Final Report

on

Inventory Preparation of E-Waste and Its Management in Kathmandu Valley

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Department of Environment

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TABLE OF CONTENTS

List of Tables

List of Figures

List of Abbreviations

%	-	Percent
BFR	-	Brominates Flamed Retardant
CO_2	-	Carbon Dioxide
CFC	-	Chlorofluorocarbon
CV	-	Curriculum Vitae
DANIDA	-	Danish International Development Agency
DOE	-	Department of Environment
EEE	-	Electrical and Electronic Equipment
GDP	-	Gross Domestic Production
HCFC	-	Hydro Chloro Fluoro Carbon
HFC	-	Hydrofluorocarbons
LCD	-	Liquid Crystal Display
EEE	-	Electric and Electronic Equipments
WEEE	-	Waste of Electric and Electronic Equipments
IT	-	Information Technology
CRT	-	Cathode Ray Tube
PVC	-	Poly Vinyl Chloride

Executive Summary

The electronic waste (e-waste) is one of the rapidly growing waste streams in the world. The increasing market penetration rate in developing countries, replacement market in developed countries and the high obsolescence rates make e-waste as one of the fastest growing waste stream. Many environmental related issues; trans-boundary and international level trades of electronic and electric equipment, similar trade associated with e-waste at focal point has driven many countries to introduce policy level interventions. There is a dire need to facilitate the recovery, recycle and reuse of useful materials from waste generated from a process and/or from the use of any material. This will definitely help in reducing the wastes destined for final disposal which in turn will ensure the environmentally sound management of all materials. It is much more expensive in the developed countries to recycle or dispose electronic waste, as there are many more environmental regulations that have to be addressed while handling hazardous waste. In Nepal, the quantity of e-waste has been steadily increasing and has emerged as one of the most significant forms of waste. Economic progress and desire to adopt newest technologies has made the availability of electronic devices easier which also has increased the obsolescence rate. The economic gap among the urban population has also increased the processing of old and discarded electronic products. The growth of e-waste has significant social, environment and economic impacts. The increase of electrical and electronic products, consumption rates and higher obsolescence rate has led to higher generation of e-waste. In this study, mainly five electronic devices, mobile phones, computers, televisions, washing machines and refrigerators have been studied. This study is aligned with the JETRO methodology used to perform similar study in Thailand. In depth consultation and desk study resulted in selecting the right methodology, which has led to identification and categorization of major e-waste producing sectors. The sectors are chiefly divided into five groups namely household, repairing shops, dealers and retailers, service sectors and scrap dealers. Sampling formulae was used to determine the required sampling size and the e-waste inventory was calculated on the basis of primary data collected from the samples. While quantifying the inventory, the results based on samples were multiplied by the approximate population size based on the different secondary sources.

In course of the study, for the survey of the household sector, a total of 396 samples are taken, although the minimum requirement of the sample size was 384 for the Kathmandu valley household population size of 765,824 in consideration with 0.5 as degree of accuracy and confidence level as 95%. The findings show that the household sector produced/collected a

highest amount of e-waste compare to all other above mentioned sectors and it is estimated to be 15857.98 tons in quantity of unused EEEs.

Similarly, in consideration with the pollution sizes, the sample sizes taken for the survey of Service, Retailers and dealers, Repair shops and Scrap dealers sectors are 32, 27, 25 and 20 and the study shows that each of these sectors contribute in generation of e-waste in the quantities of 270.75 t, 190.21 t, 20.53 t and 1,391 t respectively.

The estimated collection/generation of e-waste volume by scrap dealers around the valley is a significant amount considering the status of Nepal as a developing country. The import from India, China and third countries is steadily on the rise which signifies the consumerism that has developed in Nepal. Based on the imports and use of EEEs, the e-waste inventory based on the increasing obsolescence rate in Kathmandu for the year 2017 has been estimated to be 17730.44 tons. The scrap dealers are found to be the last component in the value chain. All the unused items ultimately reach the dealers in scrap value where a limited facility of segregation and recycling is available. Thus the collected waste is found to be transported to India for extraction of useful/precious elements and recycling.

Although Nepal's constitution 2072 ensures the right of people to live in pollution free and clean environment, due to the lack of rules and regulations regarding the import/export and trade of e-waste, termed under the hazardous waste by various directives worldwide, the basic rights are not addressed practically. Different practices on the worldwide arena are summarized in this study and based on that recommendations have been forwarded.

