BENEFITS AND NEED OF E-WASTE RECYCLING IN INDIA

By

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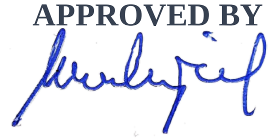

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Admissions

Dedication

This dissertation is dedicated to my beloved daughter, Ishanna Jethalya, and to the future generations of this Planet we call Earth or Prithvi (पृथ्वी: in Hindi): Our Home.

To Ishanna, your presence in my life has been a constant source of joy and motivation. May you grow up in a world that values sustainability and responsible consumption. This work is a step towards ensuring a healthier planet for you and all the children of the future.

To the future generations, I hope this research inspires you to utilize your electrical and electronic equipment to their fullest potential and to recycle them responsibly. Proper e-waste management is not just a necessity but a crucial key to conserving our precious Mother Nature from further exploitation.

May this work serve as a reminder of our responsibility to protect the environment and ensure a sustainable future for all.

With love and hope,

Piyush Jethalya

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Finally, I am grateful to all those who have directly or indirectly supported me in this endeavor. Your contributions, no matter how small, have played a vital role in the successful completion of this dissertation.

Thank you all for your unwavering support and encouragement.

Sincerely,

Piyush Jethalya

ABSTRACT

BENEFITS AND NEED OF E-WASTE RECYCLING IN INDIA

For recycling companies to flourish, consumers must understand the health and ecological risks of electronic garbage. Waste electronics may harm both. Buyers will be motivated by the consequences of not recycling outdated devices. Formal electronic waste management requires current knowledge and recycler-government partnership. If end-user knowledge and cooperation increased, the system would collapse, but the country's electronic waste management rules can't assist with collection and recycling. The system would fail. Compare India's policies to discover coverage gaps. Recycling and consumer surveys are done for this project. Some ignorant Northern Indians had never heard of "e-waste." The research revealed this. Four independent constructs—familiarity with fundamental language, practices, advantages, and challenges—and one dependent construct—total awareness—were discovered using structural equation modelling. This study sought causal links between persons and organisational users. The data was analysed using SPSS and AMOS v20. Four SEM models mediate, while the fifth does not. No model mediates. Unmediated structural equation modelling (SEM) was optimal for India. The results reveal the government must enhance user awareness in all institutions. The SEM was limited to end-users due to the high response rate (five times the questions answered). They had exclusive SEM. Because SEM requirements were not met, regression analysis will examine impacts. Punjab leads, Chandigarh second, Haryana third. Chandigarh leads. Uttar Pradesh ranks fourth, while Himachal Pradesh is least knowledgeable. States compete hard. Another one-way analysis of variance assessed state-level variations in targeted population knowledge. This research says electronic waste's health and environmental effects are unclear. A big knowledge gap exists.

India handles just 5% of electronic garbage officially and 95% unofficially. Inefficient electronic waste management. Electronic waste presents serious health and environmental dangers, thus proper treatment and safety are crucial. India has a plan to recycle e-waste. Examples of electronic waste and formal recycling: Pay attention to these four parameters since they will greatly impact the process. Address educational, legislative, electronic waste collection, and obsolete device recycling. Many methods and legislative amendments were

recommended to improve end-user knowledge during policy comparison. This research will evaluate electronic waste management regulations, recycler and end user understanding, recycler-state board collaboration, and an effective Indian plan structure.

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CHAPTER-1: INTRODUCTION

1.1 Introduction

There is a significant quantity of electronic equipment that has been firmly ingrained in the lives of the normal person. This includes mobile phones, computers, LEDs, and other gadgets that are similar in nature. Despite the fact that electronic gadgets are supposed to make people's life simpler and more comfortable, the majority of people are uneducated on how to properly dispose of electronic garbage, as stated by Needhidasan et al. (2014). Those electronic and electrical products that have reached the end of their useful lives, as decided by the manufacturer, according to the expiration date or the functional life of the equipment, are deemed to be included in the category of e-waste. Fax machines, photocopiers, mobile phones, CD players, TVs, printers, and computers are all examples of devices that are often used. These devices also include photocopiers and fax machines, among others. The following are some further instances of electronic instruments: fax machines, photocopiers, mobile phones, and CD players. A variety of electrical items that have been rejected are shown in both Figure 1.1 and Figure 1.2. Figure 1.2, on the other hand, shows printed circuit boards (PCB) that have been sorted. In order to demonstrate the same idea, both of these figures are included in this presentation.

Figure 1.1 E-Waste

Because of the changes that have occurred in lifestyle as well as the technologies that are now available, there has been a significant growth in the demand for electronic devices and household appliances that are powered by electricity. This desire has happened as a result of the fact that these technologies are now accessible. It is impossible to escape the use of these electronic devices since they have become an essential component of everyone's daily routine. Despite the fact that many consumer electronics may have good benefits, there are also others that can have detrimental affects on people's lives.

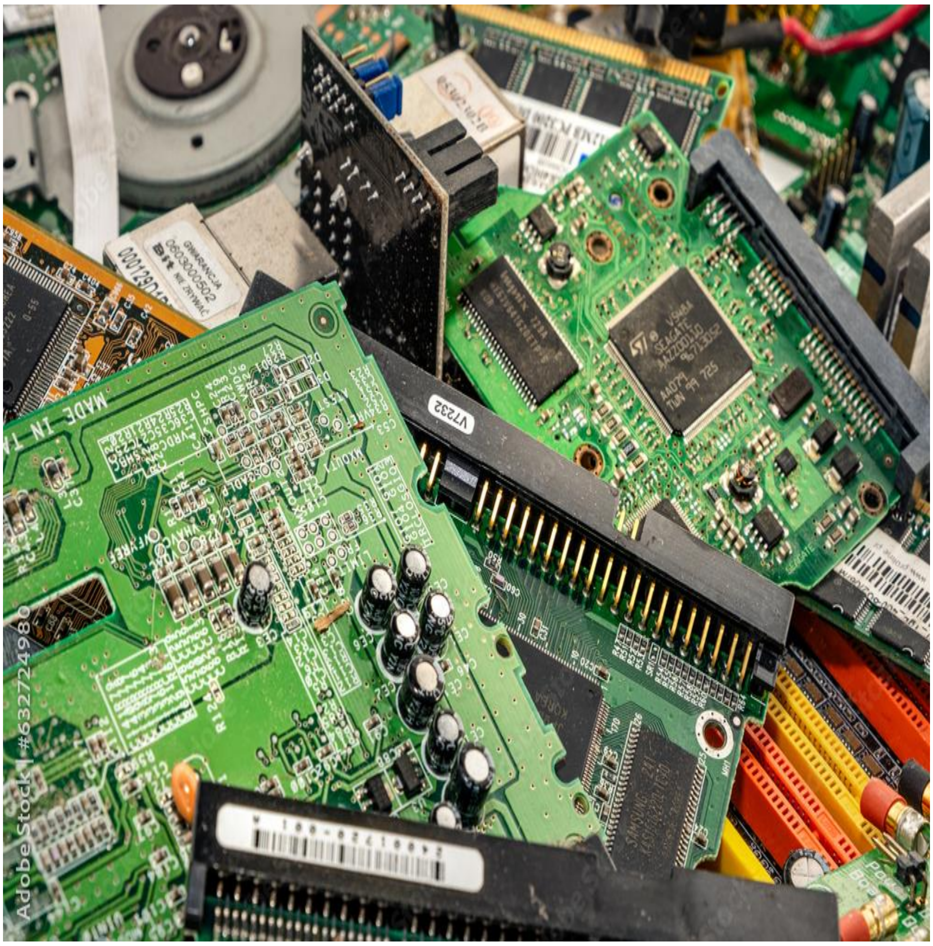


Figure 1.2 Sorted Printed Circuit Boards (PCB) from E-waste

It is quite probable that these gadgets will have substantial adverse effects on the ecosystem if they are released into the environment. This is due to the fact that they contain poisonous metals that are detrimental to human life. In the event that they come into contact with the environment, it is quite probable that they will have extremely harmful effects on a huge scale. When it comes to the world's industries, it is reasonable to claim that the electronic sector is among the most swiftly increasing and fast rising sectors. At the same time as there has been a growth in the manufacturing of electrical and electronic equipment, there has also been an increase in the utilisation of such equipment, as stated by Garlapati (2016). Rapid expansion, urbanisation, and an increased interest in consumer products are all factors that contribute to this increase.A gloomy situation has begun to develop as a consequence of the ever-increasing quantity of electronic trash that is being created by businesses that deal with electronic devices. This garbage is being produced by organisations that focus on electronic gadgets.

According to the results of Wath et al. (2010), it has developed into a waste that is of critical relevance in India, both in terms of the quantity of it and the toxicity of it. This is stated in both of the aforementioned ways. The management of electronic trash is one of the most significant difficulties that the majority of governments throughout the globe are now facing. According to Wath et al. (2010), the most significant issue that is associated with its manufacturing is the substantial increase in the quantity of it. Second, there is the issue of how to dispose of it, which should not be harmful to the environment and should adhere to scientific norms. There is a connection between the growth of the substance and both of these issues here. The phrase "electronic trash" refers to a collection of objects that includes electronic gadgets such as computers, televisions, refrigerators, mobile phones, audio players, and other electronic devices that have been used for their whole lives but have been abandoned by their owners. These electronic equipment are considered to be "electronic trash." Components, sub-assemblies, and consumables that are seen as outmoded or undesired by a user are included in the category of electronic garbage (Marra and Palmer, 2011; Bhuie et al., 2004; Cairns, 2005). Electronic trash comprises a broad variety of things. There are a few other names for electronic waste, including wasted electronic equipment, waste electrical and electronic equipment, and any other kinds of goods that are comparable.

A structure that is not only rather unique but also quite complicated is found in the garbage that is generated by electrical equipment. The substance contains around one thousand different chemicals, and depending on the nature of the material, these substances may be classified as either non-hazardous or hazardous components. The classification of these substances is determined by the components. As stated by the European Union in the year 2002, the aforementioned categories are comprised of the electrical appliances that are included in the following:

1. Large appliances that are often found in the home, such as refrigerators, laundry dryers, and other kitchen appliances; a wide range of household equipment, such as vacuum cleaners, cleaning solutions, grinders, and other similar things; and a variety of other appliances that are commonly found in the home.

3. Electronic devices that are connected to information technology (including but not limited to portable computers, printers, telephones, and so on)

4. Electronics meant for the general population, in particular televisions, radios, amplifiers, and other devices of a like kind

5. Equipment for an electric lighting system, which may include high-energy sodium lights, LED bulbs, and other devices of a similar kind

6. Equipment that is driven by electricity, such as drills, sewing machines, and other products that are connected to this category, among others without limitation

7. Various types of toys and sporting equipment, such as electronic trains, online gaming gadgets, and other things of a similar kind

8. Dispensers that are completely automated (for cold and hot bottles, warm beverages, and other types of drinks, etc.) of a variety of different kinds

According to the findings of a study that was carried out and made public by the Central Pollution Control Board of India in 2019, as little as three percent of the electronic garbage that was produced in 2018 was treated via proper processes. The results of the research indicate that the most common problem that is now present in India is the accumulation of electronic waste. The rise in the production of electrical and electronic equipment (EEE) may be attributed to a number of factors, the most important of which being industrialization and modernization. On the other hand, the increase in the creation of EEE may be attributed to a variety of different factors. These factors include, among other things, the harsh treatment of electronic equipment, the shorter lifespan of electronic products, and the rapid advancement of technology in a relatively short length of time. The informal channels are responsible for the management of more than ninety percent of the electronic waste. This is because there is a lack of enough infrastructure that makes use of traditional methods to extract the precious resources. This is the reason why this is the case. When pollutants such as mercury and arsenic, amongst others, make their way into landfills, they ultimately lead to the pollution of ground water for the environment. This is the case the great majority of the time. The most popular method for recovering key components from electronic items that have been abandoned is to burn them in an open environment. This is the most typical strategy. Carbon emissions and harmful chemicals are released into the atmosphere as a consequence of this process, which results in a significant amount of carbon emission. A hurdle to the accomplishment of formal recycling objectives for electronic waste recycling is the insufficient implementation of electronic waste recycling (EPR), which stands for electronic waste recycling. Furthermore, the illicit importation of electronic equipment or the trafficking of abandoned electronic gadgets across international boundaries is becoming an increasingly significant issue in India. This is a problem that is growing increasingly prevalent.

1.2 In both developing and developed countries, electronic waste:

There is a difficulty that applies to the recycling of electronic trash all over the world, and that problem is the organisation of electronic garbage. E-waste management was first established and managed in Switzerland, making it the first nation to do so. The two components that serve as the foundation for the electronic waste recycling system in Switzerland and other developing countries are the Advance Recycling Fee (ARF) and Extended Producer Responsibility (EPR). Both of these acronyms are designed to encourage recycling of electronic trash. When both of these components are present, recycling of electronic trash is guaranteed.

Germany, the United Kingdom, the United States of America, and France are among the countries that are among the major producers of electronic trash on a worldwide scale. Other countries that are among the leading producers include France. According to estimates, these countries produce between 1.5 million and 3 million tonnes of electronic waste every single year.The disposal of electronic waste in these countries is carried out in line with the procedures that have been established worldwide. Khan (2017) claims that a comprehensive recycling plan for electronic trash, beginning with an effective collecting method and continuing through the extraction and disposal of materials, has promised to be a financial opportunity that is beneficial for companies. This opportunity has the potential to help businesses save money.

There have been a number of recent scientific studies that have come to the conclusion that industrialised countries are producing electronic trash at a rate that is twice as fast as that of developing ones. An further development that has taken place is that developed countries are not only sending their electronic garbage to less developed nations, but they are also sending it to less developed nations. These electronic waste products are being treated manually in poor nations because to the high unemployment rate and the availability of manpower at a lower cost. They are also being handled manually. This occurs as a result of the increased availability of workers in the market. As a consequence of this, there are significant consequences being created for both the environment and the communities that are present in that area. Because of the processing of enormous amounts of electronic waste that are transferred from countries in Europe to nations in West Africa, there is a significant amount of environmental pollution and health problems for the people who live in the region. This is a result of the fact that the electronic waste is transported from Europe to West Africa. These wastes are processed at locations that are not very prominent in terms of their facilities.

1.3 Handling, Disposal, Environmental Impacts, and Concerns Regarding the Health and Safety of Electronic Waste

Getting rid of electronic waste is a challenging task due to the processes involved in its manufacturing. There are a lot of poisonous chemicals and other dangerous things in the waste that electronics generate. This is on top of the fact that there are other chemicals present that might also be harmful. These contaminants pose a threat to human health and safety in addition to harming the environment. They represent a threat to the natural environment. In addition to potentially dangerous elements like lead, mercury, and hexavalent chromium, the waste produced by materials like cathode ray tubes (CRTs), photo copier cartridges, capacitors, selenium drums (copiers), and electrolytes contains a diverse range of pollutants (Research Unit Rajya Sabha, 2011). Many contaminants, including some potentially harmful substances, are present in the trash in issue.

The process of disposing of electronic waste is difficult to carry out in any region of the world. Throwing it out with regular household garbage might cause it to break down into harmful toxins that harm earth. For the simple reason that these pollutants might create problems for Mother Earth. Although burning and landfilling are the two most popular ways to dispose of electronic trash, they are both harmful to the environment. Not only are the recycling procedures being presented here very disgusting, but they also present serious risks to both humans and the environment. Table 1.1 provides a summary of the many compounds that might be present in electronic waste. Furthermore, this listing also includes the health hazards linked to certain chemicals.

Table 1.1 (Research Unit Rajya Sabha, 2011) The following table presents the many health risks that are associated with the various components of electronic trash.

Metal	Health Hazards
Lead	Affects the kidney and reproductive system. Affects the mental development of offspring
Chromium	Damage liver and kidneys also cause lung cancer
Mercury	Central nervous system and immunity
Beryllium	Lung Diseases
Cadmium	Pain in joints, spine and softens the bones
Plastics	Harms reproductive and immune system

1.4 E-waste management strategies

In order to find solutions to the issues that are occurring on both the national and international levels, a substantial amount of research is now being carried out on the management of electronic waste. For the purpose of addressing the difficulties that are now taking place, this research is currently being carried out. The management of electronic waste has been accomplished via the establishment and implementation of a variety of technologies, such as extended producer responsibility, MCA, MFA, and LCA. These instruments have been used in the management of electronic waste. However, in industrialised countries, the management of electronic waste has advanced further by implementing the ejection of rubbish from electric and electronic equipment (Directive 2002/96/EC), which has the effect of reducing the amount of waste that is destroyed and improving the state of the environment (EU, 2002). The outcomes of a number of studies indicate that the components that have been removed have the potential to be recycled in the future. Furthermore, it is possible that these components might also be used to facilitate the healing of valuable and rare metals.

1.5 STRATEGIES TO MANAGE E-SCRAP IN ASIAN COUNTRIES

Over the course of the past few years, a number of organisations, including the Basel Convention, have organised a significant number of workshops and conducted research in an effort to gain a better understanding of the numerous obstacles that are associated with the implementation of Environmentally Sound Management (ESM) of electronic waste in Asian countries. This effort is part of an effort to gain a better understanding of the numerous obstacles that are associated with the implementation of ESM. According to the findings of the research that has been carried out, it has been established that there is a deficiency in the availability of a catalogue for electronic waste, a smaller number of staff members who possess the necessary expertise to carry out ESM procedures, an inadequate infrastructure, and a lack of comprehension regarding the impact that electronic waste has on the environment.

1.6 E-waste in India

When it comes to the generation of waste products that are the result of electrical and electronic devices inside the country, the state of Maharashtra is the one that is responsible for the biggest number of waste products. In accordance with the United Nations Environment Programme (UNEP), in order to achieve geographically broad coverage, it is necessary to make use of increasingly sophisticated estimating techniques for the purpose of analysing the information that is currently accessible. On the subject of the growing quantity of electronic waste that is being produced, there is now an inadequate amount of information that is easily accessible. The incorporation of electronic trash, and more especially garbage from computers, into the process of managing solid waste contributes to the increased difficulty of managing solid waste. According to Saoji (2012), the problem is becoming more complicated as a result of the fact that electronic waste from wealthy nations is being transported to poor and economically disadvantaged countries under the presumption of free trade. This is a situation that is becoming more difficult to deal with. Because of this, the issue is increasing the amount of difficulty it presents. Over one thousand tonnes of abandoned electronic equipment have been sent to India from wealthy countries with the goal of being repurposed for charitable purposes. These donations have been made with the objective of reusing the technology for charitable reasons. Just a tiny fraction of all electronic devices are finally meant to be recycled by official recycling units, and the final destination for these imported products is to be thrown away to informal recycling units either immediately or after a little bit of reuse was accomplished. According to the findings of a study that was conducted by Greenpeace in the year 2005, recycling units for electronic trash had a significant number of compounds that are very harmful. These chemicals included dioxins and furans, both of which are toxins that are known to be fatal. When they are engaged in the process of recycling, the workers at these firms are provided with very little or no protection. This is the case throughout the duration of their work.

1.7 Indian E-waste Management

Due to the fact that they do not have a complete understanding of the nature of this waste, it is not unusual for individuals to throw away electronic waste together with regular household rubbish. Rag pickers are the individuals who are responsible for the process of separating tech trash from other types of waste among other types of garbage. In order to generate revenue, rag pickers may sometimes sell electronic garbage to scrap merchants in the towns in which they are locally located. This is because the rubbish contains components that are not only useful but also reusable. This is the reason for this trend. Businesses that deal in scrap are the ones who bring in the electronic scrap that they have accumulated for the aim of informal recycling. According to Gupta and Kumar (2014), informal recyclers are the ones who are accountable for the use of procedures that are both dangerous and outmoded in order to deal with electronic waste.

According to Ramachandra and Varghese (2004), about seventy-five percent of materials that are considered to be electronic trash are left at home. This is because there is a lack of awareness and decision-making about the administration of these objects, which is the explanation for this situation. Electronic garbage is often permitted to gather in a variety of settings, including residential areas, workplaces, and industrial sites, without being subject to any rules since it is not subject to any restrictions. Due to the fact that individuals are under the notion that their electronic waste has a value that can be sold, they are reluctant to get rid of it as fast as possible (Sinha, 2008a). It is not uncommon for consumers to make an effort to find prospective purchasers in order to resell the products that they have purchased. Electronic waste is often disposed of in landfills with other types of garbage that are collected from residences. This is a standard practice. It has been mentioned by Robinson (2009) that landfilling is the most common approach that is used for the disposal of electronic trash from all over the globe. The research conducted by Ladou and Lovegrove (2008)a indicates that electronic waste is often mixed up with other types of household waste and is not recycled in the appropriate manner on a consistent occurrence. The process of recycling electronic garbage is becoming into a professional field that is governed by informal stakeholders. This area is developing into a more significant one. There are a substantial number of Asian countries that do not have legislation in place for the recycling of electronic trash, as stated by Greenpeace (2005b).

It has been stated by Wath et al. (2010) that non-OECD nations such as China and India face a significant obstacle in the shape of the informal recycling of electronic waste. It is a significant obstacle to overcome. The Ministry of Environment and Forests published a study in 2008 that said that the recycling of electronic trash takes place in less formal settings that do not have stringent manufacturing rules. This information was found in the report. The dominance of the informal sector, according to Skinner et al. (2010), results in recycling systems that are not only harmful but also ineffective. The informal sector is the most prominent sector, which is why this is the case. According to Chatterjee (2012), the informal sectors in India are responsible for recycling more than ninety-five percent of the electronic waste that is created. On the other hand, only five percent of the waste is recycled via legitimate distribution channels. Greenpeace (2008) has stated that just three percent of India's electronic trash is recycled in facilities that have been awarded certification. This information comes from the organization's publication. It is carried to unauthorised recycling yards situated in major cities like as Mumbai, Delhi, Bangalore, and Pune. The remaining three percent is delivered to these yards. Even though the majority of it is in the informal sector, India has a corridor that is well-organized when it comes to the collection, disassembly, and recycling of electronic components. This is despite the fact that the majority of it is in the informal sector. According to Manomaivibool (2009a), local merchants who are known as kabadiwalas are supposed to gather garbage from door to door in each and every minute unit. This behaviour is said to take place in every single minute. Rag pickers are those who work in informal industries and are responsible for collecting electronic waste and disassembling it in order to recover reusable components and pieces that have the potential to be resold. In order to recover bits and components that may be reused, this recovery procedure is carried out. There has been a limited amount of study conducted on the many stakeholders, their influence on the economy, their influence on the environment, as well as the health and safety of recycling workers and people in the surrounding area. Borthakur (2014).

Figure 1.3: Handling (Land-filing) of E-waste in Informal Recycling Unit (Source- The Indian Express, 2017)

The majority of the tasks that are involved in the processing of electronic trash in India are carried out by the informal sector. The collection, disassembly, classification, and transportation of garbage are some of the tasks that fall under this category of employment. A significant number of people in India use their electronic garbage as both a source of cash and an abundant supply of recyclable material. This is because they believe that their electronic waste can be recycled. Rag pickers make up a substantial portion of the population in India. As a result, they are recognised by that name. It is via the collection of garbage items, such as plastics and polythene bags, that these folks ensure their financial stability. Children are often used in the process of recycling electronic waste, which is a common practice. It is only via the scrap metal that they collect and subsequently sell to local merchants that they are able to generate income. This is the sole form of income that they provide. It is a key cause for their ignorance that they are unaware of the ways in which electronic trash may have a negative influence not only on human health but also on the environment. As a result of the lack of safety equipment that has been brought up to date to reflect the present state of affairs, there is a shortage of electronic waste disposal equipment.

In India's informal recycling sector, the bulk of the operations that are engaged in the management of electronic garbage include manual collection, sorting, transportation, and recycling using just one's hands and other equipment (Figure 1.3). This is the case for the majority of the activities. Safety and health concerns are not given priority since there is a lack of understanding about the negative effects that electronic waste may have. There are two types of electronic waste: equipment that is still operational and equipment that has died. On the second-hand market, reusable electronic devices are made accessible for potential buyers to purchase. Figure 1.4 illustrates the process of disassembling items that are not operating correctly in order to discover components that may be reused. This is done during the process of deconstructing the product. In order to recover precious metals and nonmetals, components that cannot be reused are burned in the open air. This is done in order to get the desired results.

In order to recover valuable metals like as gold, silver, and other precious metals, informal recyclers often use the approach of dipping dead printed circuit boards (PCBs) in drums that are filled with chemicals or acids. This method is used to recover valuable metals of various types. Within the context of the process of recovering precious metals, this approach is often used. Due to the fact that these two procedures lead to the production of biohazardous gases during the processing of electronic waste, they pose a significant threat not only to the health of workers but also to the environment where they are carried out.

Figure 1.4: Working on Printed Circuit Boards (PCB) in Informal Recycling Unit (Source-Sheshu Babu, Sabrang India, 2018)

1.8 IMPACT OF INFORMAL RECYCLING

Electronic waste is handled in a manner that is quite harsh, analogous to the way that rubbish from households is handled. This is done by informal recyclers who are not particularly aware of the potential negative consequences that electronic waste may have. The management of electronic waste is performed by the use of conventional methods, with just a few preventative steps being carried out. Not only does the illegal recycling of electronic trash have the potential to have a significant negative impact on the health of individuals, but it also has a significant number of negative effects on the environment.

1.8.1 Social and Economic Impacts

Within the context of the contemporary society, the prevalence of electrical and electronic devices is increasing, and the number of individuals who make use of these devices is expanding at a fast rate. The use of these electronic devices is increasingly becoming an essential component of day-to-day life, not just in urban areas but also in more rural sections of the globe. To even begin to fathom what their lives would be like if they did not have access to a broad variety of electrical and electronic devices, such as computers, televisions, mobile phones, and so on, it is impossible to envision what their lives would be like. Describe the way their life would be like. Those who are working in urban areas are the ones who are most likely to be impacted by this finding. These items provide a significant contribution to the economic and social development of any town, as well as to the overall growth and development of the country as a whole. Both of these aspects are important. For instance, in the current world, it is inconceivable to conceive of the feasibility of developing and effectively running contemporary corporate organisations without the support of Electrical and Electronic Equipment (EEE). This is because EEE is essential to business operations. A whole industry that is equivalent to the information technology business has emerged as a result of the contributions and help that information and telecommunications equipment has provided. This industry may be compared to the information technology firm. Beginning with kindergarten and extending all the way up to faculty education, there is a significant amount of utilisation of electrical and electronic technology, especially computer systems, in the field of education. This is the case across the whole educational system. Currently, the banking industry also offers financial services via the use of mobile phones and the internet. This is a relatively recent

development. Due to the fact that mobile phone banking and internet banking are not only easy to use and affordable, but also need a significant amount of time, the clients of the sector are actively encouraged to make use of these methods.
At this moment in time, a person is required to depend on electrical and electronic technology to a certain degree, regardless of whether or not they are willing to do so of their own free choice. This requires them to rely on technology to a certain extent.

On the other side, the recycling of electronic trash has the potential to significantly boost the number of employment opportunities that are accessible in India. 2009 (year) Authors Wath et al. (2010) The recovery of useable parts, materials, and components from electronic equipment that has been discarded may be a source of cash for those who are experiencing difficulties in their financial situation. Because the collection, disassembly, recovery, and segregation of electronic scraps are primarily carried out manually, this sector offers a significant number of employment opportunities in India (Baud et al., 2001) in a number of cities, particularly for those who are illiterate and those who are poor in urban areas. This sector is particularly beneficial for those who are unemployed. It is estimated that more than 10,000 persons, including women and children, are involved in the informal management of electronic waste operations in Delhi alone (EMPA, 2004). This number includes individuals who have not received any official training. These individuals are included in this total, even if they have not undergone any formal training. Because of this, the e-scrap management industry provides work chances in addition to a source of income for those who are interested in it. According to Wath et al. (2010), throughout the process of establishing the escrap recycling system for India, it is necessary to have a firm grip on both of these issues and to manage them effectively.

1.8.2 The Relationship between Occupational Health and the Environment

Businesses in India that are responsible for the management of electronic waste offer significant risks not only to the environment but also to the general health of their employees. These risks are not limited to the environment alone. There are a lot of scientific studies that have come to the conclusion that not only does the health of the people who work in recycling units suffer from major effects, but also the health of the people who live in the vicinity of the locations where electronic trash is disposed of would suffer severe consequences. The personnel are subjected to a high level of exposure to the hazardous compounds that are disposed of, which is the reason for this. It is a major cause for worry in India due to the fact that a sizeable number of the individuals who are engaged in the recycling industry are not only uneducated but also living in poverty. This is an issue that is seen in many different parts of the country.

In spite of the fact that the improper disposal of electronic waste poses a risk not only to their own health but also to the health of the world as a whole, they are utterly oblivious to the risk that they are unleashing into the environment from the improper handling of electronic trash. Indeed, these kinds of recycling factories are places where pollution of the air, water, and land is allowed to continue unchecked while it is allowed to take place. This is the case because they are allowed to take place. The measuring and monitoring of these pollution ramifications have not been carried out with any degree of success. Neither of these things has been conducted. Following the completion of their investigation, Wath et al. (2010) came to the conclusion that the whole procedure of managing electronic waste in India requires a significant amount of laborious effort. Adding insult to injury, the bulk of the treatments and recovery operations are carried out by using obsolete equipment and methodology, which results in the discharge of pollutants that are not under control. This is a situation that creates a situation that is even more problematic. This is a circumstance that makes the problem even more difficult.

The research was carried out by Panwar and Ahmed (2018) in order to investigate the levels of soil and water pollution that are present in the vicinity of informal recycling operations for electronic trash in Krishna Vihar, which is located in Delhi. Their objective was to ascertain the level of pollution that affected the area. There were multiple hand pumps situated at the place where recyclable electronic trash was disposed of, and a total of five hundred millilitres of water was collected as a sample from each of these pumps. As a consequence of this, soil samples were taken from the area that corresponds to the ground level. Table 1.2 provides an illustration of the impacts that toxic metals have on the water as well as the soil within the environment. These impacts are detailed in the table that contains them.

Table 1.2: Soil and Water Pollution caused by Discarded Electronics Products

Water			Soil		
Hazardous Metals	Concentration Found	Std. Concentration	Hazardous Metals	Concentration Found	Std. Concentration
Lead	1.25 mg/litre	0.05 mg/litre	Lead	298.10 mg/kg	100 mg/kg
Cadmium	0.28 mg/litre	0.01 mg/litre	Cadmium	47.77 mg/kg	3 mg/kg
Nickel	0.29 mg/litre	0.05 mg/litre	Nickel	41.44 mg/kg	50 mg/kg
Chromium	0.83 mg/litre	0.05 mg/litre	Chromium	145.18 mg/kg	50 mg/kg
Zinc	1.39 mg/litre	5 mg/litre	Zinc	174.83 mg/kg	300 mg/kg

The research that was carried out by Gangwara et al. (2019) included the collection of air samples with the aid of Respirable Dust Samplers (RDS), and the analysis of heavy metals was carried out with the assistance of Inductively Coupled Plasma–Optical Emission Spectrometry (ICP-OES). Both of these methods were used in order to determine the presence of heavy metal molecules. For the purpose of determining the concentrations of heavy metals, both of these approaches were used. They arrived at the conclusion that the burning of electronic rubbish in open locations has made a substantial contribution to air pollution, which is the reason for the high levels of heavy metal exposure that are experienced by the people who inhabit in the neighbourhood. This conclusion was reached as a result of their investigation about the matter. This conclusion was arrived at as a consequence of the investigation that they conducted. In Table 1.3, which can be found lower down on this page, this conclusion is presented for your information.

Table 1.3: Air Pollution Caused by Discarded Electronics Equipment

Air	
Measured Value	Standard Value
243.310 ± 22.729 µg/m3	100 µg/m3

1.9 Challenges

In developing nations, there has been a lack of efficient and trustworthy monitoring of the whole WEEE life cycle, from collection to storage to exchange and disposal (Otieno and Omwenga 2015). The lack of standardisation across all of these operations makes this a reality. The fact that this is the case was stated by them. Furthermore, this is crucial for public safety, environmental preservation, and the recycling of electronic gadgets. Research by Ghadimzadeh and Askari (2014) revealed that there are a number of techniques for disposing of electronic waste, and that these methods are both difficult to manage and provide significant challenges. Furthermore, these writers argued that two major contributors to the buildup of electronic waste are the lack of data on the quantity of electronic trash being produced and the absence of state-level regulations and processes that are beneficial to the management of electronic waste. A major contributor to the buildup of electronic waste is the absence of data on the quantity of such garbage being produced.

Balde et al. (2015) states that the legislation aimed at removing electronic garbage from circulation has been implemented for the first time in an African nation, namely Nigeria. Achieving this is a monumental feat. Nobody seems to agree on anything, and there's also a severe shortage of information and experience when it comes to processing and managing electronic trash. The majority of India's businesses in the informal economy recycle a considerable amount of electronic trash, say Tyagi et al. (2015). By stating this, one may allude to the study's location in India. Garbage collection has been overseen by local scrap merchants over the last several years. This indicates that they have been in charge of garbage collection. The management procedure continues with disassembling and sorting the electronic goods after collection of the garbage. This step happens just after the electronic trash is collected. I. Disassembling electronic devices; (ii) heating or disassembling printed circuit boards (PCB) by hand; (iii) separating copper and aluminium from cables; (iv) melting or breaking plastic components; (v) sweeping toner; and (vi) an open acid leaching process to recover valuable metals from electronic waste are all steps in the specific procedure that involves the use of primitive methods. The author claims that most people tasked with trash collection lack formal education, and that those tasked with dealing with technology waste are similarly incompetent and untrained. The author goes on to say that these individuals had never received any kind of training previously. On top of that, they have to find old items, fix them up, and then put them back on the market as refurbished goods. It is within their domain to handle this matter. They are in a position to take charge of this situation. The possible health risks linked with burning the artefacts to extract the metals are unknown to them, as far as their knowledge goes. In order to achieve their goals, they simply resort to the usual illegal tactics, such as burning the merchandise.

Some of the issues that have been identified so far are listed here; there are likely many more: The state agencies in charge of dealing with electronic trash lack organisation and enough resources to handle the problems and difficulties that come with it. (i) locals aren't very knowledgeable about how discarded electronics may harm ecosystems and human health. (ii) There is a lack of organisation on the part of the state authorities. Omwenga and Otieno (2015) state that the individuals in charge of WEEE administration have not received the necessary instructions to do their jobs. This finding is quite similar to one that Lundgren (2012) reached. The general public, he said, has a pitiful grasp of the potentially dangerous idea of electronic rubbish, and waste management solutions are far from refined. It has come to light that there is a dearth of data on the administration of electronic garbage, particularly in regards to the volume of electronic rubbish produced and its origins. Because many developing nations lack legislation or rules addressing the disposal of electronic waste, the handling of this kind of garbage presents a multitude of challenges. This is yet another major issue that needs fixing. According to studies mostly carried out in Africa, the only two countries with officially sanctioned strategies for recycling electronic waste are Cameroon and Nigeria. The findings are solid since the research was conducted. On the other side, further bills are pending in Kenya, Ethiopia, and Ghana on the legislative front. Nonetheless, no system for dealing with electronic waste currently exists in Africa (Balde et al., 2015). Even if electronic waste has risen to the level of a governmental concern, this remains the case. Despite concerns about the issue of electronic device waste, this has occurred.

Over the course of many decades, the world has undergone a transformation as a direct consequence of the technological advances in the field of electronics. This change has occurred globally. According to Dwivedy (2013), several functional electronic and electrical devices have been developed and manufactured as a result of these technological developments. Anywhere in the universe, these technological developments might endanger human life.

A more recent addition to the hazardous waste stream is electronic garbage, which consists of decommissioned electrical and electronic devices. Included in this is the process of removing electrical machine waste. According to Mundada et al. (2004), electronic waste is one of the many waste streams that is rapidly expanding over the whole universe. This is a kind of electronic trash that goes into several waste streams. A common meaning of "e-waste" encompasses "electronic equipment that has been abandoned and is powered by electrical energy in order for it to function with the purpose for which it was designed." Things that are considered "e-scrap" include things that are useful to people and those that are harmful to people's health.

Hence, it is always crucial to use one-of-a-kind management techniques and procedures to prevent pollutant discharge into the environment and guarantee they do not harm public health (Robinson, 2009). The production and use of electrical and electronic equipment have both seen substantial increases throughout the last two years. Nearly all of this may be explained by the remarkable progress made in the realm of information and communication technology.

There has been a meteoric surge in the demand for American-made consumer gadgets since then. Aside from having quick growth arcades for electrical and electronic items, the two emerging countries of India and China both have significant e-scrap generators (Khetriwal et al., 2005; Widmer et al., 2005). You might say that both of these nations are on the rise. Demand for domestic consumer electronics has been on the rise ever since India's economy began to grow at one of the world's quickest rates. One country that exemplifies this phenomena is India.

1.10 E-WASTE RECYCLING

The electronic waste supply chain is mostly comprised of the following entities: buyers, sellers, traders, smelters, exporters, recyclers, manufacturers, and dismantlers. Buyers, sellers, shippers, and recyclers are some of the other players. Despite the fact that electronic waste has only recently emerged as an issue, it presents a chance that might be commercially quite significant. This is because there is a lot of valuable minerals in the electronic trash, and the amount of garbage is rather large. Among the many useful metals that may be discovered in electronic trash are gold, silver, copper, iron, aluminium, and many more. Widmer et al. (2005) reports that these useful components account for almost 60% of the overall weight, with pollutants accounting for barely 2%. Due to this, recycling electronic trash is an enormous undertaking, posing problems with waste management and the recovery of precious materials. This is because recycling electronic waste is a part of the process. Huisman et al. (2007) states that collecting electronic devices that have reached end of life (EOL) is the usual technique for recovering electronic trash. The next step is to have them taken apart by a dismantler. In order to find out whether the goods would be better off recycled or resold, an evaluation is done at the dismantler's workplace. Product disposition options include sending it to a remanufacturer, refurbisher, or reseller, depending on the likelihood of product use. It is the responsibility of refurbishers and resellers to get the whole product ready for resale, while remanufacturers are in charge of removing and reselling the reusable components. It is also the responsibility of remanufacturers to retrieve the reusable components. An overview of the computer and IT waste recovery system's core process is shown in Figure 1.5.

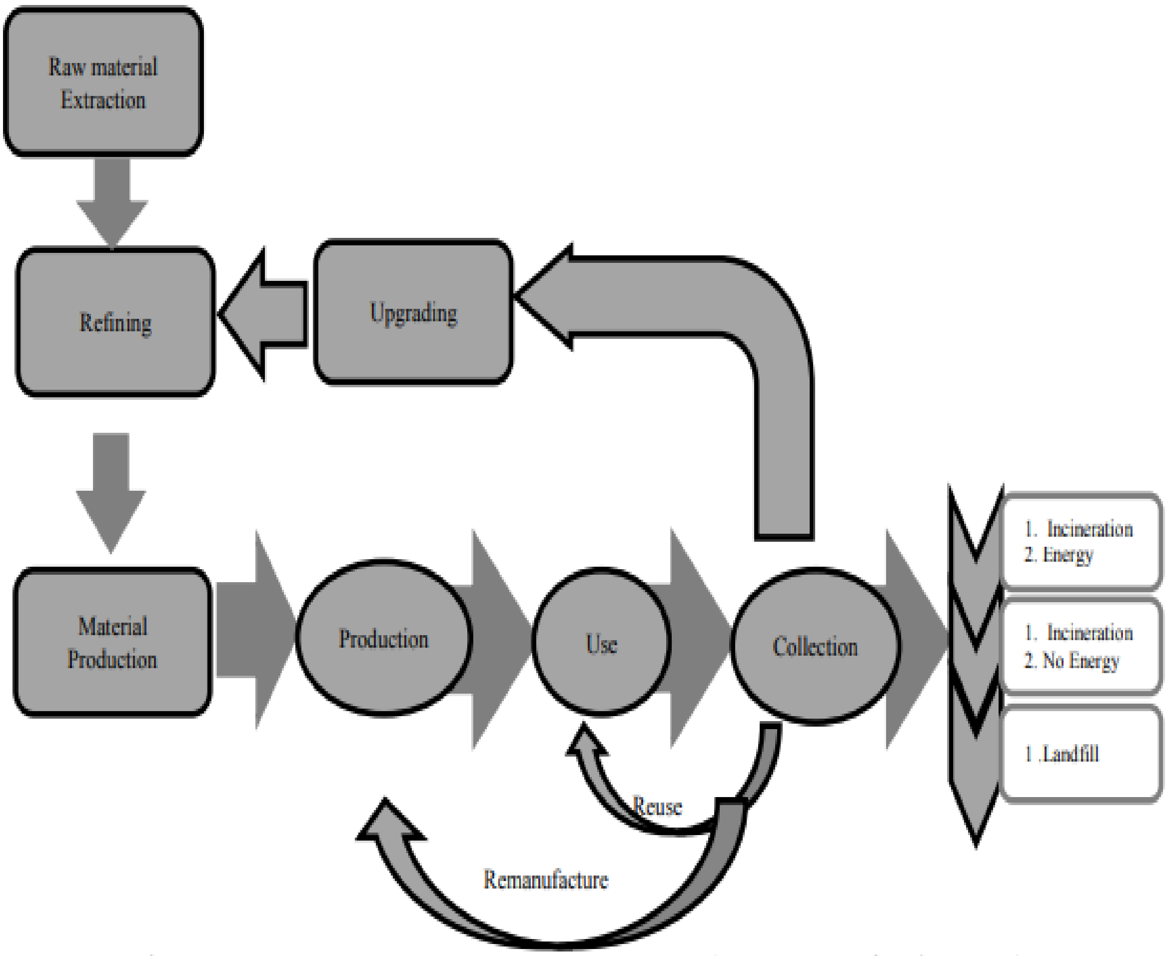


Figure 1.5: Common E-waste recovery system (Source- Dwivedy, 2013)

When a discarded electrical device is determined to be useless, it is broken down into several commodities that may be salvaged. It is common practice to sort valuable materials into separate commodities streams based on their properties, while sending hazardous materials to specific waste-processing facilities. When sorting materials, it is usual practice to use a minimum of two shredders. Making the materials smaller makes them easier to work with in subsequent processing steps, such as the magnetic separator and the eddy current separator. Recycling firms often use supplementary technology to achieve efficient material separation and resource recovery, according to Sodhi and Reimer (2001).

Companies that own large appliances or other tangible items often neglect the resources at their disposal. They may be distinguished from the most accessible materials, such steel, and perform a simple procedure to separate it from the other components in the first processing step, according to Ferrao and Amaral (2006). Following the process of product separation, the metal streams are sent to smelters, while the plastics and other commodities are shipped to refineries, incinerators, or landfills. Smelters, on the other side, are in charge of processing metal streams. The formal technique for recycling electronic garbage consists of the phases shown in Figure 1.6.

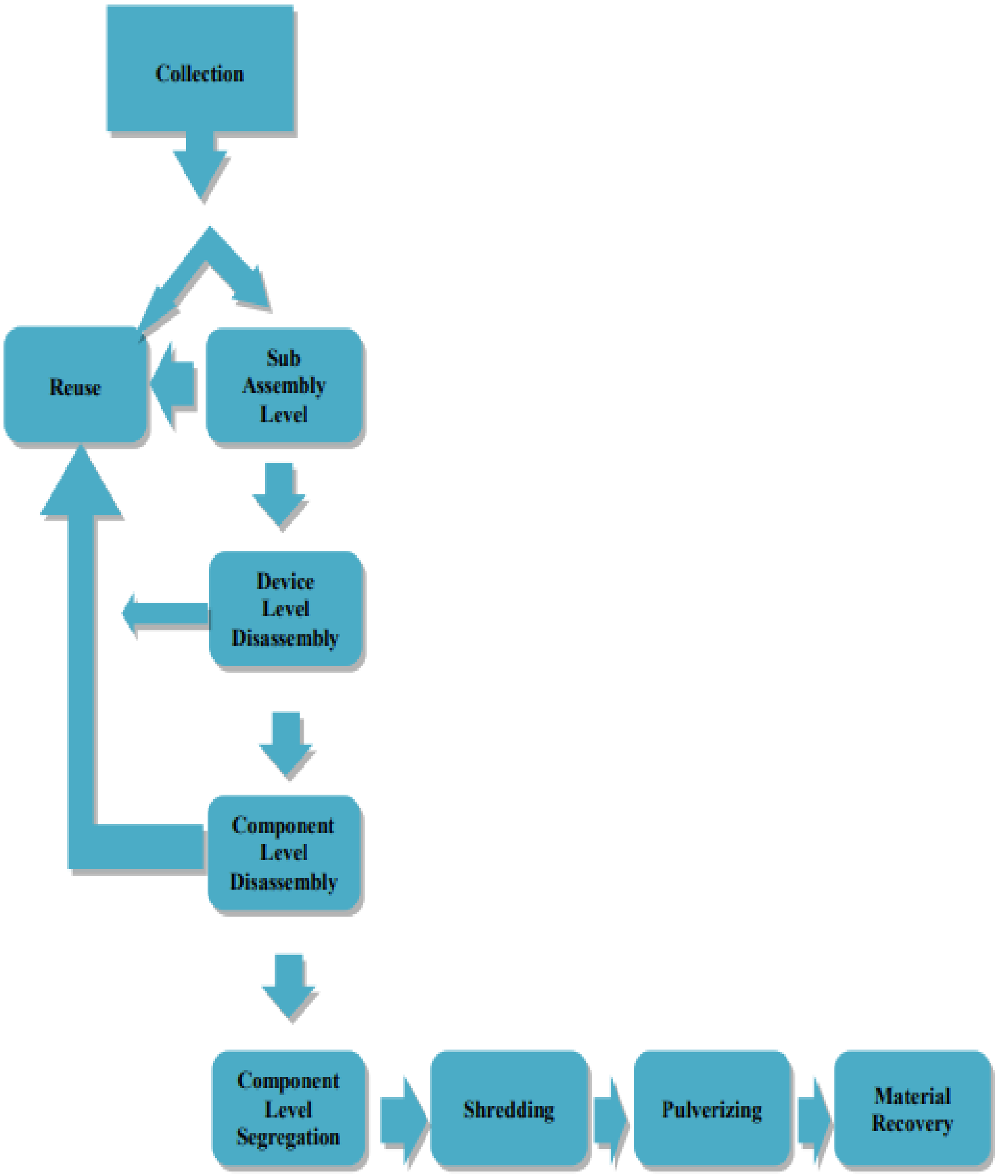


Figure 1.6: Stages in Recycling for Recovery of Materials (Source- Cui and Forssberg, 2003)

Sorting and disassembling electronic waste is the first step in recycling; further steps include shredding, pulverising, and material recovery. This process of recycling is repeated until all of the materials have been recovered. It is feasible to distinguish between operational and non-operational components by implementing the segregation mechanism for the operative ones. Components that aren't working are taken apart even more, and those that are are put to good use again.

