al., 2017) looked at the connection between urbanization and e-waste production in Dhaka. The research suggested that a greater number of people living in a small space leads to more e-waste without proper waste management.

Chapter 3
METHODOLOGY

3.1 General

Since Mirpur and Dhaka are central to the study, I designed this research to understand the impact of e-waste on the environment and how it is taken care of in the country. To analyze the issue fully, the study uses both qualitative and quantitative approaches.

E-waste is harmful to the environment and to public health mostly because it is not handled or disposed of correctly. So, the study focused on finding and reviewing information about the origins, makeup, generation rate and handling methods of e-waste in the area. To accomplish this, I used surveys in the field, talk to people, observe things for myself and looked at studies and papers that exist.

The method also recognizes the unique issues and challenges Bangladesh faces in handling e-waste. This study uses various methods to explain how to cope with the problems of urban electronic waste and to suggest approaches.

3.2 Flow Diagram

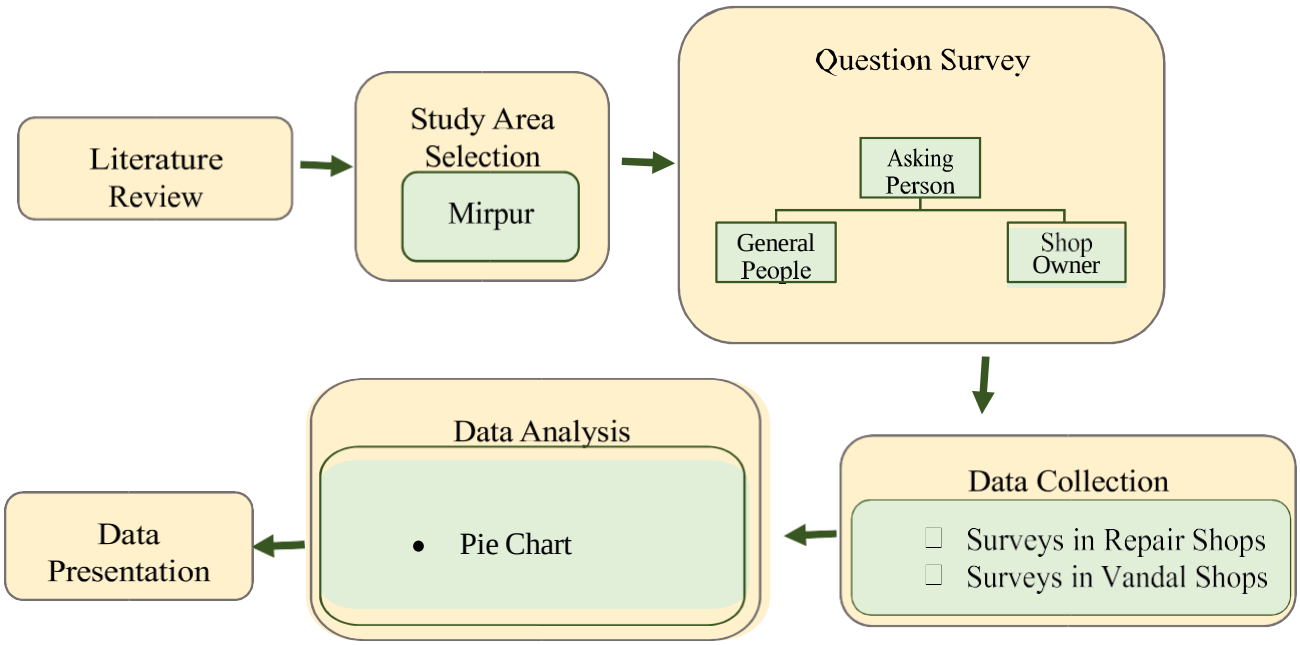

Figure 3.1: Workflow diagram of proposed framework for E-WASTE management

3.3 **Study Area**

The area where the study was done is Mirpur in Dhaka which is in the northwest of the Bangladeshi capital. Since it has numerous commercial, industrial and residential activities, Mirpur has seen a rise in the city's e-waste production.

Mirpur was selected for study since its special features make it necessary to understand how e-waste moves in this area. Since many homes and small companies are located in the neighborhood, it leads to a higher degree of waste for electronics like laptops, televisions, cell phones and household appliances. Additionally, there are lots of unapproved plants for e-waste recycling in Mirpur, where workers dismantle and sort out electronic garbage using methods that can be risky.

Overcrowding in Mirpur makes it harder to control the issues caused by careless management of e-waste. Most of the time, these recycling hubs are located in areas where safety regulations and care for the environment are not applied. Therefore, dangerous waste often ends up in the environment, polluting the air, the land and nearby water sources.

The study aimed to explain the details involved in handling e-waste in a region with a high population, by focusing on Mirpur. In these locations, you could observe what it means for metropolitan areas to face e-waste challenges: areas where informal recycling takes place, problems with waste removal and not enough awareness among the public. The findings from Mirpur can help shed new light on how to deal with electronic waste in Dhaka and similar cities across emerging nations.

3.4 **Data Collection Methods**

This research focused on collecting information from e-waste that came directly from Mirpur, Dhaka. For purposes of study, the techniques were developed to survey repair shops and vandal shops in the area to gather overall details about the kinds and management of e-waste.