This study is an effort to know the quantity of e-waste generated and techniques of management in Kathmandu valley. As the quantity of e-waste generated in Kathmandu is significant, which needs to be evaluated, verified and re-emphasized for raising an alarm over the sheer magnitude of the potential problem.

1. INTRODUCTION

1.1 Background:

Electronic waste or e-waste is the term used to describe old, end-of-life electronic appliances such as computers, laptops, TVs, DVD players, mobile phones, MP3 players, etc., which have been disposed by their original users. E-waste is one of the rapidly growing problems of the world. E-waste comprises of a multitude of components, some containing toxic substances that can have an adverse impact on human health and the environment if not handled properly. In Nepal, E-waste management assumes greater significance not only due to the generation of its own e-waste but also because of the dumping of e-waste from developed countries. This is coupled with Nepal's lack of appropriate infrastructure and procedures for its disposal and recycling.

The production of electrical and electronic equipment (EEE) is one of the fastest growing global manufacturing activities. Rapid economic growth, coupled with urbanization and a growing demand for consumer goods, has increased both the consumption and the production of EEE. The information technology (IT) industry has been one of the major drivers of change in the economy in the last decade and has contributed significantly to the digital revolution being experienced by the world. New electronic gadgets and appliances have infiltrated every aspect of our daily lives, providing our society with more comfort, health and security and with easy information acquisition and exchange. The knowledge society however is creating its own toxic footprints.

E-waste has been categorized into three main categories, i.e., Large Household Appliances, IT and Telecom and Consumer Equipment. Refrigerator and washing machine represent large household appliances; PC, monitor and laptop represent IT and Telecom, while TV represents Consumer Equipment.

Each of these e-waste items has been classified with respect to 26 common components found in them. These components form the ‘building blocks’ of each item and therefore they are readily ‘identifiable’ and ‘removable.’ These components are metal, motor/ compressor, cooling, plastic, insulation, glass, LCD, rubber, wiring/electrical, concrete, transformer, magnetron, textile, circuit board, fluorescent lamp, incandescent lamp, heating element, thermostat, brominated flamed retardant (BFR)-containing plastic, batteries, CFC/HCFC/HFC/HC, external electric cables, refractory ceramic fibers, radioactive substances and electrolyte capacitors.

The increasing ‘market penetration’ in the developing countries, ‘replacement market’ in the developed countries and ‘high obsolescence rate’ make e-waste one of the fastest waste streams. This new kind of waste is posing a serious challenge in disposal and recycling to both developed and developing countries while having some of the world's most advanced high-tech software and hardware developing facilities. The dumping of e-waste, particularly computer waste, into Nepal from developed countries (‘green passport’ according to Gutierrez), because the latter find it convenient and economical to export waste, has further complicated the problems with waste management. All this has made e-waste management an issue of environment and health concern.

EEEs are made of a multitude of components, some containing toxic substances that have an adverse impact on human health and the environment if not handled properly. Often, these hazards arise due to the improper recycling and disposal processes used. It can have serious repercussions for those in proximity to places where e-waste is recycled or burnt. Waste from the white and brown goods is less toxic as compared with grey goods. A computer contains highly toxic chemicals like lead, cadmium, mercury, beryllium, BFR, polyvinyl chloride and phosphor compounds.

1.2 Objectives of the Consulting Service

The development or long-term objective is to study and prepare the inventory of electronic waste in the Kathmandu Valley. However, this particular consulting service has the objective of only collection, compilation and quantification of information and data relating to electronic products used in the Valley that will contribute to e-waste upon the useful life or due to obsolescence.

1.3 Scope of Work

The scope of work consisted of:

- Identification of the products containing significantly electronic items that becomes e-waste ultimately in the Kathmandu Valley.
- Collection of data and information on year-wise import as well as production/ assembly indigenously
- Preparation of a report that will be useful to prepare e-waste inventory later.
- Made recommendation to management of e-waste.