1.11 The scope of the research as well as its significance

On a worldwide basis, India produces more electronic garbage than any other country. The process for dealing with electronic trash, however, has not received the attention it needs. The onus for coming up with and enforcing the appropriate legislation and policies for electronic waste management lies on the government. When looking at the different states in India, it's clear that the northern states generate more electronic garbage than their southern counterparts.

According to the available data, Delhi may be home to a plethora of processing facilities dedicated to the proper disposal of electronic trash. It is the responsibility of these establishments to manage electronic trash. The study delves into the procedure for handling electronic garbage in the northern Indian regions. Mostly because most of the processes used to control electrical waste originate in northern parts of India. An increasing amount of electronic waste is being generated due to the fact that several developing countries, like India, are engaging in the daily illicit importation of electronic waste. People are using unofficial means to dispose of their technological waste. The reason for this is because electronic trash contains precious components including gold, copper, aluminium, and more.

The informal recycling operations are being carried out by industries, which are oblivious to the fact that useful components coexist with substances that might be harmful. In addition to harming the ecology, these harmful components are also inflicting harm on the individuals who labour in these makeshift recycling centres. There are environmental problems caused by these components as well. To protect citizens from a wide range of potentially harmful risks, the government should institute an appropriate system for regulating the disposal of electronic waste and look into ways to end the illicit importation of such waste through strict enforcement of existing laws. Additionally, people need to be educated about the key issues surrounding electronic trash and made aware of the possible negative effects of this waste via the use of effective ways.

1.12 A STRUCTURE OF THE RESEARCH

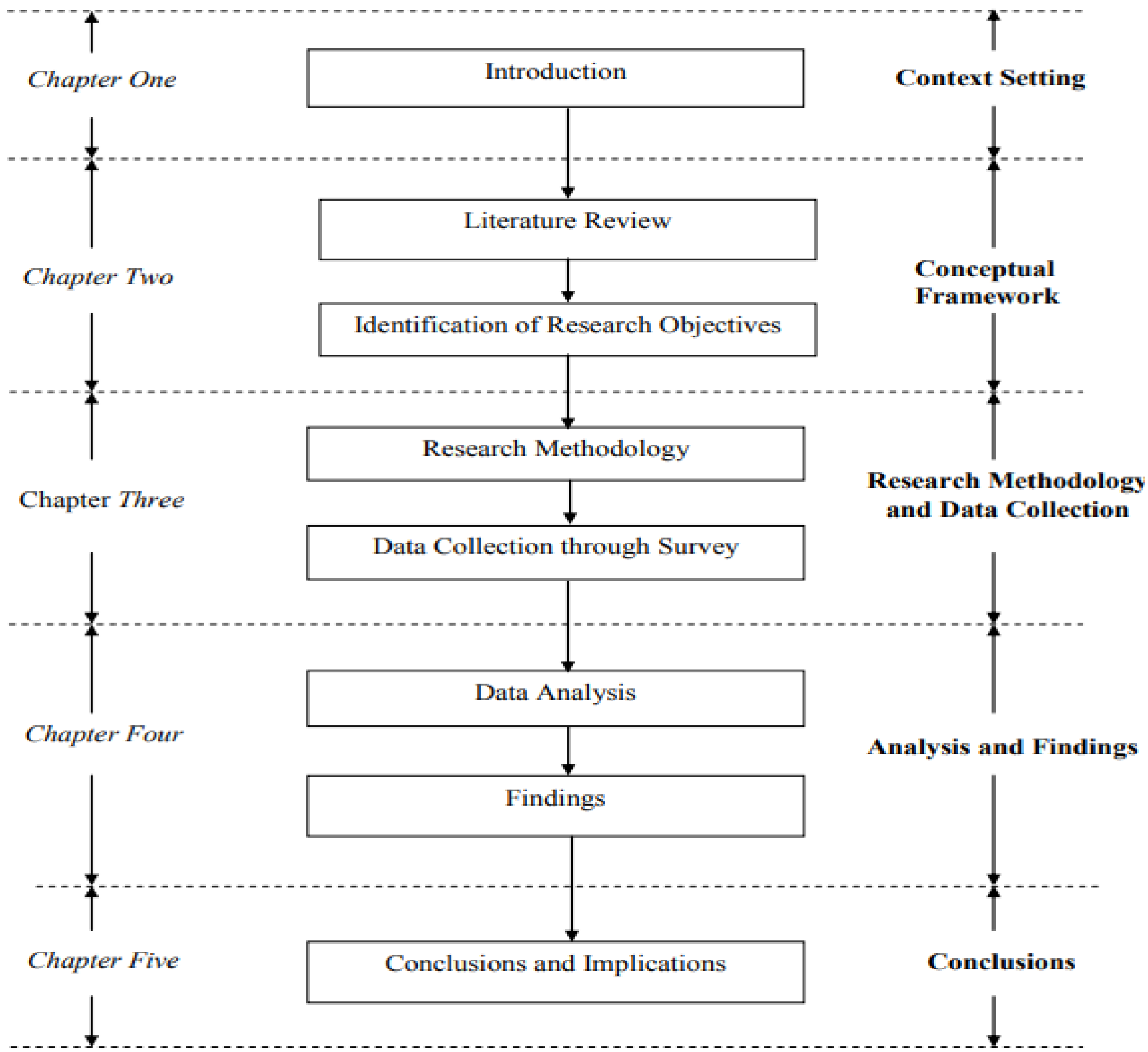


Figure 1.7: Schema of the Study

The first chapter provides an overview of the aims of the research as well as the setting in which the current study is being conducted. An additional function of this chapter is to act as an introduction to the first chapter.

In the second chapter, which also helps to create the conceptual framework that will be utilised for the research, there is a complete description of the many streams of literature that have been investigated. A full summary of these streams of literature is presented. The methodology of the study as well as the technique for gathering data are both broken down and explained in great depth in the third chapter of the report. Additionally, an examination of the data that was gathered earlier is included in the fourth chapter, which is where the results are presented. In the fifth and last chapter of this dissertation, a summary of the findings is presented, and an analysis of the implications of those findings for both theory and practice is carried out. An illustration of the structure of this thesis may be found in the figure that was shown in the paragraph that came before this one.

CHAPTER-2: LITERATURE REVIEW

2.1 Introduction

By all accounts, India is the country seeing the most rapid increase in the amount of garbage generated by electronic devices. This is true for every nation; it doesn't matter which one is being mentioned. There has been no organised attempt to recover abandoned electronic gadgets in India until the aforementioned year: 2011. This held true up until 2011. This was the reality, after all. The amount of waste produced in India is under-estimated, according to Manish and Chakrabarti's 2019 research. As mentioned before, one of their results was this. Currently, there is a dearth of reliable data sources that can provide this information online. An accurate assessment of India's garbage production is getting increasingly challenging in the present climate. The scenario has led to a dearth of data, which is the reason for this. A great deal of separate research goes into producing estimates, and the method of obtaining estimates is the means by which these estimates are obtained. Utilising multiple study pieces completes the construction of estimations.

According to Manish and Chakrabarti (2019), over 70% of the total electronic rubbish that has been produced in the US since 2005 originates from only ten states. The researcher's results constitute the basis of this material. The data given here is based on the findings of the aforementioned researchers. The Environmental Protection Agency's (EPA) website was the source of this data, which contained all of the information that was questioned throughout its collecting. Computing this proportion required factoring in the total volume of electronic garbage generated throughout the nation. In order to get the intended outcome, this was done. This precise figure could only be arrived at by factoring in the total amount of trash produced by each state. The bulk of the nation's electronic trash originates from these states. When it comes to the quantity of electronic trash that is generated, these states are at the top of the heap. The states listed below are largely to blame for the exponential growth of electronic garbage. The research that was conducted as part of the inquiry was aimed at India.

countries like India, which is still experiencing rapid economic growth, generate electronic waste from a wide range of sources, including domestic consumers and buyers in many other industrialised nations. Domestic and foreign consumers alike produce this trash. This is so because people generate technological waste in the comfort of their own homes. Companies with their headquarters in these nations are responsible for producing this waste. It is believed that almost 70% of the electronic waste processed in India originates from other countries that are seen as economically developed, according to the 2011 edition of the book authored by McAllister.

According to the United Nations Environment Programme (UNEP), electronic trash will double from 2007 to 2020 (McAllister, 2013). This anticipated growth is predicted to occur from 2007 to 2020. Within that time range, this increase would happen, sometime between 2007 and 2020. A 2019 research by Manish and Chakrabarti found that India produces around 2 million metric tonnes of electronic waste each year. What follows is a rundown of all the circumstances that have persisted throughout 2018. It is possible to separate the whole procedure for dealing with electronic trash in India into many separate steps. Each of these stages is unique. To make sure these procedures are executed correctly, they need to be carried out in different places around the country. Collection, transportation, sorting, processing, recycling, and recycling are all steps in this process. This technique also include recycling. A large number of components make it up. The unregulated but highly-connected informal sector has a significant impact on the situation at every stage. There is a statistically significant level of this impact. Not only does this cause the asset's value to fall, but it also makes it impossible to recover the value—something that might have been possible under other conditions. If the conditions were different, this situation may have happened. An integral part of this approach includes procedures such as acid leaching and open-air burning, to name a few. What follows is a description of some of the other steps that make up this approach.

Both of these steps need to be taken and completed for them to be considered complete. These informal networks are associated with businesses that sell used goods, those who fix things, and those that sell on various kinds of e-commerce platforms (Manish and Chakrabarti, 2019). All of these businesses are involved in the recycling of old electronics, which means that they all gather used parts and components.

2.2 Issues & Importance

However, according to Huihui (2019), the fast depreciation of electrical and electronic devices is the root cause of the ever-increasing and unmanageable volume of electronic waste. This garbage has accumulated since these technologies are becoming out of date so quickly. They have lost all power over this garbage. The existence of these substances will cause major problems for both human and environmental health, since electronic trash may include a large number of toxic and dangerous chemicals. Consequently, coming up with a long-term and short-term solution to limit or drastically cut down on electronic waste production is of the highest significance. Given the current state of affairs, this is the rationale. The ability to collect created electronic trash is the most critical consideration in determining the feasibility of establishing a formal system for recycling this kind of garbage.

Researching how well end users understand the harmful effects of electronic waste would be a good next step, according to the study's authors (Kwatra, 2014). After the inquiry was over, they finally arrived at this conclusion. This regulation was put in place since the people who use electronic devices on a daily basis are the ones who are ultimately to blame for the buildup of electronic waste. The authors discovered a substantial information and awareness gap concerning the management of electronic waste, even though regulations for its disposal are already in existence. This was indeed the case, and the writers took notice of it. The research was conducted in Delhi, India, specifically to learn more about people's opinions on where the problem of electronic waste and recycling first came from. Those who took part in the study were asked about the ways they personally dealt with electronic garbage at home.

This procedure was a part of the survey that was administered. The authors found that most respondents from middle-class households still hadn't heard of the problems associated with technological waste. The results here are consistent with what the authors found. People who are knowledgeable about the problems associated with electronic waste may find a wealth of information via printed media and the Internet. Additionally, it has been shown that a significant portion of the survey participants are unaware of the proper protocols for recycling electronic garbage. An aggregate rate of 12–26% of consumers take part in product exchange schemes, where they may turn in their old electronics for newer models of the same thing. Appliances, laptops, and refrigerators are just a few examples of the many consumer devices that are part of these exchange networks. In addition to adding to the overall amount of electronic waste, throwing out electronics before they reach the end of their useful life or the specified life cycle puts extra strain on the resources used to make these items. Because of this, the ecosystem is strained even more. Some poll takers have gone on record as saying they would gladly pay a little more to ensure that their properly disposed of electronics get recycled. According to their statements, this is something they are prepared to undertake.

According to David's (2008) research and analysis, the three biggest problems affecting the whole planet right now are climate change, the disposal of technological trash, and the generation of greenhouse gases. In modern electronic devices, antennas are the most common component used for communication. This includes desktop computers, mobile phones, and similar devices. The average amount of time that Indian consumers keep their old electronics out of landfills is far longer than the norm when compared to consumers in other countries who do the same. In India, people prefer not to throw away broken electronics rather to have them mended or pass them on to someone else. Because of this, this pattern is developing. Sinha (2008) argues that a lack of urgency in disposing of e-waste is due, in part, to an all-encompassing view of "e-waste as a product" that treats it like any other product. This is due to the fact that discarded electronics are technically products. It is often thought that consumer goods in India have a much longer average lifetime than in the West, despite the fact that Western nations normally have a far shorter average lifespan.

What Joseph accomplished in 2007 This essay explores the challenges posed by the current state of electronic waste management in India and offers some suggestions for moving forward with a solution. The article focuses in on the challenges that the topic presents. The study set out to examine the relevant methods and the obstacles that must be surmounted in order to determine a solution to this new issue. The study was conducted with a strong emphasis on India. India served as the location of both the inquiry and the research. Various regulatory bodies, consumers, recyclers, importers, and manufacturers/assemblers of electronic waste may all work together under this waste management strategy to collect and recycle all of the things that are deemed e-waste. You are presented with this method of trash management. One effective method of waste management is the use of this approach when dealing with trash. The already-significant problem of solid waste management in India is become much more complicated with the advent of electronic garbage. The significance of this subject has been rising recently. You might say that this issue has persisted for quite some time. Proper disposal of electronic waste and subsequent recovery of components of major importance requires the establishment of appropriate standards. Reason being, getting these components back is equally important. When developing new electronic devices, it is crucial to keep end-of-life management in mind at every stage of the process. No matter what, this need must be satisfied.

According to Pandey's forecast (2004), the information technology and electronics industries are anticipated to play a pivotal role in driving global economic growth in the next century. People used to think that companies dealing with electronics didn't cause any pollution; however, that's no longer true. It was formerly believed by many that this was the case. It is becoming more obvious, thanks to the globalisation of industry, that these items include a great deal of pollutants, and it is also becoming more apparent that these pollutants have a negative impact on both people and the environment. Reason being, these contaminants are harmful to ecosystems and human health. These measures were implemented on a national level as part of the efforts to reduce waste and increase productivity. There was more to the undertaking than just these courses. Some of the methodologies that were targeted by these campaigns were those that were based on the Design of Experiment (DoE) methodology. Methods such as process optimisation are examples of what this group offers.
The need of establishing reverse chain networks for the many and varied producers of electronic devices was heavily emphasised in their study (Pokharel, 2009).

Certain conditions had to be satisfied, therefore this was done. One powerful tool for reducing waste and preserving resources is the legislation that mandates the return of obsolete, end-of-life, or still-under-warranty equipment by manufacturers. Both of these objectives may be met via the implementation of this law. Producers are required to return their equipment to the manufacturing plant as per this regulation. Therefore, it is the responsibility of the companies who made the original commodities to enhance their designs so that they may be recycled and reused as much as possible. One possible approach to doing this would be to alter the products' designs. Not only that, but they are also responsible for creating a system that would gather consumers' unwanted electronic devices. The responsibility to accomplish this is another duty that these organisations have. One factor that contributed to the creation of this system is the high demand for reconditioned items and components. The creation of a system for a reverse supply network is affected by both the quantity of items brought back and the quantity of products brought back. Meeting this criterion is critical for meeting the requirements for the system's expansion. The authors modelled the reverse supply chain mathematically, assuming that the returned goods were collected in a warehouse and then sent to recycling companies for further processing. It was thought that these two steps would be completed prior to the goods being shipped to recycling firms. In order to make sure the things got where they were supposed to go. In response to the current need for replacement components, functional parts and components are being made accessible on the secondary market.

Carol and Canan's 2005 article consistently emphasised the merit of survey research methodology. This was carried out all during their partnership. This was carried out continuously throughout their dissertation. Not only did the writers clarify the most important and pervasive problems with Reverse Supply Chain Management (RSCM), but they also analysed empirical research, the current state of business, and management behaviour. On top of that, they clarified the most common and important problems. Better more, the authors provided guidance on how to handle these challenges.

2.3 Key Trends or perspective

Electronic waste has become an enormous global environmental issue due to the dramatic increase in its production, as shown by Ahirwar's research (2021). Because of this, a major environmental issue has emerged. The global reach of this problem has been growing recently. Collecting and treating electronic garbage in a systematic way to recover valuable components is known as recycling electronic waste. The term "recycling electronic scrap" describes this kind of recycling. The goal in doing this is to increase the amount of electronic waste that gets recycled. In addition to helping the secondary market meet the demands for replacement parts, this practical tool may help decrease the ever-increasing mountain of electronic garbage, which is good for the national economy. With any luck, this tool will contribute to the deluge of electronic trash already in existence. The authors continued by pointing out that, if not properly disposed of, electronic waste may pose a threat to human health by releasing toxic compounds like lead and mercury. As they proceeded with their conversation, this was said. This is what happens when trash isn't disposed of properly. However, to maximise the benefits of recycling formal electronic waste, a number of preparatory steps are required. Included in this group are initiatives to enhance the design of electronic equipment, speed up the official recycling of electronic waste, and implement rules against the use of harmful substances in electronic devices. Not only that, but the writers also highlighted a plethora of tactics and solutions that may be used to increase the official recycling of electronic waste. Additionally, research has been conducted to examine the present global trends in escrap generation. On top of that, simultaneously investigated the effects of electronic scrap's toxic byproducts on human health and examined the procedures utilised to deal with this kind of garbage. There has been very little discussion of viable options for recycling electronic garbage that does not harm the environment.

Researcher Kalana (2010) set out to learn about the various strategies now used by families in the Malaysian city of Shah Alam, in the state of Selangor. The primary goal of the study was to better understand the different approaches to electronic waste management. People were asked to fill out a large number of surveys that aimed to gather data on EEE equipment disposal attitudes and use habits. In order to gather data, this was done. Researchers in Shah Alam discovered that reselling electronic equipment or retaining them for around 47 percent and 48 percent of the time, respectively, were the most effective ways for households to dispose of electronic waste. This was the case with the two methods in question. Some 22% of the electronic trash sent to recycling centres actually made it through the sorting process. The current state of affairs was caused by the lack of consumer-friendly take-back patterns. This was the initial cause of the problem. Among the many causes of this problem was the fact that there were no systems in place to allow for the item's return at any point. The majority of homes do not have the knowledge or experience to properly dispose of electronic garbage in an eco-friendly way, according to the research. Not only that, but people didn't know where to find electronic trash or what to do when they needed to dispose of it.

Building collaboration among the different parties was vital for the government to bring the issue of electrical waste to the general public's notice. In this respect, the government's intervention was necessary.

There has been a significant increase in the unlawful export of electronic waste, which poses a hazard to both people and the environment. Given that the conclusion is indeed plausible to draw, it is a valid one to reach. It is possible to get this conclusion by analysing the data. Gupta (2018) claims that poor nations might suffer as a result of fast expansion of global trade, which could lead to different waste disposal expenditures at the local level and affect the environment. These countries could suffer as a result of these spending. The reason for this is the possibility of fast growth in international commerce. In all likelihood, these countries will feel the pinch of this event's unfavourable effects. As the illicit trade of electronic waste is projected to grow in developing nations like India, it is critical to ensure that those involved in this trade have access to the resources they need to perpetuate it. Reason being, it's crucial to keep providing possibilities and incentives for those that engage in this kind of trading. One plausible explanation for the rise in the practice of exporting hazardous electronic waste—which is itself made more susceptible to fraudulent activities—is the convenience of global trade. This is because engaging in such behaviour opens the door to greater possibilities for deceitful business practices. The specific reason for this is because the activity leads to the transportation of hazardous waste. Several experts have brought to light the fact that the rapid accumulation of electronic waste, together with the poisonous nature of this waste, is a major factor in the decline of human and environmental health. A lot of authorities have said this. Another reason to be worried is the alarming rate of electronic waste production.

Being knowledgeable about the many regulations enacted in India to curb pollution is crucial. The national consensus on the proper disposal of electronic waste is the driving force behind the development of these rules. It is also very important to remember that these restrictions have been officially put in place. While making judgements, this crucial aspect must be considered. As stated by Fayustov (2020), in order to be in line with the standards set in 2011 for the processing and management of electronic waste, there must be acceptable producers and importers of electronic goods who can appropriately handle electronic garbage. It is necessary to fulfil a condition. It is a direct outcome of the rules and restrictions put in place in 2011 to address the industry's dearth of suitable importers and manufacturers. To ensure the proper disposal of obsolete electronic equipment, a thorough set of rules must be established. It is necessary to do this in order to guarantee proper disposal. Producers in the US have been granted the go-ahead to build proper facilities for collecting electronic garbage. This is due to the fact that the company's supply of us is really important. Not only that, but these benefits are accessible to the rest of the community as well. As per Devi (2019), ensuring that the parties' responsibilities are fulfilled in an acceptable way is of the highest significance. To achieve this goal, it is necessary to uphold regulations that are based on the production of electronic waste. The regulations were implemented in 2016 with the aim of controlling electronic waste. The year 2016 saw the implementation of these limitations. The parties are required to behave in accordance with the regulations that govern the production of electronic waste within the context of this particular circumstance. On the other hand, it also suggests a quite broad definition of "e-waste" alongside this. Decisions about the treatment and storage of the material should be guided by this definition. It is of the utmost importance to follow the technique precisely and without deviation.

Gupta et al. (2018) found that manufacturers can't ensure their production facilities are environmentally sustainable in the long run unless they fully grasp the electrical and electronic equipment their customers need. This must be accomplished if their manufacturing facilities are to operate in an ecologically friendly manner. This is very weighty and crucial in terms of environmental conservation for the sake of future generations. This is necessary to ensure that industrial operations maintain their commitment to environmental responsibility in the future, which is the main goal. That businesses don't overlook garbage collection as an option for effective waste management would be much appreciated. A revised set of laws governing the correct disposal of electronic trash was implemented in 2018. This rule governs the process of disposing of old electronics. To account for the changes in priority that have occurred throughout time, this guideline has been revised many times. During these revisions, the goals for electronic trash collection were reevaluated, and there was an increase of almost 10% between 2017 and 2018.

Findings from the 2019 research by George et al. indicate a rate of around 22.2 percent from 2018 to 2019, 30 percent from 2019 to 2020, and continued at that rate in subsequent years. The study was carried out in 2019. It was crucial to pick the equipment for testing electronic waste using a random selection strategy, since no other method would have sufficed. Using this approach was the only option. It was because of the mandates aimed at getting businesses to cut down on their electronic waste that this happened.

2.4 Outline of the body

It is logical to assume that India's ability to manage electronic waste is constrained due to the nation's inadequate infrastructural capabilities. However, this theory is supported by the fact that India's population is relatively tiny. Among the many arguments in favour of this idea is the fact that India has a very inadequate system in place for preserving obsolete electronic equipment. Considering the massive amount of trash generated in India every year, recycling only makes up around 22% of the country's overall electronic garbage. To give you an idea of proportion, recycling makes up just around 22% of total electronic trash. Only a small fraction of Indian governments have publicly stated their intention to fund recycling centres for used electronics. In the end, the plan was intended to cover anything from 25 to 50 percent of the total cost of the effort to clean up electronic garbage, and the Indian government contributed financially to its development. In an effort to encourage the development of this technology, the Indian government has allocated these funds. This investment will be used to bolster existing Indian companies that handle electronic waste processing, according to research done by Venkatakrishna in 2020. This investment is now being planned in India. The amount of after that required for the plan may cause serious limitations if there is a lack of properly authorised recycling facilities. Because of this, recycling facilities are less common today than they were in the past. This is what happens when a region's recycling capacity is inadequate in comparison to its residents' need for recycling services.

The official sector's ability to classify and disassemble mechanical and manual components for recycling has made some little progress. What follows is an examination of these changes in additional detail. Given its potential for recycling, this process might be considered a recycling approach. One school of thought holds that the Indian government's current mechanism for disposing of electronic trash constitutes recycling in and of itself. To be more precise, this is because public money is going towards government-run waste collection and landfill disposal schemes. In order to guarantee the safety of the massive extraction process involved in recycling electronic waste, India's final surviving infrastructure component is presently undergoing an urgent preservation effort. The fact that this choice has linguistic underpinnings makes its expression feasible. A more general approach might be appropriate when bringing this up. To be more precise, this is because the most time- and labor-intensive part of the process is the massive extraction.

To combat the increasingly dangerous pollution approaches and health risk factors, research done by Maheswari et al. in 2020 indicates that environmental pollution has to be ramped up. This explanation is provided since handling the responsibility to answer these concerns is of the utmost importance. Given the nature of this condition, it may be seen as mandatory. Two methods that come to mind when thinking about the process of recovering metal from electronic trash in the informal sector are acid leaching and open-air burning. The implementation of two distinct methods is shown here. Both of these methods involve igniting the trash outside in the fresh air. The habit of burning trash outside in the open air is essential to all of these options. This is a crucial part. Acid leaching, a separate procedure from the others, is another option. To recycle and process certain events that pose risks to humans and the environment, a high level of technical knowledge may be required. Each of these tasks involves complex systems, the most essential of which are contributing to this. This is because there are a great deal of different procedures involved in recycling and processing, and some of these processes are infamously difficult to implement.

The results of the study demonstrated that these consequences could be mitigated through the use of safer chemicals and through the application of certain changes to product style that are part of EXTENDED PRODUCER RESPONSIBILITY (ERP) (Uddin, 2012). Substituting potentially dangerous molecules with less harmful ones may help lessen the impact on the environment of these consequences. To achieve this goal, a legal framework is required that mandates adherence to the RoHS and EPR standards. Combining EPR and RoHS with eco-friendly technologies for electronic waste consumption and employment could lead to a workable solution for the responsible management of electronic waste without negatively impacting the environment. Establishing industry-wide targets for the reduction of waste caused by electronic technology is the duty of the firms that produce and sell electronic goods. For large amounts of electronic waste, businesses should only use certified recyclers; for non-tradable devices, they should transfer them to private developers with the proper authorization for final disposal. Businesses should also buy back client obsolete electronics. Because of this, people will be able to dispose of less electronic garbage in landfills, which is good for everyone.

The bulk of trash is problematic in and of itself, as shown by a 2014 research completed by colleagues. Leachate and lowland gas, byproducts of decomposition, are explosive and pose a threat to water contamination. There is a possibility that all of these things may harm water. Concurrently, medical treatment and monitoring, as well as the development of lowland areas, are all governed by stringent restrictions. The reason for this is because lowland areas are associated with far greater hazards. Since no one wants a lowland site in their 'back yard', most design authority choose to incorporate a figured quarry into the landscape instead. It is widely anticipated that this will not transpire. The reason for this is the convenience of working with figured quarries as opposed to traditional ones. Utilising product design may help decrease the amount and kind of garbage created over time, in addition to maximising a product's useful life and minimising its disposal needs. It is critical that everyone—from producers to retailers to customers to trash collectors—do their bit to lessen the environmental damage that human-made goods cause. Doing this is really necessary. If it's really want to do the part to keep the planet habitable, it should adopt a goods-centered policy.

According to Williams (2003), the growing secondary market for secondhand computers in underdeveloped countries is allowing more people to buy computers and providing them with access to technology at more affordable prices. Furthermore, it should be mentioned that charitable organisations like Computer Mentor, Computer Aid, Global Computer Exchange, and Computers for Schools are constantly contacting organisations worldwide to donate reconditioned and old computers that they have obtained. Reusing technological artefacts for many purposes may reduce their environmental impact. This will ensure that existing pieces of machinery last longer and reduce the need for new equipment. On top of that, saving money is a major perk of recycling.

Several states are now drafting legislation to address electronic waste, according to an article published in 2008 (Kahhat). However, a comprehensive federal regulation covering all types of electronic waste (including both residential and non-residential sources) is still lacking. The problem remains unsolved, even though several states are now drafting legislation to deal with electronic trash. The best course of action would be to establish federal regulations governing electronic trash, according to 2005 analysis by the US Government Accountability Office. The report offered a proposal similar to this. Federal rules and regulations are to blame for the emergence of this issue. These rules and regulations will bring together national policies and laws to make up for the lack of legislation in most states. Increased efficiency in the national system responsible for managing electronic garbage is a direct result of this rise. In this made-up scenario, the e-Market for returned deposits will facilitate the collection, recycling, and reusing of obsolete electronics by providing a venue for residential customers to sell their old equipment.

The development of a system that can successfully manage this kind of garbage requires the active participation of everyone, from the general public to those responsible for producing electronic waste (Sivaraman, 2013). The legislative branch is responsible for ensuring that environmental initiatives get enough funding and for enforcing the nation's officially agreed-upon environmental standards. Ensuring full fulfilment of this commitment is the responsibility of the government. Establishing licencing and certification systems like estewardship has the potential to deter people from engaging in unlawful deals with electronic rubbish and those who trade in it. Many diseases and problems may be prevented with proper management and disposal of electronic waste. These include skin, respiratory, digestive, immunological, endocrine system, and brain issues among many more. The fact that electronic waste mostly contains known carcinogens, heavy metals, and hazardous chemicals is well knowledge.

2.5 THEORY OF REASONED ACTION

Finding out what factors influence customers' willingness to return their electronic trash to producers or local authorities is crucial for manufacturers to implement reverse logistics on e-waste goods. This is because producers are obligated to establish a system to recycle electronic waste. In studies examining people's beliefs and actions, the theories of planned behaviour (TPB) and reasoned action (TRA) have been extensively used. In the realm of scientific inquiry, both of these ideas have found useful implementations. Thus, several issues that have been highlighted by previous investigations have been applied to the research report (TRA). One of the TRA's detractors made the valid point that the law only applies to situations when people's free will is fully at play. For this reason, one of the most common criticisms is that predictions made for non-controllable events always end in disaster. This is similar to what Liska stated when she noted that people are powerless due to a lack of resources (time, information, skill, and opportunity). This idea is similar to one that was covered in the paragraph preceding it. In the aforementioned scenarios, it will be more challenging for the TRA to conduct a more precise assessment of a population member's behaviour. To tackle the problem of inadequate voluntary control over the targeted behaviour, an extension of the Targeted conduct Intervention (TPB) was created. In order to do this, he created the TPB. This activity was done in an effort to go around the limitations that were put in place. The TPB has been one of the most studied models of the attitude-behavior relationship over the last fifty years due to its widespread usage. The greatest noticeable impact has also come from its use.

The theory of response analysis (TRA) states that the most important and immediate factor in determining an action is the individual's intention or goal. Just to illustrate the point, consider the following statement: "I intend to separate waste before disposal" (Ajzen, 1985, 1991). Ajzen proposed this idea first. The best approach to judge someone's behaviour, according to this school of thought, is to look at how motivated or prepared they are to behave. Attitude and subjective norms (SNs) are two of several components that, according to the Rational Act Theory (TRA), contribute to an individual's goal-directed behaviour.

Psychology scholars that are interested in ecological problems have looked at the link between social networks and wasteful behaviour. The TRA model may be able to make reasonable decisions, according to research by Connell (1993). This is because people may choose for themselves the level of agency they wish to have when it comes to socially important recycling behaviours. One thing that sets the TRA paradigm apart from others is its emphasis on logical decision-making. Recycling for a purpose is more important than recycling as an end in itself, according to Jones (1989), who also studied what motivates people to recycle. mostly because most individuals think about the impact of their recycling habits on the environment before they begin to recycle. Several experts have raised questions about the reliability of the evidence for SNs, arguing that it is insufficient to draw firm conclusions (Ajzen, 1991; Hogg, 1997). The data obtained shows that opportunity and ability significantly affect purpose, as a consequence of integrating several components into the TRA model proposed by Thøgersen (1994). In particular, the opportunity and capability models demonstrated this.

In 1994, Thøgersen found that attitude, not intention, was the most important factor in determining how individuals would really behave when it came to trash separation. According to the results of many research that have looked into the TRA (Ajzen, 1985, 1991), the theory seems plausible.

There exists a disparity between the two kinds of data, namely, people's intentions and their actual behaviour, when it’s use TRA to anticipate people's actions based on what can see. This is because there is a huge discrepancy between the stated goals and the actually accomplished goals. Given the separation between the two, using purpose as the primary criteria presents a number of challenges. Although the model may account for the observed variation in conduct, many meta-analyses have cast doubt on its prediction abilities.

Sutton (1998) states that TRA's prediction accuracy falls anywhere between 19% and 38% of the time. So that it might be utilised with everyday tasks, Edward (1993) modified this method. Considering the results of the Likert-scale polls he conducted were inherently ambiguous, this was done. Recycling, reusing, and composting are just procedures that some people consider to be repetitive. Reason being, these tasks need doing the same things over and over again. Several things might impact a person's final decision, such as their financial situation, their level of knowledge in their chosen profession, and their ability to handle the situation. One possible difference across environments is the extent to which an individual's intrinsic drive moderates the impact of extrinsic influences on their conduct. Wherever these issues arise, they are exacerbated to an even greater extent due to inadequate infrastructure, ineffectual government aid, and a lack of resources. One probable explanation for the lack of consistency in TRA results might be the limited number of components that have been thoroughly examined.

2.6 Culture as Important Factor to Technology Adoption

Delcea et al. (2020) found that there are a lot of formal procedures, one of which is consumer education, for the collection and recycling of electronic garbage. Prior studies have shown a favourable correlation between consumer recycling habits, knowledge, self-efficacy, and societal standards. Examining the link between the two was the driving force for this research.

Aside from that, the writers looked at how various groups' initiatives affect the recovery rate of abandoned electronics and the level of consumer awareness of the issue, including NGOs and other government agencies. The authors monitored the impact of many demographic variables over time in their pursuit of a better understanding of end users' perspectives on recycling. Factors such as gender, age, educational attainment, income, and others were taken into account. The final consumers' perspectives on recycling were the focus of this research. Another demographic variable that was considered was age. Previous study has shown that consumers' demographic and socioeconomic details may provide insight into their recycling attitudes and behaviours. While some studies have speculated that cultural differences might account for the disproportionately high recycling rates in certain countries, other investigations have shown that this is not the case. Results from their study in Romania show that demographics have a big role in deciding whether or not Romanians would choose to recycle their old electronics. The paper's writers reached this verdict after finishing their investigation in Romania. This conclusion is derived on the study that the paper's authors have carried out in Romania. Lawmakers may find this information useful for gaining a better grasp on consumer recycling habits and formulating regulations for a more effective system of electronic waste management.

In 2020, Kalana conducted a study to ascertain the degree of understanding and familiarity had by Shah Alam's audience. Findings from his survey indicate that most consumers either have a basic understanding of proper electronic waste disposal or have no idea what he is talking about. Based on the information at this time, the following conclusion is inevitable. It would seem from the previously gathered data that the people of Shah Alam like their old electrical gadgets, which they keep in their very own junkyards. When other people's unwanted possessions end up in the trash, they eventually make their way there. It was shocking to hear the author say that consumer education has a strong correlation with effective electronic waste disposal and recycling. It was a surprising finding.
When it comes to technology, users may choose between two options with those choices. Delaying action until catastrophic failures expose systemic defects, distortions, and self-deceptions is a plausible option. Cultural norms may also help stop systemic distortions from happening, which is a huge boon in case of a disaster. By doing this, the likelihood of disastrous failures is reduced.

Reducing demands, managing electronic waste, and creating cleaner, more sustainable, and ecologically friendly objects are all challenges and opportunities presented by the future scenario. Therefore, finding workable solutions to the problem of electronic waste is of the utmost importance. In a perfect world, these solutions would integrate the appropriate technology with skilled workers sourced from the informal sector. Adopting an appropriate policy and an effective regulatory framework is crucial for the long-term safe and environmentally conscious disposal of electronic trash. The importance of this cannot be overstated. This is a fundamental need that has to be met. For any policy or regulation regarding electronic waste to be properly implemented, the fundamental ideas of transparency, accountability, and longevity must be included. This measure is essential for ensuring proper compliance with the policy or regulation.

2.7 Consumer's Awareness

Consumers' level of knowledge significantly impacts the official collection and recycling of electronic waste (Delcea et al., 2020). Results show that customers' knowledge, self-efficacy, social norms, and behaviours are favourably correlated with their electronic waste recycling behaviours.

The authors also looked at how different institutions, such NGOs, government initiatives, and social media, have impacted the usage of user education and the collection of old electronics. The authors used a range of demographic data to ascertain the impact of parameters like age, gender, education level, income, and so on on the prediction of customers' attitudes towards recycling over time. According to a number of studies, customers' attitudes towards recycling could be influenced by their demographic and socioeconomic features. In contrast, some scholars have posited that cultural differences may account for the observed variety in recycling habits. The authors concluded that demographic characteristics significantly impact the motivation to recycle old electronic trash based on their study in Romania. First, lawmakers may use this research to have a better grasp on consumer recycling behaviours. Second, lawmakers might use it to craft laws that make electronic waste management more efficient.

Kalana discussed the level of knowledge and awareness among Shah Alam clients in 2020. He found that most consumers have a complete lack of knowledge when it comes to electronic waste and proper disposal methods. According to the data that has been presented, the people living in Shah Alam really value their older electrical appliances. They put them in a junkyard and mix them with the rest of the trash that people's houses produce.

The author found that there is a strong correlation between the effective recycling and disposal of electronic waste and the transmission of information to customers.

One reason for the low incidence of recycling behaviour among consumers is the lack of a uniform set of regulations in the US for recycling electronic waste, according to Arain et al. (2020). The poor recycling rates are mostly caused by a lack of knowledge on the traits of consumer behaviour. The writers studied customer behaviour and the challenges they posed when recycling electronic waste at a prestigious university in the Midwest of America. The authors surveyed faculty, graduate students, and undergraduates to learn more about their recycling habits, attitudes, and expertise. They found that consumers' lack of knowledge about products and disposal sites, the proximity of recycling facilities to their homes, and the availability of free disposal services are all factors that impact consumers' decisions. Recycling incentives and expanded access to low-or no-cost recycling services should be high priorities for lawmakers and waste management experts who want to see electronic waste recycled sustainably.

Rapid electrical and electronic device obsolescence leads to an unmanageably large quantity of electronic waste (Nguyen and Huihui, 2019). The potential presence of several toxic and dangerous substances in electronic waste poses serious risks to the well-being of both humans and the environment. Therefore, finding a long-term solution to the problem of electronic waste and reducing its production are of the highest significance. How well electronic waste is gathered is a key component of any formal system's ability to recycle its contents.

Customers' actions and understanding are highlighted as crucial for effective electronic waste disposal by the writers. The authors also stress the significance of conducting well-structured surveys to find out how knowledgeable end customers are. Below is a list of the eight most important factors that the writers considered when creating their surveys.

Customer demographics, housing conditions, consumer knowledge, recycling habits, consumer convenience, economic benefit, electronic waste type or basic language, consumer willingness and behaviour are the eight factors that are taken into account.

Information, however 39% of Indian consumers had just a cursory understanding of the laws governing the disposal of electronic waste in the nation. Despite the government of India's persistent attempts to fortify the system for handling electronic waste, the formal administration of electronic waste remains in its infancy. The results of this study help us understand how much consumers know about electronic waste management, and they also encourage more people in Bengaluru and India to participate in the formal recycling of electronic waste, say Kumar and Li (2018).

The acronym GSCM stands for "green supply chain management," a concept that aims to lessen the environmental impact of technological progress. To achieve this goal, it’s considered the consequences of electronic waste at every step of the supply chain. Kaur et al. (2017)

introduced the Decision-Making Trial and Evaluation Laboratory (DEMATEL) as a method to study the problems related to GSCM operations in Canada. A total of seven manufacturing companies involved in the electrical goods sector are to thank for this. Findings from the research pointed to knowledge, dedication, and product design as the three main types of challenges. Lack of awareness, recommendations for training, technical competence, and effort are all instances of knowledge-related barriers that could impede the discovery of ecological potential. other examples of commitment-related barriers are companies' lack of CSR initiatives, whereas other examples of product design barriers include the challenge of creating items with a high processing potential. You might think of both of these obstacles as instances of comparable difficulties.

Sivathanu (2016) found that end users' level of knowledge and awareness, together with their choices, greatly impacts the efficiency of electronic waste disposal. In the first round of the study, 600 clients in Pune were surveyed using a standard questionnaire. The study found that there are five main factors that influence customers' decisions about the disposal of electronic waste. Several factors lead to the accumulation of electronic waste. Some of them include being aware of (i) the potential dangers to people and the environment, (ii) the importance of proper disposal, (iii) the role of various stakeholders in e-waste management, and (v) how easy it is to recycle.

When designing a suitable system for the disposal of electronic trash, it is essential to consider the level of customer knowledge. Research shows that 58.5% of all consumers were familiar with the term "e-waste." The majority of customers (94%) are professionals with advanced degrees or other related occupations, and an impressive 88% are from high-income households. An individual's familiarity with proper electronic waste disposal practices is positively correlated with their wealth and level of education, the investigators found. Nearly 91% of consumers who are aware of the problem choose to have the proper authorities dispose of and manage their electronic waste. The data also contains this interesting piece of information. Insights gained from the study's results may help important stakeholders comprehend the factors that influence customers' choices about the handling and disposal of electronic trash.

Aurangabad is a city in the Indian state of Maharashtra, and in 2015, researchers Anam and Siddiqui studied consumer behaviour there. A majority of the participants (82%) understood what "electronic trash" was, while a minority (12%) had never heard the term "e-waste." The authors also found that 70% of the population did not know that e-waste could be harmful to health.

Either those in the younger demographic and those with less education had no idea the dangers of electronic waste, or they had a hazy understanding of them. Among those eligible to respond, over 50% had a fair grasp of the processes involved in managing and disposing of electronic waste. About half of the target demographic has decided that the current method of collecting electronic garbage works for them. The Municipal Corporation's solid waste collectors are also tasked with collecting such rubbish. However, the remaining respondents felt the system was too complex and ill-suited to their abilities. Conversely, even without compensation, over half of individuals would still send their old electronics to authorised recycling centres. Some of the most common ways people put old electronics to use again, according to the poll, are by selling them on a secondhand market or exchange, giving them to someone for a little payment, or storing them for later use.

Economic factors and the fast advancement of technology have led to an explosion in the affordability of electronic items, which has led to a significant increase in the enormous quantities of electronic rubbish, or e-waste, according to Shah (2014). This may attribute the dramatic increase in sales to this. The inclusion of highly dangerous substances in this garbage compounds the already substantial issue of waste disposal caused by the sheer amount of electronic equipment. Public education on government regulations and the risks of electronic waste is critical for active participation in management systems and the ability to convince producers to adhere to standards. As part of the study, interviewed Indian families in Ahmedabad, India, to better understand their perspective on this aspect of the e-waste issue. In order to build a framework for interviews with members of the general public, it also sought the perspectives of individuals such as government officials, representatives of non-governmental organisations (NGOs), and workers in both formal and informal settings who deal with electronic trash. In order to provide the groundwork for interviewing regular people, this is necessary. The majority of respondents were aware of the regulations governing electronic garbage, its negative effects on humans and the environment, and the lack of participation in formal recycling programmes for this kind of trash, according to the results. Approximately 25% of respondents knew that it was possible to salvage usable parts or components from old electrical devices. This is why public education campaigns that tackle the problems of electronic waste management need more funding from the government. To satisfy their need to be at the forefront of technical developments, somewhat more than 61% of the population has lately purchased new electronic devices.

Moreover, 35% of people often sell or donate old gadgets to friends, family, and acquaintances. However, around 25% of the people are trying to help with the initiative still have their old, broken equipment lying around for a long time. Some 61% of people still don't think their old electronics are a waste of space. They strongly believe that these relics may be either repaired and put to use again at a later date or utilised to make new parts or materials. Surprisingly, 63% of the sample had no idea that there were official collection services, and 65% of respondents were either unaware of or completely oblivious to the potential risks to human and environmental health posed by electronic waste. According to their research, more than 90% of those surveyed were unaware of the regulations regarding the disposal of electronic waste.

In most cases, the final consumers may be traced as the originators of electronic garbage. Therefore, Kwatra et al. (2014) stressed the need of consumers understanding the negative effects of e-waste. Even with rules in place, the authors claim, many still don't know how to properly dispose of electronic waste. Using the residents of Delhi, India as a case study, this investigation seeks to identify the causes of the city's recycling and technological waste problems. Using a questionnaire, survey takers were asked to detail their own domestic procedures for dealing with electronic trash. It was found by the authors that a large number of respondents from the middle class are still not aware of the problems associated with technology waste. Those who are aware of the problems associated with electronic waste often become so by reading about them in newspapers and online. Additionally, many poll takers are confused about the best way to discard their old devices. Only between 12% to 26% of the population takes part in the initiatives that allow people to trade in their old electronics for new ones. Two things happen when people throw away electronics: first, it increases the amount of electronic trash, and second, it puts more strain on the resources that were used to manufacture them. Participants have also agreed to pay for certain additional costs associated with recycling the officially discarded electronics.

According to the author's research, there is a lack of knowledge on the health risks, environmental effects, and laws associated with electronic waste among authorities, recyclers, and end users. The author proposed three simple measures in response to a particular issue, which, if put into action, may affect public behaviour. Being sensitised, being directed, and being aware are the three components. "Sensitization" refers to the realisation that old electronics are garbage, while "orientation" refers to the knowledge of proper disposal methods for electronic waste. "Awareness" refers to the understanding that e-waste management is a new and pressing issue. One of the major issues with handling electronic waste effectively is that India hasn't even been nationally sensitised, according to Agrawal (2014).