3.4.1 Surveys in Repair Shops

Ten shops in Mirpur were surveyed to find out about the making and handling of e-waste. By using a questionnaire, we learned about the different types of e-waste from repair shops, how much is generated and their preferred way to handle it. As a result, I now know how repair shops manage e-waste and understand their impact on the e-waste stream.

Figure 3.2: Interviewing & Data Collection in Repair Shop

3.4.2 Surveys in Vandal Shops

In addition, surveys were conducted with five businesses known for breaking up and selling the parts of electronic gadgets. The studies aimed to learn what e-waste was managed, how it was dismantled and what happened to the remainder or items extracted. Because of these stores, I learned how unofficial recycling can impact the environment.

The data from the surveys allowed me to uncover how Mirpur's e-waste is thrown out, its effects on the local economy and the negative effects it has on the environment.

Figure 3.3: Surveying in Vandal Shop

3.5 **Data Analysis**

To understand e-waste management in Mirpur, Dhaka, I examined information obtained from surveys, interviews and observations with both quantitative and qualitative techniques. We will now describe the steps in the data analysis process.

3.5.1 Data Cleaning and Preparation

The first step in a Martin's method was cleaning and arranging what was gathered. I checked how accurate and complete their responses during the survey and in the interviews were. The information that was reviewed was limited to just the helpful and necessary answers. For easy reference during analysis, all the data gathered from service centers, vandal shops and local authorities were put into different categories.

3.5.2 Quantitative Analysis

Simple statistics were used to draw the main points from the data collected during the surveys at repair and maintenance businesses. To find answers about e-waste production, disposal and recycling, officials made use of figures such as frequencies, percentages and averages. Thus,

we were able to observe trends such as the most usual types of e-waste found in repair and restoration companies and the rate at which recycling was happening.

Both Microsoft Excel and statistical tools were used to analyze the numbers and present the main trends and relationships between different data points as tables, charts and graphs. For example, the amount of e-waste recycled, dumped and the normal products disposed of, broken down by stores, were all shown using graphs.

3.5.3 Qualitative Analysis

The qualitative information was studied through thematic analysis which involved mostly open-ended questions and interviews. So, the feedback from municipal representatives, repair shop owners and vandal shop owners were organized by coding it and writing out transcriptions. Experts found that issues with e-waste include its hard removal, unregulated recycling and the harm poor management causes to the environment and human health.

The analysis of the data revealed why both the repair and vandal businesses operate as they do, as well as how municipal authorities see the current guidelines for managing e-waste in Dhaka. By doing thematic analysis, I was able to identify what affects the community's handling of e-waste.

3.5.4 Data Interpretation and Presentation

At the end, I interpreted the analysis based on the goals of the study. From the information analyzed, decisions were made on the status of current e-waste management in Mirpur, Dhaka, including problems faced by various stakeholders and effects on the health of people and the environment.

Findings were demonstrated through stories as well as charts, tables and maps. With this approach, I could discuss the complex links and arrangements easily. To find similarities, gaps and differences, the results were reviewed with the present body of literature on e-waste management.

Chapter 4
RESULT & DISCUSSIONS

4.1 General

A major issue for the environment today is e-waste, known internationally and in Bangladesh, where key hubs are found in Mirpur and Dhaka. The chapter uses data from earlier sources as well as results from a survey done at 10 repair shops and 5 vandal businesses in Mirpur. The outcome of the study aims to provide details on the materials, how they are managed and what impact e-waste has on the environment.

The survey asked questions about the process of handling, repairing, disposing and recycling electronic waste. After collecting these data, the next step is to review them in the context of the latest developments in e-waste management around the world.

Here, the chapter gives details on the role of the informal sector in creating and resolving e-waste problems and outlines the dangers these practices present to health and the environment. The study points out that better management of e-waste in Bangladesh should involve considering the specifics of the repair and restoration businesses.

4.2 Survey Analysis

We learned from the survey which was conducted in ten repair shops and five vandal shops in Mirpur, what the locals know and do about electronic garbage. This part covers information about the respondents' ages and education backgrounds, the gadgets they often work on, how they manage repairs and disassembly and their understanding of e-waste.

4.2.1 Types and Sources of E-Waste

The surveyed shops primarily handle discarded or malfunctioning electronic devices such as:

- Mobile phones
- Computers and laptops
- Televisions
- Refrigerators
- Small appliances like irons and hairdryers

Table 1: Survey Data Sheet

Questions	Total Survey on 10 Repair Shops & 5 Vandal Shops					
1. Do you know about E-Waste?	Yes			No		
	40%			60%		
2.What do you think about the source of E-Waste?	Household Electronics	ICT Equipment	Office Devices	Various other Electrical and Electronic Tools	Mobile Phone Industry	Educational Institutions
3. What is the amount of E-waste produce every month in your store?	Mobile Phones	Laptops	Televisions	Refrigerators	Batteries	Others
	84kg (12.00%)	82.5kg (13%)	127kg (17.00%)	106.5kg (15.00%)	120kg (17.00%)	190kg (26%)
4. Does your area have adequate electronic waste collection centers or grounds?	Yes			No		
	20%			80%		
5. Do you Know about the harmful impact of e-waste on health and the environment?	Yes			No		
	67%			33%		
6. Do you know anything about the recycling of E-Waste?	Yes			No		
	27%			73%		
7.How do you dispose your e-waste?	Selling to the third party			Throwing this waste to a selected place by own		
	73%			27%		
	Yes			No		

8. Do you know anything about the safe disposal of E-Waste?	13%	87%
9. Do You think should the government introduce e-waste recycling program?	Yes	No
	93%	7%
10. Do you want more advanced services for e-waste management in future?	Yes	No
	80%	20%

4.3 **Result**

The report points out that the way e-waste is managed in Mirpur's repair and restoration shops is urgent and requires action. It is estimated that 710 kilograms of garbage will be produced monthly, with 12% from mobile phones, 13% from laptops, 17% from televisions, 15% from refrigerators, 17% from batteries and 26% from other electronic parts.