To complete the scope of work, the following tasks were envisaged as far as possible:

Existing Situation

- Baseline study: Following baseline study was done during this work:-
  - ✓ Identification of the products containing significantly electronic items that becomes e-waste ultimately in the Kathmandu Valley
  - ✓ Types used in these sources, year of installation, capacity, cost and location
  - ✓ Conversion rate to E-waste
  - ✓ Different pollutants (E-waste) generated throughout the Fiscal Year (Preferably for last five years).
  - ✓ Review of the existing policies, legal framework
  - ✓ Existing regional and international practices
  - ✓ System of registration of Electronic goods in Nepal.
  - ✓ Estimation of per capita waste generated in the Valley

- Conduction of field studies in the different sources for the following aspects
  - ✓ To monitor and inspect the scrap dealer/vendor of E-Waste in Kathmandu valley including all three districts in the valley.
  - ✓ Detailed observation of various areas/sources and types of controls adapted to pinpoint specific problem areas and causes of E-waste generation.
  - ✓ Generation of data through field observation as well as literature survey based on each type of electronic goods those ultimately convert to E-Waste.

- Data analysis of the collected E-waste information for the purpose of estimation/quantification of the E-Waste as per the identified suitable methods.
- Projection of the possible E-Waste generation in the Valley in future.
- General overview of criteria/practices adopted by the concerned government authorities for phasing-out or management of different Types of electronic goods those ultimately convert to E-waste as well as the waste generated at present.

1.4 Limitations of this study:

There are certain limitations associated with this study. The information available is limited. Preliminary analysis of only a few of the important e-waste generating items is carried out. Not all the Electric and Electronic Equipments (EEE's) have been considered in the study. The electronic items/devices considered in this study are mobile phones, televisions, computers, washing machines and refrigerators. There has been a very little research on e-waste in case of Nepal, so there's a vast research gap in this field which makes the literatures unavailable for past years.

The most relevant data source of import of electronic items is the data maintained with the Department of Customs. However, the usage statistics may not be completely dependent on the import registered in Department of Customs only as illegal imports of electronic items is also seen in the Nepalese market.

Similarly, the data has not been maintained for the amount production or assembly of the electronic products in any organization. The study is based on the data and information provided by different persons and organization verbally.

The no. of samples for the sectors other than household sector is based on ad hoc assumption. The samples for different sectors have been made as inclusive as possible. Thus collected samples represent the general population of a valley. However it may not be equally dispersed in all areas.

The data collected from the various entities based on verbal information as there are not any recorded data. The final estimation of e-waste generation in Kathmandu valley is expansion on the sample size, which may not align to the exact value.

2. LITERATURE REVIEW

After the industrial and agricultural revolution, the world is currently in the phase of the Information Technology (IT) revolution. The IT revolution causes many improvements in productivity and efficiency. It has improved quality of life and electrical and electronic products have become an important part of our everyday life. The rapid growth of the use of electrical and electronic products has given rise to a new environmental challenge for E-waste management.

"Electronic waste" may be defined as all secondary computers, entertainment electronic devices, mobile phones, and other items such as TVs and refrigerators, whether sold, donated, or discarded by their original owners. This definition includes used electronics which are destined for reuse, resale, salvage, recycling, or disposal. Others define the reusable (working and repairable electronics) and secondary scrap (copper, steel, plastic, etc.) to be "commodities", and reserve the term "waste" for residue or material which was represented as working or repairable but which is dumped or disposed or discarded by the buyer rather than recycled, including residue from reuse and recycling operations. Because loads of surplus electronics are frequently commingled (good, recyclable, and non recyclable), several public policy advocates apply the term "e-waste" broadly to all surplus electronics.

The United States Environmental Protection Agency (EPA) refers to obsolete computers under the term "hazardous household waste". Debate continues over the distinction between "commodity" and "waste" electronics definitions. Some exporters may deliberately leave difficult-to-spot obsolete or non-working equipment mixed in loads of working equipment (through ignorance, or to avoid more costly treatment processes). Protectionists may broaden the definition of "waste" electronics. The high value of the computer recycling subset of electronic waste (working and reusable laptops, computers, and components like RAM) can help pay the cost of transportation for a large number of worthless "commodities".