There is an uncontrolled industry in India that produces over 90% of the country's electrical waste. Much of the unplanned area is occupied by urban slums in metropolitan zones. Recycling is very efficient in these slums because there are so many low-wage workers. People who work in the informal economy are more likely to be exposed to hazardous conditions on the job because they lack access to or cannot afford basic safety equipment. Using wire cutter pliers, it is common practice to use child labour to remove the circuit boards from the electrical debris. Everything that has happened is due to their lack of understanding about the risks that electronic waste presents to both humans and the environment. Nitric acid is used to remove the silver and gold off the circuit board. Both private companies and government agencies are looking to optimise their revenues by selling their old electronics to reputable recyclers. Half of India's household appliance circuit boards wind up in Moradabad, Uttar Pradesh, popularly known as Peetal Nagri, "the brass city." As a result, genuine guidelines for recycling e-waste need to be put in place (Das, 2014).

Scientists Bhat and Patil (2014) investigated how people in the city of Pune dispose of their old electronics and how knowledgeable they are about the issue. When it comes to disposing of electronic garbage, the public at large is clueless about official protocols, rules, and collection sites. This conclusion, drawn from an examination of survey data, asserts that end-user knowledge in the city of Pune is outstanding, but superficial. Most people now just combine their electronic waste with regular municipal solid waste as an informal disposal technique. Most purchasers do this.

Afroz et al. (2013) aimed to gauge the public's familiarity with Kuala Lumpur, the capital city of Malaysia. The writers drew attention to the fact that similar issues, such the illicit import of used and faulty equipment, are afflicting both India and Malaysia. According to the research, 65% of buyers think about environmental impacts while making electronics purchases, however 60% of people don't know that electronic trash may hurt people and ecosystems. The existing method for dealing with electronic waste has a flaw: only around 2–3% of those who took the survey really participate in the official recycling scheme. In the meanwhile, more than half of the people surveyed were willing to pay a little extra to support the improvement of Kuala Lumpur's official e-waste recycling scheme.

The present state of affairs and the primary obstacles to better waste management in China were investigated by Chi et al. (2011). These days, electronic trash processing in China is handled by illegal recycling companies.

Greater growth rates are encountered in numerous aspects of everyday life in China as a result of rapid economic development and a dramatically expanding population. Recycling even a little amount of WEEE may have catastrophic consequences for ecosystems and human health. By giving collectors a fair price for their equipment, the government is rewarding them equitably. Collectors are being courted by both collectors and the official management firm. Businesses with a focus on environmental recycling may find this approach useful as it combines the advantages of informal collecting with environmentally regulated processing of WEEE.

Risks related to electronic waste originate with its informal recycling, say Luo et al. (2011). The authors conducted their investigation in the region of Guangdong in southern China. In the area around the temporary e-waste recycling centres, they measured the concentrations of heavy metals in soil and crops. Also, they found that informal recyclers often resorted to open burning as a means of extracting valuable minerals. Heavy elements such as lead, cadmium, zinc, and copper were found in soil samples at significant amounts, according to scientists. Furthermore, the soil samples included lead and cadmium concentrations that exceeded the acceptable limits for vegetable crops in China.

Recycling outdated electronics is a great option for many people living in poverty in metropolitan areas to earn some more money. Poor urbanites have a particularly hard time learning about the dangers of electronic trash improper disposal poses to their health and the environment. When women and children are engaged in management tasks connected to recycling electronic garbage, the conditions get much worse. The ability to recover valuable components, parts, and materials makes WEEE recycling a potentially financially beneficial practice for those in need (Wath et al., 2010).

Tang et al. (2010), who examined the impact of E. waste on soil, brought attention to the fact that used electronics include significant amounts of harmful substances. The writers headed to Wenling, a brand new facility in Taizhou, China, that processes electronic trash. Researchers Tang et al. (2010) took many soil samples from the location and discovered heavy metal levels that were much higher than the limitations set by the Chinese federal government. In addition, studies have shown that heavy metal and polycyclic aromatic hydrocarbon (PAH) concentrations in soil are much higher in native regions next to small home workshops than in areas around other plant kinds.

Hung and Wang (2009) looked at the main components and difficulties of the electronics sector.

This information was gathered from four different Chinese electrical equipment manufacturers, in addition to their own observations, interviews, and data retrieved from company websites. Furthermore, the authors claimed that while the drivers in the electronic sector's reverse logistics fluctuate from one organisation to another, the impediments stay consistent and unchanging across all sectors. Their primary concerns are manufacturers' lack of access to financial help, the need of making large initial investments to establish the reverse supply chain for electronic devices, and the absence of rules and regulations that oblige makers of electronic products to do so. In addition to the issues already mentioned, the authors brought attention to the fact that end users' lack of knowledge and inadequate recycling techniques serve as roadblocks to the official collecting and recycling of abandoned electronic equipment.

With that goal in mind, this article set out to provide an in-depth evaluation of the many internal and external factors that impact the reverse supply chain for electrical devices in developing nations. A complex interaction between China's political ideology and economics may influence the viewpoints and activities of electronic device makers when it comes to environmental management.

A research and report made by David (2008) states that technology waste, climate change, and greenhouse gas emissions are the most important global challenges presently. Almost all modern electrical devices rely on antennas in some way. This includes laptops, mobile phones, and numerous more. Customers in India typically utilise their outdated devices for a long time before tossing them away. Instead of simply dumping the devices away, you may get them mended or donate them to someone else. Due to the universal consensus on "e-waste as a product," individuals are unwilling to dispose of it rapidly (Sinha, 2008b). In India, the average lifetime of a consumer goods is significantly greater than in wealthy nations.

The bulk of electronic trash in India is disposed of in landfills or incinerators for non-recyclable items, according to the Ministry of Environment and Forests (2008). Poorly managed landfills in most Indian towns represent a danger to groundwater, surface water, and air pollution and other environmental risks. It is currently tough to analyse the effect of electronic junk thrown in landfills on the environment owing to the availability of different waste streams (MoEF, 2008). As a consequence of local weather patterns, the relative amounts of different contaminants in the air, water, and soil surrounding landfills could alter over time. Soil and air pollution are the ultimate effects of most rubbish being incinerated in open locations or deposited illegally.

The difficulties and possible solutions linked with electronic waste management in India were brought to light by Joseph (2007). Looking at this expanding issue from an Indian viewpoint, the study brought out the connected approaches and barriers that must be solved. It offers a mechanism for managing trash in which regulatory organisations, consumers, importers, recyclers, and manufacturers/assemblers all chip in to collect and recycle electronic waste. The introduction of electromagnetic trash has further exacerbated the already-significant challenge of solid waste management in India. Establishing suitable criteria is essential for the aim of disposing of electronic waste and recovering valuable materials. Prioritising end-of-life management should be a top consideration when developing new electronic items.

It looked at how many harmful elements affected ecosystems and human health, and ranked the relative dangers of several precious and hazardous metals. The many steps of formal electronic waste management are superbly described in this paper. research published by India's Rajya Sabha Secretariat in 2007

How people feel and act when it comes to recycling and disposing of old electronics was studied by Huang et al. (2006). Ningbo, China was the site of the writers' poll. In addition, the authors discovered that about half of the respondents were unhappy with Ningbo's environmental conditions, and about 22.6 percent of the study's participants identified electronic waste as the most pressing environmental issue. The survey also found that manufacturers are seen as being connected to the government and individuals, the latter of which are the most important factors in protecting the environment.

Only a few of researchers make sure that each of the three parties involved get enough weight. Around 80% of people were willing to pay a recycling fee to guarantee that abandoned electronic equipment was treated environmentally responsibly, and 60% of people segregated e-waste from domestic rubbish before it was finally disposed of.

This is now know that people buy new electronics, especially smartphones and laptops, for a variety of important reasons. A few examples of these causes include the availability of new products, the need for more features, and the demand for additional storage capacity. The great majority of those who took the survey either sold their old electronics on the secondary market or gave them to somebody they knew who could use them.

Peralta and Fontanos (2006) conducted study on the issue of electronic waste in the Philippines, specifically focusing on its problems and metrics. Because people rely on electronic devices all the time in areas like homes and offices, a new environmental concern called e-waste has arisen. These tools pose a serious threat to human and environmental health because they contain toxic compounds including lead, chromium, cadmium, mercury, and beryllium. Even while most commonly used electronics are safe to use, they may nonetheless release harmful substances when stored or disposed of improperly. The estimates derived from this study could serve as a starting point for developing and implementing the necessary management strategies to handle the e-scrap.

For landfills to last longer and provide a new tool for the restoration of substances, it is important to fortify recycling companies, as this may help remove electronic trash from landfills.

Carol and Canan (2005) elaborated on the value of survey-based approach. In addition to discussing the current state of affairs in business and management practices, the writers elucidated the most pressing issue in RSCM and research that used empirical approaches.

According to Pandey et al. (2004), the electronics and information technology industries will propel the world economy forward in the next century. People used to think that the electronics sector didn't produce any pollution at all. More and more evidence is emerging from the globalisation of industry that the items it produces include harmful levels of pollutants that affect both humans and the natural environment. In an effort to cut down on waste and boost efficiency, national programmes were created to use Design of Experiment (DoE) principles, such process optimisation.

2.8 Adopted Methodology for the Management of Electronic Waste

Anandh et al. (2021) states that reusing abandoned electronic equipment is one of the best end-of-life (EOL) options in terms of environmental impact and socioeconomic benefits. In order to show the important and emerging subjects of the reuse assessment of electronic waste, the authors of this study used a systematic literature review approach to find the existing body of knowledge.

From 12,216 articles published between 2005 and 2019, searched the Web of Science, ProQuest, and Google Scholar. From this, choose 331 papers for this research. Two sub-periods were used to further separate the research publications that were chosen for further consideration: 2005–2014 and 2015–2019. The purpose of this was to track the development of research themes and include the most recent research publications into the current literature on e-waste reuse assessment. The writers used SciMat and VOSViewer to do the bibliographic study. First, the ways in which consumers behave when it comes to electronic waste: using, disposing of, reusing, and recycling. Second, it will be evaluate the potential for e-squander to be reused. Third, it will discuss product recovery strategies and market analyses for remanufacturing discarded electronics. Lastly, it will look at the marginal function analysis (MFA) of e-scrap in the context of the circular economy. With the use of bibliographic research, these four main categories were discovered. More research has to be conducted in poor countries on the impact of government subsidies on product service systems, circular economies, and discarded electronic equipment. In addition, the writers raised a number of research topics. The questions covered a range of topics, including the following: the effects on the environment and the law of recycling old electronics; the flow of illegally imported and dumped electronics from wealthy nations and their sale on secondary markets; the laws and regulations that control the disposal of old electronics; and lastly, the influence of developing nations' informal sector income.

An increasing amount of electronic trash has become a major worldwide environmental concern, as shown by the research of Ahirwar et al. (2021). Electronic waste recycling entails gathering and processing waste in a systematic way to extract useful components. Contributes to national economic development, helps alleviate the ever-increasing mountain of electronic waste, and satisfies the need for spare parts on the secondary market. Furthermore, the authors emphasised that electronic waste, if not disposed of via formal channels, might include toxic elements including lead, mercury, and others of a similar kind. To maximise the benefits of formal recycling of electronic trash, it is essential to improve the design of electronic equipment, speed up recycling processes, and implement laws on the use of hazardous substances in electronic devices. Also, to improve the official recycling of electronic waste, the writers brought attention to a number of different possibilities and ways. The effects of toxic chemicals created from electronic waste on human health have also been studied, and there is a synopsis of the pathways for managing electronic waste. Few methods have been proposed for the efficient and environmentally friendly recycling of electronic trash.

The factors that impact the approach of young end users to managing electronic trash in an environment characterised by an expanding economy were investigated by incorporating habits into a famous model that predicts people's behaviour, specifically, the theory of planned behaviour. A large portion of the increasing problem of electronic waste is attributable to the fact that young consumers are leading the way in all three stages of the consumption, manufacturing, and management processes. The survey data was analysed using a multivariate statistical method called PLS-SEM, which stands for partial least squares structural equation modelling. The results show that the integrated model has robustness and great explanatory power; it can explain over 47% of the variance in young consumers' propensity to recycle electronic garbage. The degree to which young people are motivated to recycle their electronic waste is strongly correlated with their recycling behaviours and attitudes. Remarkably, young consumers' intentions to recycle electronic waste were unaffected by the theory of planned behaviour (TPB) components, which include behavioural control and subjective standards. These findings suggest that efforts to recycle e-waste should centre on changing people's mindsets and creating targeted signals to encourage recycling. Beyond this, the study offered a slew of societal and practical implications that might aid in the push for electronic waste recycling initiatives. Aboelmaged in the year 2021.

Kalana (2020) conducted his study at Shah Alam, Malaysia. Electronic waste management system (EMS) techniques and knowledge were the main foci of his study. The author found that just 22% of electronic trash gets sent to official recycling centres, which is a direct consequence of the absence of efficient take-back routes for consumers. The author found this out after surveying the residents of Shah Alam to find out how they like to dispose of their old electronics. There is currently no formal, organised procedure for collecting household electronics trash. The results show that most people prefer to hold on to their old or damaged electronics for a while before giving them a second chance or just throwing them away.

The term "modern-day devil" was used by Nautiyal and Agarwal (2020) to sum up technological waste. People are using a wide range of electronic devices without being adequately informed on how to properly dispose of them. An rising variety of electronic gadgets is being used more and more often, especially by younger generations. The authors went on to say that humans and the environment are both threatened by the lack of a structured approach to dealing with electronic trash. Several countries and organisations are working together to protect human health and the environment. To the same end, they are devoting a lot of resources to developing a sustainable management system that can properly recycle electronic waste. This study uncovered several detrimental effects of electronic waste and offered the best way to eliminate it.

The focus of electronic waste management organisations like the Basel Convention has been on lowering the generation of electronic waste and regulating its movement across international boundaries. Developed countries often ship their discarded electronics to developing countries under the guise of benevolent donations, completely oblivious to the potential repercussions. The authors also stress the importance of subsidy-style incentive programmes to get end users to use official channels instead of leaving their electronic trash in public places.

Based on their empirical research, the authors concluded that customers' gender and employment do not significantly impact the amount of time they spend using electronic devices.

It follows that consumers' propensity to retire or discard electronic equipment does not vary much according to demographic variables like gender or employment. Conversely, one important component that determines how often these things end up in the dump is the age of the consumers.

As to Singhal et al. (2019), remanufacturing from garbage is the best way to make used electronics last longer and lessen the impact of all the problems associated with electronic waste. Such remanufacturing enterprises are still in their infancy in developing countries like India, in contrast to the massive scale at which they occur in industrialised nations. The writers of this research uncovered, explored, and established connections among the many factors influencing India's remanufacturing processes. After reviewing the literature, consulting with experts in the field, and surveying end users, the authors identified fifteen factors that affect electronic waste management. To round up their investigation, the authors surveyed 484 students and 12 experts from different schools and electrical firms to get their take on these factors. By using Interpretive Structural Modelling (ISM), to classify these fifteen components into eight levels and find their connection all at once. The handling of electronic trash is greatly affected by a number of crucial factors. Some of these factors include management's vision, the actions of return systems, the level of consumer awareness, and the government's generous incentive programmes. The fifteen factors were categorised into four main categories based on their driving and dependent power using the MICMAC technique, which stands for Matrixed Impacts Croise's Multiplication Appliquee a UN Classement. The results of this study indicate that there are no external factors that motivate consumers to properly dispose of their old electronics.

Furthermore, there are important determinants such as the intention to buy and the execution of an efficient marketing mix plan. Methods for handling and disposing of electronic waste were studied by Kitila and Woldemikael (2019), who also analysed descriptive and explanatory models. The authors also considered 72 GSD individuals from educational institutes. Also, 100 houses in the NSL and Bole sub-cities were taken into account by the writers.

The massive quantity of electronic trash created and the dumping of such rubbish from other wealthy countries is a major issue in Vietnam. The Vietnamese people add another careless link to the chain of destruction that is the recycling system for electronic waste. Researchers are just scratching the surface of this topic at the moment due to the paucity of available studies. Research like this is useful for figuring out how people usually recycle their old electronics. This study is based on the theory of planned behaviour (TPB). In order to determine what factors impact the attitudes of Danang city, Vietnam residents, structural equation modelling (SEM) models were developed. The authors conducted a research with 520 participants and found that end users' behavioural attitude is directly impacted by their awareness of recycling, social esteem, regulations, the cost of recycling, and the inconvenience of recycling, among other things. The possible intents of consumers about recycling techniques for electronic waste are also heavily influenced by laws and regulations. Nguyen et al. 2019 found that consumers' intentions to recycle are negatively affected by the inconvenience of recycling.

Various approaches for recycling electronic waste were evaluated in 2018 by Abdelbasir et al.. The ever-increasing use of electrical and electronic devices is leading to a mountain of electronic trash, or e-waste.

As far back as any culture can remember, the proper recycling of this particular trash has been ranked among the highest priorities. Printed circuit boards are not only filled with valuable metals, but also with dangerous halogenated chemicals. These boards are the backbone of almost every piece of electrical and electronic hardware. As a result, proper disposal measures must be put in place to guarantee a safer world and minimise health risks as much as feasible. The main methods utilised for the handling of waste PCB (WPCB) are physical disassembly and chemical treatments. Since they are less intrusive, easier to implement, and less harmful to the environment, physical recycling technologies like density separation or magnetic separation are seen to be superior for recovering and reusing metal components. On top of that, they save electricity. In addition to passing strict laws and actively managing electronic waste, the recycling sector and the government must work together to find a solution to this problem.

Using data collected between 2008 and 2015, Favot and Grassetti (2017) studied the efficacy of electronic waste collection from homes in 22 regions of Italy. The authors looked at how various explanatory variables affected the collection of electronic waste. Age, gender, family size, education, migration, and income were all seen as independent factors in this socioeconomic and demographic study. Population density, the existence of metropoles and macroregions, the features of the territory, the proportion of home garbage collected separately, and the number of e-waste collection stations were also evaluated as independent variables. These techno-organizational factors were further examined. When looking at the quantity of electronic waste collected from each resident annually, the results show that there is a positive association between the number of collection stations and the percentage of females. To illustrate the point, a 1% change to the percentage of females in the population corresponds to a 7.5 % change to the collection rate, whereas a 1% change to the input (the presence of collection sites) changes the output (the results of the collection) by 2.5 %. Contrarily, the population density is inversely related to the frequency of electronic waste collection. Notably, the Northern regions perform similarly to the Central regions, but there is a discrepancy between the Southern areas and the Central regions; the Southern regions have a result that is 0.66 times lower than the Central regions. Since 2008, there has been a consistent increase in the performance of the formal electronic waste recycling system, which is positively affected by the availability of additional collection stations. The authors ranked Tuscany (in the centre of the country) as the region with the best performance, followed by Sardinia (in the south) and Sicily (in the east).

The main obstacle to effectively managing electronic trash and developing resource retrieval strategies is the lack of the necessary infrastructure, despite the fact that the demand for reprocessed resources has been on the rise. The correct disposal of hazardous electronic waste requires a processing system that can handle the trash efficiently; this will prevent the pollution of resources further down the line (Zeng et al., 2017b).

Numerous rare earth elements (REEs), basic metals, and precious metals are crucial to the civilization's prosperity. Isildar et al. (2017) summarised the present state of electronic waste management and the latest technological advances in metal recovery from various e-waste devices.

According to Awasthi et al.' 2017 research, the rapid accumulation of electronic waste has emerged as a major issue on a global scale. As far as electronics are concerned, the printed circuit boards, or PCBs, are the most economically important part of the whole. Precious metals like gold, silver, zinc, and others like them make up printed circuit boards.

The past decade has seen a proliferation of solutions to pollution and the massive recovery of precious metals from discarded printed circuit boards. While these procedures have their uses, they are also associated with a variety of issues that need further research. The purpose of this review article is to examine recycling procedures using a SWOT analysis. In addition, further research into the recycling of discarded PCBs is necessary to improve the methods now used for large-scale equipment. Despite w-PCBs' status as a major pollutant, the informal sector uses treatment procedures that are both conventional and highly unscientific to extract precious metals from them. Methods such as open chemical leaching, manual disassembly and segregation, and others fall under this category.

The methods utilised to process w-PCBs in an efficient, eco-friendly, and cost-effective way were the subject of a SWOT analysis, which stands for strengths, weaknesses, opportunities, and threats. The goal was to separate the metals from the non-metal components. Utilising bio-leaching processes including bacteria and fungus may be achieved to remove base and precious metals from w-PCBs. These procedures are feasible from a technological standpoint, safe for the environment, and economical. However, several experts have highlighted the metal hustling difficulties and their low reaction rate as major concerns. This examination also covered the fundamentals of the issues related to w-PCB recycling. Existing technology must be upgraded and new technologies must be developed to dispose of old electronic devices in a more efficient and environmentally friendly manner.

The focus of Ganguly's (2016) study was the management of electronic trash in India. The purpose of this article was to provide a high-level introduction to the topic of electronic waste, including its history, current state, and potential hazards to human and environmental health.

Solid waste management is a huge industry that creates many employment, especially with the addition of electronic trash to the disposal programme. The level of sophistication in this field is increasing with time. With the goal of reclaiming valuable metals, plastics, and glass, among other things, the author outlined the formal and informal recycling sectors and how they work together. In particular, it highlighted the responsibility of many parties, including as producers, buyers, and authorities, to lessen the impact of electronic waste. The papers also go over some potential solutions for dealing with electronic waste. Environmentally friendly information technology ideas, design principles, and contemporary ways for tackling instructional issues are all part of these processes. These recommendations aim to reduce infrastructure and waste recycling costs. To get a general understanding of the detrimental effects of technological waste, one may utilise social media, comprehensive education, and news articles.

A study on the present situation and threats to MSWM in India was carried out by Joshi and Ahmed in 2016. Municipal solid waste management (MSW) was the target of this research, which aimed to assess its features. On top of that, it place a premium on thoroughly investigating MSW generation, treatment options, collection, and characterization. A major factor in the emergence of municipal solid trash as a major issue in India is the country's fast urbanisation and unregulated population growth rate. The benefits of sorting garbage into biodegradable, recyclable, and inert components should be understood by people at the point of generation so that proper waste management may be ensured. To recycle non-biodegradable useable pieces from rubbish, resources must be created and the garbage must be seen as an organised recycling sector or industry.

Physical combustion and chemical treatments using strong acids are two very dangerous treatment procedures. The early inhabitants of this planet were careless when it came to recycling and waste management. So far, many tragic events have marred history, and if current trends continue, things could become lot worse (Kumar and Mehta, 2016). When an electrical device's useful life has expired and it can no longer be fixed, it is considered e-waste. At the same time as the radio and telephone were being developed at the turn of the nineteenth century, the idea of electronic waste began to take shape. As the usage of electronic products in the IT sector continues to rapidly expand in the early 21st century, the quantity of electronic trash is increasing at an exponential rate. Given the current situation, electronic waste has become one of the most alarming and major environmental issues. Most of the blame for this goes to those who throw away old electronics in an unreasonable manner. There is a real concern that the presence of toxic substances in electronic waste might endanger human health and harm the environment. Both developing and developed countries are still worried about this. More study and technical developments are needed to provide sustainable and ecologically beneficial garbage disposal systems, as opposed to depending on informal disposal techniques. Kumar and Mehta (2016) conducted research on the steps that citizens and governments may take to reduce their impact on the environment while disposing of old electronics.

During the process of recovering electronic garbage, Cayumil et al. (2016) examined the concentration of precious metals. A large number of metals that were previously unknown have been found thanks to this particular investigation. Main substances, secondary substances, and tertiary substances are the three levels of categorization used in this article to describe potentially harmful chemicals. Electronic trash often contains heavy metals including lead, mercury, nickel, and others as its main components. Secondary chemicals including acids, dangerous compounds, and waste residuals are created when electronic trash is not properly treated.

The recycling of electronic trash produces tertiary compounds, which are excess reagents. Electronic waste is considered a resource of considerable worth due to the fact that it may be used to recover several precious and vital materials. The extraction process has several benefits, including increasing GDP and facilitating the commercial and employment development of previously untapped areas. Efficient management of electronic waste, including proper recycling and reusing of materials, may transfer conservation protection. The most effective and eco-conscious strategy for dealing with electronic trash is the one that can bring recycling of this material out of the shadows and into the light of day. Dasgupta et al. (2015) states that the disposal of electronic waste, along with the production of electronic waste and the handling of various electronic devices, has created a complex issue. One solution is for end users to find ways to divert funds from the disposal pattern, such as through recycling and reusing.

The hazardous substances, collecting, transporting, recycling, and the procedure of recovering valuable resources are only a few of the many issues connected with electronic waste management. For the purpose of understanding the effects of electronic waste after recycling, it is necessary to have a products and materials inquiry implementation. Reusing and recycling resources is crucial because it may create new materials from secondary sources in the future. Recycling offers a potential alternative supply of materials that are becoming more scarce. The goal of Vadoudi et al.' 2015 research was to examine electronic waste systems from a resource recovery and recycling perspective. Their analysis of the data collected in France also included a mapping of the electronic waste movement. The French people, in 2010, disposed of about 15 lakh tonnes of rubbish, which is more than the national average. More than 11 lakh tonnes of rubbish remained, with an estimated 4.3 lakh tonnes of electronic junk recycled with residue. Most electronic waste consists of the following materials: aluminium (12%), plastic (22%), glass (7%), ferrous metals (37%), and copper (22%). Vadoudi et al. (2015) conducted research that helps build recyclable programmes for electronic trash and resources within the French setting.

Global and national waste infrastructure management are being impeded by the massive amounts of electronic garbage (Erinn et al., 2014). Electronic garbage, including old computers and other devices, was subjected to material and flow analysis (MFA). Along with this, evaluations of dynamic flows were conducted using the market supply method.

A study conducted by Suja et al. (2014) found that improper disposal of electronic waste may pose risks to both human and environmental health. Among the many toxic chemicals and heavy metals found in electronic trash are lead (Pb), mercury (Hg), zinc (Zn), and others. However, there is a promising market for the official recycling of electronic waste that may provide large profits. The government must prioritise legislation, law enforcement, and initiatives that maximise the recovery of electronic trash in order to guarantee this transition. This is due to the fact that electronic waste contains a variety of valuable metals, including gold, silver, platinum, palladium, and others. The government has designated sites for the disposal of waste electronic equipment that does not have any commercial worth. Malaysia has taken strong measures by enacting laws and processes that rely on data collected from reliable sources to address the issue of electronic waste. On top of that, recycling of electronic trash is strictly limited to official industries in Malaysia. It would be wise to set up effective standards that incentivize the adoption of eco-friendly practices and technology that do not harm the people handling electronic waste.

The amount of electrical and electronic equipment that has been utilised has increased significantly during the previous few decades, according to Wang and Xu (2014). Since they include valuable components, recyclers are driven to recycle abandoned electronic equipment. For this same reason, recycling companies collect and repurpose these gadgets. The authors of this research mainly focused on the methods and technologies that may be used to handle electronic waste. The authors paid special attention to the recovery of components that were not made of metal. The existence of brominates flame retardants makes the pyrolysis process problematic, despite it being the approach with the lowest energy usage for recovering plastic. Compared to pyrolysis, the environmental effect of supercritical fluids (SCF) and gasification processes is much less severe, even if the amount of energy utilised is considerably larger. To recycle glass from cathode ray tubes (CRTs) and liquid crystal displays (LCDs), it is necessary to extract lead metal from the glass components of old electronics. Prior to recycling LCD glass, both of these steps are required. There is no more crucial step in recycling than this one. Research of the local environmental effects of recycling operations is required before recycling is institutionalised as a manufacturing process.

Gupta et al. (2014) proposed an argument that the increasing applications and initial attractiveness of electrical and electronic equipment lead to the production of a substantial volume of electronic waste. Source: Gupta et al. (2014).

The biotic and abiotic parts of the ecosystem might be severely damaged if this massive amount of garbage is not handled with extreme care. This is due to the fact that trash is an inevitable consequence of human endeavours. Recycling activities must be carried out regularly using state-of-the-art equipment if this kind of garbage is to be handled correctly. In developing nations like Indonesia, Brazil, China, and India, organisations prioritise commercial interests above environmental restrictions when it comes to recycling and composting. Reason being, these countries' economies are still in the early stages of development. This has led to a precipitous fall in both the economic recovery of recyclable materials and the maintenance of a sustainable environment via organised garbage recycling; moreover, recycling rubbish is now seen as a social obligation. Several potentially harmful components are included in electronic trash; Gupta et al. (2014) highlighted the possible negative impacts of these components. After this, a variety of very lucrative methods were used to recycle both metallic and non-metallic elements found in electronic waste. To recycle electronic trash, several procedures were used.

The massive issue of electronic waste is a direct outcome of the rapid pace of technological development in the current world. This issue has escalated to a critical level. In the event that these wastes are not managed appropriately, they include several harmful elements that endanger human and environmental health. Patel and Kasture (2014) reviewed the literature extensively to determine the effects of electronic trash. The authors also looked at the prospect of using biological systems for waste management.

The goal of the research by Perkins et al. (2014) was to identify the extent of the problems associated with e-scrap's informal management techniques. Their study set out to achieve this exact objective. One factor adding to the ever-increasing volume of electronic waste is the covert transfer of electronic garbage from industrialised nations to less developed ones. A worsening of this situation is the rising generation of electronic garbage. In order to achieve its goals, this study piece focused on the need of recycling electronic trash while simultaneously stressing the need of conducting recycling operations in an eco-conscious manner. The writers stressed the significance of repairing and reusing products instead of throwing them away when it comes to goods in their entirety. There are several situations in which it is acceptable to dispose of electronic equipment after all attempts at recovery and reuse have failed. Both developed and developing countries should hire skilled workers and provide enough safety equipment for electronic waste recycling. About 22.5 percent of the total volume of electronic trash is treated by facilities that are suitable for recycling and provide the required safety precautions for workers.

There can be no economic disparity between wealthy and poor nations when determining the acceptable risk criteria for secondary and hazardous electronic waste.

Needhidasan and Chidambaram (2014) used electronic waste to investigate the increasing danger that electronic waste poses to metropolitan areas in India. This problem is becoming more common in both wealthy and impoverished nations throughout the world.

According to previous research, India generated 0.4 million metric tonnes of electronic waste in 2010. At the end of the 2013–2014 fiscal year, this figure had risen substantially to between half a million and sixty thousand metric tonnes.

In order to manage the growing amount of electronic trash, several recycling and disposal strategies are being used. These techniques have the potential to open up new areas of metallurgy, which may make it easier to extract metal from discarded electronics. More efficient and less harmful to the environment methods of trash disposal may soon be within reach, thanks to novel technology tools.

To find out how being exposed to electronic waste affects one's mental and neurodevelopmental health, physical health, education, aggression, and other criminal behaviours, Grant et al. (2013) searched five databases: PubMed, Embase, Web of Science, PsycNET, and CINAHL. The search ran from January 1, 1965, to December 17, 2012. Finding out how strongly these consequences are linked to exposure to electronic waste was the driving force for work. The authors documented the effects associated with exposure to electronic waste after collecting 2,274 data from South-East China. Among these discoveries were changes to thyroid function, changes to cell expression and function, diminished lung function, altered temperament and behaviour, and poorer infant outcomes. A decreased immunity was seen in boys who were born and raised in locations with electronic waste recycling facilities compared to boys from other regions. Specifically, this was true for boys aged eight to nine. Additionally, the investigators discovered that immune system function was negatively correlated with blood chromium levels in children and adolescents aged 11–13. Most of the research that was reviewed found that areas with large amounts of electronic waste are associated with higher rates of spontaneous abortions, stillbirths, early deliveries, and lower birth weights in infants. According to the results, this is the inevitable conclusion. This indicates that compared to persons in other locations, those whose homes or places of employment are responsible for recycling electronic waste are more likely to have their DNA damaged.

For the purpose of environmentally appropriate disposal of electronic trash, industrialised nations have established standards for its handling (Kiddee et al., 2013). The goal in doing this was to guarantee the secure disposal of all electronic trash. Research into electronic waste management has been lacking in detail, which makes it difficult to find solutions to the issues that arise from this kind of trash. There is a deficiency here. Among the many facets examined in this research were the following: collection techniques, transportation facilities, component separation procedures, and the recovery of rare and precious materials from abandoned electronic equipment. A number of developed nations have found success in managing electronic device waste, therefore the researchers looked at those strategies as well. There are several types of evaluations that are employed, such as the Life Cycle Assessment (LCA), Material Flow Analysis (MFA), Multi Criteria Analysis (MCA), and Extended Producer Responsibility (EPR).

Das and Dutta (2013) assumed that recycling procedures could restore returned or abandoned electronic equipment to a state that is "as good as new." They also hypothesised that the recovered and restored items could be sold to primary market buyers at very fair prices. That was their conviction. A closed loop architecture with a Three Way Recovery (TWR) option was also suggested by the authors. This was an additional suggestion that they made. The remanufacturing of products, reusing of parts, and recovery of raw materials are all examples of TWR.

The principle of reducing, reusing, and recycling—also known as the 3-R idea—is explained simply and clearly in this essay by Dwivedy (2013). This study went a step further by providing two separate scenarios for India to evaluate the present and future flows of electronic garbage. This was for the Indian subcontinent. One utopian assumption made by the first framework is that most objects that are no longer needed are either repurposed or put aside for future use. Additionally, there is the gloomy case, which is defined by the fact that a large quantity of merchandise is still in storage.

Used materials undergo disassembly and testing before being used to create the refurbishment. Ultimately, the refurbishing may need the replacement of certain components.

To examine the distribution of electronic garbage, Dashkova (2012) conducted a comparative study between the Swiss and the Ontario provinces. According to Dashkova (2012), who aimed to assess Ontario's electronic waste management system, the Logical Framework Approach (LFA) served as the analytical framework. Using Switzerland's electronic waste management system as a case study, the author aims to provide comparative comparisons. By using the lesson drawing method, the researcher was able to glean important insights that may improve the performance of Ontario's newly implemented electronic waste management system.

Managing this increasing danger is a concern that many countries throughout the globe are now facing, say Herat and Agamuthu (2012). There is either no system in place or very limited access to environmentally safe methods of disposing of electronic trash in low-income nations. This study aims to investigate the difficulties encountered by Asian countries in their quest to find an environmentally appropriate solution to the issue of electronic trash. The writers surveyed Asian nations to learn more about electronic trash and the problems, obstacles, and potential solutions related to it. According to the study's findings, Asian nations account for the disposal of 20–50 million tonnes of electronic waste each year produced by the global population. Based on the study's findings, this conclusion was made. A large number of countries are now putting up defensive mechanisms to safeguard themselves against this new danger.

In 2012, Saoji, conducted research in India focusing on the management of electronic trash and the increasing health and environmental risks associated with it. In light of both the disposal of electronic trash from industrialised countries and the rapid rise of its own electronic waste, recycling of electronic rubbish has become an extremely important issue. Due to the significant disparity between the rates of electronic waste generation and disposal and recycling, the technological community and environmentalists will face a formidable challenge from electronic waste. Modern technical advancements, proper planning, and the provision of suitable tools for personnel performing disposal operations are all necessary for effective handling of electronic waste. This have already made a decision on this. On top of that, educating the public about the increasing dangers of electronic waste—which may harm both humans and the environment—is crucial.

Chemical concerns related to the disposal of old electronics were the subject of research by Tsydenova et al. (2011). The results of this research were released to the public in 2011. The goal of this study is to summarise the current knowledge on the hazards of recycling and proposed alternatives for the disposal of e-waste, or waste electrical and electronic equipment. The research will be carried out to achieve this. A lot of the concerns that have come up are due to the fact that electronic trash contains heavy metals and other potentially dangerous chemicals. A number of potential end-of-life treatment options, including the improper recycling of electronic trash, might endanger human and environmental health. It is important to consider this option.

The researchers at Kalana et al. (2010) set out to learn about the various approaches to electronic waste management that are already in use by homes in Shah Alam, Selangor, Malaysia. It was decided to conduct a range of surveys to gather data on attitudes and patterns of behaviour around EEE use and disposal.

The findings showed that keeping the devices in one's possession or reselling them were the most effective methods for people of Shah Alam to dispose of their electronic trash. There was a percentage difference of around 48% and 37%. A pitiful 22% of electronic trash actually made it to recycling centres. This occurred because customers were not offered any take-back initiatives that worked very well. There was a significant knowledge gap among families on the best practices for the environmentally responsible disposal of electronic trash and the locations where this might be accomplished.

To get more people talking about electrical waste, the government had to make sure all the many parties involved were working together.

Using a method called Material Flow Analysis (MFA), Perrine et al. (2010) evaluated the treatment of tiny waste electronic equipment (EEE). Gold measurement, linked to strict EEE rules in the US and Germany, was the primary emphasis of this study. Nevertheless, even though the percentage of precious metals found in EEE is quite small, these metals have significant commercial worth.

Jinglei et al. wrote an article in 2010 that covered the subject of WEEE recycling in China. A considerable portion of China's electronic trash is handled by the country's informal sectors. Not surprisingly, China plays a pivotal role in the worldwide recycling of WEEE, given that it is the biggest importer of electronic trash in the world. The writers conducted study into the e-scrap management industry and found the hurdles and issues associated with it, along with the best ways to overcome them.

Based on their research, Ramzy et al. (2010) recommend using monodisposal land filling as the best technique for managing electronic trash. This facility will serve as a temporary storage location for the mining operations that are scheduled to occur in the future. It is evident from the results of this research that this approach provides a practical means of managing electronic trash.

Aside from providing support to official garbage recycling bodies like municipalities, the formal e-waste management industry in metropolitan and semi-urban regions employs a huge number of individuals. Because the researchers focus on only one or two steps in the electronic waste management process, recycling rates go up or down depending on their findings. This is the current state of affairs despite the fact that informal firms and SMEs have long-standing links. The regular operation of the system is ensured by the valuable contributions made by each succeeding level. Many steps are involved in the informal sector's recycling of electronic waste, including collecting, handling, transporting, sorting, and disassembling. Even worse, a large portion of India's informal sector is involved in the extraction of important resources. These units are very polluting due to their procedures, and they are mostly unregulated. The risks they are placing themselves in are sometimes completely unknown to them as well (Raghupathy et al., 2010).

It is important to use many reuse strategies for electronic waste management since this kind of trash contains a diverse array of components, some of which are harmful and others of which are valuable. This is due to the fact that recycling e-waste might reduce its negative impact on both humans and the environment. According to research by Gaidajis et al. (2010), recycling methods for electronic trash might potentially salvage precious metals, over 95% of the materials from decommissioned computers, and around 45% of the materials from cathode ray tubes (CRTs). It is also possible to recover valuable metals by using the recycling procedures.

Electronic waste is only one of many types of rubbish that scrap merchants gather. They also take old newspapers, books, cardboard, plastics, ferrous-tin products, glass bottles, and more. Sorting the many forms of trash helps achieve this goal. Through middlemen, tiny sellers resell the trash to wholesalers. The next step, though probably not the least, is transportation to the landfills for further processing. In light of this, it is not unreasonable to assume that electronic waste accounts for a negligible percentage of India's overall recyclable rubbish. The research of Wath et al. (2010) indicates that the Kawariwala is responsible for collecting trash from various users. Among these users are institutions, families, corporations, and government agencies.

The waste management practices and outcomes of electronic waste disposal in India were studied by Wath et al. (2010). Topics covered in this study included electronic scrap, how it is classified, e-waste scenarios in India and around the world, reusability, the hazardous elements found in e-waste, recovery and reuse methods, and the environmental and occupational hazards linked to these practices. Reusability of e-waste was also covered in the research. In addition to creating problems for both the environment and the workplace, the materials recovery and reuse options in India are rather outdated, which is a major worry. Improving the management and control of electronic waste requires immediate attention to various treatment stages in relation to recovery and recycling options. Improving control and management to a substantial degree requires this to be done. It is critical for the country to develop new programmes and best practices similar to EPR and ARF at this time.

Research on the consequences of electronic waste disposal on aquatic ecosystems was conducted in Accra, Ghana, by Yu and Williams (2009). The potential outcomes of throwing away such technological waste are addressed in this specific piece of writing. Disassembling electronic garbage is common practice in developing countries like Ghana, where workers employ the most basic procedures and equipment while taking the fewest possible safety measures. This is due to the fact that Ghana is a growing economy nation. It is common practice to make large piles of dismantled electronic waste outdoors after the disassembly procedure is complete. There are a lot of heavy metals and natural chemical elements in electronic trash, and the current operations and storage techniques put nearby residents and workers at danger of exposure to these substances. Reason being, these elements are thought to be dangerous. The amount of electronic waste wasted in Ghana is increasing by over 20,000 tonnes every year. There is a high risk of significant harm to the aquatic environment due to the fact that open-air piles of electronic waste are frequently wet or flooded by rain, which leads to runoff from these locations to nearby waterways. As a result, the aquatic environment is in risk of suffering significant harm. Water and sediment analyses in Ghana have shown pollutants associated with electronic trash in the country's water systems.

When Lars et al. (2009) set out to explore this, they mainly focused on the RFID level. Any product with an electrical or electronic component must bear this level. It seems that the environmental impacts will be concerning and difficult to predict even from the start. The article also featured a study of the possible outcomes for electronic waste management, which might have both good and bad aspects.

Accordingly, the writers analysed the pros and downsides of RFID at the item level within the framework of waste management and recycling by looking at EU legislation. In the US, there are around 4,010 malfunctioning electronics, 2,077 that are out of date, and 1,856 that are completely useless. Domestic appliances manufacture these items.

Another 11,153 pieces of broken electronics, 15,911 pieces of outdated electronics, and 11,153 pieces of non-working electronics are produced by public sector organisations and educational institutions. The main reason for the lengthier storage of rubbish has been the recycling of resources, and there is a lack of approved disposal solutions. This is because there is a dearth of suitable disposal options.

According to Chatterjee and Kumar (2009), the issue of waste material from electronic devices has become a major worry for society due to the absence of developed landfills and recycling facilities that are adequate. This issue has changed throughout the years. The biggest problem for developing nations is the buildup of technological trash and the illegal recycling of precious metals. The reason for this is because recycling processes often result in the creation of harmful compounds and waste. In less developed nations, there is a potential business opportunity in the recycling of printed circuit boards (PCBs) that contain valuable metals like gold, silver, and platinum. The high cost of recycling electronic waste makes it unfeasible in affluent nations due to strict regulatory enforcement. Similarly, most discarded electronics end up in emerging and impoverished countries like Pakistan, India, and China due to this same reason. Due to lax enforcement of rules governing the disposal of electronic trash and the availability of labour in these nations at much cheaper wages compared to other nations.

One of the main reasons why people engage in informal recycling is because there are no regulations or safety precautions in place to prevent the extraction of valuable metals like gold, silver, and others from printed circuit boards (PCBs). This is the main justification for the sector's existence. There are serious dangers that this practice poses to the workers, the environment, and society at large.

The informal sector will work as an integral part of the formal sector by carrying out their proposed strategy so that the formal sector may run its operations according to the standards set by the former. The collection, disassembly, and separation of electronic trash may be accomplished inside the formal sector via informal means. To facilitate the informal sector's ability to carry out these operations, the formal sector must provide financial and technical assistance. The primary focus of official channels should be on recycling printed circuit boards in order to achieve valuable material recovery while ensuring the highest possible level of safety.

Although they get a little payment for their services, Kabaris are mostly responsible for collecting customers' electronic waste from door to door. Kawaris reduce the amount of manual work that towns must do for trash collection since they are the most competent people in the area of electronic waste collection (Chatterjee and Kumar, 2009).

Joseph (2007) uncovered many problems associated with electronic waste management over the course of his investigation. Listed below are a few issues that need fixing: 'Difficulty in inventorying;' unhealthy circumstances in informal recycling; inadequate regulation; inadequate awareness; and authorities' unwillingness to promote formal recycling initiatives.

As a result, (i) harmful substances are allowed to enter the waste stream without any measures to prevent their known negative impacts on human and environmental health, and (ii) resources are lost when valuable materials are discarded or unhealthy conditions are created during informal recycling. The author highlights the coexisting problems and possible answers to this expanding problem in light of recent events in India. The author suggests a mechanism for managing trash that would divide up the labour of collecting and recycling old electronics. Everyone from consumers to institutions that oversee regulations to recyclers and importers are members of this group. Electronic waste collection and recycling is an obligation that’s all share.

In 2007, Victoria et al. (2007) proposed a Supply Chain Management (SCM) model that incorporates both forward and backward supply chain management. A reverse chain method based on the preexisting forward chain processes was established to aid in the creation of this model. In their view, this is possible by including more reverse-chain sub-process activities into the current supply chain system.

China has a lot of serious problems with recycling electrical trash. An increase in the flow of malfunctioning electronic devices has contributed significantly to environmental pollution, as has the absence of an effective regulated collecting system and suitable management procedures, as well as inadequate recycling technologies. The number of insufficient recycling methods has increased significantly as a result of this. In order to decrease costs associated with trash PCs, a Monte Carlo mathematical model was built after a material flow analysis and an economic steam analysis of garbage PCs were conducted (Wen et al., 2007).

The vast majority of the menages felt this was a bad idea to bring old electronics straight to the scrap market. Practically speaking, they deal with the EEE by selling it or trading it with the merchants (UNEP, 2007). Back in 2007, Streicher and Yang laid out the existing state of affairs and the main problems that are preventing China's WEEE recycling industry from growing. In an effort to reduce the quantity of electronic trash, more informal methods are currently being used. Deconstruction and demolition of about 12% of WEEE goods helps with industry-wide material recovery.

When it comes to recycling and electronic waste management in India, the informal sector really steps up to the plate. An estimated 95% of the currently available electronic scrap is recycled by the unlicensed sector, according to estimations given by MAIT-GTZ (2007).

The most obvious example of a device made to be used once and then thrown away is the electronic devices on the market, according to Lise et al. (2006). Product obsolescence is on the rise in the electronics industry due to rising customer expectations and technological advancements. In collaboration with HP, researchers examined potential future scenarios for the disposal of electronic trash in Europe. A less dangerous product might be developed by transforming secondary raw materials and undesirable and troublesome components, according to one of their proposals.