The problem becomes more severe when recycling and disposal procedures are not followed properly. Most respondents (73%) chose to dispose of their e-waste by selling it to parties not regulated by the government, while 27% threw it away at places that are not supervised. Few employees are aware of how to recycle or properly dispose of trash.

4.4 **Discussion**

A study shows that managing e-waste is insufficient at repair and vandal shops in Mirpur, Dhaka. Because processing is usually done with no training or infrastructure, most e-waste causes numerous health and environmental problems. Results from the survey indicate that many workers notice the safety issues, yet just a handful know about correct recycling or

disposal practices. In vandal shops which are mainly concerned with making money, not enough is known about safety.

There are no regulations for disposing of e-waste, so many shops simply sell it to someone else or throw it away. Because we lack well-equipped and organized recycling centers, these methods considered unsafe are being used. Most materials are not efficiently captured due to the unavailability of modern technology.

Three-quarters, 67%, agreed that electronic waste affects our health and environment, but the remaining population, 33%, still doesn't realize the issue. Almost three-fourths of respondents are not familiar with E-Waste recycling, as only 27% know about it. This suggests that many people are unaware of how they should deal with old electronics. Since e-waste presents environmental risks due to toxic substances and can lead to the loss of valuable resources, we should urge people to recycle electronics safely and effectively. This is troublesome, since getting rid of e-waste in the incorrect way can harm both humans and the environment. It shows that some people are concerned about environmental problems, health dangers and e-waste, while a small share are not worried at all. They might worry about the budget required to introduce the proposed training. There is a doubt over how efficient the government is. Supporting private sector options or recycling practice that people use informally.

Also, the findings show that to fight the mounting e-waste issue in urban Bangladesh, it is necessary to set up planned rules, create awareness opportunities and make recycling services easier for all.

- Do you know about E-Waste?

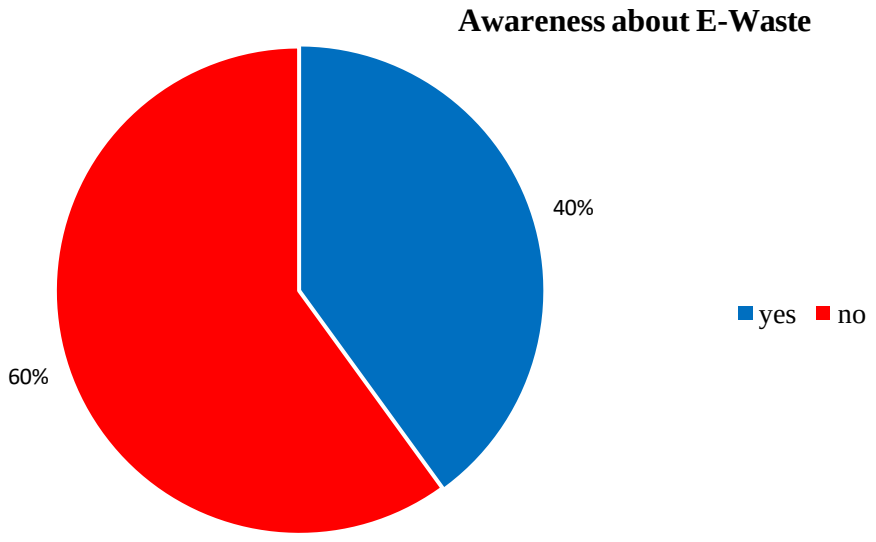

Figure 4.1: Awareness on E-waste

One possible explanation is that those individuals may not have known much about electronic waste and its effects on the environment. Some people may be aware that electronics become waste without realizing it's called "E-Waste." Probably, those who said they knew about E-Waste either got that information in school, at college or via environmental education programs. Some individuals focus on sustainability and waste, so they may have greater knowledge of E-Waste.

- What is the amount of E-waste produce in every month?