Obsolete electrical or electronic devices, or electronic waste (e-waste), has become a pressing global issue as it is now the world’s fastest growing waste stream (Ogunseitan et al., 2009). Estimation of e-waste recycling rates and recovery differs by region. It is estimated that only 25% of e-waste generated in the European Union (Perkins et al., 2014) and 40% in the United States (US-EPA, 2015) each year is properly recycled, while the rest becomes ‘untraceable’. Rapid economic growth has created massive demand for new electronics, increasing both the

production and the consumption of electrical and electronic equipment across the world. The electronics industry has become the world's largest and fastest growing manufacturing industry (Schwarzer et al., 2005). At the global level, e-waste production was expected to reach 93.5 million tons in 2016 (Tiwari and Dhawan, 2014), yet e-waste management technologies, particularly in newly industrializing countries, are still at their early stages. It is estimated that 17–34% of e-waste produced in economically developed countries are exported annually (including illegal exports) to developing countries (Breivik et al., 2014). This includes discarded but repairable and reusable electronic goods that enter secondary markets before reaching the waste stream. Since the adoption of the Basel Convention in 1989, the legal trade of e-waste has slowed, particularly from developed countries to less developed ones (Lepawsky, 2015).

2.1 Definition by Basel convention

Waste Electronic and Electrical Equipment (WEEE) was defined in different technique policy, regulations and management ordinance respectively in China, but the major content was quite identical. The typical definition was from “Technique Policy for Waste Household Electric and Electronic Equipment Pollution Prevention” which was issued by State Environmental Protection Administration (hereinafter “SEPA”) in April 27th, 2006 and definition of WEEE was as following:

Home electric and electronic equipment means home electric equipment and similar appliance, including TV, refrigerator, air conditioner, washing machine, cleaner, etc., electronic equipment means information technology and communication equipment, office equipment, including personal computer, printer, electro graph, duplicating machine telephone, etc.

Waste home electric and electronic equipment means discarded home electric and electronic equipment those lost use value or use value could not satisfy requirement; and their component, accessory and materials, including:

- Waste home electric and electronic equipment by consumers (users).
- Disqualification products and their components, accessory and material in the process of e-products generation.
- Waste components, accessory and material in the process of servicing or updating.

- Those were regarded as waste home electric and electronic equipment according to relevant law and regulations.

In many researching reports, books, newspapers, journals and any other literature, “Waste home electric and electronic equipment” equals to “waste electronic and electric equipment”, shorted by “e-waste”.

2.2 Categories of E-waste

E-waste is the term used to describe old, end-of-life, or defective electrical and electronic equipments. E-waste includes computers, electronics, mobile phones, household appliances, etc. which have been disposed of by users. According to the European Waste of Electrical and Electronic Equipments (WEEE) Directive, the specific products of electronic waste are as explain in Table 2-1.

Table 2-1: Electrical and electronic equipments covered by WEEE Directive

Product Category	Specific Product Name
Large household appliances	Refrigerators, freezers, washing machines, clothes dryers, dish-washing machines, electric stoves, microwaves, electric heating appliances, electric fans, air conditioner appliances, etc
Small household appliances	Vacuum cleaners, carpet sweepers, irons, toasters, fryers, coffee grinders, electric knives, coffee machines, tooth brushes, shavers, clocks, scales, hair dryers , etc.
IT & Telecommunications equipment	Mainframes, minicomputer, printer units, personal computers, notebook computers, copying equipment, electric and electronic typewriters, pocket and desk calculators, user terminals and systems, facsimiles, telephones, cordless telephones, cellular telephones, answering systems
Consumer equipment	Radio sets, television sets, video cameras, video recorders, audio amplifiers, musical instruments, etc.

Lighting equipment	Straight fluorescent lamps, high pressure sodium lamps and metal halide lamps, low pressure sodium lamps, other lighting equipments
Electrical and electronic tools	Drills, saws, sewing machines
Toys, leisure and sports equipment	Electric trains or car racing sets, hand-held video game consoles , video games, etc.
Medical devices	Radiotherapy equipments, cardiology, dialysis, pulmonary ventilators, nuclear medicine, laboratory equipments for in-vitro diagnosis, analyzers, freezers, etc.
Monitoring and control instruments	Smoke detectors, heating regulators, thermostats, measuring, weighing or adjusting appliances for household or as laboratory equipments, etc.
Automatic dispensers	Automatic dispensers for hot drinks, automatic dispensers for solid products, etc.

2.3 Sources and Characteristics of E-waste

E-waste is generated by major sectors as shown in Figure 1.