Timothy et al. (2006) provided support for the method of disposal that included land filling for the disposal of obsolete electronic equipment. The Toxicity Characteristic Leaching Procedure (TCLP), often called the batch test with an acetic acid solution, is the most used test in the US. The electronic devices that were about to be thrown away are classified as Toxicity Characteristic (TC) hazardous waste under the Resource Conservation and Recovery Act. Investigators used a technique known as the Toxicity Characteristic leaching Procedure (TCLP) to determine the TC of the discarded electronic products. They tested thirteen distinct electrical devices using either the regular TCLP or other tailored variants to determine how well they worked. Electronic equipment like mobile phones, which include a smaller amount of plastic than ferrous metal, are more likely to leak lead over the TC limit than products like PCs and printers, which contain a larger proportion of ferrous metal. Reason being, the human body has an easier time absorbing plastic than ferrous metal.

2.9 Protocols for the Secure Disposal of Electronic Waste

A comprehensive literature assessment of WEEE from a Circular Economy (CE) standpoint is necessary, according to Bressanelli et al. (2020). To evaluate each of the 115 research publications that were included for the evaluation, the authors used the following four criteria:

Think about recycling, reusing, remanufacturing, and waste reduction, the four cornerstones of the circular economy. The goals and the approaches should be carefully considered. Think about the terrain as you plot the course of action. Take into account not just the life cycle phases but also the different players.

There has to be further research because the writers have pointed out several holes in what is already known. This article aims to lay the groundwork for electronic equipment manufacturers, providers of services, end-of-life (EOL) stakeholders, and legislators to use the findings of previous studies to make decisions that drastically cut down on escrap. In order to provide consumers the chance to reap financial benefits, this literature review argued that product designers should think about the price of their items. Not to mention the environmental effect that their goods would inevitably have. The researchers who wrote this study only looked at articles published in very prestigious journals that have a real impact. Conference papers, technical reports, and other research materials may have offered valuable insights into the issue of formal recycling of electronic trash; nevertheless, these suggestions were not taken into account.

Most of the UEEE marketed by rich countries is reportedly going to less developed countries (Maphosa & Maphosa, 2020). As a result, developing nations are facing a major challenge with the disposal of electronic waste. In order to have a better grasp of how individuals in Sub-Saharan Africa deal with an abundance of electronic garbage, a study combed through a mountain of literature about recycling IT. Despite receiving the majority of the discarded electronics from wealthy countries, poorer nations have a far lower pool of resources available for escrap recycling. The opposite is true in developed countries, where there is an abundance of literature on the topic. The writers used the systematic literature review (SLR) method to assign a score to each article after scanning Sabinet, EBSCO Host, and Web of Science for research papers. Finally, out of a total of 151,558 publications, the authors selected 25 research papers to conduct the analysis and answer the study questions. The authors found that out of all the articles published on the topic of electronic waste management in the Sub-Saharan African region, more than 80% were from only three countries: Ghana, South Africa, and Nigeria. In addition, this article highlighted how the shortage of infrastructure and the lack of regulation were the main problems that prevented a formal system for electronic waste management from being established. Most of these countries handle electronic trash using a combination of institutional and informal recycling programmes, according to the reviewed literature.

Amer et al. (2019) states that electronic waste is one of the fastest growing waste sources. This is a direct outcome of the incredible pace of technological advancement in the electronics industry. Real effort is required for the management of this specific trash kind to be successful. Reducing the harmful impacts of electronic waste on humans and the environment requires the creation of a suitable plan for the efficient formal handling of electronic waste. The proper handling of this unusual waste product is a major issue for the governments of many countries. The study's overarching goal was to learn about and evaluate effective practices in electronic waste management in many nations so that it can set up a system that works. To effectively handle electronic waste via established channels, consumer education and the creation of an efficient reverse supply chain are prerequisites. The results of this study will be crucial if policymakers and governments are really considering creating an environmentally friendly and long-term solution for recycling electronic waste.

The regulations governing Extended Producer Responsibility (EPR) have a major influence on the processes involved in the recycling and disposal of electronic trash. The movement and supply chain of WEEE were illuminated by Bahers and Kim (2018) using Material Flow Analysis (MFA). Also, they thought of putting EPR into action. Bahers and Kim (2018) conducted an extensive case study on the application of EPR for electronic trash in the Midi-Pyrenees and the metropolitan area of Toulouse. The WEEE chain's MFA states that the moment waste material is transferred, the awareness of the repercussions of depreciation in operational activities becomes apparent.

In order to encourage the formal collection and recycling of electronic waste, need to identify the factors that impact end users' recycling behaviours with respect to electronic waste and the extent to which these factors impact consumers' recycling behaviours. The authors argue that environmental incentives and behavioural costs for recycling electronic junk are the two most crucial components of the system for recycling electronic rubbish. In contrast, it may only take a short while to handle behavioural costs efficiently. The study also zeroed attention on two field studies that looked at the results of direct and indirect methods for reducing behavioural costs. These investigations were place in their native habitats. Direct methods included infrastructural improvements like curbside collection, while indirect methods included materials and social incentives. The direct technique increased the official quantities of recycled electronic garbage by a factor of fourteen, according to the authors. Distinct differences exist between the two sets of participants even in the second study, which looked at how social incentives affected group norms, identification, and commitment. Based on these numbers, it seems that social rewards might be a way to lower the barriers to participation. Otto et al. (2018) suggests that social incentive-based electronic waste collection programmes could be more effective than expensive infrastructure upgrades like electronic trash cans.

An inventory of the formal waste management system's crucial components is provided by Islam and Huda (2018). Reverse logistics and the closed-loop supply chain are two components that fall within this category. When thinking about major end-of-life issues, the RL/CLSC includes electric waste. Despite the availability of several research papers dealing with e-scrap in general in the RL and CLSC disciplines, I have not seen any review articles that tackle the specific issues associated with e-scrap. The authors use a content analysis method to track down and analyse 157 publications published between 1999 and May 2017. In order to address this issue, the decision was made to implement this measure. There are four stages to the process: gathering materials, analysing them descriptively, classifying them, and finally, evaluating them. Four separate types of research within the RL and CLSC of the e-waste industry were identified and studied by these writers. Included in this set of tasks are the conceptual framework, qualitative research, decision-making, and performance evaluation. For the benefit of future researchers, it pointed out the holes in the existing literature in an effort to find new avenues of investigation. The purpose of this review article is to provide information on WEEE projects that focus on RL/CLSC so that academics, practitioners, and industry insiders may better understand these initiatives.

Gu et al. (2017) found that there are a lot of problems with the official techniques of dealing with electronic trash. Some of the items that could be discovered among them include an informal sector that is expanding, a disconnect between goals and behaviours, poor collection rates, illicit transportation that is active, problems with integrating eco-design, and regulation that is ineffective.

The phrase "e-waste" is defined by Garalpati (2016) as any electrical and electronic device that is no longer being produced or has served its useful life. This word is often used to describe electrical waste. Examples of electronic waste include large appliances used around the house, such as refrigerators, air conditioners, mobile phones, and personal stereos; abandoned consumer electronics; and broken computers. There is a dramatic rise in the quantity of this kind of trash. Due to the ongoing technological advancements in electrical and electronic technologies, the rate of obsolescence is rather significant. In other words, new products are hitting store shelves at a fairly regular interval.

It is possible to recycle discharged hazardous materials by the transformation of trash into secondary commodities, which is beneficial to the environment. Hazardous materials may be recycled in this way. Environmentally responsible management on a national or regional scale requires the construction of infrastructure for the collection, transportation, processing, storage, recovery, and disposal of electronic waste. Regulatory firms must provide suitable facilities and launch substantial incentive schemes to motivate personnel to improve their performance. The goal is to motivate the staff. According to Garalpati (2016), the government should back initiatives that get people who generate and collect electronic waste to form their own networks to trade and recycle it. The federal, state, and local levels of government should all support these endeavours.

Anderberg and Potting (2016) investigated the illicit dumping of electronic waste in Pakistan. In addition to discussing the problems facing the Pakistani government, this article set out to look at the possibility of recycling old electronics whenever the necessity arose. It has also come to light that the informal sector has poor administration, which adds to the problems of running this particular tiny business. To provide a comprehensive Social Life Cycle Assessment (SLCA) of ICT-related commodities, this research's results may be combined with data on other phases of their life cycle. This is achieved by addressing a significant gap in a understanding way.

Because of new technology and how people's lives have changed, the electronic industry has changed drastically (Annamalai, 2015). The introduction of several new, frequently used goods is a direct outcome of this transition. As with many other nations, India has felt the effects of the information technology revolution. A substantial quantity of waste electrical and electronic equipment (WEEE) has accumulated as a result of the country's population using more and more electronic gadgets. In addition, many unofficial, unregulated firms have flourished due to the lack of severe environmental laws and regulations governing the disposal of dangerous electronic trash. Staff members lacking in appropriate training were found to have handled over 95% of the total electronic waste. Both they and the environment are placed at risk when these people engage in potentially dangerous activities without using PPE. The goal of this project is to find ways to dispose of large amounts of electronic garbage in a safe way and to address the health issues associated with the informal dumping of such material.

On top of that, there are already regulations in place that businesses must follow when tracking the technological products they make. The goal of the environmental protection approach known as Extended Producer Responsibility (EPR) is to reduce the harmful impact that certain products and their packaging have on the natural environment. The rationale for this is to make sure that the makers of the products are answerable throughout the duration of the product's use. The Extended Producer Responsibility (EPR) programme is also in charge of this issue. Producing new things from easily recyclable components may allow the manufacturer to further decrease resource waste. When it comes to electronic public relations (EPR), one of the biggest challenges in India is the sheer volume of informal channels that people utilise. All stakeholders in India, including the government, individual producers, and end users, must work together to collect and handle electronic trash efficiently, according to research by Kwatra et al. (2014).

Worldwide, people are using more and more electronic devices, which means that the amount of electronic waste is also growing at a similar pace (Belis et al., 2014). Several nations have passed legislation requiring the collecting and recycling of old electronic gadgets in an attempt to solve this pressing problem. Numerous study publications available online state that end users' awareness is crucial for facilitating the official collection and recycling of electronic waste. To better understand electronic waste, the authors conducted a more comprehensive review of studies published in the area from 1992 to August 2014 to extract, characterise, and evaluate key research themes. Finally, the writers reviewed 37 articles that covered various aspects of electronic trash, including its creation, processing, classification, societal effects, economic consequences, and the idea of recycling and reusing electrical devices. Not only were the various types and subcategories of electronic waste identified, but the locations that were analysed were also identified in order to conduct a temporal study.

Jecton and Mwololo (2013) offered a workable plan for Kenya to manage the processes, collection, transportation, administration, and monitoring of evolving forms of solid waste (e-waste). Kenya would be the site of the plan's execution. In spite of the fact that only about 10% of businesses really have disposal strategies or frameworks in place, the data showed that over 90% of end users did not. The government's regulations for the disposal of electronic waste had a major role in this disaster, despite the best efforts of all parties concerned.

Borthakur and Sinha (2013) conducted study on the management of electronic waste in India. Research in this area has mostly focused on the risks connected with electronic waste management practices, such as improper disposal, recycling, and storage decisions. Examining the present state of the processes utilised to dispose of electronic trash in India was one of the research's aims.

Many mistakenly assume that no one is aware of the fact that obsolete electronics pose serious risks to ecosystems, recycling workers' well-being, and air quality. In India, there are mainly two groups that deal with the recycling of old electrical gadgets. Both the professional recycling sector and the more informal recycling firm fall under these categories.

Organisations such as kabaris (junk merchants), dismantlers, recyclers, schools, government organisations, IT firms, the public and commercial sectors, and similar institutions are all part of this group. Here you may find India's informal economy. Companies like kabaris (scrap collectors/junk dealers), dismantlers, recyclers, and whole vendors are receiving electronic garbage (Borthakur and Sinha, 2013). The objective is to provide additional options for management. This is done after the disposal of the technological equipment in the garbage.

Thousands of individuals have found work in the electronic waste treatment business, according to many studies. According to the Environmental Management and Policy Association (2004), the reuse industry employs over 10,000 individuals, with the majority of them based in Delhi. India is home to more than 2,000 unofficial recyclers and an estimated 270 kawariwalas, or large- and medium-scale recyclers. This group of people works in the reconditioning industry. Approximately twenty thousand to twenty-five thousand unskilled workers call Delhi's informal sector home, according to Chatterjee (2012).

Conversely, developing nations often have very limited or nonexistent ESM procedures for their electronic waste. A major problem that affects the whole continent is the transboundary movement of electronic garbage. There are many intricate social and environmental factors that must be considered while dealing with the informal recycling sector. This sort of risk is particularly high for these nations when they try to extract ESM from e-scrap. This article aims to explore the difficulties Asian nations have in finding economically viable methods for recycling electronic waste, in line with the claims made by Herat and Agamuthu (2012).

Based on their research, Araujo et al. (2012) developed a model to predict how much electrical and electronic trash Brazil may generate. Especially in countries where the economy is still growing, recycling various types of electronic and electrical waste might bring in a tidy sum. The construction of facilities to handle electronic garbage was authorised by a new piece of Brazilian law for solid waste management that was enacted in 2010. Customers' actions in regard to the dangers of e-scrap should be carefully studied, as the results showed that product longevity is the most crucial factor. The "boom" in technological innovation has failed to materialise, despite Brazil's fast growing market. Utilising the seven selected commodities results in a total annual WEEE creation per population of 3.8 kilogrammes, irrespective of the time of year. It is worth mentioning that this particular estimate greatly influenced the 2008 development of several WEEE products. The results of this study make it very evident that more surveys collecting data on WEEE production and collection are needed to make accurate predictions about future WEEE production levels.

The term "electronic scrap," an acronym of "e-scrap," was used by Wath et al. (2011) to describe obsolete electronic devices. This class includes a wide array of electrical appliances, such as smartphones, tablets, desktop computers, TVs, refrigerators, and countless more. Some people in society may have thought these items were defective or unattractive, thus the original buyers may have thrown them out. Modern electronic equipment is in high demand, and this is fueled by a number of factors, including the availability of affordable, state-of-the-art electronics and the ongoing development of technological advancements. Electronic waste, even when disposed of in an unauthorised manner, includes certain harmful components that may harm people and the environment. The governments of many nations and several electronic equipment manufacturers collaborated to develop an ESM strategy for the lawful disposal of abandoned electronic equipment. This article provides a clear and succinct definition of electronic waste, covering all the bases: what it is, how it is classified, and what exactly constitutes recoverable, recyclable, and hazardous components. Beyond that, it delves into the background of e-scrap in India and beyond. The writers also covered the best practices, recycling options, and recovery methods for disposing of government electronic trash. The many challenges surrounding the disposal of electronic trash are acknowledged and investigated in this article, with a focus on India.

Research by Bhutta and Yang (2011) investigated the growing concern about the proper disposal of electronic trash and its effects on the natural world. By 2007, only around 15% of all EOL devices were taken in for formal recycling, with the remaining 80% ending up in landfills, as per the rules that control the handling of EOL electronic trash.

In addition to lowering emissions of greenhouse gases, recycling electrical items has far-reaching repercussions for water, soil, and air quality. The increase in waste steam is a direct outcome of the increased solid waste, which causes this to happen. In the future, tougher restrictions, innovative technological solutions, and public education on recycling and waste management will lessen the illicit dumping of computer and electronics waste. Communities searching for the most effective strategy to become more environmentally responsible should consider training programmes that teach citizens how to recycle, reuse, and dispose of electronic gadgets.

Ababio (2010) states that open burning and manual disassembly are two of the most basic methods currently employed to dispose of electronic waste. While visiting the facility in Agbogbloshie, Ghana, found that the appliances had been stripped of their metal, plastic, and condenser components. Despite their little perceived effort, these components are the most expensive. Reusable parts and secondary raw materials are byproducts of this technique. It has been determined that some parts, including PCBs, will be recycled in Asia.

Many obstacles were experienced by the writers when they were working to formalise the disposal of electronic trash. A lack of readily available infrastructure, an insufficient or nonexistent regulatory framework, a growth in the quantity of imported or manufactured electronic trash, and an inadequate amount of knowledge on the risks of electronic waste were among these issues.

Various commercial and governmental groups around the nation are participating in the auctions in order to sell the trash. Since the government lacks laws that effectively recycles electronic debris, scrap metal merchants are not allowed to sell abandoned electronic equipment to official industries. This paper discusses many subjects related to electronic waste, including how it is classified, the present status of E-waste management in India and globally, the valuable and hazardous materials found in E-waste, recycling and recovery methods, and the problems that can occur in the workplace and the environment due to improperly discarded electronics (Wath et al., 2010).

Official recyclers' involvement in electronic waste recycling and management processes is one element altering the recycling environment (Raghupathy et al., 2010). A combination of variables, including increased monitoring, heightened public consciousness, and political engagement, is bringing this about. By using BAT, these certified recyclers can dispose of electronic waste in an eco-friendly manner. The recovery of resources is enhanced, and there is little effect on human health. The most populous cities in India still have state governments that aren't very good at collecting and disposing of electronic garbage in an eco-friendly way. It is critical to think about the right prevailing concept while dealing with electronic trash collection, processing, and management.

Li and Zhang (2010) state that it is crucial to integrate an EPR system with the current technology for recycling electronic waste. This is because discarded electronics pose serious risks to ecosystems and human health. Public reporting that is both effective and efficient is crucial for escrap management, transportation, recycling, and collection as it helps to define stakeholder responsibilities. After discovering that recycling businesses in China were interested in the topic, the authors analysed the actions these companies took and offered suggestions for how EPR might be effectively implemented in the country. The government should also keep a watch on unlicensed recycling facilities for electronic debris and crack down on illegal recycling marketplaces.

When asked about the difficulties of implementing reverse logistics, every single organisation that took part in the survey cited a lack of regulations as the biggest problem. Except for Company C, which gets special treatment from the local government where it is based, everyone else follows this regulation. The high costs of recycling operations (mainly related to transportation and reprocessing), insufficient advertising and a lack of understanding of reverse logistics, and the unpredictability of recycled item demand and supply were common problems faced by all of the companies that were considered.

New information contradicts long-held beliefs on issues like public ignorance of environmental issues and the absence of environmental laws and regulations. To be more specific, China has not yet enacted any environmental laws, decrees, or rules on par with those enacted by the EU. Everyone from large corporations to mom-and-pop shops feels that more people need to know the dangers of e-waste, or used electronic devices, and how to properly dispose of them (Lau and Wang, 2009).

In 2009, Yu and Williams conducted a study on the techniques and procedures that are utilised in China for the purpose of recycling outmoded electronic and electrical technology. Companies located in China are among the most prominent participants in the worldwide market for recycling of discarded electronic and electrical devices. The technique that may be employed to develop an integrated electronic waste management and recycling practice is the major topic of this research. Implementing curbside collectors into the current system may be performed in a variety of ways, one of which is by preventing electronic rubbish from entering illegal recycling sectors.

On the other hand, there is a potential that an attempt will be made to unite formal recycling organisations with casual recycling sectors that make use of more modern technology. The authors also advocated the formation of ecological business parks as a method of facilitating the process of commencing the development of relevant businesses and companies for the recycling of electronic trash. The main purpose of these parks would be to develop links between these enterprises and the activities of industries that are situated either upstream or downstream from them.

In the Philippines, there is a popular notion that once garbage is collected from houses, the problem of waste generation is removed totally. This is owing to the fact that a considerable percentage of individuals have neglected to install toilets in their community. Their major concern, on the other hand, is the efficiency with which rubbish is collected and transported to municipal disposal facilities. Recently, a number of different firms have taken the initiative to become active participants in Solid Waste Management (SWM), an activity that has garnered encouragement from state governments. When it comes to recycling and recovery operations, non-governmental organisations (NGOs) are the ones that supply the information that is necessary to develop Community-Based Waste Management (CBWM) systems.

It is feasible for service providers, such as drivers and trash collectors, to boost the operations of the system's solid waste management system if they keep constant touch with one another. The extension of the SWM chain in an appropriate way involves the engagement of a vast number of performers; yet, the regulatory authorities of the government are largely accountable for this work. In conclusion, in order to carry out effective service delivery and system expansion, it is vital to simplify roles and responsibilities and to retain active engagement from all prospective stakeholders. (2009) United Nations Environment Programme

In agreement with the results of Shen et al. (2009), the electrical and electronics industry is the sector that is increasing at the greatest pace globally. This new development has resulted in a huge surge in the WEEE. In response to the environmental difficulties that are involved with the recycling of electronic garbage, a number of governments and organisations have adopted legislation to encourage a larger proportion of recycling and reuse of outmoded electronic equipment. The objective of this article was to establish all of the characteristics that the Chinese secondary market for secondhand electronics must achieve in order to be deemed successful.

The study that was undertaken by Carisma (2009) was conducted with the objective of discovering the elements that either enable or impede the management of electronic trash in the Philippines. In this study, a variety of cultural, political, and economic factors were explored in order to establish the causes and situations that have delayed the adoption of solutions for the management of electronic waste. The formal recycling of this material is made more difficult by the lack of standards and norms for the management of electronic trash, as well as by the fact that the Basel Ban amendment has not been put into force. The proposed policy orientations are mainly employed in order to establish the policy frameworks for the management of electronic waste and to decrease the various hurdles that have been identified. The results of the current study show that it is vital to take into consideration past socioeconomic difficulties with relation to the creation of an EPR project, especially the framework that is already in place.

Robert and Nora (2009) undertake an examination of the computer initiatives in the United States that are sensitive to the environment. "Green computing" is a word that is used in the context of computers to indicate approaches that are more efficient in making use of their resources while still retaining their overall performance. Through the course of the previous few years, the concepts "green computing" and "green information technology" have grown increasingly prominent and relevant.

As a consequence of ineffective implementation of hazardous waste management legislation, developing countries such as Nigeria do not have well-established legal channels for the collection, storage, transportation, sorting, and disposal of hazardous waste. This is a concern as these nations should have these channels in place. Neither the rules nor the regulations relating to general waste management are exceptionally severe, and no specialist legislations are in existence to control the disposal of electronic rubbish. However, despite the presence of cutting-edge technology and recycling facilities that are state-of-the-art, only a very tiny fraction of electronic garbage is recycled in a formal way. As a consequence, a large amount of the electronic trash is being handled by illegal sectors, which are defined by a severe lack of safety requirements. For the disposal of electrical waste, this business generally makes use of open landfills, recycling facilities in backyards, and bodies of surface water like lakes and rivers. The authors Nnorom and Osibanjo (2008) say that these countries do not possess a comprehensive framework that is capable of managing and monitoring hazardous and toxic waste and commodities.

Within the sphere of stakeholders, there are two separate categories: the official sector and the informal sector. Companies such as Nokia and Hewlett-Packard are typically regarded to be part of the stakeholder community in India. These firms offer servicing facilities and/or take-back programmes for consumers who have electronic waste products. Two examples of the several organisations and organisations that have an EMS in place to recycle their outdated electronic and electrical equipment are Tech Mahindra and Tata Technology Limited. There are many more companies and groups as well. In contrast to the official sector, which is responsible for recycling and eventual disposal, the informal sector mostly focused on classifying and disassembling the components that are found in electronic trash.

In spite of this, Thiel (2008) has raised attention to the fact that in order to dramatically lower the carbon footprints of wireless systems, it is important to apply creative design ideas and materials in the manufacture of antennas in large numbers. When it comes to WEEE and RoHS compliance systems, design engineers are needed to undertake study on the most current designs and methods.

As part of a comprehensive strategy in China, Wen and Hu (2008) performed research on an innovative method to the remediation of electronic garbage. This article, which focused on the here and now, featured a variety of distinct things, including an analysis of the flow of components of EEE and a brief discussion of the strategies that are taken to control e-waste. China is under a tremendous amount of pressure to find answers to the difficulties that are related with electronic trash. Implementing a management policy mindset has been the technique that the Chinese government has been pursuing in an attempt to handle the challenging challenges. In order to build a set of management standards, it is possible to take into account the pattern of electronic goods as well as the techniques for collecting, recycling, and disposing of electronic trash. These management techniques will play a proactive role in the development of sustainable practices, which will be excellent not only for society but also for the economy.

Kahhat et al. (2008) performed study on a number of techniques to the management of electronic trash in the United States. The goal of this study was to explore the issues that are linked with the management and control systems for electronic waste in the United States. Further inquiry into the genuine components that are considered to have an influence on the execution and acceptability of official recycling initiatives in the United States was carried out as part of the study.

According to the authors' knowledge, there is no comprehensive federal regulation that handles the complete issue of electronic trash in either the residential or non-residential waste sectors. Two of the benefits that are anticipated to arise from the recommended approach, which seeks to enhance material recovery via recycling, are an increase in the collection of electronic trash, as well as an improvement in resource utilisation and a decrease in environmental impact. In conclusion, it is very evident that the United States of America is in serious need of adopting new guidelines for the gathering, recycling, and repurposing of electronic waste. It is probable that the e-commerce business provides the most practical alternative system for treating electronic waste, which is known as the Returned Deposit Structure (RDS).

In order to cope with this issue, the key aim is to limit the quantity of electronic waste that is created. Electronic device producers have a duty to guarantee that their goods are not merely reusable but also able to be maintained and adaptable to new situations. Materials that are less damaging, readily recoverable, and recyclable ought to be utilised more regularly, as stated by Joseph K. Joseph (2007). These items may be returned for the purposes of remanufacturing, recycling, or reuse provided they are returned in the right way.

According to the results of Liu et al. (2006), the lack of a national management strategy has resulted in severe harmful consequences on both human and environmental health as a consequence of the adoption of informal recycling techniques for electronic garbage. All of these effects have already taken place, and they will continue to do so in the years to come. China has taken urgent action as a consequence of the troubling development in the manufacturing of electronic rubbish both locally and globally, as well as the clandestine importation of this waste. The goal of this study was to explore the most recent innovations in recycling, and the driving force behind it was the identification of the key issues that are associated with the approaches that are now being utilised to manage electronic waste in China. It is believed that roughly sixty percent of the overall volume of electronic garbage gets disseminated via informal pathways that are helped by local scrap merchants. In addition, more than ninety percent of Chinese people feel that even after their electronic equipment have reached the end of their useful life, they still have worth; consequently, they are not ready to pay anything to recycle them. On the other hand, China, like the majority of other developing countries, has legislation surrounding electronic trash. These limitations are not enforced to a sufficient degree, which is a truly regrettable scenario. Furthermore, rules that generate extended producer responsibility (EPR) have been adopted, but neither the scope of the EPR nor the implementation of the EPR have been fully addressed. As a consequence of the fact that informal sector units have their own well-established systems for collecting, transporting, sorting, and recycling, official recycling units have a tough time competing with these units.

Yoon and Jang (2006) focused their study on the benefits and downsides of recycling electronic garbage in Korea by choosing Extended Producer Responsibility (EPR) as the key topic of their analysis. A big economic opportunity is projected to show itself in Korea in the form of recycling electronic trash as a consequence of the exponential development in the generation of electronic waste. As a consequence of the fact that Korea has only just begun to think about electronic trash, the idea is still in its juvenile beginnings. Because of the significant expenditures connected with processing, only a minor percentage of electronic waste is being refurbished and resold via the procedure. The previous arguments give an explanation for this.

John et al. (2006) discovered that the disposal of consumer electronics (CE) was a sensitive subject throughout their investigation. Because of the ever-increasing demand for electronic things and the decreased lifetime of these products, the quantity of waste created by electronic gadgets has dramatically expanded. The amount of electronic rubbish that is deposited in landfills in Japan contains a large percentage.

It is needed to effectively implement directives pertaining to the Restriction of Hazardous Substances (RoHS) and other regulations in order to reduce the amount of electronic garbage that is created.

In the event that an EEE is returned or goes through an exchange, the obligation of disposing of it in a proper way lies completely on the enterprise. gadgets that are more energy-efficient are initially more costly; yet, buyers are progressively modifying their purchase habits to adopt these more expensive devices. It is usual for items that have gotten high star ratings for their environmental friendliness to be offered at a premium price. According to Sinha (2004), the informal sector of scrap merchants, also known as kabariwalas in the local language, plays a crucial part in the recycling of electronic rubbish in India, regardless of whether the recycling is done on a small or major scale. When it comes to the situation in India, no one is able to produce an exact estimate of the number of persons who are involved in the huge system of recycling and collecting electronic garbage. According to Sinha (2004), the absence of a monitoring system makes the process of data collection considerably more hard.

According to Knoth et al. (2004), the average lifetime of electronic devices is reducing at an alarming pace, while the amount of time necessary to manufacture new items is lowering at an ever-increasing rate. Computers may be upgraded, repurposed, refurbished, remanufactured, recycled, or disposed of when they approach the end of their useful life. Other solutions include recycling machines. Recyclable materials and disposal are two other options that may be taken. The writers did a study on the Multi Life Cycle Centre (MLCC), which is an abbreviation for the facility.

In the study that Antony et al 2002, they explored the environmental and strategic concerns that are involved with the execution of the manufacturer's requirement for business-to-business activities within an information technology system. In addition, the authors of this study took into account the duty of the producer as well as the environmental benefits of formal treatment of electronic waste. Throughout their entire life cycle, scientists have been examining not only the ever-changing EEE but also the environmental implications that come from their presence. The sector of electronic waste is continually developing as a consequence of the continuing development of technology within the business. In addition, the authors explored the particulars of EEE fire safety in order to better ensure the safety of end users as well as the status of the environment. In order to further lower the risk of fires developing, the researchers also advised the usage of fire retardants.

According to Mead et al. (1999), Nortel Networks is used to simplify the exchange of data and information on the environmental information management system throughout the entire of the product life cycle. In addition, this comprises procedures that are aimed to increase the functioning of the objects. In addition to that, this essay delves fully into the regulations and the information demands of customers that are the driving factors for the escrap management system. At the same time that the researchers were seeking for product data, they evaluated the following four probable roads:

2.10 E-waste Management Framework

In order to solve the environmental problems associated with electronic waste, Fathima et al. (2017) developed a technique that is effective and beneficial to the environment. In order to better manage this kind of trash, this was done.

There are now procedures in place in India to handle electronic waste; however, these methods are very ineffective and harm both humans and the environment. In order to assess the present state of e-waste management worldwide, this research suggests building an online platform. All of this was done with the preexisting rules and regulations in mind. An online platform is now under development to facilitate the proper disposal of electronic waste by connecting consumers with recycling suppliers. When individuals report their unwanted goods online, the authorities may learn more about the products' specs. The next phase is for consumers to get quotes from the various agencies. Gathering information on businesses' and organisations' electronic waste is the first stage in completing the analysis that will lead to the creation of a suitable report. Many different government bodies will get the statistical viewpoint that is shared in the article. Additional protocols for the recycling of electronic waste will be developed in the event that the evaluating research is cited by the government. With a focus on the needs of underdeveloped countries, this presentation aims to provide a resource for recycling electronic garbage.

Ghosh et al. (2016) analysed the programmes run by the BRICS nations—China, South Africa, Russia, India, and Brazil—to collect and recycle old electronics. An analysis of the data revealed that all of these nations are using the same model to handle their E-waste. In order to meet the Basel criterion, the authors compared and analysed the current WEEE management solutions. In contrast to more developed institutions, the BRICS nations have failed to incorporate any lessons learned from the EU and the US. The study suggests that the BRICS countries may benefit from a system that recycles old electronics, and it provides a groundbreaking foundation for such a system. In addition, the research showed that the BRICS countries have many shared problems. And there were major problems with both management systems and WEEE disposal, according to the study's results.
Research conducted by Kilica et al. (2015) indicates that the quantity of electronic waste increases as the number of devices utilised increases. There are few types of solid waste as

dangerous as electronic garbage, which poses several health dangers to humans. Recyling old electronics is an issue of paramount importance for every country because of the potential environmental and financial benefits of recycling them. Because it helps recover important resources and transfers things that customers have rejected to producers, the reverse supply chain is an essential part of the flow of commodities. The authors set out to eliminate unused electrical devices by constructing a reverse logistics system in Turkey. To comply with the recycling targets established by the EU Directive for each product category, conduct a strategic analysis of the locations of a collection stations and recycling facilities. Several countries currently have systems in place for recycling electronic waste, according to study by Jecton and Timothy (2013).

On top of that, they suggested a protocol that lawmakers in Kenya should follow when dealing with electronic trash. For this data set, researchers employed both quantitative and qualitative methods. Methods such as these were supplemented by the writers' own first-hand experiences, interviews, and literary reviews. Kenya is not immune to the growing problem of electronic trash, a uniquely modern kind of solid waste. Many factors contribute to the enormous issue of electronic waste, including the sheer volume of materials produced, the harm it does to humans and the environment, and the lack of laws aimed at controlling it. The primary goal of this study was to identify existing gaps in understanding of the technologies used to recycle electronic waste, including but not limited to stakeholder participation, financing, collection, sorting, disposal, and monitoring. The writers of the piece stressed that recycling electronic waste is a lucrative business that helps the economy, the environment, and the job market. Their suggestions for bettering economic and social circumstances while protecting the environment were equally noteworthy.
The growing amount of electronic trash is having a major impact on human and environmental well-being, say Rahman and Subramanian (2012). To alleviate the problem of recycling electronic waste, they also suggested a solution that involves removing usable parts from old devices. Doing so would alleviate some of the strain on recycling electronic waste. By establishing a connection between the main factors that affected the computer management programme that was ultimately rejected, this essay aimed to provide the groundwork for an effective framework for computer administration. Among the many factors they uncovered, the three most crucial ones were resource availability, electronic waste quantity and quality, and recycling process organisation. However, regulations, enticing incentive programmes, and

consumer demand all work together to formally recycle electronic trash. It would be wise to examine these drivers. Using the Decision Making Trial and Evaluation Laboratory (DEMATEL) technique, this research aims to determine the nature of the causal link between the different components.

The analysis carried out by Ramzy et al. (2010) examined the growing quantities of electronic trash. Over 1.36 million metric tonnes (MT) of electronic garbage was dumped in American landfills, according to the computed data. More than that, however, the paper covered a wide range of other issues related to the planning and administration of electronic waste systems throughout the US. Further, in analysing the current recycling systems in the US, it considered feedback from end-users. The need of recognising when electronic equipment have accomplished their "end of life" and the relevance of maximising services that include refurbishing and reuse are just two of the many suggested solutions.
In his discussion of the economics of EWR systems, Boma (2010) elaborated more on the significance of uncertainty. The purpose of developing the Mass Flow and Economics (MFE) model was to investigate how various system factors affect the system's economic performance. It is the responsibility of the system administrators to maintain control over the quantity, quality, and timeliness of returns. The model's inputs, compilation, product, secondary market, and EOL components were all very well-defined. Age, distribution, depreciation rate, processing cost, material composition, and commodity prices are some of the factors considered by Boma when calculating the profit from reuse. However, processing costs and product weight are the two most critical variables in calculating the possible profit from recycling.

In their 2009 research, Mutha and Pokharel emphasised the importance of reverse chain networks and how many electrical device manufacturers are developing them. It is also important to develop regulations that compel manufacturers to accept returns of things that are no longer needed or that are still under warranty. Less waste means more resources may be preserved. As a result, OEMs must make changes to their products' designs to encourage more recycling and reusing. They should also set up a method to collect the electronic gadgets that customers give up after using them so they can conserve resources. The need for refurbished items and components, together with the quantity of objects returned, will dictate the construction of a system for a reverse supply network. Researchers who developed the mathematical model for the reverse supply chain predicated their work on the idea that recyclables would first be collected at a warehouse and then sent to recycling centres. The need for replacement parts is met by releasing functional components and parts onto the market for resale as used goods.

Research undertaken in 2009 by Mitsutaka et al. focused on the uncontrolled recycling of electronic waste. This might cause pollution, health problems, and other problems, which is a major concern in the area. In order to create a system that can manage electronic waste properly, this research was conducted. The first order of business is to gather data that may be used to assess the electronic waste flow. Most of these details pertain to the current situation in Japan. Factors such as product composition, Life Cycle Assessments (LCAs) of electronic devices, recycling costs, and overall rates of electronic waste creation are considered, among others, when establishing criteria for the management of electronic waste. After much deliberation, the researchers settled on the tele-inverse manufacturing paradigm, which may provide the groundwork for the recycling of old electronics in the near future.

Particular processes were the subject of Wang and Chou's (2009) investigation of the proper disposal of personal computers in Taiwan. Several system characteristics make it hard to regulate, even if issues with electronic waste should be considered an emergency. The goal of this piece was to lay forth a plan for how Taiwan may better handle its electronic waste. To do this, the authors look at what other researchers have found and then draw their own conclusions.

The garbage industry in India is booming, say Borthakur and Sinha (2013), with participants including dealers, collectors, handlers, dismantlers, and recyclers. When looking for work, most of these people turned to the underground economy. The locals refer to these small-scale businesses as "kawariwalas" since they sell scrap metal and collect it from people's homes. (Manomaivibool, 2009b).

2.11 RESEARCH GAP

The onus for recycling the waste products of electronic devices lies on consumers, with recyclers shouldering the bulk of the task. There is a huge knowledge gap between recyclers and customers on their respective responsibilities in relation to the reduction of electronic waste and its treatment. Unfortunately, the recycling business is struggling due to this information gap. Green buying and reverse supply chain management are two initiatives that developed countries are eager to have implemented, and many poor countries are eager to follow behind. Both the reduction of landfill waste and the creation of new jobs are motivated by the desire to preserve the earth's precious mineral wealth. The execution of such initiatives is lacking in emerging countries like India and China, according to the research. It became apparent of this. There is a critical shortage of infrastructure, technology, and, most importantly, participation from the informal sector when it comes to managing computer and electronic trash. There is no greater challenge than this. It is obvious that this is a troublesome issue. Several countries are clearly trying to build the formal industry in electronic waste management in order to come up with suitable methods for managing electronic waste. All the pain that has already been endured is being further damaged by this. The development of conceptual framework approaches is crucial for reducing the effects of electronic waste on the health of humans and the planet's ecology. The makers should be the first stop on this route, and the recyclers should be the final. Nevertheless, a considerable portion of the existing technologies are only in the conceptual phase. The participation of key stakeholders is essential for the successful deployment of these technologies. Despite the development of several groundbreaking technologies using chemical and biological approaches, these advancements remain in the conceptual stage. Despite the creation of these technology, this remains the case.

Here is a list of the research gaps that have been noticed throughout the process of completing a comprehensive study of the relevant information.

1. In terms of electronic waste collection and recycling processes, customer understanding is paramount. indicating the effective disposal of electronic waste in India, however, there is a lack of available data indicating the extent to which consumers understand the topic. There is a major restriction here.

2. The State Pollution Control Board (SPCB) and formal recyclers need to be studied to find out how to deal with the problems of electronic waste management. If the problems are to be adequately addressed, this condition must be satisfied. All publically accessible research points to this being the case. To further assess their performance in meeting their goals regarding the management of electronic waste, it is necessary to

examine the part played by these two organisations in coordinating and enhancing their cooperation. This task must be completed in order to ascertain the current degree of success.

3. Thirdly, the existing research indicates that official channels only collect 5% of the entire electronic waste created in India by the Indian government. More study of the effectiveness of the Indian government's policy on electronic waste, as well as comparisons to other countries' programmes, is also urgently needed. This is because, in industrialised countries, a large percentage of the recycling of electronic waste occurs inside the formal sector. Because a large portion of the electronic waste is recycled by the formal sector, this is the case.

4. An index for the different states of India's knowledge on electronic waste management has to be developed so that an evaluation of that information can be carried out.

5. Since the current laws and system have failed to sufficiently handle the issue of properly managing electronic waste in India, it is imperative to establish a framework for the efficient management of electronic waste from an Indian perspective.

CHAPTER-3: RESEARCH METHODOLOGY

3.1 Introduction

The research goals for this study have been defined by performing a review of the existing literature and gathering insights from preliminary conversations with practitioners, experts, and academics. This was done in order to fulfil the aim of this study. In this chapter, the author offers a description of the information requirements, the sources of information, the method of data collecting that was followed, as well as the methods or instruments that were utilised for data analysis in order to meet the goals. All of these are explained in detail.

3.2 RESEARCH OBJECTIVES

The following is a list of the five research goals that have been agreed upon for the present study:

Research objective 1: This research's major purpose is to determine the extent to which consumers and recyclers are aware of the availability of environmentally friendly electronic waste disposal alternatives. This is the primary objective of this study. Individuals and companies alike are considered to be recyclers and consumers when it comes to dealing directly with electronic equipment. This category of persons comprises both individuals and businesses. Recycling companies are the ones who are liable for effectively managing electronic trash, whereas consumers are the ones who are responsible for creating electronic garbage in the first place. In order to achieve this goal, it is vital to determine the extent to which end users and recyclers are aware of the potentially harmful repercussions that have been caused by electronic trash. End users and recyclers are both responsible for recycling electronic waste. Consumers who are fully aware of the potentially harmful effects that may occur from improper disposal of electronic garbage will dispose of their electronic waste products in an acceptable manner, even if doing so requires them to spend some time and money out of their own pocket. Uninformed consumers, on the other hand, will be held accountable for the negative impacts that their activities will have on the environment and the living species that inhabit it as a result of their actions. During the course of this assessment, the areas in which the customers are discovered to have a much lower level of knowledge will be identified. Because of this, the process of developing efforts that are appropriate for boosting awareness will be simplified, which will result in a direct benefit.

Research objective 2: For the second purpose of the research project, which is to "examine the role of the government-approved collection centres and state boards along with their coordination in achieving e-waste management objectives," the research project's second objective reads. During the course of the research project, it is anticipated that this aim will be achieved. When it comes to the process of putting in place official procedures for the handling of electronic trash, recycling organisations and state boards are both very important individuals to have on board. Not only are state pollution control boards compelled to regularly educate and inspire recyclers, but they are also expected to monitor their performance and ensure that they are following to the approved course of action. This is a requirement that is imposed on them. The evaluation of the amount of cooperation that exists between recyclers and the government entities that are active in the process of managing electronic waste is the second aim that will be accomplished. These actions are taken with the purpose of accomplishing the objectives of the electronic waste management system.

Research objective 3: This research has three goals: the third purpose is to investigate the similarities and differences between the policies of the Indian government regarding the management of electronic waste and the policies of industrialised countries in order to identify the inadequacies that are present within the system that is currently in place." For the purpose of ensuring that electronic trash is collected and recycled in the proper way, it is essential for the law that governs the management of electronic waste in a country to be stringent and efficient. There are a lot of things that can be learned by comparing the policies of one nation to the policies of other countries, and there is a lot that can be gained from this comparison as well as the lessons that can be pulled from it. The existing policy framework may be examined with the use of this comparison, which enables the identification of areas within the framework that are lacking in strength. For the purpose of accomplishing this goal, a comparison has been made between the policies of India and those of the United States of America, the United Kingdom, Japan, Germany, China, and Kenya with regard to the management of electronic waste. In addition, recommendations have been made with the intention of enhancing the policy framework that is in place in India.

Research objective 4: "To develop an e-waste management awareness index and calculate the e-waste management index for various states in northern India in order to have a comparative analysis," is the fourth purpose of the research project's objectives. This objective helps to ensure that the project is successful. In the past, there was a person who uttered the phrase, "What gets measured gets improved." There is a famous saying that says this. Among the many tasks at hand is the development of an index that may rank the states of the country according to the general understanding of how to properly dispose of electronic waste. In order to generate this index, one must first generate an index that may be used for this purpose. In order to achieve this goal, the major focus is on the development of an index that takes into consideration the different levels of knowledge that people, organisations, and recyclers possess. Haryana, Punjab, Uttar Pradesh, Himachal Pradesh, and Chandigarh were the five states that were taken into account during the course of this research project. The identical method was used in order to give scores to each of these states that were involved in the study.

Research objective 5: In order to achieve efficient management of electronic waste, the fifth purpose of the research is to construct a strategic framework for an electronic waste management system in the context of India. This intention is to achieve effective management of electronic waste. All of the aforementioned goals will be accomplished via the implementation of this plan. A management structure that is both efficient and successful is the foundation upon which any significant corporate culture is constructed. The foundation of the culture is situated here. The establishment of a strategic framework for an efficient electronic waste management system that is capable of being implemented within the context of India is the fundamental aim of this purpose. In order to ascertain whether or not there were any coverage gaps and to develop an efficient strategic framework, it was decided that the existing systems for electronic waste needed to be evaluated. This was done at the same time.

3.3 RESEARCH DESIGN

It was chosen to carry out a research project that is both exploratory and explanatory in character. This decision was made due to the fact that the amount of study that has been undertaken on the subject of electronic waste management in India is much less than what was anticipated it would be. For the purpose of this specific investigation, the research technique that was used included a number of different components, including interview schedules, questionnaire-based surveys, and a review of the relevant literature.

3.4 Review of the Literature

In addition to structural equation modelling (SEM), a variety of various factors of electronic trash collection, transportation, segregation, and recycling were taken into consideration throughout the whole of the reviews of the relevant literature. It was feasible to identify the gaps that were there in the area as a result of the insights that were received from the publication of the literature. This, in turn, resulted in the formulation of the research objectives and the formulation of the methodology for the current investigation. In addition to gaining a greater understanding of the subject at hand, the review of pertinent literature greatly simplified the process of defining the method that would be used in the ongoing inquiry. More than that, the literature was useful for picking out the first set of items to gauge people's familiarity with EW management. All of this followed the guidelines laid forth by the research. This is how it found out what was initially: using a list of things.