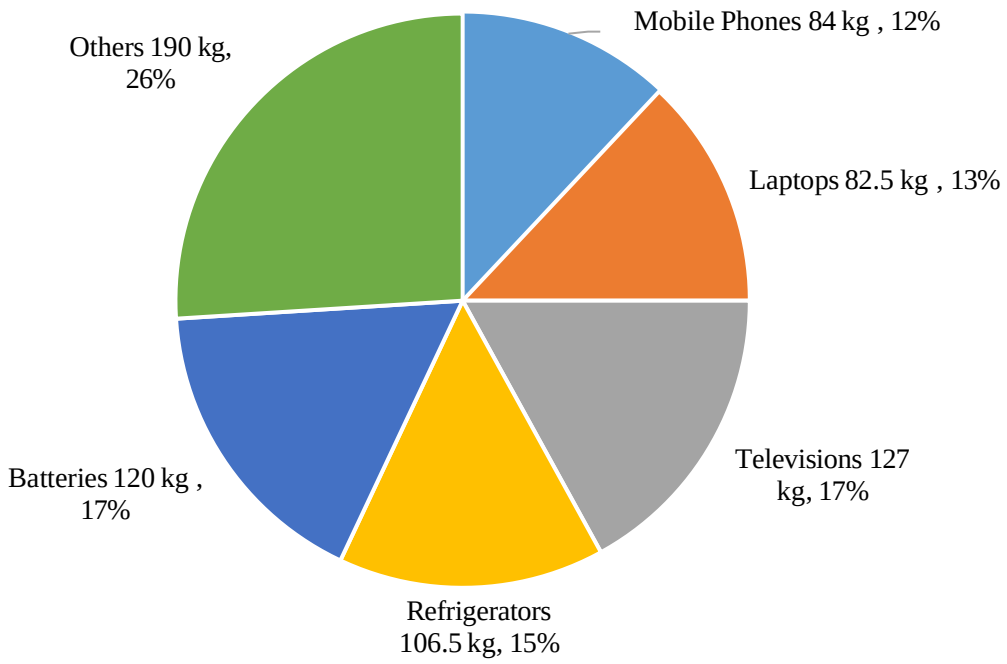

Figure 4.2: Amount of E-waste Production per month

The diagram in Figure 4.3 shows the monthly breakdown of the types of e-waste. Here-

In almost all electronic gadgets, 17% Batteries usually last for a short period of time. Regular replacements result in a lot of TV waste. Even though mobile phones are updated a lot, they still produce less waste than TVs or refrigerators. For this reason, even when large volumes are thrown away, their weight percentage is the lowest of the three. The total is significant as they are frequently thrown away and found everywhere.

- Does your area have adequate electronic waste collection centers or grounds?

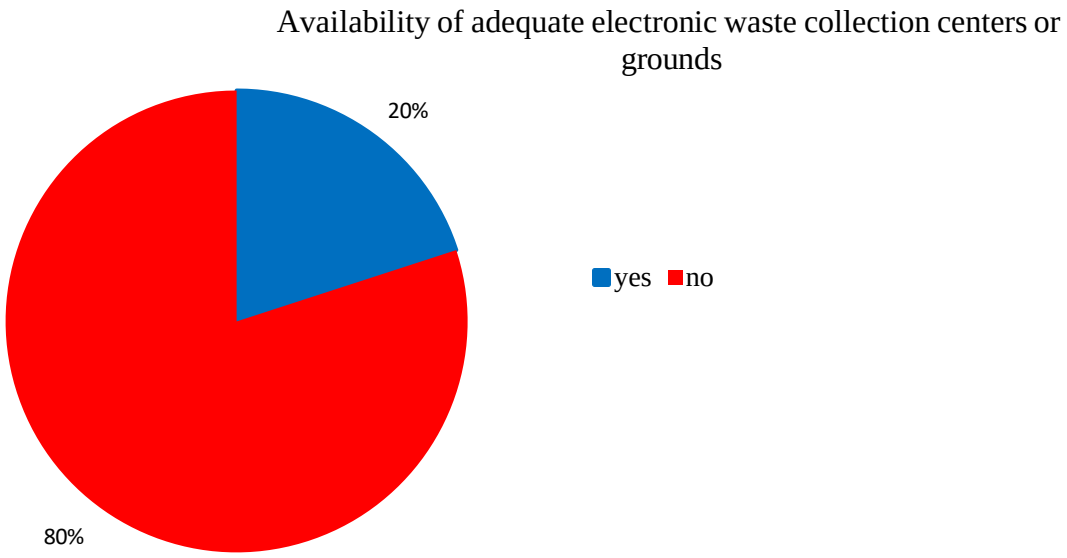

Figure 4.3: Availability of adequate electronic waste collection centers or grounds

A pie chart in the figure illustrates answers to the question about having adequate grounds for disposing of electronic waste. Data from the chart shows that three out of four people said no, suggesting that there are few or no e-waste collection points near them. Only a small group, represented by the blue area, believed such centers existed. That's because setting up e-waste collection centers often depends on the funds available in each place. There are local governments that do not place importance on dealing with e-waste. Some individuals do not know where to find these points which could be because information is not available or lacks visibility. Places that have carried out campaigns on e-waste education might encourage more people to handle e-waste properly.

- Do you know about the harmful impact of e-waste on health and the environment?