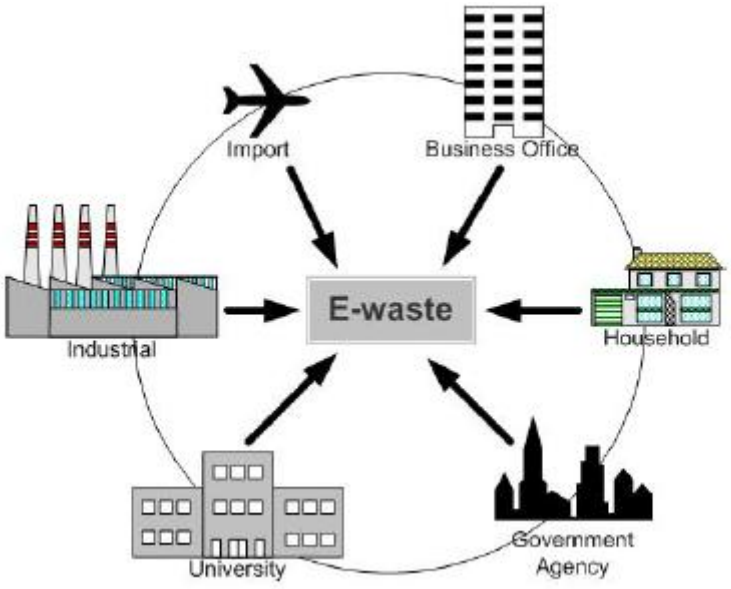

Figure 2.1:Sources of E-waste

2.3.1 Household:

Household is the major source of electrical and electronic equipments because of the arrival of new technology and customers often want to buy new appliances for a better life-style. Thus, the old or defective appliances are discarded. For example, currently, computer industries deliver new technologies and upgrades to the market every month. The useful life-time of a personal computer has reduced from five years down to two years because of new software are incompatible or insufficient with older hardware. Thus, customers are forced to buy new computers.

E-waste that comes from households can be divided into two different parts. The first part consists of household appliances known as white goods. At least, each house has general appliances such as washing machines and air conditioners. These large white goods make up the majority of E-waste by weight. The second part is the personal electronic equipments known as brown goods such as computers, television and mobile phones. These small and medium sized items are in huge majority by number (Darby and Obara, 2005).

2.3.2 Business, Institution, and Government agency:

The small and large businesses, institutions and government agencies have a high number of electrical and electronic equipments especially electronic products such as computers, printers, copiers, etc. In large businesses, employee's computers are upgraded regularly for compatibility with the new software. For example, Microsoft Corporation, the biggest company in computer's software with over 50,000 employees worldwide replaces each computer about every three years (Kunacheva, 2006) By law it is illegal for these users to dispose of computers to landfill and thus, this E-waste goes to the re-use, refurbish, recycling, and export market.

Some large companies rent their computers from rental companies or manufacturers such as Hewlett Packard and IBM, who take back usable and unusable computers at the end of contracts. Rental companies take out hundreds or thousands of computers at a time and these computers are going to be E-waste. The number of rental computers is huge in comparison to the sales of new computers to companies. Even the national government and universities are now getting into rental rather than buying computers (IBM, 2006).

2.3.3 Manufacturer

Manufacturers generate E-waste when new products are coming off the production line. E-waste can be the products which do not meet quality standard or wastes that come from the processing. These wastes should be properly handled. In United States, many computer manufacturers signed contracts with recycling companies to handle their E-waste. Other manufacturers handle their own waste, for instance, Hewlett Packard is one of high tech's most active recyclers, having recaptured and recycled more than 3.3 billion pounds of computer and printing hardware and 682 million ink and toner cartridges since 1987.

Through its HP Planet Partners program, which recently celebrated its 25th anniversary, HP offers take back and recycling programs to keep used electronics and printing supplies out of landfills in more than 70 countries and territories. It also collaborates with governments and industry stakeholders to promote innovative solutions for managing electronics equipment at the end of its life cycle (Hewlett-Packard, 2017).

2.3.4 Import

The developing country like Nepal usually imports refurbished electronic devices from developed countries. The used products from the developed countries are still good enough because the price is cheaper and the quality is acceptable. But life-time of the second hand products is shorter than the new products. Thus, these second hand products would be released to the environment as E-waste shortly. Even though most developing countries signed the contract on the Basel Convention but the illegal import is still found.