3.5 Exploratory Interviews

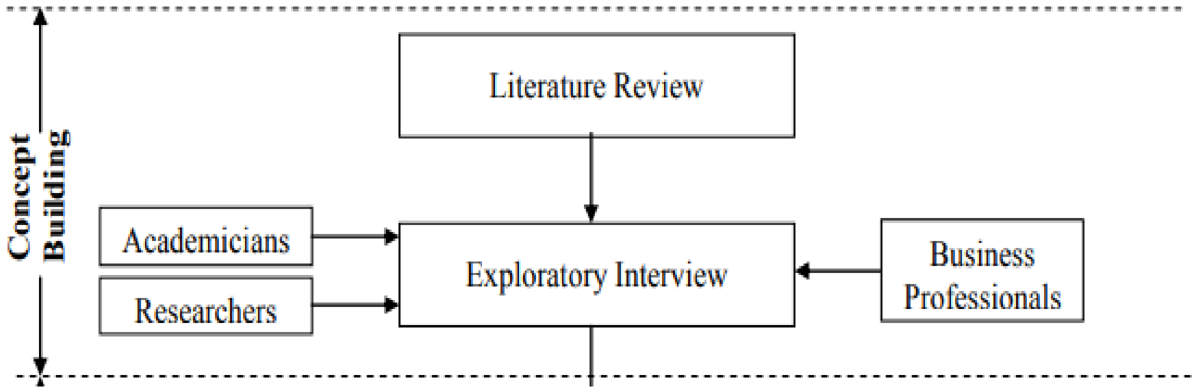
Following an examination of the relevant literature, it has become abundantly evident that India has only conducted a limited number of studies on the issue of computer and electronic trash. This is the conclusion that can be drawn from the previous statement. On the other hand, there is seldom ever a model that has been built in a thorough way for the purpose of evaluating people's knowledge of electronic trash. In situations where there is a scarcity of theoretical models on the issues that are being investigated (Nix, 2001; Seth et al., 2006), as well as in circumstances where the existing body of literature does not adequately describe the contours of the issue that is being investigated (Saunders, 2009), the significance of exploratory interviews intensifies. This is because when there is a dearth of theoretical models, the importance of exploratory interviews increases.

The purpose of this study was to conduct a series of exploratory interviews with three practitioners who were working in recycling facilities. It was the general managers and vice presidents of the recycling units that were responsible for these practitioners. Furthermore, in order to participate in the research, four academics who are currently working at universities and other institutions and who have published works in the fields of industrial engineering and management were selected to take part. The purpose of the exploratory investigations that were carried out was to acquire a comprehensive understanding of the following: the construction and operation of the electronic waste recycling units in the states of northern India; the coordination between the recyclers and state boards; and the evaluation of the system that is currently in place for the management of electronic waste. Investigations were conducted with these objectives in mind.

It was decided to undertake in-depth interviews with these specialists, during which open-ended questions were asked. To provide a greater level of specificity, these interviews were carried out. The use of exploratory interviews resulted in the acquisition of significant insights, which led to the enhancement of the literature evaluation and the achievement of a comprehensive comprehension of the subject matter that was the subject of the study. All of the practitioners and academics who took part in the study were in complete agreement with one another with regard to the question of whether or not the specific research goals were relevant. In addition, the executives offered support in the process of screening and validating the questions that were included on the questionnaires that were sent to the participants.

The design of the framework for the study was the climax of the learning that was obtained, and the interviewing of exploratory participants and the examination of relevant literature were the pinnacle of the learning that was gathered overall. The constructs that are the subject of this research are defined and described by this framework. It also assigns each of these constructs their respective roles (specifically, dependent, independent, and mediating), establishes the relationships between them, and reveals the types of interactions that take place between them as well as the direction in which they take place. Following the principles of structural equation modelling (Hussey and Eagan, 2007) is being done in order to create a schematic diagram that will serve as a representation of this framework. This is being done in order to fulfil the aim of producing the diagram. In addition to this, the conceptual framework is now undergoing the process of being translated into a model that is capable of being evaluated via many independent experiments. The propositions that characterise the connections between the constructs are now being recast as a collection of hypotheses in order to make it possible for this to be carried out.

An illustration of the framework of the research endeavour that is presently being carried out may be seen in figure 3.1, which can be found below:



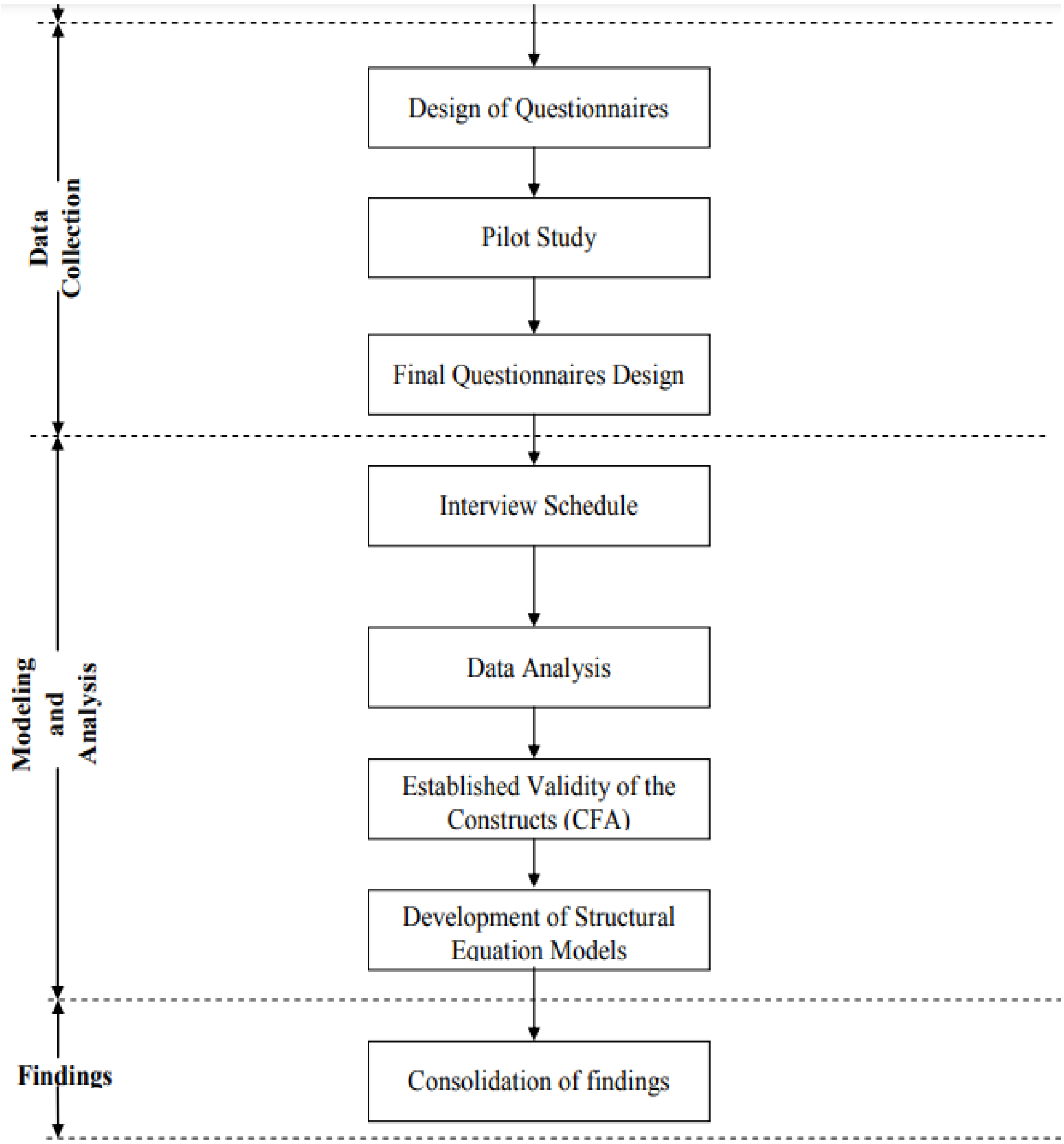


Figure 3.1: An Overview of Research Methodology used for the SEM

3.6 Survey Research

According to Saunders et al. (2009), survey research is a well-established kind of study that involves the collection of information from a sample of respondents via the use of a structured questionnaire or a schedule. There is another name for this kind of study, and that is exploratory research. Using this approach, the researcher will gather information in a setting that is characterised by its natural characteristics. It is feasible to achieve a degree of precision that is commonly accepted that can be achieved via the use of the survey method, which may be of aid in the determination of information on a more extended population (McIntyre, 2005). Furthermore, the survey questionnaire method has been considered to be both cost-effective and convenient in the literature for the purpose of researching qualitative issues such as the perceptions of respondents regarding the overall awareness level of consumers and recyclers, as well as the effectiveness of coordination between recyclers and state authorities. This is because the method has been used to collect information from individuals who have already participated in the survey. This is due to the fact that the approach has been used to gather information from those who have previously taken part in the survey. For the objective of this investigation, the technique of survey research was used in a confirmatory fashion in order to empirically predict the links that exist between the different components. The approach that Kamakoty and Sohani (2015) used for their inquiry is comparable to this strategy, which is likewise comparable to that methodology.

3.7 Sampling

A thorough collection of people, groups, or things that the researchers intend to explore during the course of their inquiry is what is meant by the term "sampling population" when it is used in the context of research. Within the context of this particular scenario, it is plausible to assume that the population for the survey is made up of persons who recycle, customers who are individuals, and consumers who are connected with organisations in the northern region of India. One of the components that constitute the population frame is a list that contains all of the prospective respondents from whom the sample is gathered. This list is one of the components that forms the population frame. A specific sampling technique stipulates that the sample is comprised of the individuals who were chosen from the general population to take part in the survey. These individuals are the ones who make up the sample. An strategy known as snowball sampling is being used in order to make contact with the respondents who were prepared to take part in the survey and who provided information that was beneficial to the research undertaking. In accordance with the method that was recommended by Kureshi et al. (2010), this is the recommended approach. In particular, the difficulties that are involved with the collecting of data, especially in terms of reaching respondents who are ready to contribute information and who have high levels of knowledge, are the reason for this (Forza, 2002). According to the claims that have been made, the use of probabilistic sampling is considered to be suitable within the context of operations management. It was decided that the sample size should be selected in such a way that it would be feasible to get a minimum of one hundred respondents (Hair et al., 2010) or at least five times as many observations (Hatcher, 1994) as there are variables that need to be investigated. This was the conclusion that was reached.

3.8 The Construction of Items for the Questionnaire

Interviews were carried out with groups comprising of those working in the fields of "Industrial Engineering" and "Management." These groups included three industry practitioners and four academics. A combination of conducting interviews with a particular emphasis on groups and drawing on insights from the existing body of research were used in the construction of the questionnaires. While they were in the process of recycling electronic waste, the specialists who work in industrial resources brought to everyone's attention the challenges that they are now encountering. For the purpose of better aligning the questionnaire with the particular aims of the study project, the academics offered their expert recommendations to make the required revisions. After conducting a thorough analysis of the feedback provided by both the academics and the industry resource workers, the questionnaires underwent the final stages of refinement. It was finally decided to put these modifications into effect.

3.9 Pilot Testing

It is the same as the purpose of a prototype, which is to carry out preliminary testing on a scale that is more limited, and the pilot study is designed to do the same thing. For the purpose of conducting the pre-testing of the questionnaires, the final questionnaire was sent to three different groups of individuals, as stated by Hair et al. (2015). A number of people, including business executives, coworkers, and members of the demographic that was being targeted, were among those who received this communication. Business professionals were charged with the responsibility of ensuring that the investigation did not include any queries that seemed to be directly linked to the subject matter. This was done since it is possible that this may possibly reveal the investigator's evident lack of competence on a certain issue. Due to the fact that the colleague was in charge of assessing whether or not the questionnaires were capable of achieving the objectives of the study, it was their responsibility to make that conclusion. It was entrusted to the population that was being targeted with the obligation of giving inputs on anything that may potentially have an influence on the responses of the respondents who were the primary focus of the survey. In the questionnaires that were sent to a considerable number of individuals, each and every question that could possibly be asked was included in the questionnaires. Among these people were six colleagues, four academics, two consultants, and four practitioners who were considered to be experts and members of the target audience. Following the conclusion of the event, the full replies were collected from these specific individuals.

With the aid of the activity, the participants were able to cut down on the number of questionnaire questions that had meanings that were similar to with those of other questions. Within the context of the evaluation of "overall awareness" about the management of electronic waste or electronic waste management, a Likert-type scale with five points was used as the instrument of choice. There was a range of values on the scale, from 1 (no concept) to 5 (very updated knowledge/awareness), with 1 indicating that there was no concept and 5 indicating that there was extremely accurate knowledge/awareness. When it comes to boosting the rate of response as well as the quality of the answer, the use of a Likert-type scale with five points delivers a large amount of influence compared to other methods. Additionally, it is advantageous in that it lessens the level of discomfort that the folks who are reacting to the scenario are experiencing, as stated by Collier and Bienstock (2006). The statement is represented as the test item on the Likert scale, and it is expected of the respondents that they would demonstrate the amount of knowledge that they possess on the statement. It is possible that this degree of knowledge might range from having no notion to having a very high level of upgrading their information quite often.
In order to accomplish the objective of correctly measuring each and every component, a wide range of different indicator items were developed. Therefore, the questions on the scale that are used to assess the degree of awareness and cooperation between recyclers and state boards are selected from the existing body of research, analysed with the experts, and then modified via the use of exploratory interviews. This is done as a result of the fact that the scale is used to evaluate the level of awareness.

3.10 The Administration of Surveys

A questionnaire and structured interviews are used to collect the information from people, organisations, and recyclers situated in the northern region of India. The information is gathered via the use of a questionnaire. For the purpose of obtaining responses from persons who had the highest level of management, the questionnaires were sent to top and middle-level managers who were employed in organisations and recycling units for electronic trash. By selecting the respondents in such a way that makes them representative of a variety of levels within the hierarchy as well as functional areas of management, the intention was to enhance the reliability of the data. It has been stated by Boyer and Pagell (2000) that the execution of this strategy is in accordance with their suggestion. It was during the months of November and December of 2017 that the preliminary testing of the questions was carried out, and the survey was carried out during the months of April and September of 2018. In order to evaluate the questions, their preliminary testing methods were carried out.

An individual meeting or visit was conducted with persons, organisations, and recycling facilities in northern India that deal with electronic trash in order to acquire the necessary information. This was done in order to collect the information that was needed. Personal inspections were carried out at a number of different places, such as universities and schools, amongst others, that include substantial quantities of electronic devices. These devices include computers, laptops, refrigerators, air conditioners, and other components that are equivalent. Additionally, it was something that was done to visit recycling facilities across the area. The organisations made it possible for people to have direct contact with the head of the department or their representative from a range of institutions and management of e-waste recycling facilities in order to record their replies to the questionnaires. This was conducted in order to ensure that the responses were accurately recorded. It was chosen to have a one-on-one interaction with individual end users in order to collect information from them regarding the harmful effect that electronic waste has on the health of persons as well as the environment. This was done in order to get such information.

3.11 RESPONDENTS' DEMOGRAPHIC PROFILE TO BE DISCUSSED

One may get a visual depiction of the demographic profile of the persons who took part in the survey by looking at Figure 3.2. Among those who participated in the survey, 78% were male, while just 22% were female. 78% of the total respondents were male, while the remaining respondents were female. The responses received from persons who were between the ages of twenty-two and thirty-nine made up seventy-seven percent of the total responses. Those who were between the ages of 30 and 39 years old made up 37% of the total number of respondents, while those who were between the ages of 40 and 49 years old and those who were beyond the age of 50 made up 21% and 15% of the total, respectively. In terms of the overall number of respondents, those who were between these ages made up 37% of the percentage. A total of forty-three percent of the respondents had finished their undergraduate degrees, while twenty-two-six percent of the respondents had completed their graduate degrees. Thirty-one percent of the respondents had achieved a professional level of study. Twenty-four percent of the total replies were from the state of Haryana, while nineteen percent came from the state of Punjab, twenty-four percent came from the state of Uttar Pradesh, seventeen percent came from the state of Himachal Pradesh, and sixteen percent came from Chandigarh. There were only fifteen percent of the total respondents who had a net income that was less than one lakh rupees per year. On the other hand, the majority of respondents (39%) belonged to the income group that ranged from one lakh to five lakh rupees per year. Twenty-six percent of the total respondents had an annual income that was between five lakh and ten lakh rupees, and twenty percent of the respondents were in the income group that had an annual income that was more than ten lakh rupees. In addition, twenty-six percent of the respondents had a total income that was between five lakh and ten lakh rupees. It is clear that the respondents were distributed throughout the various categories in a manner that was relatively equitable with regard to each of the demographic parameters. This is obvious when this is taken into account.

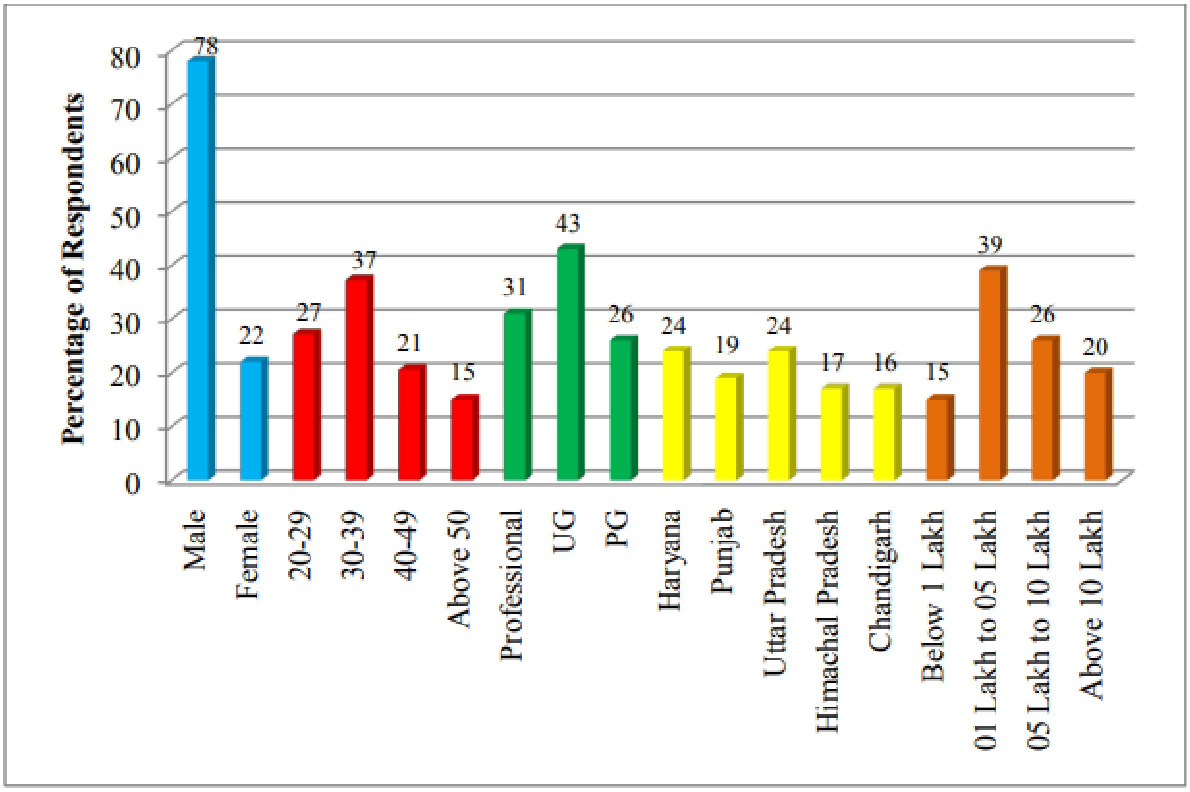


Figure 3.2: Demographic Profile of Respondents

3.12 DATA HANDLING AND METHOLOGY FOR ANALYSIS

For the purpose of carrying out an analysis, the questionnaires that had been filled out were gathered for the purpose of achieving the goals that were set for the study. Utilising Microsoft Office Excel 2007 was the method that was used in order to successfully complete the process of data entering. Following completion of the data entry procedure, the whole data set was subjected to a manual comparison with the replies that were provided in the questionnaires. The reason for this was to ensure that the information that was included inside it was accurate, therefore this was done.

It was necessary to make use of both the Analysis of Moment Structures (AMOS) version 20 and the SPSS version 20 in order to correctly carry out the analysis of the data. Immediately after the end of the data input procedure, the information was subsequently imported into SPSS and AMOS for the purpose of conducting analysis. The objectives of the data analysis were to arrive at conclusions that were relevant and to establish the links that exist between the variables that were dependent and those that were independent. These objectives were accomplished via the utilisation of the data that was obtained.

3.13 An Examination of Confirmatory Factors

Through the use of a method known as confirmatory factor analysis (CFA), it is feasible to determine whether or not the factor structure is consistent. Canonical factor analysis, often known as CFA, is a theory-centered approach that is used in the field of research. Its primary objective is to ascertain whether or not the factor structure is in accordance with what is expected on the basis of the theoretical foundations of the subject of study. As a result, confirmatory factor analysis necessitates the incorporation of particulars about the structure of the factors inside the framework of the investigation, and it often incorporates an assumption regarding the manifest variables that would load on which factors (Chu and Murrmann, 2006). This is due to the fact that the structure of the components is an important component of the investigation.

To verify that an adequate number of pertinent questions have been asked in order to provide an accurate measurement of each dimension or construct, CFA makes certain that this task has been completed. Utilising the data gathering technique is the means by which this objective is attained. Additionally, the usage of convolutional factor analysis (CFA) is a technique that may be employed to evaluate the significance of factor loading. According to MacCallum R.C. et al. (1999, 2001), it is vital to take into mind the likelihood that components with a loading rate of less than 0.7 will not be taken into consideration for future research. This is something that should be taken into seriously. Another area that can be further investigated with the assistance of CFA is the acceptability of the data. This investigation can be carried out in order to further investigate the acceptability of the measurement model in terms of the statistical fitness of the data.

In order to comply with the CFA approach, it is necessary to give priority to the definition of the CFA-Model, which takes into account both the latent constructs and the manifest variables. In the current inquiry, structural equation modelling (SEM) was used, and AMOS v20 software was utilised to facilitate its execution. In order to make the analysis of the data easier to understand, CFA was carried out.

3.14 Validity of Construct

The method of construct validation is comprised of an assortment of components, the most important of which are face validity, content validity, and construct validity.

1. Validity of the Face

Taking a look at the metric and determining whether or not each measure seems to be an accurate picture of the construct on its face is one method that may be used to ascertain whether or not the face is genuine. In 2015, Trochim et al. published their findings.

2. Validity of the Content

A questionnaire's content validity may be verified by the use of subjective analysis, which is a method that is utilised. There is a possibility that the content validity of the questionnaire may be established if both the experts and the respondents are in agreement that the questionnaire adequately covers all of the areas that are the subject of the study. For the purpose of achieving the objective of acquiring content validity, it is of the utmost importance that the analytical metrics be seen as being connected to the concept in a manner that is both scientific and practical. In the year 1994, Nunnally and Bernstein were the ones that developed the publishing. Regarding the goal of this study, the validity of the material was examined by making use of the insights that were generated from the existing body of research, in addition to establishing contact with academics and practitioners.

3. Validity of Construct

Findings from the study by Hair et al. (2015) indicate that it is a phrase that characterises how well an observation aligns with the notion it is meant to study. In addition, studies done by Dangi and Dewan show that it may be discriminantly and convergently valid. 2016 was the year.

3.14.1 The Validity of Convergent

Since convergent validity indicates that all of the statements chosen to represent each construct have significant relationships to those constructions, it implies that this is true. According to the data, this is indeed the case. As is evident from this, everything has been finished. The fact that the different assertions are strongly related to the linked constructs provides more evidence of convergent validity. Not only that, but this is also accurate, and it goes hand in hand with the strong connections between the ideas. The construct's convergent validity is evaluated using many ways. For each construct on the scale, we have the Average Variance Extracted (AVE) statistics, the Composite Reliability (CR) data, and the construct loadings of all statements inside the construct. This utilise all of these methods to check whether the construct is convergently valid. For any assertion to be considered valid, the standardised slope coefficient should be greater than 0.7. This will ensure that the criteria for convergent validity are met. When checking if the requirements are satisfied, this happens. The present predicament is a result of the necessity of convergent validity. In order to fully grasp the many characteristics linked to all the constructs pertaining to electronic waste management, it is essential that each variable's CR estimate exceeds 0.7. Such a condition has to be satisfied. Furthermore, for all extracted components to be deemed genuine, the average variance extracted (AVE) statistics had to exceed 0.5.

3.14.2 Value of Discriminant Analysis

The existence of discriminant validity conveys the message that the many concepts, each of which expresses a unique quality, do not have a meaningful link with one another in terms of the information that they contain. In a different way of stating it, it ensures that the things that measure one construct are not dependent on the things that measure other constructions at any point in time. Discriminant validity makes it abundantly clear that the replies that were obtained in response to the various statements that detailed the various components of the constructs are not comparable to one another. Given that the answers were really received, this is clearly the case. This is the case since there were several statements. The correlation between the several sets of components used to construct the scale is used to assess its discriminant validity. This correlation is used to determine whether or not the scale is discriminatory. In addition to the fact that the occurrence of this is something that is expected, it is also anticipated that the relationship between the constructions would not be particularly strong. The procedure of determining the greatest correlation between each construct and all other constructs is carried out during the CFA analysis. This means that the process is carried out. It is very evident that the computation in issue is known as the Maximum Shared Variance (MSV), which is also the name of the calculation itself. In each and every construction, it is anticipated that the average value will be higher than the mean squared value of the build. This is the case regardless of the actual construction.

3.15 Utilizing structural equation modeling (SEM), the development of a conceptual framework for the study was carried out.

After successfully completing the process of collecting the verified factor structure, a number of potential models that are based on Structural Equation Modelling (SEM) were hypothesised. These models were based on the method of structural equation modelling. In accordance with what was predicted, these theoretical models are going to be used in order to investigate the causal relationship that exists between the several components.

When applied to the collection of latent components that the researchers have discovered, structural equation modelling may be thought of as an expanded application of regression analysis (Jenatabadi, 2015; Suhr, 2006). This is a plausible way of thinking about the modelling technique. That is something that might be taken into consideration. An introduction to structural equation modelling (SEM) was presented by De Carvalho and Chima (2014) in the form of a presentation. The goal of this presentation was to look at some of the linkages between external and endogenous contributing components in order to analyse the cause-and-effect interactions. With the use of statistical fitness indices, it may find out how well the model represents the data. Among these indexes are CMIN/df, GFI, AGFI, and CFI, to name a few. This used a structural equation model to look at the connection between four independent variables—familiarity with basic terminology, practices, benefits, and barriers—and one dependent construct—consumers' and recyclers' awareness of the dangers posed by electronic waste to humans and the environment. This model set out to do just that—examine the interplay between the independent factors and the dependent construct. The original goal of creating the model was to look at the relationship between these two types of ideas. Furthermore, structural equation modelling (SEM) models were constructed to study the relationships between the causes and effects of the variables by creating a connection between the dependent and independent variables.

Specificating the model that is going to be estimated is the first step in the process of applying structural equation modelling (SEM), which is an acronym for structural equation modelling.

It is one of the most significant processes in the process of defining the model to define the structural and measurement components that comprise the model. This is one of the steps that is included in the process. In the structural section, the specification of hypothesised relationships among latent variables is an essential component that requires careful attention. Consequently, this provides a theoretical framework that is going to be investigated, and it also makes it possible to evaluate the framework.

The Size of the Sample for the Research: Calculating the Size of the Sample Without respect to the structural equation model that is being taken into account, the sample size is the most significant component that must be taken into mind. In order to conduct a survey with a big number of respondents, it is not practical to call each individual and record their comments. This is because it would be impossible to finish the survey. In a similar manner, judgements are made on the size of the sample, which is intended to be representative of the whole population. This action is carried out for the same reason. It has been recommended by Hair et al. (2010) that the sample size for structural equation modelling (SEM) should be somewhere in the region of one hundred to two hundred subjects. This is a requirement that must be kept in mind. As an example, if the questionnaire has twenty-two items, then the sample size must consist of at least one hundred individuals or be more than one hundred. A total of 305 persons, 110 organisations, and 35 recyclers were surveyed in order to gather information for the purpose of achieving the goals of the research. However, due to the fact that it was not feasible to get all of the information, some instances of the facts were not taken into consideration. A total of 287 questionnaires were completed and collected from individual consumers, 104 questionnaires were received from organisational consumers, and 33 questionnaires were collected from recyclers. All of these questions were collected from consumers. Each and every one of these questions was taken into consideration while doing the final study. Due to the fact that the sample size of recyclers did not match the basic restrictions, it was not able to conduct the assessment of the cause-and-effect analysis using structural equation modelling (SEM). In accordance with these rules, the number of individuals who responded must not be equal to or more than five times the total number of questions from which responses were obtained. Instead of going with the second alternative, the decision was made to go forward with regression analysis.

3.16 PSYCHOLOGICAL THEORY

For the aim of gaining an understanding of human thoughts, emotions, and actions, the field of psychology makes use of theories as a method of establishing a framework for the purpose of such an understanding. There are a great number of distinct theories that have been proposed with the purpose of comprehending and predicting various elements of human conduct. It is with the intention of that these thoughts have been put forth.

3.16.1 Theory of Reasoned Actions

Intentions are influenced by one's attitude as well as the standards that one has for themselves, therefore there is a connection between conduct and intentions. It might be said that there is a connection between actions and intentions.

An individual's attitude may be defined as the anticipated value of the multiple outcomes that might result from an activity, as well as the likelihood of receiving each consequence. This is a way of describing the attitude of a person. These are the kinds of definitions that are applicable to every single person. According to the same lines of reasoning, the subjective norm is made up of the individuals' anticipated value of probability to the action that is provided by a variety of people that they respect, as well as their desire to follow them.

3.16.2 Theory of Planned Behaviour

In spite of the fact that the theory of reasoned acts presupposes the existence of volitional control, it is not feasible for this control to be present in each and every circumstance. The behaviour that is anticipated by the Theory of Reasoned Actions could not be seen in a great number of different scenarios as a result of this being the case. The expansion of the Theory of Reasoned Actions to include the Theory of Planned Behaviour was a direct result of the development of this particular case.

Under these conditions, attitude is calculated by multiplying the attitude towards success by the likelihood of success, and the attitude towards failure by the probability of failure. This is done in order to determine the attitude. The likelihood of failure is a factor that multiplies both of these important considerations. It is possible to say the same thing about behavioural expectation, just as it is the case with behavioural expectation, which is the result of the combination of purpose and likelihood to govern specific activities. The perceived likelihood of control and the actual probability of control are two unique things that are separated from one another. These two things are separated from one another from one another.

There are a number of factors that play a role in determining whether or not the actions that are projected will coincide with the actions that actually take place. These factors include skill, willpower, confidence level, the amount of time that elapses between the measurement of intention and the time when actual behaviour occurs, and the presence of conditions that are either favourable or unfavourable.

3.16.3 Akzen's Theory of Planned Behaviour

Information, which serves as the base, is the ground upon which attitudes and subjective standards are established. Consequently, the first thing that needs to be done in order to achieve the conduct that is desired is to acquire knowledge and awareness. This is the appropriate course of action. This is because the issue of electronic trash is becoming worse on a daily basis, which is the exact reason why this is happening. The bulk of the time, the conduct that is intended is being disposed of in a formal way. This is the behaviour that is desired. There is a dearth of understanding on the many components that make up electronic trash, which might lead to a significant problem in developing countries like India. This could be the cause of the problem. According to Akzen's theory of planned conduct, the first stages towards achieving the behaviour that is ultimately desired are the acquisition of knowledge and awareness. This is the first action that must be taken in order to achieve the conduct that will ultimately be considered desirable. Due to the fact that this is the case, the present study endeavour has made an effort to determine the amount of information that people possess regarding the several facets of the management of electronic trash. The data indicated that the level of awareness was quite low. This was the conclusion reached. As a consequence of this, it is absolutely necessary for the government to take action in order to promote a rise in the level of knowledge among the general population. Attitudes, subjective norms, intents, and actions are going to be evaluated in the future, according to the researchers. These evaluations are going to be carried out. It is projected that there will be an increase in the degree of awareness in the future, which will make this a possibility. This is something that will be possible. It is probable that study will be carried out in the not too distant future in order to answer the theory, which indicates that if the degree of awareness is low, then the attitude and subjective needs for good disposal should also be negative.

The outline of steps followed for SEM analysis is shown in Figure 3.3.

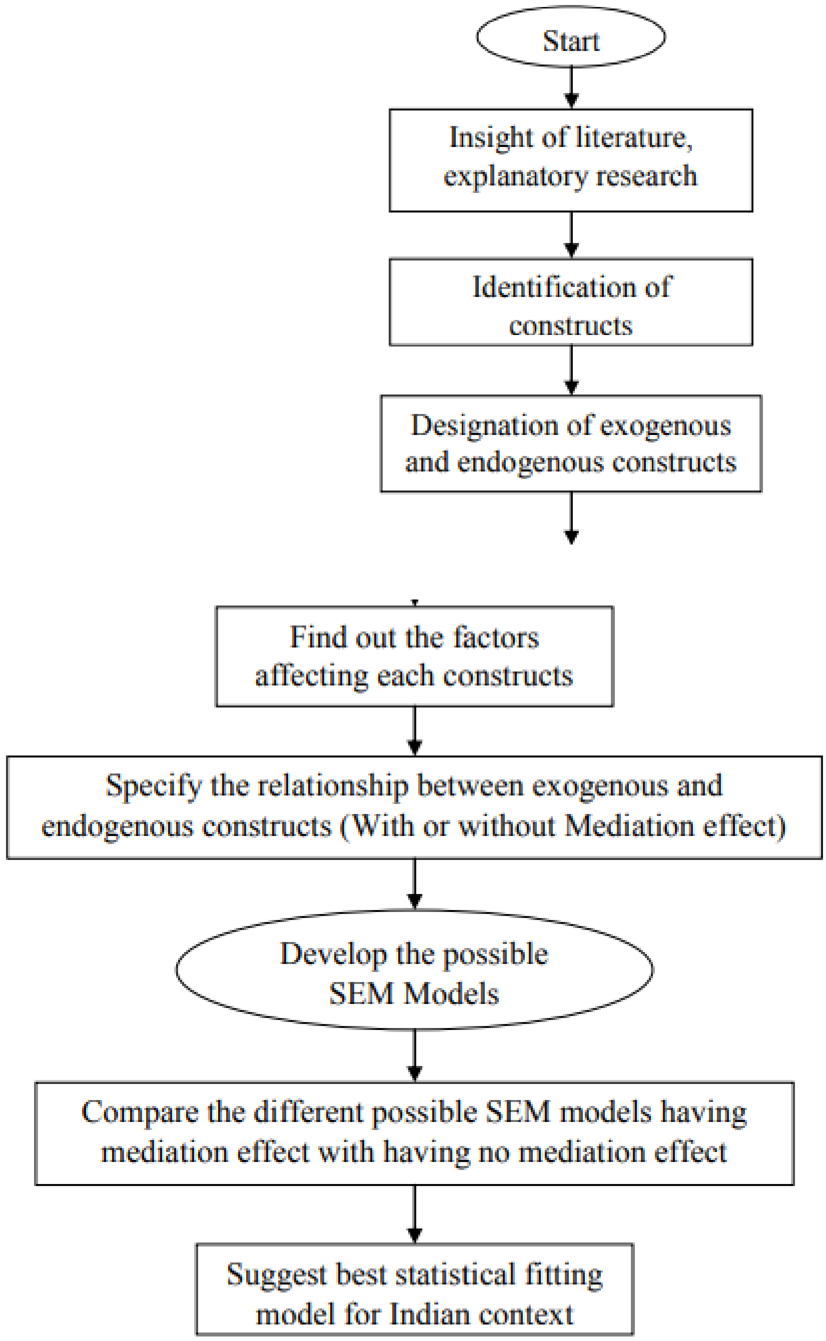


Figure 3.3: Outline of Steps followed for Structural Equation Modeling

3.17 AN OUTLINE OF THE METHODOLOGY FOR RESEARCH

1. this survey to find out how well people and companies understand the basics of electronic waste management, including the terms used, the procedures involved, the benefits and drawbacks, and the general state of knowledge when it comes to recycling electronic waste. Please raise your feet. Some perspectives that shed light on the problem that have been gathered from the research and the prior literature Recognition of constructed items is the process of acknowledging them. It is of the utmost importance to have a solid understanding of the differences between exogenous and endogenous concepts. An additional step is to determine which of the constructs are being influenced by the variables that are being considered. Explain the nature of the connection that exists between exogenous and endogenous variables (with or without the effects of mediation), and provide an explanation of how this connection works. Taking into mind the possible SEM models is something that has to be done. In this investigation, a comparison is made between the several structural equation modelling (SEM) models that are capable of having a mediation impact and those that do not own their very own mediation effect.

2. Personal visits were undertaken in order to establish contact with recycling companies and end users in order to gather replies from recyclers and end users (both individuals and organisations). This was done in order to collect as many responses as possible. In addition to that, the questionnaire that was produced was included into the visits that were carried out.

3. In order to assess the function of government-approved collection centres and recyclers, as well as state pollution control boards, an additional questionnaire was produced. The purpose of this evaluation was to determine the degree of cooperation and efficiency with which state pollution control boards and collection centres operate. The purpose of this was to determine the amount of garbage that is collected and recycled, and it was then calculated.

4. Personal visits were conducted in order to engage and have a conversation with the registered recyclers as well as the officials of the state pollution control boards in order to gather their

input. This was done in order to collect information. For the purpose of gathering information, this was carried out.

5. An investigation was conducted using Structural Equation Modelling (SEM) to ascertain the cause and effect analysis in personal and organisational cases. Considering the SPSS Amos 20.0 programme was essential for completing the test assignments. In order to examine the link between the factors that were included in the research and their causes and effects, the variables pertinent to recyclers were subjected to multivariate regression analysis. Ultimately, this analysis took three separate criteria into account. The extent to which SPCB and formal recyclers work together and how efficient they are was determined using a one-way analysis of variance.

6. In the sixth step of the process, an economic analysis was carried out by making use of the information that was obtained from the individual customers on the storage of abandoned electronic equipment at the present. Additionally, the pay-back duration was calculated with the assistance of the financial benefit that was acquired from the official recycling of electronic trash. This was done in order to identify the pay-back period. For the purpose of determining the pay-back period, this was carried out.

7 either a one-way roadway or a walkway To determine the degree of cooperation and efficiency that exists between the state boards and the approved recyclers, a statistical research known as an analysis of variance (ANOVA) was carried out. The goal of this study was to determine the amount of collaboration that exists between the two groups.

8. In order to make a comparison between the policies of the Indian government and the policies of other nations, the necessary attributes were selected and used in the process of comparison.

9. A waste awareness index for electronic trash was developed by using the answers that were obtained from people, organisations, and recyclers located in the various states. For the purpose

of computing the awareness indices of the different states in north India, the same results were used. It was decided to send out questionnaires to individuals from each of the several states. To determine whether or not there is a substantial variation in the levels of awareness that are shown by the targeted population in the states that have been picked, an extra one-way analysis of variance is used. This is done with the intention of determining whether or not there is a significant variation.

10. A strategy framework has been suggested as a potential solution to the problem of electronic waste management in India. This resolution has been advised in order to effectively solve the issue. The information that was obtained from a literature research, the responses to a questionnaire from individuals, organisations, recyclers, and the SPCB, as well as the similarities and differences that exist between the policies of the Indian government and those of other countries, are the foundations upon which this framework is created.

CHAPTER-4: DATA ANALYSIS

4.1 Evaluating the efficacy of waste management strategies via the lens of people through the use of CFA

This research investigates people's knowledge, perception, and comprehension of electronic trash to reach its goal. The government needs this measurement to properly conduct electronic garbage awareness programmes and make educated management choices. This measurement is essential for the government. A comprehensive literature research, interactions with industry experts, reading journals and newspapers, and talking to electronic waste management specialists may help one understand awareness and management. These methods accomplish this goal. Four dimensions of electronic garbage awareness have emerged from these sources. This comprehension encompasses an awareness of fundamental terminology, techniques for the management of electronic waste, the possible advantages connected with efficient management, and the difficulties associated with the implementation of formal plans. A questionnaire has several questions for each trait. certain questions employ a questionnaire to test an individual's awareness of certain traits. Many people participated in the sample survey, and their replies are recorded for each questionnaire statement. Large numbers participated in the sample survey. To assess the degree of understanding in north Indian states and the differences across states, ask enough relevant questions for each dimension or idea. To obtain a conclusion, northern Indians' knowledge must be assessed. Prior to any conclusion, this step is vital. This is achieved using confirmatory factor analysis (CFA). Component factor analysis (CFA) tests measurement theory by assessing how well variables represent constructs. Measurement theory validity is assessed using CFA. Hair et al. (2010) define measurement theory as a collection of connections that show how variables reflect an unmeasured notion. Interconnections make up measurement theory. Measurement theory is a systematic description of previous events.

A new unidimensionality control approach better aligns with concept validation. This is possible using computational factor analysis (CFA). Factor loading importance may be determined via statistical testing.

Shah and Goldstein (2006) suggest using Confirmatory Factor Analysis (CFA) to evaluate a measurement model's data fit. CFA's capacity to assess model acceptance is a benefit. Inferential statistics in Confirmatory Factor Analysis (CFA) may test hypotheses about measurement unidimensionality (Shah and Goldstein, 2006).

The CFA analyses correlation and covariance matrices of many measurement items and constructs to assess the measuring scale's reliability and accuracy. This test determines the measuring scale's reliability and precision. Convergent and discriminant concept validity results are shown below. Four electronic waste management features were hypothesised based on questionnaire responses. Only reflecting first-order components make up the measurement model.

Figure 4.1 shows five structures on a measuring scale. Understanding key terminology, e-waste management methods, potential advantages, and implementation challenges are the four components previously mentioned. This section examines the specified constructs. Fifth component measures general awareness. The structural equation modelling (SEM) analysis found that the fifth component is endogenous while the other four are exogenous. Constructions are large ellipses in the CFA diagram, while measurement statements are rectangles. Both representations demonstrate ideas. Measurement items are linked to components or builds. Unidirectional arrows link rectangles to factors. Since the constructs mimic natural occurrences, the arrows show the claims' direction. Additionally, bidirectional arrows help connect structures. The figure's arrows show component connections. According to Hair et al. (2010), the circular nodes linked by unidirectional arrows indicate measurement errors (e1, e2,..., e21) for calculating variable values. AMOS v20 was used for Confirmatory Factor Analysis (CFA) in this study.

4.2 The Authenticity of Constructs

What it mean when talk about an assessment's "construct validity" is how well it measures the mental concept or abstract idea that it claims to be measuring. Also, it might be a way to gauge how well a test delves into the topic it's evaluating. The concept validation takes into account both the idea's validity and its social validity.

4.2.1 Validity of the Face

To assess whether a measure externally reflects a construct, it must be extensively examined and evaluated (Trochim et al., 2015). Since the questions were crucial for each notion, commercial and academic professionals determined their face validity.

4.2.2 Validity of the Construct

Construct validity is the study's measuring scale's accuracy in assessing the intended notion. What is its specific definition? The results were verified using convergent and discriminant validity tests. The link between a concept and its assessment measures is called convergent validity. "Convergent validity" is the topic.

Several techniques evaluate the scale's convergent validity. Composite reliability (CR) statistics, factor loading numerous statements with a construct, and AVE data for each scale construct are some of these ways. Statisticians have identified each metric's key values. A statement has convergent validity if its standardised slope coefficient is 0.7 or higher (Hair et al., 2010). Convergent validity is about reaching. Gupta and Singh (2015), Tarofder et al. (2010), and Hair et al. (2010) state that no construction may have a Composite Reliability (CR) estimate below 0.7. It must be included. Gupta and Singh (2015) and Hair et al. (2010) recommend AVE statistics of higher than 0.5 for each component.

Convergent validity means the selected statements properly represent the factor and explain a large proportion of each component's variability in the assessment statements. Convergent validity occurs when all claims accurately depict the factor. Contrarily, discriminant validity shows that the scale's components utilised to describe distinct elements of people' e-waste management knowledge do not correlate. This suggests that each element assesses e-waste awareness differently. This is because the scale has numerous components that measure people's awareness. Correlation between scale components is used to assess discriminant validity. Given this premise, the link between the constructs is unlikely to be essential. The maximum shared variance (MSV) is calculated in conjoint factor analysis (CFA) to find the strongest association between each component and all others. Both Dangi and Dewan (2016) and Hair et al. (2010) state that for each component, AVE estimations should be higher than MSV estimates. This is true for any standalone structure. Studies conducted by Hair et al.

(2010) and O'Rourke and Hatcher (2013) have shown that constructs should have a small positive correlation below 0.7. The findings of both studies formed the basis for this suggestion. Furthermore, the anticipated correlation should be greater than the square root estimates of the average variance extracted (AVE). A measurement model to evaluate these validations was developed using AMOS. Figure 4.1, which depicts the model, follows this text. For every set of research components, CFA diagrams show the corresponding construct loadings and correlation coefficients. Furthermore, construction loads are provided.

Except for the fourth item, "knowledge of barriers," which has a factor loading of 0.15, all build items have factor loadings above 0.7. The previously presented construct-factor analysis diagram shows this information. Information came from the construct-factor analysis diagram. Given the existing situation, it is reasonable to assume that this issue does not correlate with other concerns about electronic waste management challenges. Thus, the fourth item, "To what extent does end users' negative attitude towards e-waste management hinder the adoption of formal e-waste management practises?" was removed. Many factor loadings and correlation values were generated using AMOS after this item was removed. Figure 4.2 illustrates these computations' conclusions.