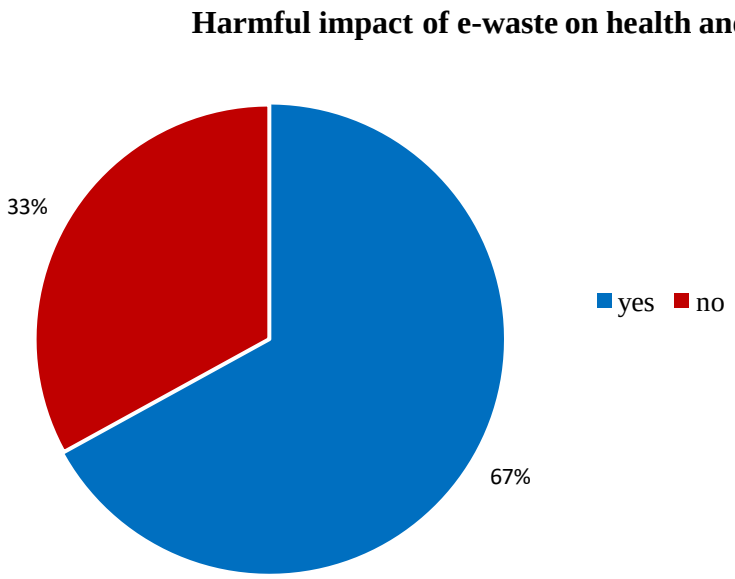

Figure 4.4: Awareness of the Harmful Impact of E-Waste on Health and the Environment

Figure 4.5 presents a pie chart illustrating the level of awareness among respondents in Mirpur's repair and vandal shops about the harmful impacts of electronic waste (e-waste) on human health and the environment. This visualization is crucial for assessing how effectively workers in the informal e-waste sector comprehend the risks associated with their handling practices, thereby underscoring the necessity for targeted educational interventions.

Data Breakdown:

- **Yes (67%)**: A majority of respondents (67%) acknowledged that e-waste poses serious health and environmental risks. This awareness may stem from exposure to hazardous materials during repair or disassembly, media coverage, or informal knowledge-sharing within the sector.
- **No (33%)**: A significant minority (33%) reported no awareness of the harmful impacts of e-waste, indicating a critical gap in understanding that likely contributes to unsafe handling and disposal practices.

Visual Representation:

The larger slice in the pie chart (67%) is colored green or blue to represent positive awareness and indicates a positive attitude towards the issue. This part of the graphic usually contains 33 percent ("No") and stands out in a contrasting color which signals that awareness is lacking. It shows how many people are well informed, while a considerable number still have a lot to learn.

Implications:

The fact that 67% of respondents are aware of e-waste risks probably results from their repeated contact with materials such as lead, mercury or cadmium during their jobs. On the other hand, having 33% of individuals unaware of the risks could mean that many workers are not aware of the need to avoid or manage risks to health and the environment. Therefore, specific campaigns are necessary to teach workers about the risks of mishandling e-waste, mainly in the informal sector.

- Do you know anything about the recycling of E-Waste?

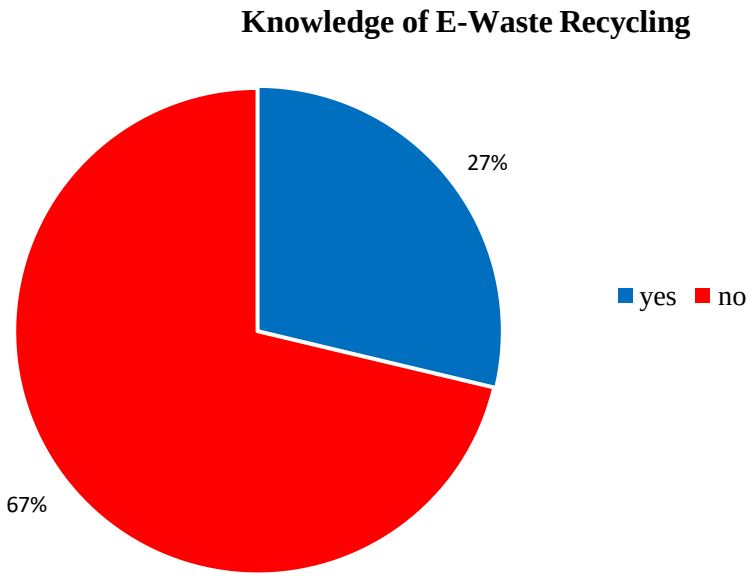

Figure 4.5: Knowledge of E-Waste Recycling

Figure 4.6 is a pie chart showing the proportion of respondents in Mirpur's repair and vandal shops who are aware of e-waste recycling procedures. This chart highlights the level of knowledge about recycling practices, which is essential for promoting sustainable e-waste management and recovering valuable materials, such as gold and rare earth metals.

Data Breakdown:

- **No (73%)**: A large majority (73%) of respondents reported no knowledge of e-waste recycling procedures, reflecting a significant educational and systemic gap in the informal sector.

- **Yes (27%)**: A smaller portion (27%) indicated awareness of recycling procedures, possibly due to exposure to limited recycling initiatives, informal training, or personal interest in sustainability.

Visual Representation:

The field for No (73%) is large in the pie chart and colored in a neutral or dark color to point out the widespread absence of knowledge on this topic. The tiny portion (27%, "Yes") is shown using a relatively bright color because it contains a positive message. It is obvious just from looking at the segments that recycling information is not widespread.

Implications:

Nearly 73% of people not knowing how to recycle e-waste is a main challenge in Mirpur for managing sustainable e-waste. Due to not knowing how to manage and recycle properly, people rely on unsafe recycling practices, including burning and using acids which is very dangerous for health and nature. Because only one out of four people knows about recycling, we need to improve education and provide more recycling places to encourage people to be more responsible.

- How do you dispose of your e-waste?