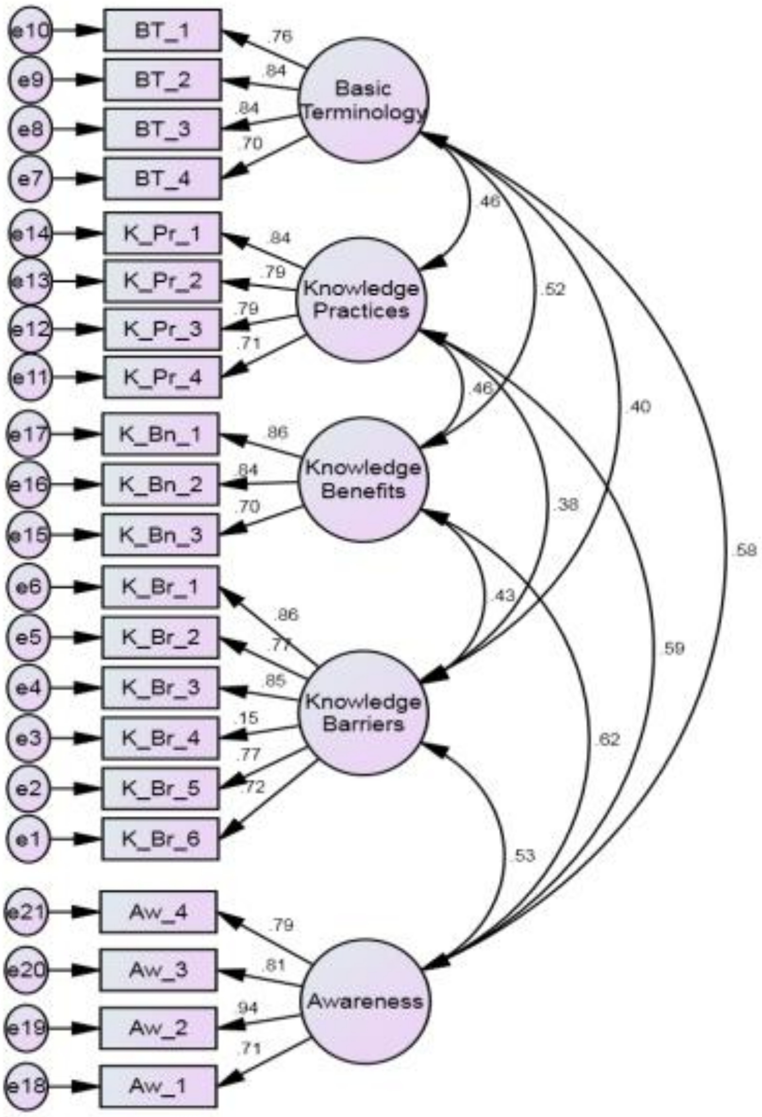


Figure 4.1: Initial CFA Model for Individuals

Except for the fourth item, "knowledge of barriers," which has a factor loading of 0.15, all of the items evaluated by the construct have factor loadings greater than 0.7. Refer to the CFA chart up there. Only the construct's fourth quantitatively scored item is exempt. Individual comments show that this topic is unrelated to other electronic waste management concerns. The fourth item, which examined how end users' unfavourable attitudes towards e-waste management limit the adoption of formal processes, was removed. The next question was coming. AMOS-recalculated factor loadings and correlation values are displayed in Figure 4.2. After their removal, this was done.

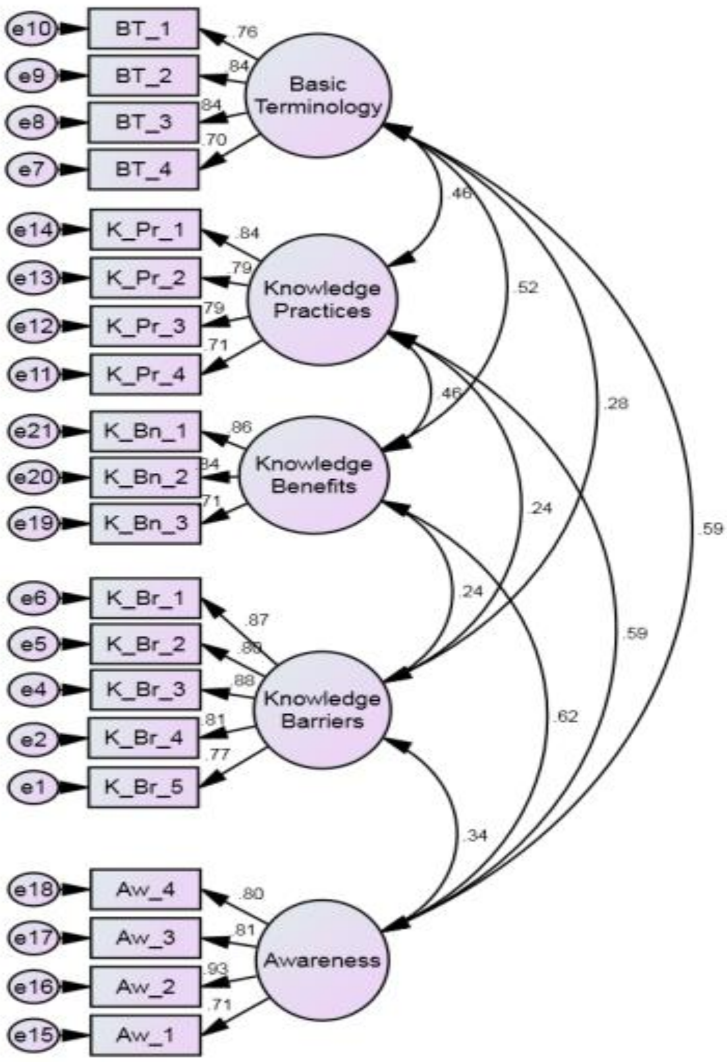


Figure 4.2: Final CFA Model for Individuals

The graphic above shows that all factor loadings surpass 0.7. Table 4.1 shows the statistical importance of all components and their link with each element of electronic waste management in the right order.

Table 4.1: Regression Weights Statistics of final CFA model for Individuals

			Standardized construct loadings	Un-Standardized Regression Weight	Standard Error	Critical Ratio	P Value
K_Br_5	<---	Knowledge of Barriers	0.770	1.00			
K_Br_4	<---		0.811	1.294	0.089	14.574	***
K_Br_3	<---		0.878	1.411	0.088	16.034	***
K_Br_2	<---		0.799	1.239	0.087	14.309	***
K_Br_1	<---		0.874	1.318	0.083	15.94	***
BT_4	<---	Basic Terminology	0.701	1.00			
BT_3	<---		0.842	1.164	0.091	12.75	***
BT_2	<---		0.837	1.164	0.092	12.7	***
BT_1	<---		0.761	1.009	0.086	11.7	***
K_Pr_4	<---	Knowledge of Practices	0.708	1.00			
K_Pr_3	<---		0.79	1.171	0.096	12.157	***
K_Pr_2	<---		0.791	1.215	0.1	12.163	***
K_Pr_1	<---		0.838	1.223	0.096	12.745	***
Aw_1	<---	Awareness	0.711	1.00			
Aw_2	<---		0.934	1.602	0.108	14.798	***
Aw_3	<---		0.808	1.267	0.097	13.11	***
Aw_4	<---		0.795	1.245	0.096	12.901	***
K_Bn_3	<---	Knowledge of Benefits	0.706	1.00			
K_Bn_2	<---		0.837	1.051	0.084	12.478	***
K_Bn_1	<---		0.855	1.021	0.081	12.599	***

4.2.3 The Validity of Convergent

The standardised construct loadings, un-standardized slope coefficients, critical ratio, regression coefficient probability of occurrence, critical weight standard error, and standardised slope coefficient are all shown in Table 4.2. It performed these calculations on a population where there was no correlation between any of the assessed items and the construct. Here are the tabulated results. The results are laid out in tables. The results show that there is a strong correlation between the constructs and the items under study, since the p-values are almost zero. All of the study's claims about e-waste management were accurate, as shown by the statistically significant positive connection in the standardised slope coefficients. Research shows this to be true.

Note that each statement's critical ratios surpass 1.96 and p-values are considerably below 0.05. Thus, random sample variation is unlikely to provide these factor loading levels. All four electronic waste management designs were shown to be valid in this investigation. Two ways may assess a structure's ability to explain measurement item variability: Composite Reliability (CR) and Average Variance Extracted (AVE) statistical indicators evaluate measurement scale reliability and validity. Both methods may be employed. These data show how much relationship between measurement items may explain variability. CR and AVE are estimated for each e-waste management structure analysed. The table below shows convergent validity indicators:

Table 4.2: Convergent Validity Statistics

	Composite Reliability (CR)	Average Variance Extracted (AVE)
Awareness	0.888	0.666
Knowledge of Barriers	0.915	0.685
Basic Terminology	0.867	0.620
Knowledge of Practices	0.863	0.613
Knowledge of Benefits	0.843	0.643

Using individual user responses, the CR estimate for all e-waste management structures is over 0.7. All constructions have AVE estimates over 0.5. Both estimates surpassed 0.5. Given this, the study suggests that all measurement problems are related to the relevant components.

4.2.4 Discriminant Validity

Establishing discriminant validity ensures that variables and dimensions are sufficiently distinct. Finding wholly different components is difficult, but not impossible. To assess electronic waste management expertise, this study calculates correlations between constructs and components. To prove discriminant validity. This data measures electronic waste management awareness. Table 4.3 shows the estimated correlations between electronic waste management components. The website provides further information on this subject.

Table 4.3: Correlations Estimates between the Constructs

			Estimate
Knowledge of Barriers	<-->	Basic Terminology	0.279
Knowledge of Barriers	<-->	Knowledge of Practices	0.245
Knowledge of Barriers	<-->	Awareness	0.344
Knowledge of Barriers	<-->	Knowledge of Benefits	0.237
Basic Terminology	<-->	Knowledge of Practices	0.457
Basic Terminology	<-->	Awareness	0.586
Basic Terminology	<-->	Knowledge of Benefits	0.516
Knowledge of Practices	<-->	Awareness	0.59
Knowledge of Practices	<-->	Knowledge of Benefits	0.46
Awareness	<-->	Knowledge of Benefits	0.618

There is only a weak relationship between various e-waste management components, as shown in Table 4.3. Knowledge of the advantages of waste management, awareness of the challenges to implementation, basic terminology, familiarity with e-waste management procedures, etc., are all part of this category. Discriminate validity requires a low correlation coefficient between electronic waste management elements. This shows discriminate validity. This study found positive Pearson correlation coefficients below 0.7 between constructs. The research revealed this. This suggests a strong link between electronic waste management methods. Discriminant validity cannot be determined by a substantial correlation between scale components. This assertion needs further proof. To achieve this aim, find the largest amount of variation a dimension has in common with any other dimension of the scale and compare it to its average extracted variance (AVE). The validity indicators are detailed in the table below:

Table 4.4: Discriminant Validity Estimates

	Composite Reliability (CR)	Average Variance Extracted (AVE)	Maximum Shared Variance (MSV)
Awareness	0.888	0.666	0.382
Knowledge of Barriers	0.915	0.685	0.118
Basic Terminology	0.867	0.620	0.343
Knowledge of Practices	0.863	0.613	0.348
Knowledge of Benefits	0.843	0.643	0.382

Discriminant validity is shown by each component's MSV and AVE values above 0.5 in the table above. In addition, the square root of the average variance extracted (AVE) for each dimension is compared to its association with all other electronic waste management parameters. The relationship between dimensions is assessed by this comparison. This verifies discriminant validity further. Table 4.5 shows the results:

Table 4.5: Square Root of AVE and Correlation Estimates

	Awareness	Knowledge of Barriers	Basic Terminology	Knowledge of Practices	Knowledge of Benefits
Awareness	**0.816**				
Knowledge of Barriers	0.344	**0.828**			
Basic Terminology	0.586	0.279	**0.787**		
Knowledge of Practices	0.590	0.245	0.457	**0.783**	
Knowledge of Benefits	0.618	0.237	0.516	0.460	**0.802**

The square root of each element's average weighted value (AVE) in electronic waste management exceeds the correlation coefficient. The facts suggest this. Statistical study confirms the measurement model's discriminant validity. The results suggest this. Table 4.6 lists the major markers of statistical compatibility in confirmatory factor analysis and structural equation modelling.

Table 4.6: Standard Values to Check the Fitness of CFA and SEM Model Statistically

Name	**Acceptable Limit**	**Source**
CMIN/df	Less than 3	(Norzaidi, 2008), (Daire Hooper *et al.*, 2008), (Lopez, 2010)
GFI	More than 0.8	(Greenspoon and Saklofske,1998), (Forza and Filippini, 1998), (Power, 2005), (Yeh, 2005)
AGFI	More than 0.8	(Gallagher, 2008), (Dangi and Dewan, 2016), (Hair, 2010)
CFI	More than 0.9	(Yeh, 2005), (O'Rourke N. And Hatcher L. 2013), (Lopez, 2010)
TLI	More than 0.9	(Hair, 2010), (Singh and Khamba, 2016)
RMSEA	Less than 0.08	(Hair, 2010), (Norzaidi, 2008), (Lopez, 2010)
Critical Ratio	More than 1.96	(O'Rourke N. And Hatcher L. 2013); Lopez, 2010)

Table 4.7 below shows the results of many indices used to assess the model's overall data fit.

Table 4.7: Statistical Fitness of CFA Model for Individuals

Goodness of fit index	CMIN/df	Goodness of Fit Index (GFI)	Augmented Goodness of Fit Index (AGFI)	Comparative Fit Index (CFI)	Tucker-Lewis Coefficient (TLI)	Root Mean Square Error Approximation (RMSEA)
Calculated value	1.933	0.906	0.876	0.957	0.949	0.057
Expected value	Less than 3	More than 0.8	More than 0.8	More than 0.9	More than 0.9	Less than 0.08

Table 4.7 shows a CMIN/df ratio of 1.933, below the limit. The GFI is 0.906, above the 0.8 threshold. However, the AGFI is 0.876, below the 0.8 requirement. Both figures surpass the threshold. The CFI is 0.957, over the predicted 0.9. Interestingly, the CFI surpasses the stated number of 0.8. The TLI value of 0.949 above the 0.9 criterion, but the RMSEA value of 0.057 is below. This contradicts the 0.08 value. Thus, all estimated values are within the permissible range, suggesting that the measurement model's statistical fit is adequate in this circumstance.

4.3 CONCLUDING Observations by the CFA

The chosen statements accurately depict and quantify electronic waste language, practices, challenges, advantages, and awareness. Each statement variability factor explains a lot of electronic waste. Each phrase was chosen to reflect and evaluate electronic waste's numerous aspects. Convergent validity supports this claim. However, the discriminant validity implies that the scale's variables used to describe distinct elements of people' overall knowledge of e-waste management do not correlate. This suggests that each element assesses e-waste awareness differently. The scale measures general awareness by including various factors. Confirmatory Factor research (CFA) showed that the constructs were not significantly related, which is vital for this study. CFA findings proved questionnaire questions' authenticity.

Since confirmatory factor analysis confirmed multiple structures and measurement questions, participants' replies may be utilised to estimate electronic waste awareness. The following tables display construction data. Tables are organised by rated attributes. Additionally, the survey's legitimacy was shown by the results.

Table 4.8: Knowledge about Basic Terminology of Individuals on E-waste Disposal System

Sr. No.	Basic Terminology	No Idea {1}	Little Knowledge {2}	Average Knowledge {3}	High Knowledge {4}	Highly Updated Knowledge {5}	Mean	SD
1	Do you have any idea of the term "e-waste"?	10.1%	40.1%	28.6%	14.3%	7.0%	2.68	1.1
2	Do you have idea about how a common man can contribute towards managing e-waste efficiently?	7.0%	31.0%	27.9%	24.0%	10.1%	2.99	1.11
3	Are you aware of hazardous materials present in e-waste?	7.0%	30.3%	29.3%	23.3%	10.1%	2.99	1.11
4	Do you consider life of the electronic product as an important factor at the time of buying a new product for reducing e-waste generation?	10.1%	39.4%	25.8%	14.3%	10.5%	2.76	1.14
Mean Total							**2.86**	

Table 4.9: Knowledge of Practices of Individuals about E-waste Management

Sr. No.	Knowledge of Practices	No Idea {1}	Little Knowledge {2}	Average Knowledge {3}	High Knowledge {4}	Highly Updated Knowledge {5}	Mean	SD
1	How do you rate official take back system used by some e-products manufacturing companies, as a good e-waste management practice.	22.0%	29.3%	17.8%	17.8%	13.2%	2.71	1.34
2	Do you know that there are better channels available for disposing e-waste rather than selling these to a normal rag picker?	27.2%	28.2%	13.9%	15.7%	15.0%	2.63	1.41
3	In Indian perspective, do you think that easy access to informal collection and recycling channels is a barrier in adopting formal e-waste management practices?	25.1%	22.0%	19.9%	20.9%	12.2%	2.73	1.36
4	Do you think that inadequate financial incentive offered by official take back channels of the companies is a barrier in their adoption in India?	19.9%	28.2%	20.9%	19.2%	11.8%	2.75	1.3
	Mean Total						**2.71**	

Table 4.10: Knowledge of Benefits of E-waste Management

Sr. No.	Knowledge of Benefits	No Idea {1}	Little Knowledge {2}	Average Knowledge {3}	High Knowledge {4}	Highly Updated Knowledge {5}	Mean	SD
1	Do you think proper removal of hazardous materials from e-waste is beneficial in minimizing negative effect on human health and environment?	21.3%	43.6%	15.7%	17.4%	2.1%	2.36	1.1
2	To what extent, do you think, formal e-waste management will reduce public health hazards?	24.7%	42.2%	14.6%	14.3%	4.2%	2.31	1.12
3	Do you think formal recycling is helpful in reducing the final volume of e-waste (Recovery of components/parts)?	34.5%	23.7%	18.8%	17.8%	5.2%	2.36	1.26
	Mean Total						**2.34**	

Table 4.11: Knowledge of Barrier of E-waste Management

Sr. No.	Knowledge of Barrier	No Idea {1}	Little Knowledge {2}	Average Knowledge {3}	High Knowledge {4}	Highly Updated Knowledge {5}	Mean	SD
1	Do you think, limited access to formal recycling facility is a barrier in formal disposal of e-waste?	39.0%	40.8%	7.3%	5.2%	7.7%	2.02	1.17
2	Do you think, easy access to informal collection channels is a barrier in adoption of formal e-waste disposal methods by individuals?	41.8%	35.2%	8.7%	7.0%	7.3%	2.03	1.20
3	Do you think lack of knowledge about hazardous effects of e-waste act as a barrier in adopting formal e-waste management practices?	46.7%	24.4%	11.8%	11.5%	5.6%	2.05	1.25
4	To what extent do you think that inadequate legislations are resulting in non-adoption of formal e-waste recycling approach?	41.1%	28.6%	15.0%	8.0%	7.3%	2.12	1.24
5	Do you think that inadequate collection efforts by recyclers/Govt. agencies are resulting in piling up of e-waste at home?	50.2%	29.3%	13.2%	4.9%	2.4%	1.80	1.01
Mean Total							**2.0**	

Table 4.12: Awareness of Individuals on E-waste Management

Sr. No.	Awareness	No Idea {1}	Little Awareness {2}	Average Awareness {3}	High Awareness {4}	Highly Updated Awareness {5}	Mean	SD
1	To what extent do you know how to dispose- off e-waste safely for human beings as well as for the environment?	30.0%	44.9%	16.7%	4.9%	3.5%	2.07	0.99
2	Are you aware of any electronic waste management policy currently implemented in India for safe disposal of electrical and electronic items?	53.7%	16.7%	17.8%	6.6%	5.2%	1.93	1.20
3	What is your perspective towards health and environmental hazards associated with e-waste?	46.0%	30.3%	14.6%	4.2%	4.9%	1.92	1.10
4	Do you think toxic/hazardous materials from discarded e-products require special treatment for environmentally sound disposal?	35.9%	33.8%	17.8%	9.1%	3.5%	2.10	1.1
Mean Total							**2.01**	

4.4 FINAL REMARKS - SURVEY

For each item in the questionnaire, you can see the percentage of respondents in Tables 4.8 to 4.12. Also included are the average scores for each question and component. The low overall score for all components calls for more reflection. This is why it's important to get the word out. This may be done by determining whether each construct significantly affects consciousness and if all constructions directly affect awareness or have intermediate effects. Furthermore, mediating effects must be identified. The government might create an awareness strategy by studying these replies. Below are some questions that this study attempted to answer.

4.5 This study examines factors affecting e-waste management knowledge.

Second, to find out how these four external variables are related by creating and testing a structural equation model. (comprehension of fundamental terminology, obstacles, advantages, and methods of e-waste treatment) and one endogenous concept, awareness. This model will evaluate the link between external and internal factors. Once the measurement model is approved, this process will begin. The initial model, which includes four external factors that influence the endogenous factor, may not be the most suitable for the given data. It is uncertain if there are any external factors that influence the relationship between the study's internal factor and external factor. Lack of written documentation on this kind of work means little information is accessible. To pick the best model for the job, multiple more structural equation models were built and compared to the original first-order model. Five distinct models were tested to assess their supremacy.

4.6 Structural Equation Model-A for Individuals

The first model examined the idea that basic terminology, behaviours, benefits, and challenges affect electronic waste management awareness. This idea was tested by correlating these characteristics. A research is investigating the cause-and-effect relationship between electronic waste management aspects and overall comprehension. This is done by modelling the structure. A research is looking at how different circumstances impact electronic waste management understanding. SEM is used in this study. To verify assumptions, structural equation modelling (SEM) was necessary:

Hypothesis 1: The first hypothesis is that one's familiarity with the basic concepts of EWM has no effect on one's overall level of awareness.

Hypothesis 2: The second hypothesis is that people's general degree of awareness has nothing to do with how well they understand methods for managing electronic trash.

Hypothesis 3: In the third hypothesis, postulate that people's awareness and understanding of the benefits of proper electronic waste management are unrelated.

Hypothesis 4: The fourth hypothesis asserts that the understanding of hurdles regarding e-waste management does not have any influence on the general awareness level of persons.

The structural model examined is shown in Figure 4.3 below.

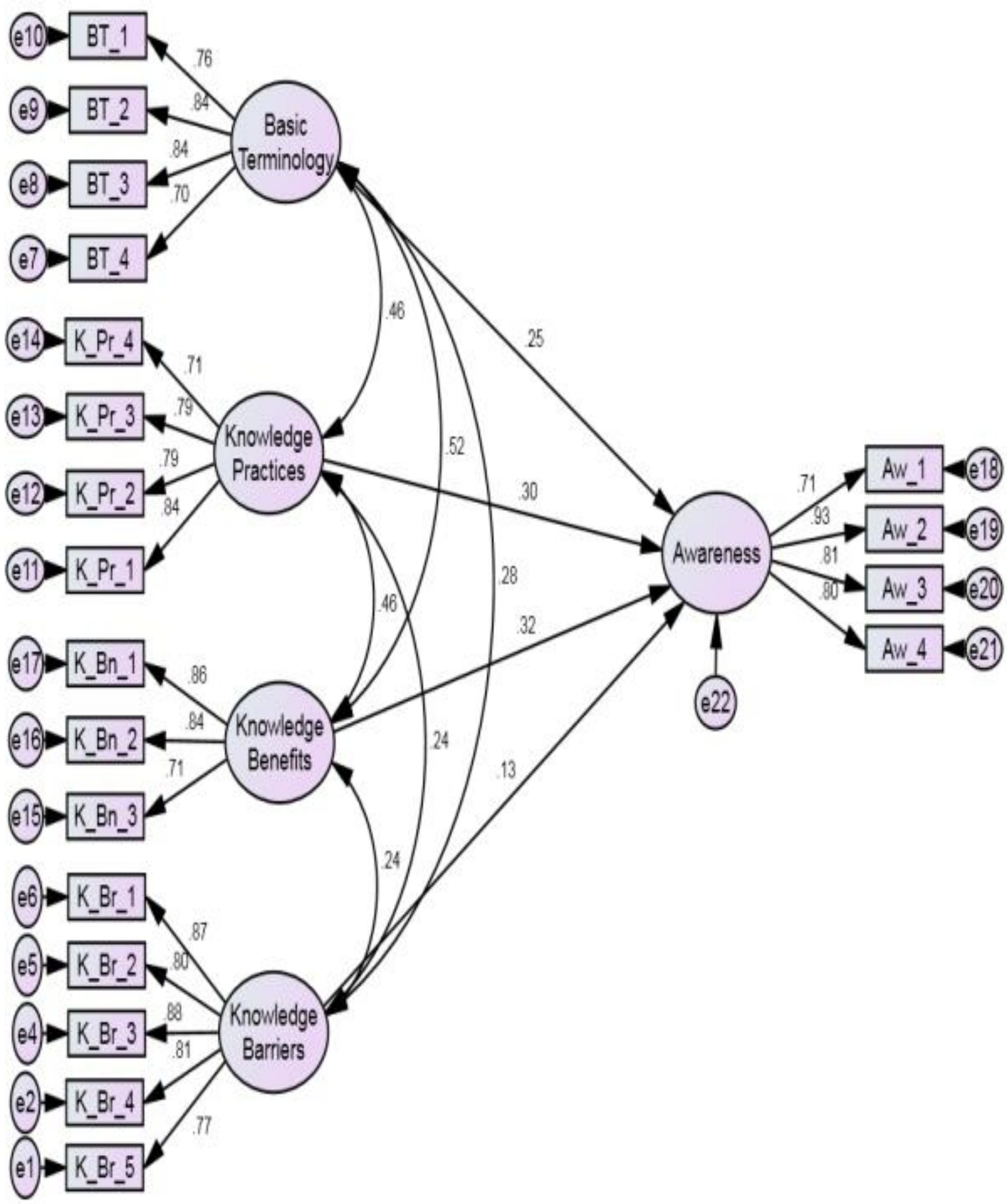


Figure 4.3: Structural Equation Model for Individuals (Model-A)

Table 4.13 then displays the following: R square, p value, crucial ratio, regression weight, standard error, and slope coefficients. The findings were obtained by the use of structural equation modelling. (SEM) method.

Table 4.13: Regression Weights for Model-A

			Standardized Slope Coefficient	Un-standardized Regression Weight	Standard Error (S.E)	Critical Ratio (C.R)	P Value	R Square
Awareness	<---	Basic Terminology	0.248	0.218	0.057	3.809	***	0.56
Awareness	<---	Knowledge of Practices	0.297	0.185	0.039	4.765	***	
Awareness	<---	Knowledge of Benefits	0.324	0.255	0.053	4.777	***	
Awareness	<---	Knowledge of Barriers	0.126	0.114	0.045	2.51	0.012	

One may determine the causal link between the endogenous variable and the exogenous variables by calculating the slope coefficient. After reviewing all electronic waste management criteria, the likelihood value of the crucial ratio is below 5%. It considered all relevant criteria before making this conclusion. The same rationale was found to explain why all confidence ratios (CR) surpass 1.96. The SEM analysis results are discussed in the following paragraphs:

H1: An individual's overall level of awareness is unaffected by the amount of knowledge they possess on the fundamental terms of electronic waste management, as stated in the first hypothesis.

Conclusion: Understanding basic e-waste management principles causes entire awareness, as shown by the standardised slope coefficient of 0.248. A p value below 0.05 indicates statistical significance. This suggests that the link indicates cause and effect. Therefore, the hypothesis is not supported, and it may be deduced that understanding of core words affects total awareness.

H2: In accordance with the second hypothesis, there is no connection between the degree to which individuals are aware of the various methods for managing electronic trash and their overall level of awareness.

Conclusion: People's knowledge and comprehension of e-waste management strategies are statistically significant ($p < 0.05$) with a standardised slope coefficient of 0.297. This shows a statistically significant relationship between the variables. This suggests a statistically significant link. The hypothesis is also disproved, showing that one's awareness of e-waste activities is strongly influenced by their comprehension of it.

H3: The third hypothesis is that awareness does not affect understanding of electronic waste disposal advantages.

Conclusion: A standardised slope coefficient of 0.324 was found between the degree to which individuals understood the expected advantages of e-waste management and their knowledge of the need for such measures, with a p-value that was less than 0.05. An inference like this might be drawn. Therefore, it is necessary to acknowledge the possible benefits of electronic waste management, and the previously stated hypothesis is also rejected with a significance level of 5%.

H4: "there is no impact of knowledge of barriers in implementing proper e-waste management on the overall awareness level of the individuals," as the conclusion points out."

Conclusion: A standardised slope coefficient of 0.126 suggests a relationship between public awareness of e-waste management and understanding the difficulties to adopting effective practices. This p-value is below 0.05. Thus, a p-value below 0.05 is necessary. Thus, this idea contradicts reality.

The study suggests that recognising the potential benefits pushes individuals to increase their customer awareness. Formal electronic waste management may have economical and environmental benefits.

Indians value economic benefits above environmental impacts while recycling. This is because Indians prioritise economic benefits above environmental concerns. Practical knowledge is the main component affecting end-user awareness. This was found after significant research. Knowledge of ecologically friendly ways to dispose of abandoned electronics and simple access to electronic trash collection facilities encourage formal electronic waste recycling. This is because people are more inclined to recycle their electronics. Barrier perception is the third factor of complete awareness after basic words. This third key component affects awareness. Electronic trash and its risks are explained in "basic terminology". The least important

component is understanding the problems.
The coefficient of determination, or R2, is a statistical metric that measures how much external factors explain dependent variable variability. For adequate fit in qualitative research, R2 should surpass 0.39. The year 2014 According to O'Rourke and Hatcher (2013). The structural equation modelling (SEM) method was used to assess user awareness of electronic garbage management. Analysis showed the SEM model has 0.56 percent R2. This came via data analysis. This conclusion was produced by examining relevant components. The R2 value of 0.56 shows that the model explains 56% of the variation in electronic waste management awareness.

This study has four components. Many goodness of fit indices were computed and compared to critical values to assess statistical fit. Below is Table 4.14 with the comparing results:

Table 4.14: Statistical Fitness of Model-A

Goodness of fit index	CMIN/df	GFI	AGFI	CFI	TLI	RMSEA
Calculated value	1.931	0.906	0.875	0.957	0.949	0.057
Expected value	Less than 3	More than 0.8	More than 0.8	More than 0.9	More than 0.9	Less than 0.08

The CMIN/df value is 1.931, below the necessary maximum of 3. The GFI exceeds the minimum of 0.8 at 0.906. The AGFI value is 0.875, above the minimal 0.8. The CFI is 0.957, over the minimal 0.9. Additionally, the TLI score of 0.949 surpasses the minimum of 0.9. The final RMSEA value is 0.057, below the maximum 0.08. All values are in Table 4.14. This implies that this structural equation modelling model fits statistically.
The following models were rigorously examined to examine this issue's potential.

4.7 Structural Equation Model-B for Individuals

This model assumes a person understands the basics, benefits, and drawbacks of electronic waste management. After becoming curious, the person will actively search out the best e-waste disposal techniques. This will improve their e-waste management knowledge. This happens when the topic is interesting enough.

This method uses practices to bridge essential terminology, advantages, challenges, and electronic waste management awareness. This improves electronic waste management understanding. Knowledge of practices might be innate or external in this method. Using the following hypothesis, model A and the mediation model will be compared: Instead of model A, it is desirable to have a mediator—a construct with practical knowledge—connect three external constructs with an endogenous construct. Figure 4.4 shows the results of experimentally testing this hypothesis using the structural model.

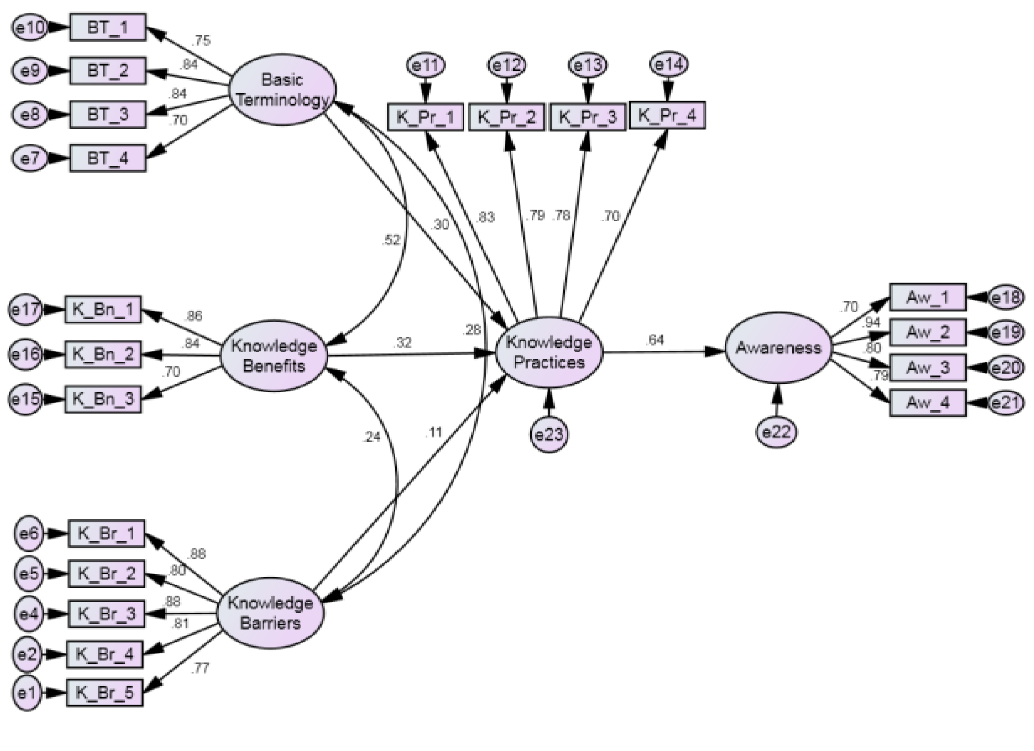


Figure 4.4: Structural Equation Model for Individuals with Mediation Effect of Practices (Model-B)

Table 4.15: Regression Weights for Model-B

			Standardized Slope Coefficient	Un-standardized Regression Weight	Standard Error	Critical Ration	P Value	R Square
Knowledge of Practices	<---	Basic Terminology	0.304	0.423	0.104	4.058	***	0.35
Knowledge of Practices	<---	Knowledge of Benefits	0.324	0.405	0.094	4.318	***	
Knowledge of Practices	<---	Knowledge of Barriers	0.111	0.159	0.085	1.868	0.062	
Awareness	<---	Knowledge of Practices	0.638	0.398	0.045	8.907	***	0.41

Various statistical fit indices for this model are shown below

Table 4.16: Statistical Fitness indices of Model-B

Goodness of fit index	CMIN/df	GFI	AGFI	CFI	TLI	RMSEA
Calculated value	2.376	0.882	0.848	0.936	0.926	0.069
Expected value	Less than 3	More than 0.8	More than 0.8	More than 0.9	More than 0.9	Less than 0.08

This paradigm states that customers' awareness is mostly determined by their strategy knowledge. People who know how to dispose of electronic waste responsibly are more likely to recycle it. People will be more inclined to recycle electronic garbage. Several variables affect end-user awareness, with understanding of benefits being the second most significant. After discussing essential terminology, consumers who understand the potential health and environmental risks of electronic waste are more likely to dispose of their old electronics at an official facility rather than keeping them at home. The electronic waste management system's problems are also examined. Finally, electronic waste management concerns must be understood.

4.8 A Criteria-Based Comparison of Different SEM Models

Comparisons between models may be made using goodness-of-fit indices. CMIN/df, GFI, AGFI, and CFI are among the index variables. Higher numbers indicate a better environmental match. The year 2010. According to Hair et al.' study.
Nothing is written.Chi-square values may also be used to compare models. In this case, the model with a lower chi-square value is better. The year 2010. According to Hair et al.' study.

Nothing is written.The coefficient of determination (R2), which measures the amount of variance in dependent variables due to independent variables, may also be used to compare the two models. According to the findings, the model with the highest R2 value best represents the data. Hair et al. debuted in 2010.
Nothing is written.At a 95% confidence level, the Standard Slope Coefficient, which encompasses all the aforementioned structures, is statistically significant. As reported by Hair et al. in 2010.

4.9 How are SEM Model-A and SEM Model-B different from one another?

Models A and B both have sufficient goodness-of-fit indices, as can be shown in Tables 4.14 and 4.16. Model A is clearly more accurate when compare the values of the two models. Model A is therefore better than Model B.In contrast to model B's 387.268, model A's Chi square statistic is 309.332. You can't miss this distinction. The Chi-square of Model A differs from that of Model B. The findings clearly show differentiation. Model B might be said to be of poorer quality compared to model A.

Model B is more powerful and can account for a wider range of events than Model A, thanks to its higher R2 value of 0.41. Model B's explaining capability is lower. They may explain 41% of the variation in Model-B and 56% of the variation in Model-A when it comes to e-waste management knowledge. The R-squared values of 0.56 and 0.41 lead to this conclusion. Table 4.15 indicates that Model A is the superior model.
4. There was no statistical significance seen in the regression coefficient that was derived from behaviour and barrier knowledge. Model A outperforms model B according to the data.

4.10 Individual applications of the Structural Equation Model-C

One learns the basic language, methods, and problems of electronic waste management. The following model evaluates alignment potential. The expectation is that the person will initially learn these principles. They will investigate the benefits of electronic waste management once their interest is piqued. Electronic waste management will be fully understood after this pursuit. The method discussed here uses benefits to bridge basic vocabulary, procedures, barriers, and general knowledge of electronic waste management. This paradigm incorporates advantages as an intrinsic and external construct.
Model A and mediation model C will be compared using this hypothesis:
Model A does not mediate between the endogenous construct and the other three external constructs, while the benefit-incorporating model does. Being acquainted with key terms is the second most effective way to raise awareness, after understanding the advantages. Here define electronic waste and discuss its possible effects on human and environmental health. Does this statement convey the situation correctly? Clients' familiarity with popular pastimes is the third major factor influencing their level of awareness and understanding. This notion states that understanding of the challenges is the least important part of handling electronic waste properly. The Indian government must remove barriers and create new legislation to collect electronic garbage efficiently.
This idea is verified by the structural model, shown in Figure 4.5 below. This principle is shown similarly.

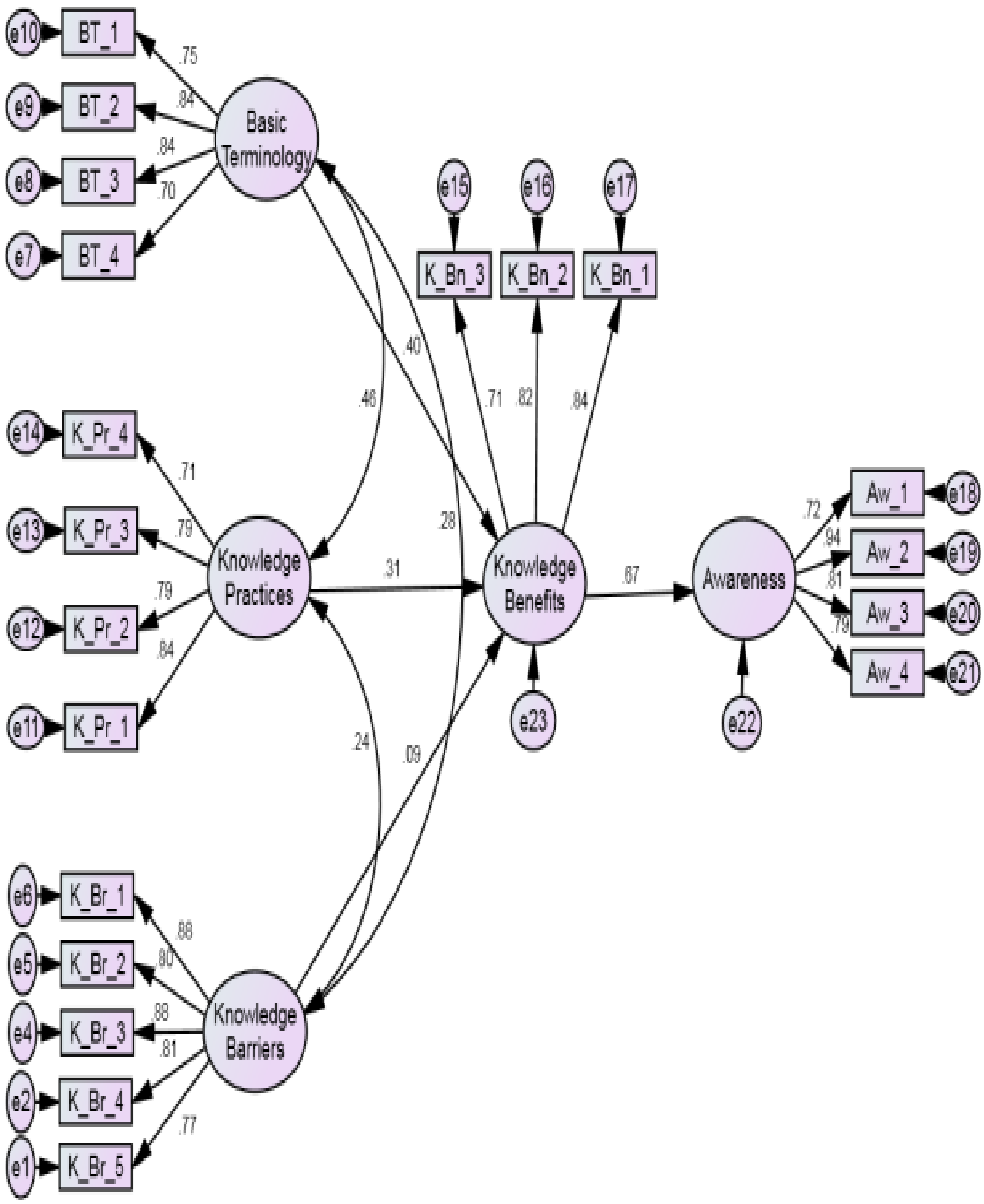


Figure 4.5: Structural Equation Model for Individuals (Model-C)

Table 4.17 summarises the statistical significance of each choice and the variations between the different regression weights.

Table 4.17: Regression Weights for Model-C

			Standardized Slope Coefficient	Un-standardized Regression Weight	Standard Error	Critical Ration	P Value	R Square
Knowledge of Benefits	<---	Basic Terminology	0.397	0.445	0.084	5.306	***	
Knowledge of Benefits	<---	Knowledge of Practices	0.313	0.247	0.055	4.483	***	0.41
Knowledge of Benefits	<---	Knowledge of Barriers	0.086	0.098	0.067	1.464	0.143	
Awareness	<---	Knowledge of Benefits	0.675	0.534	0.062	8.622	***	0.46

Take a look at Table 4.18 down below to see the model's statistical fit indices.

Table 4.18: Statistical Fitness of Model-C

Goodness of fit index	CMIN/df	GFI	AGFI	CFI	TLI	RMSEA
Calculated value	2.298	0.888	0.855	0.940	0.930	0.067
Expected value	Less than 3	More than 0.8	More than 0.8	More than 0.9	More than 0.9	Less than 0.08

Despite having adequate fit indices, this model is not as good as model A for the reasons below. The causes are:

Model A has a higher goodness-of-fit index than Model C, although both have acceptable indices (Table 4.14 and 4.17). Therefore, Model A is best. Model C's chi-square is 374.530, whereas A's is 309.332. There is no way to overlook this difference. The Chi-square value of Model C is significantly different from that of Model A, indicating that Model C may not be as good as Model A. When both models are tested at the same level, Model C's explanatory power (R2 - 0.46) is lower than Model A's (R2 - 0.56). These factors could account for as much as 56% of the variation in Model-A's and 46% of Model-C's e-waste management expertise. Results of 0.56 and 0.46 for R2 support this conclusion. Therefore, you should go with Model A.

The knowledge of advantages and constraints regression coefficient is not statistically significant. (Table 4.18).

4.11 Model-D for Differential Structural Equations in People

Next, it looked at a potentially applicable model that presupposes that individual gains interest in e-waste and has a rudimentary understanding of digital rubbish. Once their curiosity has reached a particular threshold, people will try to learn about correct e-waste management techniques, benefits, challenges, and other issues. Doing so will provide all the electronic waste management data they need. This approach bridges the basic language and electronic waste management understanding. This is done by understanding benefits, methods, and obstacles.

Advantages, practices, and difficulties are regarded internal and external to this paradigm. Three ideas may be related.

Model A, which lacks mediation, is less desirable than model B, which includes practices, advantages, and barriers as mediators between basic awareness and comprehensive consciousness. Model A will be compared to mediation model D using the following hypothesis.

Create a structural model to test this hypothesis. See Figure 4.6 for examples of this concept.