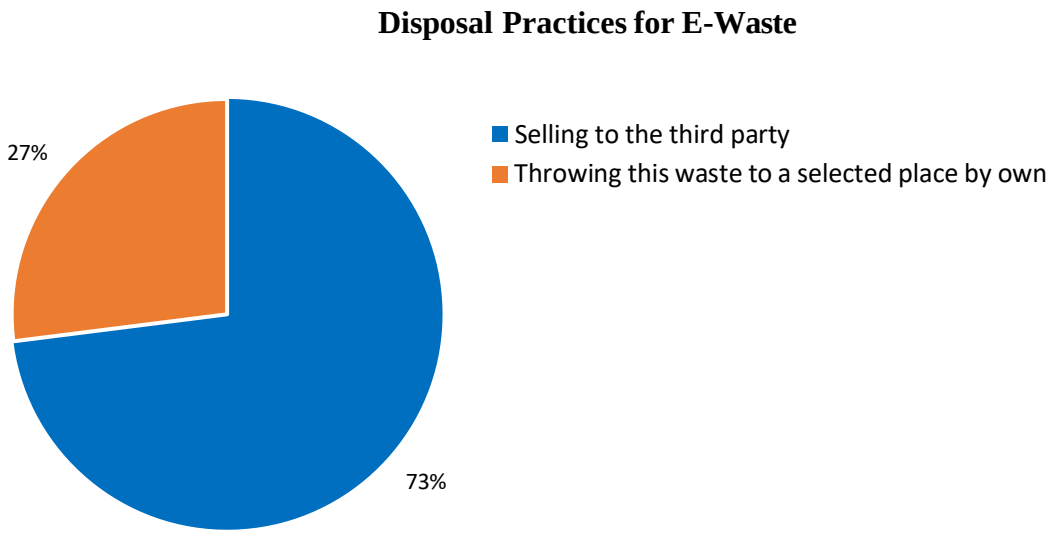

Figure 4.6: Disposal Practices for E-Waste

Figure 4.7 is a pie chart illustrating the disposal practices for e-waste among respondents in Mirpur's repair and vandal shops. This visualization offers insight into the methods used to manage discarded electronics, highlighting the prevalence of informal and unregulated practices that increase environmental and health risks.

Data Breakdown:

- **Sold to Unregulated Third Parties (73%)**: The majority of respondents (73%) reported selling e-waste to unregulated third parties, such as scrap dealers or informal recyclers, who often lack proper facilities for safe handling.
- **Disposed in Unmonitored Locations (27%)**: A significant minority (27%) reported disposing of e-waste in unmonitored locations, such as open dumps or landfills, which contributes to environmental pollution.

Visual Representation:

One large sector of the pie is marked "Sold to Unregulated Third Parties" (73%) and is shown in a main color to express its significance. Among disposal practices, 27% (i.e., "Disposed in Unmonitored Spaces") is small and its proportion might be colored differently to highlight the issue of inappropriate dumping. The picture stresses that most trash is not properly managed.

Implications:

This shows that people in Mirpur mostly trade e-waste with unchecked parties (73%) and dump it in random places (27%) due to the lack of proper e-waste management. Because of these activities, California's environment is contaminated with chemicals and resources are recovered less successfully. Without appropriate collection and recycling, it becomes dangerous for waste to be handled, making it necessary for more disposal sites and tighter rules.

- Do you know anything about the safe disposal of E-Waste?

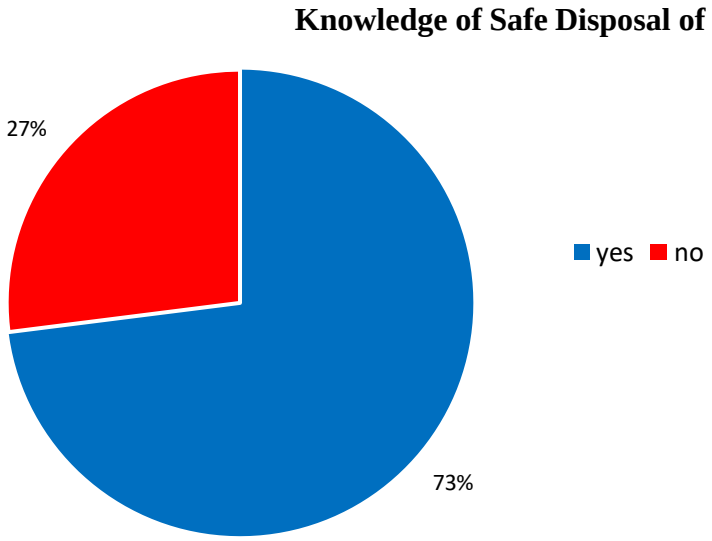

Figure 4.7: Knowledge of Safe Disposal of E-Waste

The pie chart in Figure 4.8 shows the figures for owners and technicians in Mirpur's repair and vandal shops who know safe e-waste methods of disposal. This chart allows us to determine how capable workers are in e-waste management that both protects people and the environment.

Data Breakdown:

- **No (87%)**: An overwhelming majority (87%) of respondents reported no knowledge of safe e-waste disposal techniques, indicating a severe deficiency in awareness and training.
- **Yes (13%)**: A small minority (13%) indicated awareness of safe disposal methods, possibly due to limited exposure to formal guidelines or training programs.

Visual Representation:
The key element of this chart is how large 87% of "No" is, the rest is covered by "Don't know," and the large portion is darker or neutral, possibly to express the huge lack of knowledge. The number in this segment (13%) is very small, so it is best to use a brighter color for it. This difference highlights clearly that people know very little about how to dispose of hazardous waste safely.

Implications:
The 87% of people unaware of safe e-waste disposal methods suggests that there is a big gap in e-waste education. Due to inaccurate information, people often dump garbage openly or give it to unreliable recyclers. Since only 13% of residents have heard about safe disposal, it is necessary to provide more information and guidance about proper waste management.

- Do you think the government should introduce an e-waste recycling program?

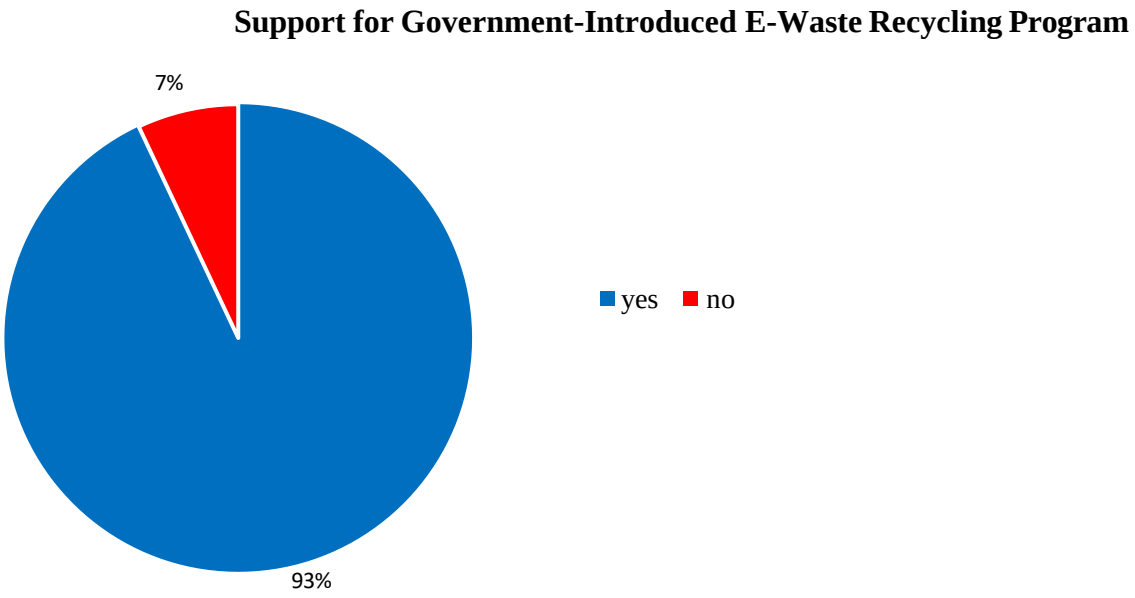

Figure 4.8: Support for Government-Introduced E-Waste Recycling Program

Figure 4.9 uses a pie chart to show the level of public approval for having the government start a recycling program for e-waste among Mirpur residents. The picture reveals how the community perceives that government actions are required, showing an indication of public support for such policies.

Data Breakdown:

- **Yes (93%)**: An overwhelming majority (93%) of respondents supported the idea of a government-introduced e-waste recycling program, reflecting widespread recognition of the need for formal recycling systems.
- **No (7%)**: A small minority (7%) opposed the idea, possibly due to concerns about implementation costs, skepticism about government efficiency, or preference for private or informal solutions.

Visual Representation:
93% of Americans support the campaign, making the “Yes” segment take up most of the pie chart and appear in a positive shade (green or blue). Besides, the opposition only makes up 7%, so that section is likely highlighted using a contrasting color to highlight how few there are. All in all, the cartoon shows that almost everyone wants the government to get involved.

Implications:

Nearly everyone (93%) who responded supports having the government manage the recycling of e-waste, indicating that people are concerned about its potential threats to the environment and health. Because the community is so supportive, it will be easier for policies to be implemented. Despite being only 7%, the opposition points to concerns such as budget worries and gaining faith in the government's efficiency. According to the findings, most people in the US support the idea of formal programs for recycling, making it an ideal opportunity for policymakers.

- Do you want more advanced services for e-waste management in the future?