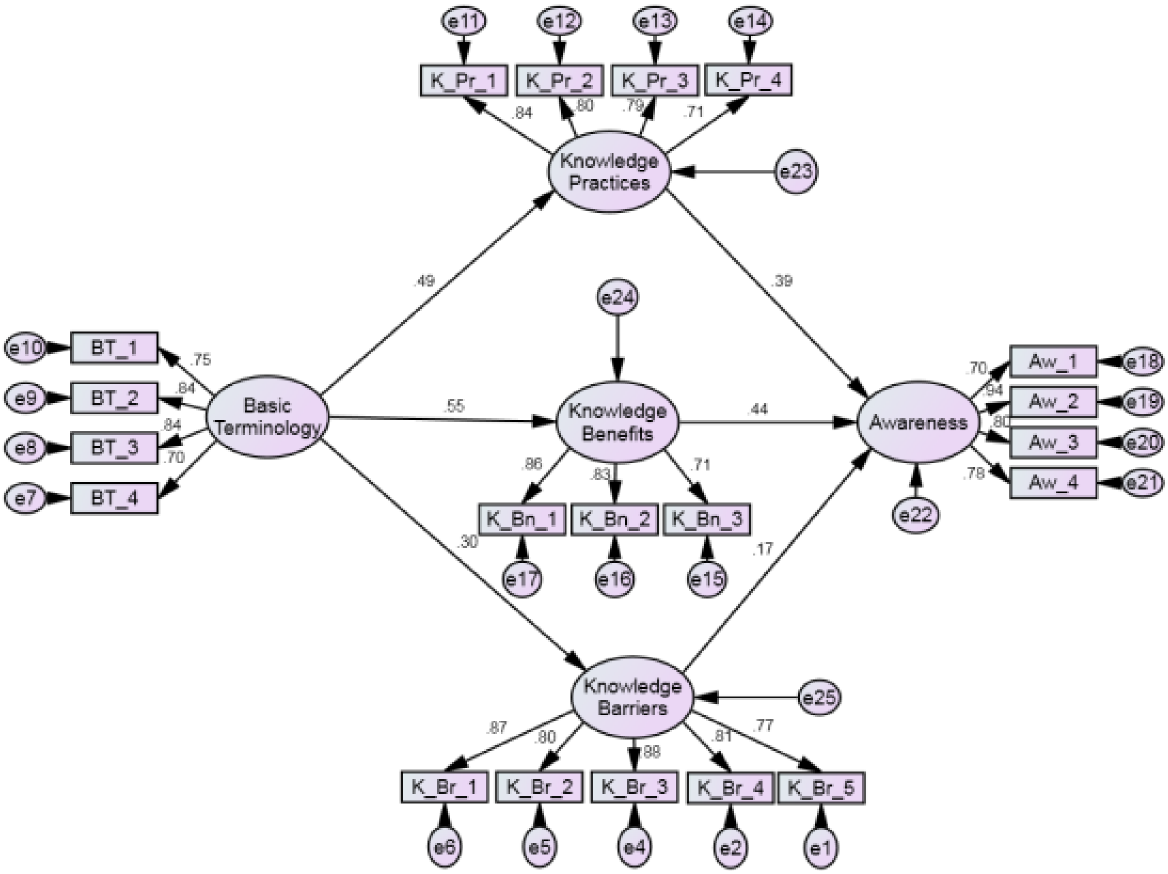


Figure 4.6 Structural Equation Model for Individuals (Model-D)

Table 4.19: Regression Weights for Model-D

			Standardized Slope Coefficient	Un-standardized Regression Weight	Standard Error	Critical Ratio	P Value	R Square
Knowledge of Practices	<--	Basic Terminology	0.495	0.695	0.099	7.016	***	0.31
Knowledge of Benefits	<--	Basic Terminology	0.553	0.617	0.085	7.221	***	0.25
Knowledge of Barriers	<--	Basic Terminology	0.296	0.288	0.065	4.404	***	0.09
Awareness	<--	Knowledge of Benefits	0.445	0.338	0.05	6.729	***	
Awareness	<--	Knowledge of Practices	0.393	0.237	0.036	6.508	***	0.52
Awareness	<--	Knowledge of Barriers	0.166	0.145	0.045	3.238	0.001	

Table 4.20: Statistical Fitness of Model-D

Goodness of fit index	CMIN/df	GFI	AGFI	CFI	TLI	RMSEA
Calculated value	2.092	0.895	0.865	0.949	0.941	0.062
Expected value	Less than 3	More than 0.8	More than 0.8	More than 0.9	More than 0.9	Less than 0.08

Among the factors affecting end-user awareness, knowing the benefits has the most impact (standardised slope coefficient: 0.445). The greatest influence comes from realising benefits. Expertise in the field seems to be the second most valuable attribute, with a standardised slope coefficient of 0.393. The amount of challenge information has less of an impact on consumer awareness. Even though all of the fit indices are within the acceptable range (Tables 4.19 and 4.20), this model is worse than model A due to the following factors: Models A and D both have excellent goodness-of-fit indices, but model A has better values. It is possible that, in the end, Prototype A will be the better option than Model D. Compared to Model A, Model D's average explanatory power is lower (R2 - 0.52). Model D's coefficient of determination (R2) is 0.52 and Model A's is 0.56, suggesting that mediating factors may account for 52% of the variation in e-waste management knowledge and, respectively, 56% and 52%. These components account for a large portion of the variation, according to the R2 values. Therefore, the body benefits most from A.

4.12 Structural Equation Model-E for Individuals

Thus, a paradigm has been studied in which basic understanding is characterised by the search for practices, benefits, and impediments. This model was extensively studied. However, these breakthroughs led to widespread understanding. Comprehensive comprehension is linked to a solid grasp of basic ideas.
See Figure 4.7 for the investigated structural model.

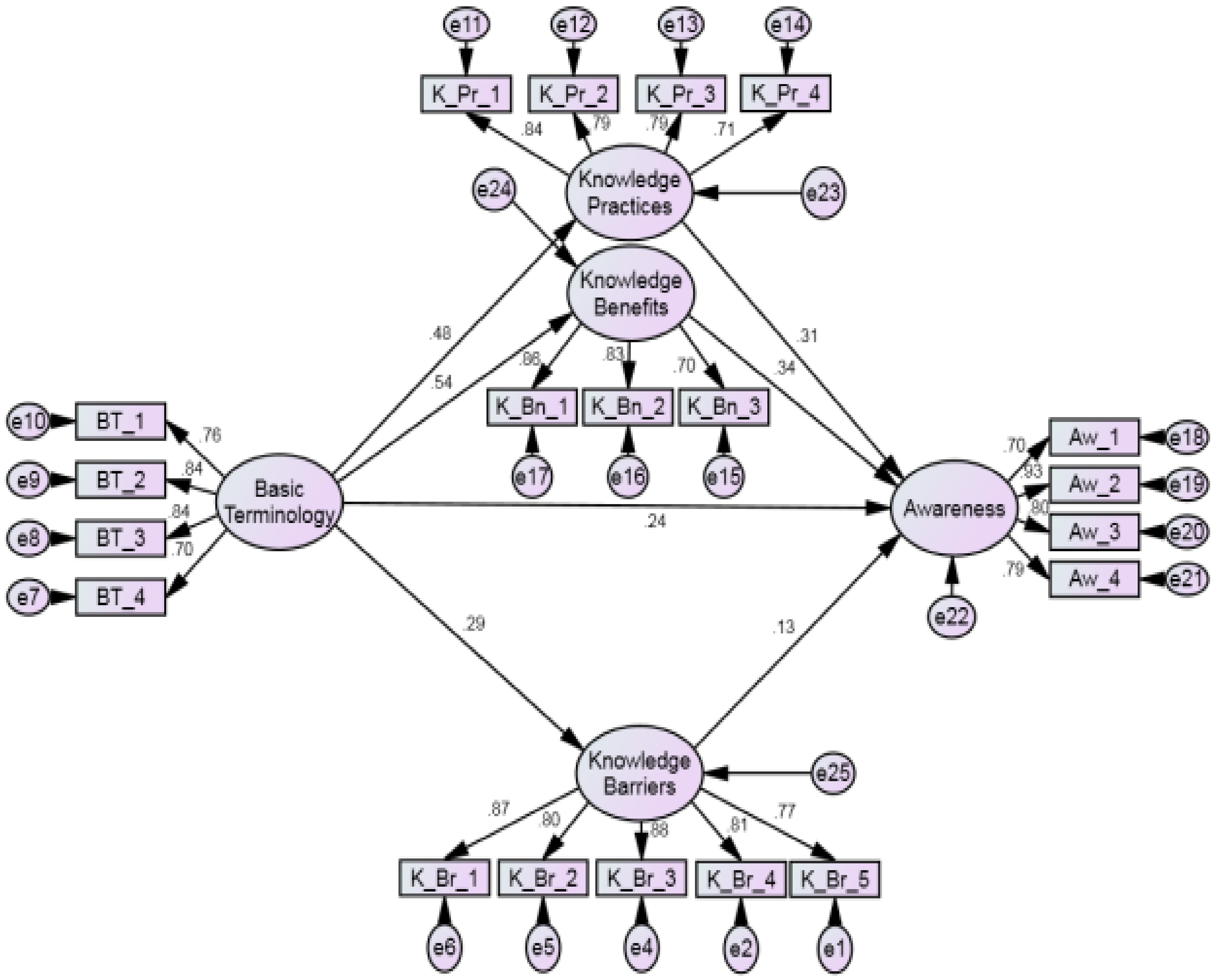


Figure 4.7 Structural Equation Model for Individuals (Model-E)

Table 4.21: Regression Weights for Model-E

			Standardized Slope Coefficient	Un-standardized Regression Weight	S.E.	C.R.	P	R-Square
Knowledge of Practices	<---	Basic Terminology	0.481	0.675	0.099	6.847	***	0.29
Knowledge of Benefits	<---	Basic Terminology	0.536	0.595	0.084	7.046	***	0.23
Knowledge of Barriers	<---	Basic Terminology	0.295	0.285	0.065	4.378	***	0.09
Awareness	<---	Knowledge of Benefits	0.336	0.26	0.052	4.98	***	0.55
Awareness	<---	Knowledge of Practices	0.312	0.191	0.038	5.059	***	
Awareness	<---	Knowledge of Barriers	0.134	0.119	0.045	2.632	0.008	
Awareness	<---	Basic Terminology	0.243	0.208	0.063	3.301	***	

All of the regression coefficients have been shown to be statistically significant at the 5% level.

Table 4.22: Statistical Fitness of Model-E

Goodness of fit index	CMIN/df	GFI	AGFI	CFI	TLI	RMSEA
Calculated value	2.027	0.900	0.871	0.952	0.944	0.060
Expected value	Less than 3	More than 0.8	More than 0.8	More than 0.9	More than 0.9	Less than 0.08

According to this method, user awareness is determined by their comprehension of the benefits. In contrast, expertise is the second most important trait, after basic vocabulary and problem-solving. The research found that obstacle awareness is the least important aspect in Northern India's electronic waste management understanding. The investigation found that barrier awareness was the least important factor.

Tables 4.21 and 4.22 demonstrate that all fit indices are within the acceptable range; yet, this model is worse than model A due to the following reasons:
1. The goodness-of-fit indexes for models A and E are satisfactory. Model A outperformed model E in terms of values. Model A wins over Model E. Model A has a Chi square statistic of 309.432, whereas model E has 330.463. In comparison to Model E, Model A's Chi square is somewhat smaller. The inadequacy of model E compared to model A may be inferred.

Model E (R2 - 0.55) does not explain as much as A (R2 - 0.56). Reason being, the correlation coefficient for Model A is greater. Model A's R2 value of 0.56 and Model E's R2 value of 0.55 for e-waste management expertise and independence from other variables, respectively, show that these variables account for 56% and 55% of the variance, respectively. Reason being, these factors explain the lion's share of the variation, as seen by the R2 values. Because of this, Model A is considered better.

4.13 SEM FOR INDIVIDUALS: CONCLUDING REMARKS and Observations

This research examines several mediation and non-mediation theories. All models have good fit values, but the one without mediation wins. The basic model lacks mediation, therefore it may deduce this outcome. All four parts of comprehensive awareness must be conveyed to highlight the detrimental impacts of electronic waste on people and the environment. Continued work leads to this conclusion. Structured equation modelling (SEM) shows that the government must address all four components to improve public awareness about electronic trash's potential harm.

4.14 Analyses of the Economy

Most people discard electronic gadgets informally when they reach their end of life. This suggests that consumers know nothing about electronic trash disposal. Since properly disposing of electronic equipment has no financial benefits, many items deemed electronic waste are discovered in homes. Using correct disposal routes, you may recover a lot of valuable items. This happens when antiques are removed from homes. The following lines examine the financial impact of this action.

The number of non-functional electronic devices in respondents' homes was questioned. Participants also categorised their income.

The study collected demographic data from four North Indian states. Below is Table 4.23 with the findings. The normal four-person household was studied throughout the inquiry. The poll has 287 respondents. They include 42 people with incomes of less than one lakh, 112 with incomes of one lakh to five lakhs, 76 with incomes of five lakhs to ten lakhs, and 57 with incomes of more than 10 lakhs. These statistics determined the percentage of families in each main income category, as shown in Table 4.24. Table 4.25 shows the total number of families and each income category's families. Table 4.26 shows metal and non-metal prices as of August 28, 2020.

Table 4.23: Population of Different States

State	Haryana	Punjab	Uttar Pradesh	Himachal Pradesh	Chandigarh	Total
Population	30,141,373	28,204,692	237,882,725	7,451,955	1,158,473	304,839,218

Table 4.24: Percentage of Families as Per Our Survey under Various Income Groups

%age of Family income (in lakh)			
Below 1 Lakh	01 to 05	05 to 10	More Than 10 lakh
15%	39%	26%	20%

Table 4.25: Number of Families in different Income Groups

Total Population	Total No. of families	Below 1 Lakh	01 to 05	05 to 10	More Than 10 lakh
304,839,218	76,209,805	11,431,471	29,721,824	19,814,549	15,241,961

Table 4.26: Rates of Different Metals/Non-metals

Metals/Non-metals	Gold (Rs. in million /kg)	Silver (Rs. in million /kg)	Ferrous (Rs. in million /tonne)	Copper (Rs. in million /tonne)	Aluminium (Rs. in million /tonne)	Plastic (Rs. in million /tonne)
Price (Rs)	5.6	0.067	0.028	0.43	0.12	0.045

To improve task accuracy, three essential principles have been prioritised. The figures show the mean, lowest, and maximum values (range) within a 95% confidence interval for each of the four income categories. The range is calculated using this formula:

$$Range = \frac{Standard\ Deviation\ (\sigma) \times 1.96}{\sqrt{n}}$$

The letter "n" indicates the number of survey respondents in each income range. The numbers and ranges used to compute the number of electronic devices rejected for various income groups are in table 4.27.

Table 4.27: Value Considered to Calculate Quantity of Various Discarded Electronics Items in Different Income Slabs

Below 1 Lakh Income Group								
Estimated Value	Mobile Phones	Computers	Laptops	TVs	LED TVs	Printers	Refrigerators	Air-Conditioners
Mean Value	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00
95 % Confidence Interval	0.4 -0.7	0	0	0	0	0	0	0
01 Lakh to 05 lakh Income Group								
Estimated Value	Mobile Phones	Computers	Laptops	TVs	LED TVs	Printers	Refrigerators	Air-Conditioners
Mean Value	1.46	0.34	0.19	0.07	0.04	0.16	0.00	0.00
95 % Confidence Interval	1.35-1.57	0.25- 0.43	0.12-0.26	0.02-0.12	0.01-0.07	0.09-.023	0	0
05 Lakh to 10 lakh Income Group								
Estimated Value	Mobile Phones	Computers	Laptops	TVs	LED TVs	Printers	Refrigerators	Air-Conditioners
Mean Value	2	0.46	0.37	0.09	0.09	0.37	0.07	0.01
95 % Confidence Interval	1.83-2.17	0.35-0.57	0.26-0.48	0.02-0.16	0.02-0.16	0.26-0.48	0.01-0.13	00-0.04
Above 10 Lakh Income Group								
Estimated Value	Mobile Phones	Computers	Laptops	TVs	LED TVs	Printers	Refrigerators	Air-Conditioners
Mean Value	2.60	0.58	0.49	0.23	0.14	0.49	0.12	0.11
95 % Confidence Interval	2.36-2.84	0.43-0.73	0.33-0.65	0.12-0.34	0.05-0.23	0.36-0.62	0.03-0.21	0.03-0.19

Table 4.28 compares the average weight of market-available electrical equipment. Electronic garbage is known to include gold, silver, copper, and other valuable materials. These commodities include valuable components that must be removed. To estimate the recovery of valuable materials from electronic garbage, it was necessary to visit both official recycling facilities in northern Indian states and illegal recycling units in Seelampur, New Delhi, and

Moradabad, Uttar Pradesh. These voyages collected vital data. Tables 4.28 and 4.29 show visit outcomes.

Table 4.28 shows the predicted formal recovery weight of electronic devices and materials.

Table 4.28

Sr. No.	Product Name	Weight of Product (Wang, 2014)	Material Recovery/Product					
			Gold (mg)	Silver (mg)	Ferrous (Kg)	Copper (Kg)	Aluminium (Kg)	Plastic (Kg)
1	Mobile Phones	125 gm	56	144	0.00164	0.0128	0.00064	0.0472
2	Computer	22 Kg	756	3122	12.23	0.92	1.62	4.12
3	Laptop	3.2 Kg	514	908	1.1	0.06	0.146	1.24
4	TV Sets	32 Kg	16.2	385	3.3	1.24	0.834	7.32
5	LED TV	16 Kg	390	932	7.5	0.63	0.751	3.9
6	Printer	8 Kg	22.4	41.8	2.84	0.26	0.02	3.72
7	Refrigerator	55 Kg	-	-	27.5	2.22	1.7	22.4
8	Air-Conditioner	50 Kg	-	-	27.2	7.83	4.72	7.85

Electronic trash disposal is regulated by governmental and informal methods. Electronic trash may include precious metals like gold, silver, and copper, as well as non-metals like plastic. Additional non-metals may be found. Gathering these precious components from abandoned electronics is important to profit. Table 4.29 shows the valuable components that may be retrieved from informal electronics recycling.

As stated in Table 4.29, the anticipated average weight of materials and electronic items recovered via informal routes.

Table 4.29

Sr. No.	Product Name	Weight of Product (Wang, 2014)	Material Recovery (Informal Channels)						
			Gold (mg)	Silver (mg)	Ferrous (Kg)	Copper (Kg)	Aluminium (Kg)	Plastic (Kg)
1	Mobile Phones	125 gm	7.5	20.3	0.00023	0.002	0.00072	0.009
2	Computer	22 Kg	101	405.2	2.53	0.14	0.21	1
3	Laptop	3.2 Kg	69.24	125	0.17	0.01	0.03	0.5
4	TV Sets	32 Kg	2.1	58.44	0.45	0.182	0.12	2.5
5	LED TV	16 Kg	51.9	125	1.01	0.096	0.1	1.05
6	Printer	8 Kg	2.4	5.3	0.35	0.041	0.003	1
7	Refrigerator	55 Kg	-	-	3.3	0.36	0.23	6.6
8	Air-Conditioner	50 Kg	-	-	3.8	1.2	0.61	2.3

To see how much money will come in via official routes, have a look at Table 4.30.

Table 4.30

Name of Products	Below 1 Lakh Income Group		01 Lakh - 05 Lakh		05 Lakh - 10 Lakh		Above 10 Lakh	
	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)
Mobile Phones	6.2	**2.1**	43.3	**98**	39.6	**104**	39.6	**114**
Computers	0		10.1		9.1		8.8	
Laptops	0		5.6		7.3		7.5	
TV Sets	0		2.1		1.8		3.5	
LED TVs	0		1.2		1.8		2.1	
Printers	0		4.7		7.3		7.5	
Refrigerators	-		0		1.4		1.8	
A.C.s	-		0		0.2		1.7	

With a 95% confidence interval, Figure 4.31 depicts the total income estimated to be earned via formal channels for lower value.

Table 4.31

Name of Products	Below 1 Lakh Income Group		01 Lakh - 05 Lakh		05 Lakh - 10 Lakh		Above 10 Lakh	
	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)
Mobile Phones	4.6	**1.5**	40.1	**69.7**	36.3	**72**	36	**75.6**
Computers	0		7.4		6.9		6.5	
Laptops	0		3.6		5.2		5	
TV Sets	0		0.6		0.4		1.8	
LED TVs	0		0.3		0.4		0.8	
Printers	0		2.7		5.2		5.5	
Refrigerators	0		0		0.2		0.45	
A.C.s	0		0		0		0.45	

Table 4.32: Total Revenue to be Generated (Formal Channels)- for Upper Value (95 % Confidence Interval)

Name of Products	Below 1 Lakh Income Group		01 Lakh - 05 Lakh		05 Lakh - 10 Lakh		Above 10 Lakh	
	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)
Mobile Phones	8.0	**2.6**	46.7	**126**	43	**137**	43.3	**153**
Computers	0		12.8		11.3		11.1	
Laptops	0		7.7		9.5		10	
TV Sets	0		3.6		3.2		5.2	
LED TVs	0		2.1		3.2		3.5	
Printers	0		6.8		9.51		9.4	
Refrigerators	0		0		2.6		3.2	
A.C.s	0		0		0.8		2.9	

Table 4.33: Total Revenue to be Generated (Informal Channels)- for Average Value

Name of Products	Below 1 Lakh Income Group		01 Lakh - 05 Lakh		05 Lakh - 10 Lakh		Above 10 Lakh	
	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)
Mobile Phones	6.2	**0.3**	43.3	**14**	39.6	**15**	39.6	**17**
Computers	0		10.1		9.1		8.8	
Laptops	0		5.6		7.3		7.5	
TV Sets	0		2.1		1.8		3.5	
LED TVs	0		1.2		1.8		2.1	
Printers	0		4.7		7.3		7.5	
Refrigerators	-		0		1.4		1.8	
A.C.s	-		0		0.2		1.7	

Table 4.34: Total Revenue to be Generated (Informal Channels)- for Lower Value (95 % Confidence Interval)

Name of Products	Below 1 Lakh Income Group		01 Lakh - 05 Lakh		05 Lakh - 10 Lakh		Above 10 Lakh	
	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)
Mobile Phones	4.65	**0.2**	40.1	**9.7**	36.3	**10**	36	**11**
Computers	0		7.4		6.9		6.5	
Laptops	0		3.6		5.2		5	
TV Sets	0		0.6		0.4		1.8	
LED TVs	0		0.3		0.4		0.76	
Printers	0		2.7		5.2		5.5	
Refrigerators	0		0		0.2		0.46	
A.C.s	0		0		0		0.46	

Table 4.35: Total Revenue to be Generated (Informal Channels)- for Upper Value (95 % Confidence Interval)

Name of Products	Below 1 Lakh Income Group		01 Lakh - 05 Lakh		05 Lakh - 10 Lakh		Above 10 Lakh	
	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)
Mobile Phones	8	**0.36**	46.7	**18**	43	**20**	43.3	**22.6**
Computers	0		12.8		11.3		11.1	
Laptops	0		7.7		9.5		10	
TV Sets	0		3.6		3.2		5.2	
LED TVs	0		2.1		3.2		3.5	
Printers	0		6.8		9.51		9.4	
Refrigerators	0		0		2.6		3.2	
A.C.s	0		0		0.8		2.9	

A research examined the costs of informal and official electronic trash disposal. This calculation uses data from Tables 4.30–4.35. Two estimates were created while estimating population parameters using a sample: a 95% confidence interval and an average point estimate. See Table 4.36 for similar data.

Table 4.36: Financial Benefit from Formal Channels w.r.t. Income Groups

Estimated Value	Value of e-waste, if disposed as per current/Informal approach (Rs in Billion)	Value if disposed through proper channel (Rs in Billion)	Financial gain from proper disposal (Rs in Billion)
Mean Value	46	318	272
95% Confidence Interval	31 - 61	219 - 419	188 - 358

As seen in the chart above, properly disposing of abandoned electronics will greatly impact the economy.

Thus, it must be create and execute a complete framework for official electronic waste disposal in a country in the next years. Delivering this pledge quickly is essential. Table 4.37 lists the populations and households of different northern Indian states. Additional data is supplied. The total number of families may be calculated using a four-person family size.

Table 4.37: Population and Number of Families w.r.t. Different States

State	Haryana	Punjab	Uttar Pradesh	Himachal Pradesh	Chandigarh
Population	30,141,373	28,204,692	237,882,725	7,451,955	1,158,473
Number of Families	7535343	7051173	59470681	1862989	289618

Table 4.38: Value Considered to Calculate Quantity of Various Discarded Electronics Items w.r.t. Different States

Haryana								
Estimated Value	Mobile Phones	Computers	Laptops	TVs	LED TVs	Printers	Refrigerators	Air-Conditioners
Mean Value	1.57	0.38	0.24	0.15	0.04	0.19	0.03	0.01
95 % Confidence Interval	1.36-1.78	0.26-0.50	0.13-0.35	0.07-0.23	00-0.09	0.10-0.28	00-0.07	00-0.04
Punjab								
Estimated Value	Mobile Phones	Computers	Laptops	TVs	LED TVs	Printers	Refrigerators	Air-Conditioners
Mean Value	1.78	0.50	0.37	0.11	0.09	0.37	0.06	0.04
95 % Confidence Interval	1.51-2.05	0.36-0.64	0.24-0.50	0.03-0.19	0.01-0.17	0.24-0.50	00-0.12	00-0.09
Uttar Pradesh								
Estimated Value	Mobile Phones	Computers	Laptops	TVs	LED TVs	Printers	Refrigerators	Air-Conditioners
Mean Value	1.57	0.28	0.22	0.04	0.04	0.21	0.03	0.01
95 % Confidence Interval	1.33-1.81	0.17-0.39	0.11-0.33	00-0.09	00-0.09	0.11-0.31	00-0.07	00-0.04
Himachal Pradesh								
Estimated Value	Mobile Phones	Computers	Laptops	TVs	LED TVs	Printers	Refrigerators	Air-Conditioners
Mean Value	1.79	0.27	0.31	0.08	0.10	0.33	0.06	0.02
95 % Confidence Interval	1.53-2.05	0.14-0.40	0.17-0.45	0.00-0.16	0.01-0.19	0.20-0.46	0.01-0.13	0.0-0.06

Chandigarh								
Estimated Value	Mobile Phones	Computers	Laptops	TVs	LED TVs	Printers	Refrigerators	Air-Conditioners
Mean Value	1.86	0.43	0.22	0.10	0.06	0.22	0.04	0.04
95 % Confidence Interval	1.61-2.11	0.28-0.58	0.10-0.34	0.02-0.18	00-0.13	0.10-0.34	00-0.10	00-0.10

For northern Indian states, Table 4.38 shows the figure used to calculate the number of abandoned electronics. This table shows abandoned electronics. Tables 4.39–4.48 show how much northern Indian states might make by processing electronic garbage legally and illegally. These tables are in northern India.

Table 4.39: Revenue to be Generated by Haryana (Formal Channels)

Name of Products	Mean Value		Lower Value (95% Confidence Interval)		Upper Value (95% Confidence Interval)	
	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)	Approx Qty. lying at home (In Millions)	Revenue (Rs. in Billion)
Mobile Phones	12	**37**	10.2	**29.4**	13.4	**50**
Computers	2.9		2		3.8	
Laptops	1.8		1		2.6	
TV Sets	1.1		0.5		1.7	
LED TVs	0.3		0		0.7	
Printers	1.4		0.75		2.1	
Refrigerators	2.3		0		0.5	
A.C.s	0.075		0		0.3	

4.15 BREAK-EVEN POINTS

Payback Period

The prices of official recycling machines are shown in the tables below. These figures also provide the processing capacity and payback time of the equipment. The following table details the various pieces of machinery and equipment required to set up a recycling operation for electronic waste with a throughput of 125 kilogrammes per hour. The costs of these items are also accounted for.

The Machine Expense Required to Set Up a 125-Kilogram-Per-Hour Electronic Waste Recycling Facility.

Sr. No.	Name of Machine	Cost of Machine (Rs)
1	Gold and Silver Recovery System	59,648,000
2	Copper Electro-refining system	28,176,000
3	Induction Furnace for melting (15 KW)	6,76,000
4	Shredding Mill	6,72,500
5	Intermediate Conveyor Belt	2,53,900
6	Overband Magnetic Separator (OBMS 300)	2,29,500
7	Granulation Mill for e-waste	6,90,300
8	Cyclone and Rotary Air Lock and feeder Valve	1,68,500
9	Dust Collection and Air Purification System	4,15,900
10	Compressor	39,000
11	Automated Size Sorter	1,78,400
12	Metal Separation Assembly	2,85,600
13	Electrical starter panel	67,000
14	Tools kit	6,500
15	Project Management and Implementation Charges	4,000,000
	Total	**95,507,100**

Total Expenditure/month

Sr. No.	Type of Labour	No. of labourers required	Salary/Month (Rs.)	Total Amount/month (Rs.)
1	Unskilled labour	3	8,000	24,000
2	Semi skilled labour	4	10,000	40,000
3	Skilled labour	3	15,000	45,000
4	Electrician	1	15,000	15,000
5	Managers	3	32,000	96,000
6	Electricity Charges	-	-	37,280
7	Rent of Building	-	-	20,000
8	Miscellaneous Expenses	-	-	25,000
			Total	**302,280**

Machines Cost (Capacity- 125 kg/Hr) (Rs. in millions)	Average Earning/ tonne (Rs. in millions)	Total Earning/month (Rs. in millions)	Approximate Expenditure/ month (Rs. in millions)	Total Saving/month (Rs. in millions)	Pay-back period
95.5	0.18	4.7	0.3	4.4	1 Year 10 Months

Assumption

Assuming the machine runs for 26 days a month at 8 hours a day, the total revenues are calculated.

4.16 OVERVIEW Thoughts on the Return on Investment

The pay-back period for a 125 kg/h plant is two years, as shown in the table. Here is the outcome of the investigation. This project is attractive because of its rapid payback time, provided that these devices are given a large amount of electronic waste to handle. Raise awareness, make sure laws and regulations are followed, and increase the quantity of information handled via official channels.

4.17 THE DIRECTION OF THE ORGANIZATION'S ELECTRONIC WASTE

Organisational respondents were investigated similarly to individual respondents. Again, the goal of this research was to validate the measuring items for each construct and distinguish the constructs being studied.

4.18 An examination of validity using CFA

The research study aims to explain the organization's awareness, perception, and comprehension of electronic waste handling and management. This research should help the Indian government develop effective management methods and awareness initiatives for electronic trash. Literature studies, journals, newspapers, and interviews with e-waste specialists have revealed several areas of knowledge concerning electronic waste management.

To measure electronic waste management expertise, the four main components below were discovered from diverse sources.

People may gauge their level of knowledge about electronic trash by reading the statements on the questionnaire. Many different types of persons and organisations were asked to respond to the survey about these assertions. To make sure enough questions have been answered to measure the degree of knowledge that northern Indian enterprises have about electronic waste management, confirmatory factor analysis (CFA) is used (Hair et al., 2010). This guarantees that appropriate questions are presented. To examine the relationship between assessment items and constructs, correlation matrices are utilised. This evaluates the measurement scale's reliability and validity. In this section, construct validity (convergent and discriminant validity) of the identified aspects of organisations' electronic waste management is explored. Four electronic waste knowledge hypotheses are being tested using the replies. Each aspect of the measurement model is high-order and reflective.

The measuring scale may differentiate five structures, as illustrated in Figure. Scales represent these constructions. These include an awareness of basic terminology, methods for managing electronic waste, the potential benefits of proper management, the obstacles that must be overcome to adopt e-waste management, and an overall awareness of organisations.

The fifth construct will be considered endogenous throughout the structural equation modelling (SEM) examination, whereas the other four will be external entities. The extracted factors of each build are huge ellipses in the CFA diagram, and the unique construction statements are rectangles related to the factors. Both representations relate to build components. Each measurement item is linked to its component or build. Single-sided straight arrows relate rectangles to factors. Since the constructions are reflective, the arrows point to the statements. Two-sided arrows merge multiple structures and show component relationships. Hair et al. (2010) claim that the error terms are linked to all statements and reveal any unexplained variance after the concept explains each statement's variation. This is true even after explaining the claim disparities.

For this investigation, AMOS v20 was used for the CFA.

4.18.1 Validity of Construct

There are two parts to the process of validating a concept: face validity and construct validity.

4.18.2 Validity of the Face

Trochim et al. (2015) define face validity as evaluating the measure's appearance and whether it accurately represents the concept being assessed. The questions applied to each concept based on academic and business specialists. Thus, facial validity is proven.

4.18.3 Validity of the Construct

All constructs may be represented from the organization's point of view by the different dimensions used to assess construct validity using CFA. One way to evaluate a scale's dependability in research is to look at its concept validity. It is also shown that discriminant and convergent analyses are valid. Verify the scale's accuracy by establishing its validity. A key relationship between several assertions and the associated idea is called "convergent validity." That is not right. The AVE statistics for each construct, the CR statistics for the constructs of the scale, and the construct loading for the claims of the concept are used to determine convergent validity. Each assertion must have a standardised slope coefficient greater than 0.7 in order to guarantee convergent validity (Hair et al., 2010). This requirement must be met. This guarantees that the company will be able to handle its electronic waste effectively. Important to provide a ballpark figure. According to Gupta and Singh (2015) and Hair et al. (2010), each extracted component has to have an AVE value larger than 0.5. Correct extracted components are guaranteed. Convergent validity suggests that all definition statements are meaningful. This result is achievable because of convergent validity. Logic may suggest this.

According to discriminant validity, the many constructs that describe the distinct properties of all constructions from the standpoint of the scale organisation are unrelated. Important because the scale assesses company performance. Discriminate validity showed that the organization's responses to the several assertions explaining structures were different. Statements were addressed. Correlating the scale's concept pairings determines discriminant validity. Given this premise, the constructs' link is unlikely to be substantial. According to structural equation modelling (CFA), "Maximum Shared Variance" (MSV) is the highest correlation between all constructs. It describes the strongest association between all constructs. Hair et al. (2010) and Dangi and Dewan (2016) advocate AVE larger than MSV for every construct. Both studies corroborate this idea. Comparing constructs needs moderate positive correlation coefficients under 0.7. Since correlation is smaller than square root, this occurs.

As indicated in the illustration, AMOS builds a measurement model for convergent and discriminant validity. Component combination construct loadings and correlation coefficients are also shown in the CFA diagram. Extra diagram element. This picture depicts construction loads.

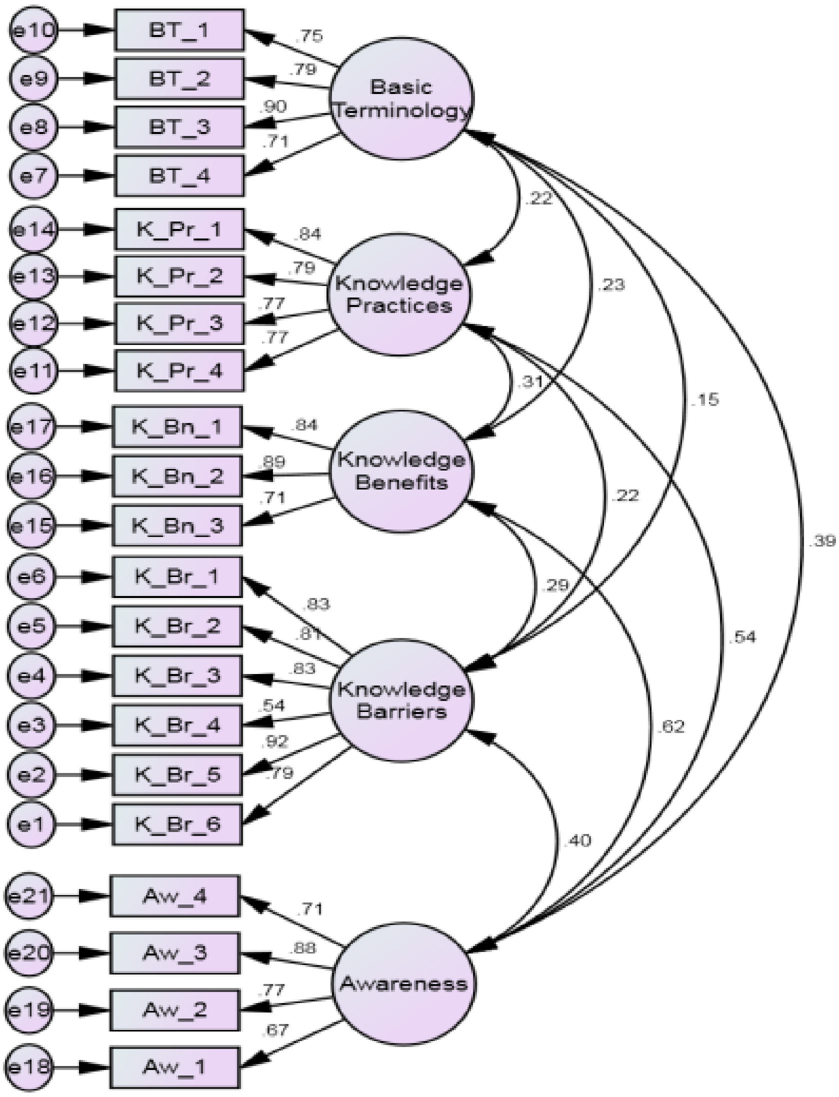


Figure 4.8: Initial CFA Model for Organizations

Tarofder et al. (2010) advocate standardised regression weights over 0.60. The data indicate this. According to Hair et al. (2010), its weight should exceed 0.7. Very good value. For each factor loading, 0.7 is critical. It was uncovered during investigation. As demonstrated in Figure 4.8, all factor loadings between rated items and constructs are more than 0.7, save one. E-waste management obstruction knowledge has this build loading. The construction loading of this item is 0.54, below the threshold of 0.7. The data suggests that business answers to this issue are unrelated to electronic waste management questions. Drawing scientific conclusions. Thus, "To what extent the poor attitude of end users towards e-waste management is a barrier in adopting formal e-waste management practises?" was eliminated. AMOS recalculates several factor loadings and correlation values after deleting this measurement item. These results are shown in the image below:

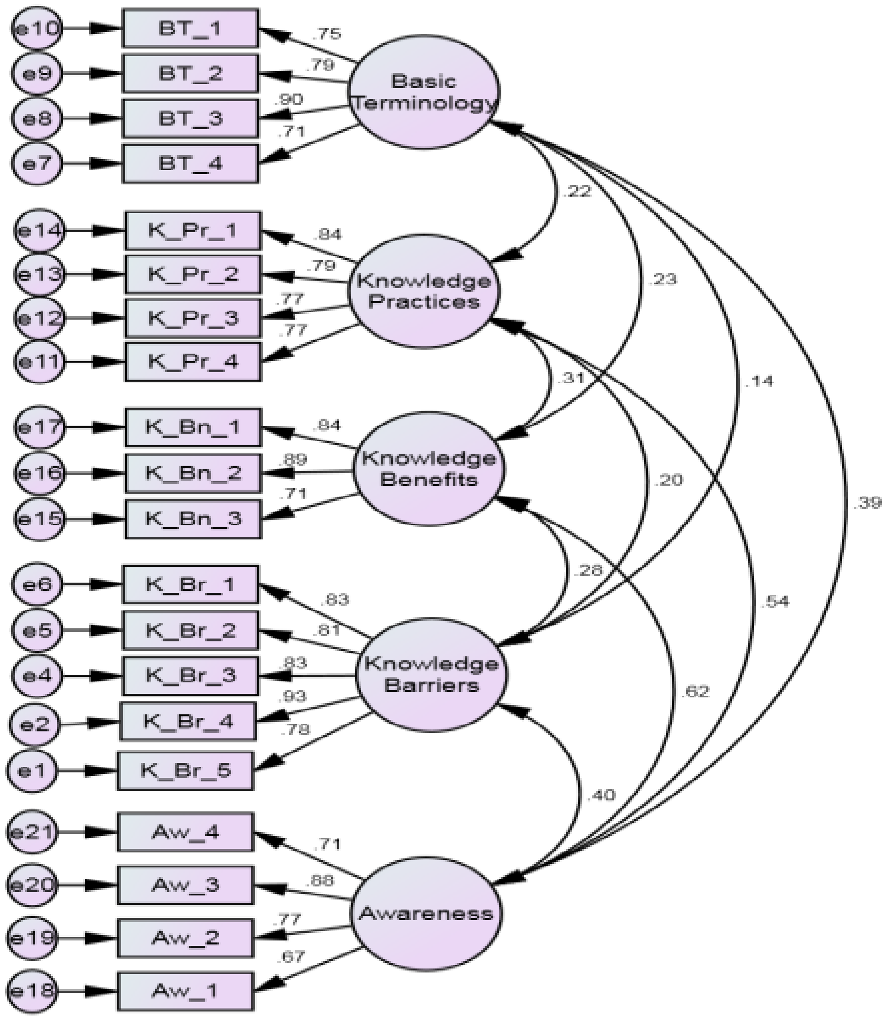


Figure 4.9: Final CFA Model for Organizations

The figure above shows that all factor loadings are greater than 0.7. The tables below include all components analysed and researched in every aspect of electronic waste management, along with their statistical significance.

Regression Weight for Organizations (CFA)

			Standardized Slope Coefficient	Un-standardized Regression Weight	Standard Error	Critical Ratio	P Value
K_Br_5	<---	Knowledge of Barriers	0.783	1.00			
K_Br_4	<---		0.932	1.278	0.118	10.816	***
K_Br_3	<---		0.831	1.128	0.121	9.356	***
K_Br_2	<---		0.806	1.061	0.118	8.998	***
K_Br_1	<---		0.833	0.926	0.099	9.385	***
BT_4	<---	Basic Terminology	0.714	1.00			
BT_3	<---		0.895	1.186	0.145	8.16	***
BT_2	<---		0.794	0.949	0.126	7.503	***
BT_1	<---		0.746	0.976	0.138	7.08	***
K_Pr_4	<---	Knowledge of Practices	0.767	1.00			
K_Pr_3	<---		0.771	1.049	0.134	7.802	***
K_Pr_2	<---		0.794	1.185	0.147	8.046	***
K_Pr_1	<---		0.838	1.104	0.13	8.468	***
K_Bn_3	<---	Knowledge of Benefits	0.713	1.00			
K_Bn_2	<---		0.893	1.147	0.143	7.992	***
K_Bn_1	<---		0.837	0.87	0.112	7.787	***
Aw_1	<---	Awareness	0.671	1.00			
Aw_2	<---		0.768	1.237	0.183	6.763	***
Aw_3	<---		0.880	1.539	0.207	7.429	***
Aw_4	<---		0.712	1.294	0.204	6.343	***

Convergent Validity

The table shows the probability values, critical ratio, standard error of the regression weight, and standardised construct loadings (standardised slope coefficient) for each one of the construct items. The research found a connection between the variables greater than 0.7 using the standardised slope coefficients. Strongly positive and statistically significant results of the standardised slope coefficients demonstrate that each research statement accurately depicted the components of each concept in electronic waste management. The crucial ratios for all of the coefficients are higher than 1.96, which means that they are statistically significant at the 5% level.

The measurement model's convergent validity is assessed using Concrete Reliability (CR) and Average Variance Extracted (AVE). How much each construct explains the component variability is shown by the magnitude of these values. Composite dependability and average variance were used to assess each concept for electronic waste management. Take a look at the results in the table below:

Convergent Validity Estimates

	Composite Reliability (CR)	Average Variance Extracted (AVE)
Knowledge of Benefits	0.857	0.669
Knowledge of Barriers	0.922	0.703
Basic Terminology	0.868	0.624
Knowledge of Practices	0.871	0.629
Awareness	0.846	0.580

CR and AVE estimates of e-waste management constructs based on respondent replies are more than 0.7 and greater than 0.5, respectively. Both estimations were based on respondent replies. Table 4.56 proves this. This investigation suggests the model has convergent validity.

4.18.4 Discriminant Validity

Discriminant validity must guarantee that all constructs are distinct. For testing, the correlation between each pair of constructs is computed and presented in the table below.

Correlations Between Constructs

			Estimate
Knowledge of Barriers	<-->	Basic Terminology	0.137
Knowledge of Barriers	<-->	Knowledge of Practices	0.201
Knowledge of Barriers	<-->	Knowledge of Benefits	0.277
Knowledge of Barriers	<-->	Awareness	0.395
Basic Terminology	<-->	Knowledge of Practices	0.219
Basic Terminology	<-->	Knowledge of Benefits	0.232
Basic Terminology	<-->	Awareness	0.387
Knowledge of Practices	<-->	Knowledge of Benefits	0.307
Knowledge of [illegible]	<-->	Awareness	0.536

The correlation study, as shown in Table, reveals a moderate Pearson's correlation coefficient between the organization's e-waste management features. This is shown by the poor correlation coefficient. This is where discriminant validity is meant to be used. Before assuming that each factor is distinct, check their maximum shared variance (MSV) and average variance extracted (AVE). The results reported above were obtained using all electronic garbage management systems. The table below displays the estimated validity measures together with their respective numbers.

Discriminant Validity Estimates

	Composite Reliability (CR)	Average Variance Extracted (AVE)	Maximum Shared Variance (MSV)
Knowledge of Benefits	0.857	0.669	0.379
Knowledge of Barriers	0.922	0.703	0.156
Basic Terminology	0.868	0.624	0.15
Knowledge of Practices	0.871	0.629	0.287
Awareness	0.846	0.58	0.379

It is clear from the table that every single build has an AVE greater than 0.5. Maximum shared variance (MSV) values below 0.5 do not exist for any construct. This demonstrates the practicality of discriminant analysis. To prove discriminant validity, another approach may be used. Using this method, calculate the square root of the average variance extracted (AVE) for each electronic waste management component and then examine their correlation coefficient.

Square Root of AVE and Correlation Estimates

	Knowledge of Benefits	Knowledge of Barriers	Basic Terminology	Knowledge of Practices	Awareness
Knowledge of Benefits	**0.818**				
Knowledge of Barriers	0.277	**0.839**			
Basic Terminology	0.232	0.137	**0.79**		
Knowledge of Practices	0.307	0.201	0.219	**0.793**	
Awareness	0.616	0.395	0.387	0.536	**0.762**

The statistical analysis of all EWM domains reveals that, when squared, the AVE outshines all other component correlation coefficients. This measuring paradigm exhibits discriminant validity as well as convergent validity, according to the study.

CONCLUDING Observations by the CFA

All statements used to evaluate the variables should significantly convey convergent validity, and each component should account for a considerable portion of its variability. Convergent validity is therefore established. Discriminant validity also shows that the scale's factors for explaining organisations' e-waste management awareness are not correlated and measure different aspects of awareness. This is "discriminant validity." The Confirmatory Factor Analysis (CFA) showed that the questionnaire items were valid and that the constructs should be distinguished. These are the prerequisites for such an analysis. The finding also confirms the survey's dependability.

Since confirmatory factor analysis validates several constructs, the measurement questions related to each construct can be used to determine companies' average electronic waste awareness. Tables grouped by construct provide a summary of the data for each item tested. The components of any construct might be the same at the individual and organisational levels after further investigation. This shows that sending the same questionnaire to both levels of an organisation is acceptable.

Sr. No.	Basic Terminology	No Idea {1}	Little Knowledge {2}	Average Knowledge {3}	High Knowledge {4}	Highly Updated Knowledge {5}	Mean	SD
1	How would you rate your personal knowledge of e-waste?	6.7%	19.2%	26.9%	31.7%	15.4%	3.30	1.15
2	Do you have idea about how an organization can contribute towards managing e-waste efficiently?	1.0%	16.3%	18.3%	39.4%	25.0%	3.71	1.05
3	Do you consider life of the electronic product as an important factor at the time of buying a new product for reducing e-waste generation?	6.7%	11.5%	21.2%	37.5%	23.1%	3.59	1.16
4	Are you aware of hazardous materials present in e-waste?	4.8%	22.1%	24.0%	23.1%	26.0%	3.43	1.23
Mean Total							**3.51**	

Sr. No.	Knowledge of Practices	No Idea {1}	Little Knowledge {2}	Average Knowledge {3}	High Knowledge {4}	Highly Updated Knowledge {5}	Mean	SD
1	In Indian perspective, do you think that easy access to informal collection and recycling channels is a barrier in adopting formal e-waste management practices?	23.1%	32.7%	14.4%	18.3%	11.5%	2.63	1.33
2	Do you know that there are better channels available for disposing e-waste rather than selling these to a normal rag picker?	31.7%	27.9%	10.6%	10.6%	19.2%	2.58	1.51
3	Do you think that inadequate financial incentive offered by official take back channels of the companies is a barrier in their adoption in India?	26.9%	20.2%	22.1%	18.3%	12.5%	2.69	1.37
4	How do you rate official take back system used by some e-products manufacturing companies, as a good e-waste management practice?	22.1%	27.9%	20.2%	18.3%	11.5%	2.69	1.32
Mean Total							**2.65**	

Sr. No.	Knowledge of Benefits	No Idea {1}	Little Knowledge {2}	Average Knowledge {3}	High Knowledge {4}	Highly Updated Knowledge {5}	Mean	SD
1	Do you think proper removal of hazardous materials from e-waste is beneficial in minimizing negative effect on human health and environment?	16.3%	50.0%	17.3%	13.5%	2.9%	2.37	1.01
2	To what extent, do you think, formal e-waste management will reduce public health hazards?	26.0%	44.2%	11.5%	7.7%	10.6%	2.33	1.24
3	Do you think formal recycling is helpful in reducing the final volume of e-waste (Recovery of components/parts)?	39.4%	25.0%	11.5%	15.4%	8.7%	2.29	1.36
Mean Total							**2.33**	

Sr. No.	Awareness	No Idea {1}	Little Awareness {2}	Average Awarenes s {3}	High Awareness {4}	Highly Updated Awareness {5}	Mean	SD
1	To what extent do you know how to dispose- of e-waste safely for human beings as well as for the environment?	22.1%	22.7%	18.8%	18.5%	17.9%	3.21	1.1
2	Are you aware of any electronic waste management policy currently implemented in India for safe disposal of electrical and electronic items?	28.1%	22.1%	18.3%	17.7%	13.8%	2.92	1.32
3	What is your perspective towards health and environmental hazards associated with e-waste?	26.9%	31.7%	20.2%	12.5%	8.7%	2.44	1.3
4	Do you think toxic/hazardous materials from discarded e-products require special treatment for environmentally sound disposal?	22.1%	32.7%	18.3%	15.4%	11.5%	2.62	1.3
Mean Total							**2.80**	

4.19 Statements of Concluding Remarks - Questionnaire

The table shows the proportion of respondents who picked each of the five alternatives and the average value for each question. For the organisational class, the mean value of knowledge concerning electronic waste management was 2.80, reflecting businesses' overall understanding. This was shown in organisational class. According to previous research, companies in northern India are not aware of how to handle electronic waste. Although the average awareness level of organisations is higher than that of people, it is not yet at the optimal level. The negative average score for all categories implies that businesses need to learn more about electronic waste's health and environmental implications. All categories averaged negative. This requires studying how structures impact general awareness. To achieve this, all constructs must be examined to see whether they directly affect total awareness or if there are intermediary effects. To address problems, the following analysis was done.

4.20 An investigation on the influence that exogenous substances have on general awareness

From an organisational viewpoint, the CFA findings explain the five electronic waste management structures. Electronic waste management involves many separate principles. This category includes knowledge of fundamental terminology, practices for e-waste management, benefits, barriers to formal management, and awareness. Five components have been addressed and appraised using various statements. These five components determine formal electronic trash recycling success. Users don't need to comprehend electronic waste management, but companies should. The next goal is to develop and test a Structure Equation Model (SEM) between four exogenous constructs—knowledge about basic terminology, practices, benefits, and barriers—and one endogenous construct. After the measurement model is correct, this test will be done. Since nobody has published this type of work before, it is not possible to determine with certainty if the first-order model with four external constructs affecting the endogenous construct is the best model. The investigated endogenous construct is linked to one or more exogenous constructs that mediate its relationship with other exogenous constructs. The same rationale led to the development of many alternative SEM models and their comparison to a mediation-free model to discover the best one. This will identify the optimal model for the job. Five models were constructed and examined to choose the best one.

4.21 Establishments Employing the Structural Equation Model—A Methodology

Gaining knowledge of the fundamental vocabulary, methods, advantages, and difficulties of e-waste management together enhance one's comprehensive understanding of the topic. A comprehensive range of stated assertions is used to assess all of the aforementioned components.

A structural model is being constructed to investigate the causal link between electronic waste management and awareness. This model is currently being construction for the purpose of investigating the connection.

To assess the validity of the following assumptions, structural equation modelling must be employed:

The first hypothesis posits that there is no correlation between business awareness and expertise of electronic waste management.

The second hypothesis is that the understanding of e-waste management procedures does not have any effect on the general awareness level of companies.

The third theory proposes that companies' level of awareness is unaffected by knowledge of the benefits of effective e-waste management.

The fourth hypothesis is that organisations' overall level of awareness is unaffected by their knowledge of the obstacles associated with electronic waste management. Concerning the fourth hypothesis, this is relevant. "

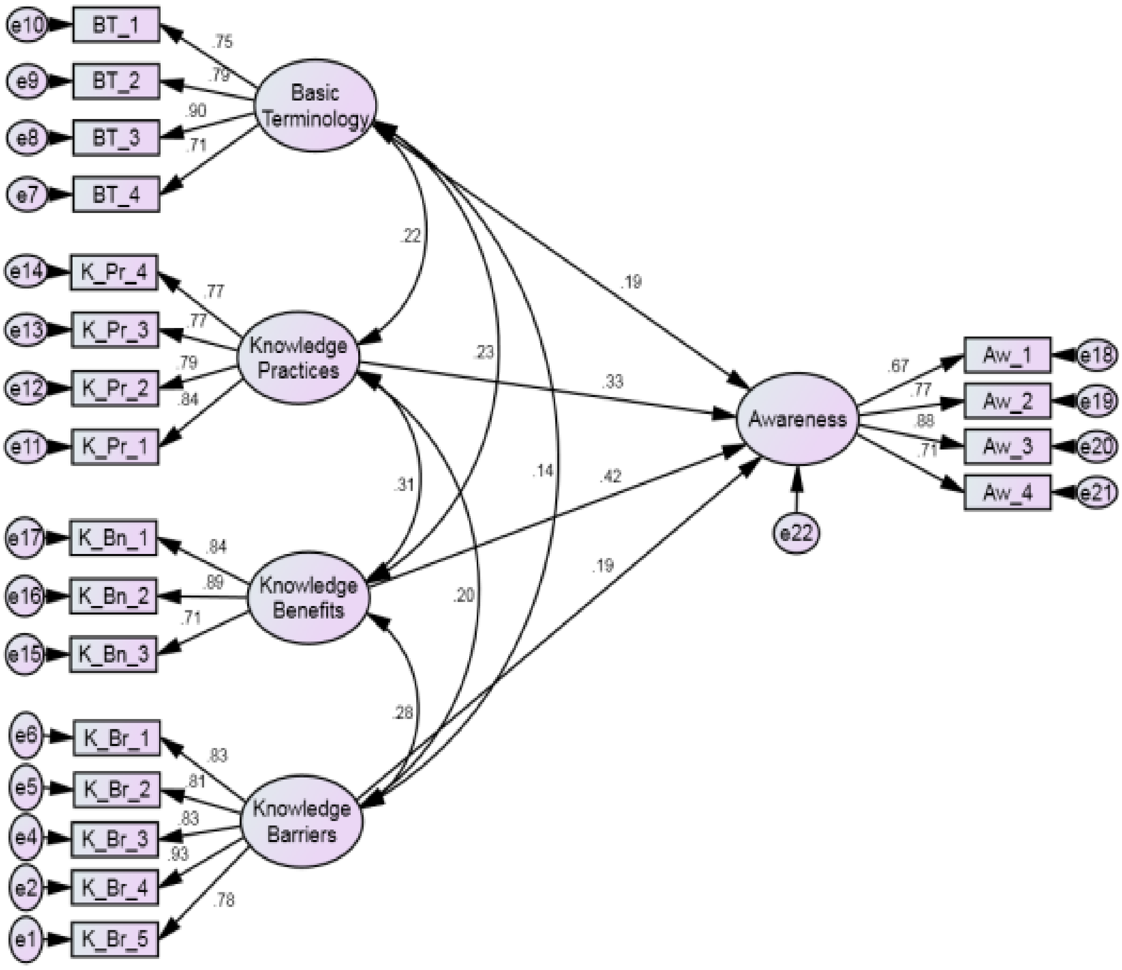


Figure 4.10: Structural Equation Model for Organizations (Model-A)

			Standardized Slope Coefficient	Un-standardized Regression Weight	Standard Error (S.E)	Critical Ratio (C.R)	P Value	R Square
Awareness	<---	Basic Terminology	0.193	0.157	0.074	2.124	0.034	0.58
Awareness	<---	Knowledge of Practices	0.327	0.21	0.064	3.299	***	
Awareness	<---	Knowledge of Benefits	0.419	0.31	0.082	3.779	***	
Awareness	<---	Knowledge of Barriers	0.187	0.16	0.076	2.122	0.034	

Every construct's p-value, standard error, critical ratio, regression weight, and slope coefficient are shown in the table above. The table contains these values. On top of that, it shows the R squared. In order to test the hypothesis of causes and effects, this are using the slope coefficient.The probability value of the crucial ratio was less than 0.05 for all electronic waste management systems considered. This was the conclusion after examining all techniques. Here are the structural equation modelling (SEM) study's results and conclusions.

H1: The first hypothesis is that company awareness is unrelated to electronic waste management terminology.

The standardised slope coefficient, which illustrates the relationship between understanding fundamental e-waste management concepts and organisational awareness, is 0.193 with a p value below 0.05. Number suggests relationship. It suggests a relationship. With a 5% level of support, the hypothesis "There is no impact of awareness about basic terminology of e-waste management on overall awareness level of the organisations" cannot be true. Companies learn more about electronic waste management by understanding its basics. A basic grasp of electronic waste management terminology is needed to assess its management at the organisational level.

H2:"There is no impact of knowledge of e-waste management practices on the overall awareness level of the organizations,"

The 0.327 standardised slope coefficient and p value below 0.05 demonstrate that e-waste management methods promote organisational awareness. The evidence shows this. "There is no impact of knowledge of e-waste management practices on overall awareness level of the organisations" cannot be supported by the data. There is no evidence to back up the idea. Businesses can raise more awareness of the problem if they learn about the processes for managing electronic trash.

H3: "There is no impact of knowledge about benefits arising out of proper e-waste management on the overall awareness level of the organizations,".

There is a significant difference between the total amount of data on e-waste management and the benefits that businesses get from it ($p < 0.05$; standardised slope coefficient = 0.419). A statistically significant p-value. According to the data, they are connected. At the 5% level of significance, the findings demonstrate that the null hypothesis "There is no impact of knowledge about benefits arising out of proper e-waste management on overall awareness level of the organisations" is rejected. Because there should be no effect based on theory, it used a 5% significance level to test the hypothesis. The advantages of proper e-waste management are what motivate people to learn more about these strategies.

H4: "There is no impact of knowledge of barriers in implementing proper e-waste management on the overall awareness level of the organizations,"

A p-value of less than 0.05 indicates a cause-and-effect relationship between organisational awareness and the standardised slope coefficient of 0.187, which illustrates the difficulties of excellent e-waste management. The significance level, p, is therefore lower than 0.05. That being said, it can say with 95% certainty that "There is no impact of knowledge of barriers in implementing proper e-waste management on overall awareness level of the organisations" is not true. Companies may become more aware of the problem if they take the time to learn about the intricacies of controlling electronic waste. Understanding the obstacles to building strategies for managing electronic waste and the solutions to overcome them is crucial for assessing companies' understanding of this issue. An effective system for managing electronic trash can only be implemented after the government removes all barriers.

According to this concept, the most effective strategy for getting people to learn more about a business is to highlight its benefits. The social, economic, and ecological benefits of formal electronic waste management are debatable. The environmental effects of any recycling company are less important to Indians than the economic benefits. In every case involving recycling, this is correct. Having a good grasp of how things work is the next effective component that impacts end-user awareness. People are more inclined to recycle electronic waste if they are aware of proper disposal methods and have easy access to collection centres. Reason being, people are increasingly recycling their old electronics. Aside from important words, understanding hurdles is the third critical component influencing overall awareness. The crucial details about electronic waste and the damage it might do are what the phrase "basic terminology" alludes to. Having knowledge of the obstacles has the least impact.

R2 should be greater than 0.39 to determine how much of the dependent variable's fluctuation may be attributed to the independent variables (O'Rourke N. and Hatcher L. 2013). This is needed to determine statistical significance. The SEM model used to describe organisational users' electronic garbage management knowledge obtained an R2 value of 0.58. Observation revealed this. This result was reached using analytical variables. A coefficient of determination (R2) of 0.58 suggests that four external factors explain 58% of awareness variance. The table below shows structural model goodness-of-fit indexes. See the table below:

Goodness of fit index	CMIN/df	GFI	AGFI	CFI	TLI	RMSEA
Calculated value	1.355	0.835	0.811	0.951	0.944	0.059
Expected value	Less than 3	More than 0.8	More than 0.8	More than 0.9	More than 0.9	Less than 0.08

Following are the fit indices generated from the measurement model that shows the numerous elements of electronic waste management:

The projected CMIN/df value is 1.355, below the maximum allowed value of 3. This means the value is below the maximum.

Above the minimum of 0.8, the Generalised Factorization Index (GFI) is at 0.835. It follows that the computations were accurate. With an AGFI of 0.811, it surpassed the lowest anticipated figure of 0.8. Over the required minimum of 0.9, the Component Factorization Index (CFI) came to 0.951. The estimated TLI is 0.944, above the minimum expected value of 0.9. Finally, the RMSEA is 0.057, below the aim of 0.08. This ensures the measurement model is statistically sound. With that, I will end this.

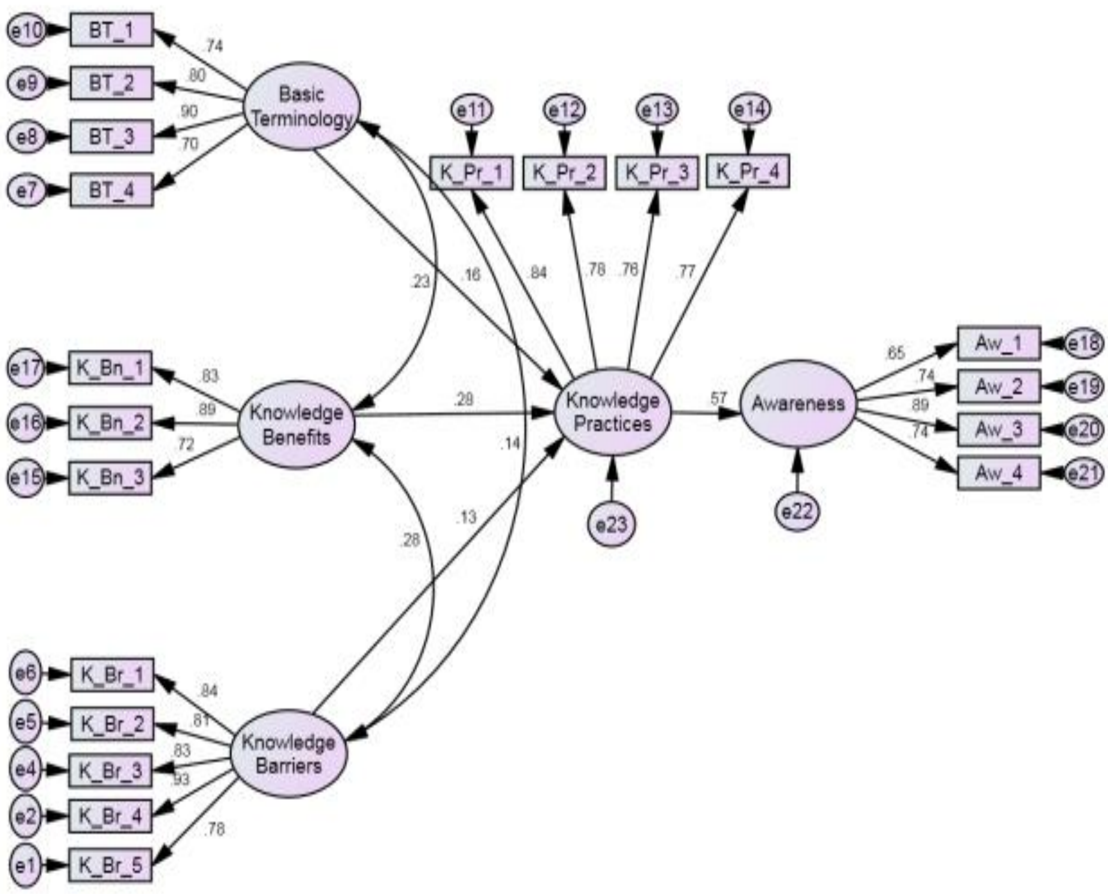
Even though it may not be the greatest match, this model satisfies all the statistical criteria for a decent fit. It is preferable to use a model with a small chi-square value. To explore this idea, many SEM models were used.

SEM Model-A: Concluding Remarks and Discussion

The structural equation modelling (SEM) shows that each building affects firms' electronic waste management awareness. The government must concentrate on all four programmes at once to raise corporate understanding of the potential dangers of electronic garbage.

4.22 Organizations in the Structural Equation Model-B Configuration

The knowledge of practices mediates between fundamental terminology, benefits, hurdles, and electronic waste management understanding in this paradigm. To use this technique, a corporation must first understand electronic waste management terms, advantages, and drawbacks. A corporation must first comprehend this, according to this plan. Once the organisation reaches a certain level, its consumers start learning about the best electronic waste management methods. This material fully educates them about electronic waste management. "Model with Knowledge about practices acting as mediator between other three exogenous constructs and endogenous construct is better than model A, which does not include mediation."



			Standardized Slope Coefficient	Un-standardized Regression Weight	Standard Error	Critical Ratio	P Value	R Square
Knowledge of Practices	<---	Basic Terminology	0.163	0.211	0.141	1.495	0.135	
Knowledge of Practices	<---	Knowledge of Benefits	0.278	0.317	0.133	2.385	0.017	0.17
Knowledge of Practices	<---	Knowledge of Barriers	0.131	0.176	0.143	1.224	0.221	
Awareness	<---	Knowledge of Practices	0.570	0.357	0.078	4.574	***	0.33

According to this model, the most influential factor on organisational consumer awareness is knowledge of practices (standardised slope coefficient: 0.570). The concept is backed by the standardisation of the slope coefficient.

Companies are more likely to recycle electronic waste if they are aware of the ecologically friendly ways to do so. Businesses will be more likely to recycle devices as a result of this. When it comes to end-user awareness, benefit information is the second most essential thing. The electronic trash management system's obstacles are defined by the core terminology. Customers will not keep their old devices at home if they are aware of the dangers that e-waste poses to human and environmental health. If individuals are aware of these outcomes, they will choose for a more structured method for properly disposing of electronic devices.

Goodness of fit index	CMIN/df	GFI	AGFI	CFI	TLI	RMSEA
Calculated value	1.548	0.821	0.801	0.926	0.913	0.073
Expected value	Less than 3	More than .8	More than 0.8	More than 0.9	More than 0.9	Less than 0.08

4.23 A Criteria-Based Comparison of Different SEM Models

Some goodness-of-fit indices that may be used to compare models include CMIN/df, GFI, AGFI, and CFI. Comparisons between models are feasible. The model with greater values will develop a better match with the environment. in 2010 In this study, Hair et al. found. The model with the smaller chi-square value is the better match when comparing the two models. in 2010 Among the most useful statistics for contrasting the two models is the coefficient of determination (R2), which Hair et al. state reflects the extent to which independent factors explain the observed variance in dependent variables. The findings show that the most accurate model is the one with the greatest R2 value. in 2010 According to Hair and co-workers. The Conventional Slope it want a 95% confidence level for each structure's coefficient. This is an additional factor to think about.(Hair et al., 2010)

How does SEM Model-B differ from Model-A?

1. Although Model A and Model B have adequate goodness-of-fit indices, Model A yields statistically better results in the comparison. This makes Model A better than Model B.

2. Model A has a Chi-square statistic of 216.829, whereas model B has 252.252. The differences are considerable. Model A's Chi square is lower than Model B's. Thus, model B may be inferior than model A.

3. Three, Model A may provide a more satisfactory explanation of events due to its greater R2 value of 0.58 compared to Model B's R2 value of 0.33. Model B's R2 is less than that of Model A.

4. For this reason, Model A is often considered the better option. At the 5% level of significance, Table 4.69 shows that there is no link between basic vocabulary comprehension and either practice knowledge or information regarding obstacles.

Analysis of Organisations using the Structural Equation Model-C

General e-waste management awareness is the dependent variable in this model, with knowledge of advantages mediating the relationship between fundamental terminology, behaviours, and barriers. This approach, which was tested to see whether it was superior, assumes that an organisation must first understand the vocabulary, practices, and concerns associated in electronic waste management. When a corporation understands these three notions, it will try to learn about the advantages of managing electronic garbage. This information will complete the individual's electronic waste management knowledge. Model A does not operate as a mediator between the three external constructions and the endogenous construct, so it may test the hypothesis that model C, which does act as a mediator, is superior."

4.24 A Structural Equation Model-D Analysis of Organisations

Based on the concept that an organisation first learns electronic waste language, the next model being examined for better match is constructed. After the level of interest in fundamental terminology rises above a certain threshold, users of the organisation try to learn about appropriate practices for managing electronic waste, the potential benefits, the challenges, and so on. Their e-waste management awareness is complete with this understanding. Thus, knowledge of advantages, practices, and challenges mediates the independent variable, crucial terminology, and the dependent variable, total e-waste management awareness. A mediator uses these three sorts of knowledge. This technique considers knowledge about behaviours, advantages, and obstacles endogenous and external constructs.

The following hypothesis will be used to compare model A and the proposed mediation model D: "Model with Knowledge about benefits, barriers, and practices acting as mediator between basic awareness and overall awareness is better than model A, which does not involve any mediation."

1.25 The Perspective of the Recycler on the Administration of Electrical Waste

O'Rourke N. and Hatcher L. (2013) claim that in order to use structural equation modelling in AMOS, a minimum of 100 respondents are required, which is equivalent to five times the number of variables. That is the very least. There were twenty-two plus one questions asked of recyclers in the study. A questionnaire was used for the purpose of data collection. Just thirty-three people took the time to respond to the survey, perhaps reflecting the low recycling rate. Reactions were possible due to the tiny sample size. This sum clearly falls short of expectations. The SEM examination of recycling data became more challenging when this was taken into account. This prompted the researchers to conduct a correlation and regression analysis to learn more about the impact of electronic waste management knowledge on fundamental concepts including practices, benefits, and terminology.

4.26 Correlation Analysis

This study takes a look at electronic waste management from the point of view of recycling advocates, exploring the connection between key terms, behaviours, advantages, obstacles, and knowledge level. To look at the statistical connection between a lot of variables, you may utilise Pearson correlation analysis. The Pearson statistic is used in correlation analysis to presume that the variables are continuous. Assuming the conditions for the correlation test are satisfied, this is true. What follows is an explanation of the Pearson correlation test's null hypothesis:

Null hypothesis: The null hypothesis states that core terminology, practices, advantages, barriers, and e-waste management awareness are unrelated among the recyclers studied.

		Awareness	Knowledge of Benefits	Knowledge of Practices	Knowledge of Barriers	Basic Terminology
Awareness	Pearson Correlation (P Value)	1	0.853 (0.000)	0.815 (0.000)	0.777 (0.000)	0.881 (0.000)
Knowledge of Benefits	Pearson Correlation (P Value)	0.853 (0.000)	1	0.682 (0.000)	0.692 (0.000)	0.811 (0.000)
Knowledge of Practices	Pearson Correlation (P Value)	0.815 (0.000)	0.682 (0.000)	1	0.547 (0.000)	0.721 (0.000)
Knowledge of Barriers	Pearson Correlation (P Value)	0.777 (0.000)	0.692 (0.000)	0.547 (0.000)	1	0.696 (0.000)
Basic Terminology	Pearson Correlation (P Value)	0.881 (0.000)	0.811 (0.000)	0.721 (0.000)	0.696 (0.000)	1

Because every connection coefficient is statistically significant, the null hypothesis that basic terminology, practices, benefits, challenges, and e-waste management awareness are unrelated cannot be adopted. This invalidates the null hypothesis. Basic vocabulary, methods, benefits, drawbacks, and electronic garbage management awareness are linked. Based on statistics, this conclusion is possible. Researchers found a favourable correlation between the following pairings: recycling knowledge and understanding of the advantages of electronic waste management Level of recycler awareness and understanding of electronic waste treatment methods. How well recyclers understand electronic garbage management difficulties. Recycling knowledge is considered together with electronic garbage management language. Recyclers' awareness depends on basic language, benefits, procedures, and obstacles. This association may be confirmed by using standardised Pearson correlation coefficients. The investigation found a strong correlation between recycling knowledge and critical terms. The strongest association was seen here. The government must prioritise fundamental language to increase recycling awareness. This is the most important element to address to reduce electronic waste's negative consequences. However, knowing processes and advantages is still important.

Knowledge of the barriers is not crucial, but fundamental terminology is the foundation for all other components, and the government must work on all of these separate factors concurrently as they are all interrelated.

4.27 Regression Analysis

Knowing the language, processes, benefits, and drawbacks of electronic waste management is a good predictor of recycler expertise. Multivariate regression research examines the relationship between the four external components and total awareness.

Multicollinearity develops in regression analysis when independent variables are highly correlated. Regression analysis assumes independent variables are unrelated. Independent variables shouldn't correlate. Independence is required for all independent variables. High correlation coefficients link independent variables. This happens with big coefficients. Correlation between independent variables influences regression model fitness.

Multicollinearity may be assessed in regression analysis using many approaches. The tolerance statistic and Variance Inflation Factor are examples of these techniques. Many sources (Hair et al., 2010; Uyanik, G. K. and Guler N., 2013; Field, A. 2013; Mooi, E. 2014; Menard, 1995) recommend tolerance statistics over 0.1 or 0.2 to minimise multicollinearity. This method eliminates multicollinearity. Research suggests VIF values should be under 10. This research may be found in Hair et al. (2010), Uyanik, G. K. and Guler N. (2013), Field (2013), Mooi (2014), and Myers (1990). Table 4.78 shows that all tolerance statistics are more than 0.1 and the variance inflation factor (VIF) is less than 10. As seen above, the regression model may be checked for multicollinearity. The regression analysis tests the following hypothesis:

One theory is that recyclers' familiarity with jargon related to EWM is unaffected by their level of experience in the field.

As for the second hypothesis, it states that recyclers' general knowledge is unrelated to their comprehension of methods for managing electronic trash.Recyclers' knowledge of the benefits of efficient electronic waste management is unaffected by their level of competence, according to the third hypothesis.

To begin, there is no correlation between recycler awareness and understanding of concepts relevant to electronic waste management.

A p-value of 0.05 was associated with basic terminology, and the overall awareness F-value was 64.224. General knowledge accurately predicts rudimentary vocabulary. The regression coefficient, t-value, and p-value all point to an increase in recycler awareness when people have a basic understanding of electronic waste management terminology (0.289, 2.707, and 0.05, respectively). These results reject, with 95% certainty, the null hypothesis that there is no effect of learning fundamental ideas on recycler awareness.

"There is no impact of knowledge of e-waste management practices on the overall awareness level of recyclers," according to the second idea.

There is a 0.265 correlation between general awareness and practical knowledge, with a t-value of 3.471 at the 5% level of significance. When the significance level exceeds 5%, something happens. A robust correlation between the variables seems to be the result of this investigation. If process knowledge does influence recycler awareness, then it can reject the null hypothesis with 95% confidence. By learning about the methods used to manage electronic trash, recyclers may expand their understanding of the field.

There is no correlation between recyclers' level of experience and their knowledge of the benefits of efficient electronic waste treatment, as stated in the third hypothesis.

unusual in character The correlation between recyclers' benefit knowledge and their level of awareness is 0.170, and the t-value is 2.214 at the 5% level of significance. They are both important. Consequently, the claim that benefits have no impact on recycling awareness may be rejected. Almost everyone is aware of the importance of recycling. An alternative explanation is that recyclers' awareness of the advantages of recycling is positively correlated with their level of general knowledge. "There is no impact of knowledge of barriers about e-waste management on the overall awareness level of recyclers," it is said, in accordance with hypothesis four.

According to the regression coefficient that connects awareness with understanding of the challenges associated with e-waste management, the overall level of recycler awareness is

0.187. Using this coefficient, it may find out how the parts are connected. The t-statistic is 2.688, according to the 5% significance level. It seems from the data that recycling awareness is favourably and considerably impacted when people have a better grasp of the challenges faced by recyclers. This allows us to reject the null hypothesis, which states that barriers do not influence recycler awareness.

Analysis of Regression: Final Thoughts and Remarks

The regression analysis shows that all independent constructions have a positive and large effect on the dependent construct, which is recyclers' general awareness of electronic waste management. The government must focus on all four structures at once to raise recyclers' knowledge of the harmful impacts of electronic trash on human health and the environment.

Statements of Concluding Remarks - Questionnaire

Recyclers' understanding of electronic trash's potential harm averages 3.96. Recyclers are aware of possible implications, proving their attentiveness. The research found that recyclers are more knowledgeable than previously thought. Electronic garbage has negative repercussions, but individuals and organisations are less aware of them than recyclers. In contrast to public knowledge, this is the case. Another reason this is needed is because recyclers treat electronic waste. Despite this, recyclers' scores are unsatisfactory when considering their understanding of proper electronic waste disposal. Recycling requires extensive instruction on the environmental effect of incorrect disposal and how to enhance living creatures. A large number of scientists support this suggestion.
This research compares consumer knowledge about ecologically friendly electronic waste disposal solutions.

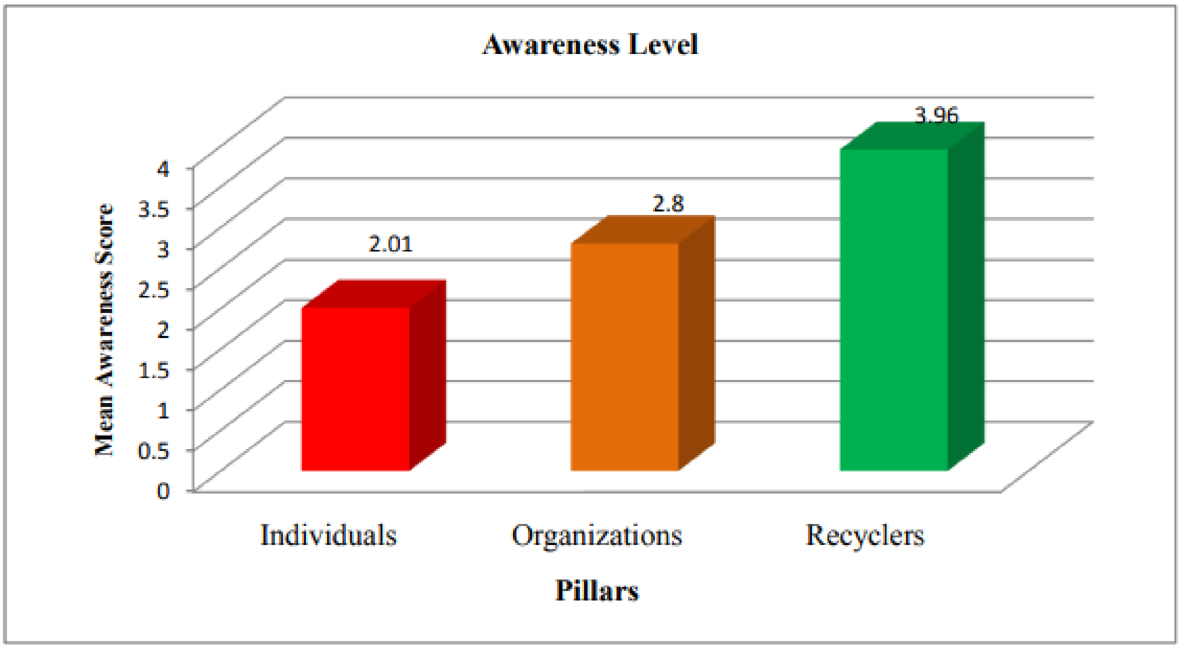


Figure 4.15: Awareness Level of Individuals, Organizations and Recyclers

The study shows that recyclers are more aware than individuals and organisations. The evidence supports this conclusion. The research found recycling awareness at 3.96. Organisations with a mean awareness score of 2.80 rank second. Figure 4.15 shows that individuals are 2.01 aware. People know the least about how electronic garbage may harm them and the environment. True for the population.

4.28 State barrons and recyclers are coordinating their efforts

The research examined data from Haryana, Punjab, and Uttar Pradesh recyclers. Recycling companies in various places manage electronic garbage. Comparison of the three states' mean score estimations is underway. The responses showed these states were distinct.

When comparing populations or binary samples, analysis of variance (ANOVA) examines several samples to see whether they are similar. By using this test, it may evaluate the probability that the observed differences in the sample are due to random error or that there is a more systematic reason for the observed disparity in the means of the two groups. This will be useful in determining whether there is a systematic explanation for the discrepancy. The mean difference is examined in this test under these conditions. It perform a one-way analysis of variance (ANOVA) to see whether the three states that have implemented or are in the process of implementing regulations for electronic waste management are comparable in terms of recyclers. That puts the hypothesis to the test. The purpose of this is to test the theory.

4.29 COMPARISON OF OPINIONS AND METHOD

India has appropriate avenues for electronic waste, but ineffective rules prevent most of it from reaching them. Lack of routes is the reason.
It is crucial that the government educate individuals, organisations, and recyclers about the risks of informal electronic trash recycling. This is because the government regulates recycling. Government rules to discourage informal recycling are crucial. The government must enforce the EPR to collect, process, and dispose of formal electronic waste. EPR stands for electronic waste collection, processing, and disposal. The government may charge electronic gadget buyers for recycling. It may be charged to customers. A new option appears. After collecting recycling funds, the manufacturer must collect and dispose of electronic waste. Manufacturers must build their own routes for trash collection, management, and disposal to be ecologically friendly. Manufacturers may be asked to build collection facilities in each city or provide door-to-door collection to efficiently collect electronic garbage. This ensured electronic trash collection. These steps are designed to gather electronic waste effectively. Manufacturers must prepare to collect outdated electronic equipment at their servicing locations. A reliable monitoring system for sold electrical items is needed to simplify recovery. A ticket number may be provided after purchase to help track and retrieve items after their shelf life expires. To ensure proper product usage, this is done. India has a complex set of laws and regulations, but its officials cannot implement them. To efficiently manage electronic waste resources, standards and guidelines must be followed throughout the process.

Financial incentives are one of the most crucial aspects that might help formalise electronic waste collection and disposal. It may be one of the most important factors.
Most end users sell their electronics to trash sellers because they lack financial incentives. This is despite garbage vendors charging unsuitable rates. Even if scrap merchants' pricing are unfair, this is true. To encourage disposal via legitimate collection routes, recyclers should pay end users a fair price at disposal. Because recyclers must pay end users a fair price. End users will be more inclined to properly dispose of their electronic waste after receiving financial incentives. This is because end consumers are more motivated. To efficiently collect electronic

waste, the government must assist build a formal collecting system that encompasses merchants, distributors, and manufacturers. This would assure efficient rubbish collection.

Electronic trash harms people and the environment, but consumers—individuals and businesses—don't understand this. Awareness among end users is crucial to enhancing official data collection. At this stage, a strict monitoring system is needed to develop awareness, which should include awareness activities

CHAPTER-5: CONCLUSION

5.1 Conclusions

Among the most important discoveries that have been made as a result of the continuing study are the following one:

1. What was found was that each of the four constructs that were used in the process of evaluating the overall awareness level of individuals and organisations had a significant impact on the overall awareness that the respondents had overall. Through the use of convergent validity, it has been shown that the multiple measurement items that were utilised in order to evaluate each of the four constructs that were being assessed are tightly related to their respective constructions. This observation was made possible by the utilisation of convergent validity. A finding that was quite similar to this one was arrived at by the use of discriminant validity, which revealed that each of the four concepts is significantly different from the others.

2. After the reliability of the questionnaire was established through the utilisation of principal component analysis (CFA), the responses that were provided by the respondents (individuals, organisations, and recyclers) were analysed, and average awareness values were computed for each construct for the respondents of each state as well as for each income category. It is feasible to draw the conclusion that the level of awareness among consumers (both Personal 2.1 and Organisational 2.8) regarding the potentially negative implications of electronic waste on both human beings and the environment is extremely low. This conclusion can be drawn based on the results of the research. On the other hand, the level of awareness among recyclers is much greater (3.96) and may be considered to be satisfactory in general.

3. The creation of an electronic waste awareness index is something that has been suggested as a potential development. Including the degrees of knowledge that people, organisations, and recyclers have about electronic waste would be included in this index. Chandigarh's residents have a mean awareness value of 3.1, which places them in the top position among the numerous north Indian states that were taken into consideration for this study. The figures that were

calculated using the proposed index show that the residents of Chandigarh have this value. This research was carried out in the geographical region of Chandigarh. Even if this value is higher than the values that were discovered for other states, it is not possible to consider this value to be something that is considered to be excellent. This is due to the fact that the figures that were obtained for other states were lower. According to the results of the study, the average awareness ratings for the states of Punjab, Haryana, Uttar Pradesh, and Himachal Pradesh were correspondingly 2.9, 2.8, 2.6, and 1.7. These figures were collected from the respondents of the survey. On the basis of the total number of replies that were obtained, these values were estimated. As a result of the fact that certain states have lower awareness indices in comparison to other states, it is clear that there is an immediate need to initiate awareness initiatives in these states. As a consequence of this, it is imperative that awareness initiatives be initiated without delay.

4. While statistical evidence did lend credence to the first-order structural equation modelling approach, researchers still wanted to see whether any external components might mediate the relationship. The results of the research told us the answer to that query. It compared the suggested model to one that doesn't account for mediation effects. Structural equation modelling (SEM) encompasses four separate models, each of which makes use of a different sort of mediation. This have proposed each and every one of these SEMs. One may argue that the first model—the one without mediation—is the most effective of the bunch, even if all of the models included have respectable fit values. The findings of this study allow for the attainment of this goal. This result is achievable due to the fact that the fit values are good. Raising end-user (individual or organisational) knowledge of the negative impacts of electronic waste on human health and the environment requires addressing all aspects that make up overall awareness at the same time. If you want to get the outcome you want, you have to do this. This resulted from the current activities that are already underway.

5. The data that was collected from the respondents on the quantity of various electronic devices that were discarded was used to produce an estimate of the amount of electronic garbage that is now dwelling in homes in the northern Indian states that were included in the present study. This estimate was obtained from the data that was received. The use of data from both official

and informal recyclers allowed for the estimation of additional financial gains that are associated with processing via formal channels. The data contained the amounts of precious elements such as gold, silver, copper, aluminium, ferrous, and plastic that were discovered in electronic equipment. Additionally, the data included disparities in the capacities of recyclers to recover these materials. The need of switching to formal channels for the management of electronic waste is further highlighted by the fact that both of these large differences already exist. It has been shown, via the use of the pay-back time method, that the payback period for the installation and utilisation of formal equipment is quite brief, with an anticipated duration of around two years. As a result, there should not be any problems in attracting investment for this purpose, provided that the government is able to enforce the formal disposal via the stringent application of legal framework principles.

6. Furthermore, research has been carried out using regression and correlation analysis to determine the cause-and-effect link between the different external factors and the overall degree of awareness. In order to determine their connection, this has been carried out. Researchers have looked into the possible relationship between the two and found it to be true. This strategy was used in order to better comprehend the nature of the connection between the two. It was decided to conduct an inquiry after the data collected from recyclers was considered. The choice was made. The Pearson correlation coefficient is statistically significant for all of the examined variable pairs, according to the correlation study. According to the research, this is the outcome. Despite the very low "p value" (0.000), this remains true since the research proves a statistically meaningful correlation. All of the factors were chosen with careful thought for the consequences they may cause, and this is a proven truth. The arguments put forth here are supported by all the factors that are being considered right now. An individual's level of familiarity with the field as a whole, as well as their familiarity with its basic terminology, practices, benefits, and challenges, all correlate positively with their level of awareness of electronic waste management. This is due to the fact that these two factors are strongly correlated with one another. Given the current state of affairs, this is the rationale. Because there is a strong positive correlation between these things, this result has been achieved. Each independent variable has a significant slope coefficient according to the regression analysis, however only at a 5% level of significance. To be regarded noteworthy, this level must be at least somewhat high. In other words, this is something that the study

proved. When the smallest quantity that may be deemed important is present, said that something is at this degree of importance. As previously shown by the results of the studies conducted, this is really truth. Here it find the degree of relevance where the least quantity that might be deemed important is present, in terms of importance. Based on this data, it can say with 95% certainty that the outcome shows a positive slope coefficient for the following: core terminology knowledge, practice knowledge, benefit knowledge, and obstacle knowledge. Because this data is readily accessible, this may draw this conclusion. One may get this conclusion with an accuracy of around 95%. With an amount of certainty equal to around 95% of the total, it is possible to reach this conclusion. So, it seems that this has a good effect on recyclers' general level of awareness around the topic.

7. The state authorities and recyclers need to work together in order to coordinate their efforts in order for the official e-scrap management system to be successful. This is a very important need. In this study, a statistical analysis known as an analysis of variance (ANOVA) was performed using a single-way design. Given that the views on the enforcement and facilitation role of the authorities for the management of electronic trash are comparable in three states (Haryana, Punjab, and Uttar Pradesh), it is obvious that there is a lack of enforcement and facilitation. This is because the authorities in these states are responsible for managing electronic waste. The authorities are not providing sufficient enforcement and facilitation, which is the reason why this is really the case.

8. For both of the relevant variables, the "p value" of the F-statistics is more than 0.05, according to the outcomes of the conducted one-way analysis of variance (ANOVA). All of this lines up with what the data analysis showed. Given the available data, this is the only reasonable conclusion to make from them. It is not completely implausible that the research would accept the hypothesis of identical methods given the provided conditions. The research shows that in every single jurisdiction, there is a severe lack of cooperation between recycling companies and state officials. In every single jurisdiction, this is the case. Indeed, this is the case in every single jurisdiction. But state officials don't provide recycling training sessions and don't listen to recyclers' recommendations. Clearly, this is a very important distinction.

Therefore, this situation necessitates adjusting in order to guarantee the proper execution of the framework for electronic waste management.

There have been comparisons drawn between India's regulations on electronic waste management and those of other nations, including the US, UK, Japan, Germany, China, and Kenya. Many important aspects of e-waste management have been the subject of these comparisons. The purpose of these kinds of comparisons is to try to figure out how India compares to other countries. It has determined that the policies have many flaws that must be immediately addressed after doing a thorough analysis of their regulations. Based on the comparisons, it is clear that India's current strategy for managing electronic waste satisfies several important requirements that help with e-waste organisation. The findings of the comparisons lead to this conclusion. There is no way that these features are being applied that could be considered appropriate. Imposing an Advanced Recycling Fee (ARF) on customers and building a comprehensive system are essential steps for the government to track the lifecycle of electronic gadgets, from production to final disposal. The authorities will be able to track the movement of electronic gadgets thanks to this. I think this is incredibly necessary so the government can monitor the movement of technological devices. There must be a strict and comprehensive system in place to keep tabs on the actions of all parties involved, including individuals, businesses, and recyclers. At the same time, it is critical to clearly define the responsibilities of every single stakeholder. Aside from being absolutely necessary, this is also critically important.

9. A strategic framework for the effective management of electronic waste was developed as a result of an in-depth review of the different countries' approaches to the management of electronic waste. Comparing various policies is another method that may be used to aid in the process of establishing an effective strategic framework for the Indian context. The government of India has to come up with a reliable method or system in order to collect electronic garbage via the right channels. This is a must. The establishment of a collecting facility that offers a door-step service, as well as buy-back centres, collection at merchants' end, and registered collection centres, is required in order to improve the collection of electronic waste. This is essential in order to achieve the goal of boosting the collection of electronic waste. Based on the results that were provided earlier, it has been determined that

the level of knowledge that end users possess is insufficient and has to be significantly expanded. It is necessary to organise awareness programmes in order to accomplish this goal. Additionally, advertisements pertaining to the negative impacts of electronic trash should be shown on television, published in newspapers, and disseminated across a number of social media platforms. DoEq should be constructed in such a manner that it is possible to easily modify electrical equipment in order to accommodate any future technological developments. This approach is recommended when it comes to electrical devices. In order to fulfil the requirements, it is necessary to carry out both an effective monitoring system and an effective implementation of Extended Producers Responsibility (EPR).

5.2 The potential for further work

The following are some of the potential future avenues in which the work that is now being done might be expanded:

1. The present work is built on four main constructions, which are core terminology, knowledge of practices, knowledge of advantages, and knowledge of difficulties. There is a possibility that these components are responsible for around sixty percent of the fluctuations in the overall state of consciousness. In spite of the fact that it is a suitable level for qualitative study, further research may be carried out in the future in order to discover other structures and explore the influence that these constructions have on total consciousness.

2. The method of measurement that was described in the current research for the goal of establishing the level of awareness in five states situated in northern India is applicable to other parts of India and may be used to assess the degree of awareness in those areas. The studies were conducted in order to determine the level of awareness in the aforementioned states.

3. It is feasible to use the model that has been supplied in order to assess the level of collaboration that exists between the formal recyclers and the state government for the rest of India. This may be done by using the model.

4. In order to detect any regulatory gaps, a comparison of the policy of India on the management of electronic waste with the policies of the United States of America, the United Kingdom, Japan, Germany, China, and Kenya has been carried out. It is possible that India's policy might be improved further by doing an analysis of the policies of other countries, such as Russia, Singapore, and Switzerland, amongst others. This work is a continuation of existing efforts.

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