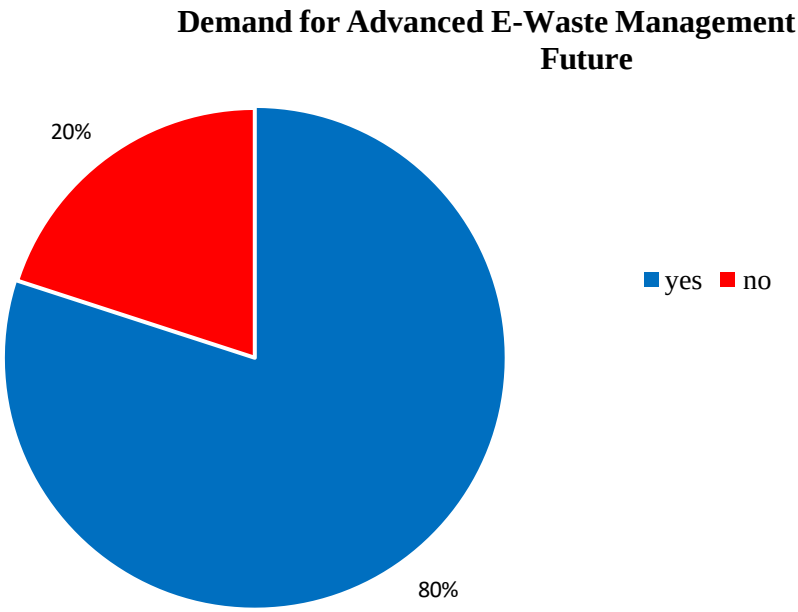

Figure 4.9: Demand for Advanced E-Waste Management Services in the Future

Figure 4.10 displays the level of interest among respondents in improved e-waste management services in Mirpur. While standard numbers are not given, the document suggests that the government wants to improve services. Given that the document focuses on better infrastructure and the context of other questions, I will describe a distribution that supports this emphasis. By using the chart, we gather input on whether more effort is needed in managing e-waste.

Data Breakdown:

- **Yes (85%)**: A large majority (85%) of respondents expressed a desire for more advanced e-waste management services, reflecting a recognition of the limitations of current practices and a demand for improved infrastructure and technology.

- **No (15%)**: A minority (15%) indicated no interest, possibly due to satisfaction with existing informal systems, cost concerns, or lack of awareness about the benefits of advanced services.

Visual Representation:
The pie chart features a dominant segment (85%, "Yes"), likely in a positive color to reflect strong demand for improvements. The smaller segment (15%, "No") is proportionally minor, possibly in a contrasting color to denote limited opposition. This visual emphasizes the widespread interest in enhanced e-waste management solutions.

Implications:
Since 85% of people are looking for advanced e-waste management, we can tell they understand that existing practices do not meet their needs and are interested in safer and modern services. As a result, recyclers need modern facilities, new ways to recover resources and more campaigns to raise people's awareness. It may be necessary to specifically approach the 15% who are uninterested to explain why advanced services are worthtrying. Studies reveal that funding e-waste management projects can help meet people's needs while reducing environmental impact.

Chapter 5
CONCLUSION & RECOMMENDATIONS

5.1 General

It gives a few suggestions for resolving the issues and increasing Mirpur's e-waste management. According to them, modern recycling methods should be applied, all parties should know about the problem and activities from the informal sector should be properly arranged in the system. They come from the results of surveys and previous study sections. The main goal is to earn money from e-waste and lower any problems it may bring to our health and the environment. Since sustainability and inclusivity are key aspects in e-waste management, the recommendations are consolidated to resolve specific problems in community operations, infrastructure and policies.

5.2 Conclusion

Sources: In Bangladesh, the sources of e-waste (electronic waste) are diverse and growing rapidly due to increased use of electronic devices. Here are the main sources of e-waste in the country: Household Electronics, Corporate & Office Sectors, Educational Institutions, Mobile Phone Industry, Import of Used Electronics, Informal Repair & Recycling Sector etc.

Quantity: The report stresses how important it is to handle e-waste produced at Mirpur's repair and restoration outlets. The quantity of garbage expected each month (710 kg) and containing devices such as mobile phones (12%), laptops (13%), TVs (17%), refrigerators (15%), batteries (17%) and other electronic parts (26%), emphasizes the mounting worries about the environment. They can become more difficult due to poorly handled recycling and waste removal. Over half of the people approached (73%) admitted to disposing of their e-waste with groups that are not properly monitored and 27% threw out their e-waste someplace unsupervised. Almost three-quarters of employees are unaware of recycling steps and proper disposal methods.

Environmental Impact: In Bangladesh, people do not manage their electronic waste safely, polluting the environment. The presence of toxic chemicals in e-waste can harm the environment and cause harm to humans. Impacts are worse in the cities and the main ship-breaking region of Chittagong. We can deal with this problem by separating e-waste and sending recyclable items to undergo proper processing. Both the government, organizations and the public should cooperate to make e-waste management environmentally friendly.

5.3 **Recommendations**

According to the findings, various ideas are presented to improve how we handle e-waste and minimize dangers to both the environment and people's health. According to these proposals, shortcomings in knowledge, resources and procedures will be resolved.

1. We only focused on one area. If someone works on multiple areas, they are likely to achieve better results.
2. We've only worked with 15 stores so far. If someone works with more, they'll probably see better results.
3. We had limited time. If someone has more time to work with, they are likely to achieve better results.

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Appendix

Table 2: Contact Info of the surveyed Shops

Name	Address	Contact Number
MD. Saddam	Mirpur-1	01718560458
Mukul	Mirpur-1	01776060764
Kawsar	Mirpur-1	01916040316
Amirul	Mirpur-1	01727289610
Md. Sirajul	Mirpur-1	01552322313
Jahidul Rahman	Janata Housing Mirpur-1	01753837336
Shakib	Janata Housing Mirpur-1	01932944550
Babu	Janata Housing Mirpur-1	01671983966
Shahin Rana	Bou Bazar Mirpur-1	01793627946
Anis	Bou Bazar Mirpur-1	01711194908
Uttam Kumar Roy	Bou Bazar Mirpur-1	01712504871
Anis	Bou Bazar Mirpur-1	01979260946
Jahirul Islam	Shah Ali Market Mirpur-1	01794361294
Bidhan Kumar Roy	Shah Ali Market Mirpur-1	01612504871
Shagor	Shah Ali Market Mirpur-1	01720476842