2.4 Composition of E-waste

Composition of E-waste is very diverse and differs in products across different categories. It contains more than 1000 different substances, which fall under "hazardous" and "nonhazardous" categories. Broadly, it consists of ferrous and non-ferrous metals, plastics, glass, wood & plywood, printed circuit boards, concrete and ceramics, rubber and other items. Iron and steel constitutes about 50% of the e-waste followed by plastics (21%), non-ferrous metals (13%) and other constituents. Non-ferrous recyclable metals are copper, aluminum and precious such as silver, gold, platinum, palladium etc. The presence of elements like lead, mercury, arsenic, cadmium, selenium and hexavalent chromium and flame retardants beyond threshold quantities in e-waste classifies them as hazardous waste. Electrical and electronic equipments are a complicated assembly of more than thousand materials. Many of them are

highly toxic such as lead and cadmium in circuit boards; lead oxide and cadmium in cathode ray tubes (CRT) monitors; mercury in switches and flat screen monitors; cadmium in batteries; polychlorinated biphenyls (PCBs) in older capacitors and transformers; and brominated flame retardants on printed circuit boards, plastic casings, cables and polyvinyl chloride (PVC).

Certain materials are hazardous depending on their condition and density. For example, between 1997 and 2004, Ralff et al. (2004) estimated that the 315 million PCs have become outdated. This will result in the discard of 550,000 tonnes of lead, 900 tonnes of cadmium, 180 tonnes of mercury, and 500 tonnes of chromium. Toxic substances like cadmium, mercury and lead are commonly used in electrical and electronic products can contaminate the land, water and air. Considerable hazards for health and environment may happen, if E-waste is not properly managed. Darby and Obara (2005) noted that the hazardous content of the components is a major concern especially in the United Kingdom where more than 90% of E-waste is landfilled, incinerated, or recovered without any pre-treatment. The major toxic substances in E-waste can be found as in Table 2-2.

Table 2-2: Hazardous substances in E-waste

Substance	Occurrence in E-waste	Health Effect
Lead	CRT screens, batteries, cable covering, printed circuit boards	Damage to central and peripheral nervous system, circulatory system, blood system and kidneys; brain development affected.
Cadmium	Rechargeable NiCd-batteries, fluorescent layer (CRT screens), printer inks and toners, photocopying-machines, chip resistors, infra-red detectors, and semiconductor chips	Accumulation in the human body particularly kidneys (Itai Itai disease) and cause irreversible effects.
Mercury	Thermostats, sensors, relays, switches (e.g. PCB and measuring equipment), medical equipments, lamps, mobile phones, and in batteries	Damage to brain, kidneys as well as the fetus. Damage nervous system (Minamata disease). When inorganic mercury comes in contact with water, methyl mercury is formed and gets accumulated in living organisms.

Chromium	Decorative, hardener / Steel housing, data tapes, floppy-disks, and printed circuit boards	Produce various toxic effects within cells, strong allergic reactions, irritating to eyes, skin, membranes and may cause DNA damage.
Barium	PCs and television front panel of CRT	Can irritate and damage to the eyes, nose, throat, and lungs.
Polyvinyl Chloride (PVC)	Wiring and computer housings (fire - retardant)	Form dioxins when burnt. Cancer, hormone disorder, and skin disease.
Brominated Flame Retardants(BFRs)	Wiring, computer housings, components, plastic covers, and printed circuit boards	Form dioxins when burnt. Cancer, hormone disorder, and skin disease
Beryllium	Printed circuit boards and Power supply boxes	Beryllium Disease (Beryllicosis), lung cancer, and skin disease.

(Kunacheva, 2006)

2.4.1 Plastics containing Brominated Flame Retardants (BFRs)

Two families of BFRs have been used in electrical & electronic equipment. The first is Poly brominated dipheny1 ethers (PBDPEs), which includes DBPE (decabromodipheny1 oxide), and PBPE (penta bromo di-phenyl oxide). In the electronics industry, BDPE is the dominant and PBDPE BFR is used primarily in computer housings. The second family of BFRs is the phenolic, which includes TBBPA (tetra bromo-bis phenol A). TBBPA (also referred to as TBBA) is used primarily in printed circuit boards.

2.4.2 Liquid Crystal Display (LCDs)

LCD consists of liquid crystals, which are embedded between thin layers of glass and electrical elements. A cellular phone display can contain about 0.5 mg of liquid crystals, a notebook display about half a gram. The LCD, first used predominately in notebook and laptop computers, is now moving into the desktop computer market. Most LCDs have a lamp. For small LCDs, the main consideration for the dismantler will be whether or not there is a lamp present. Liquid crystals come under suspicion of being a health hazard. About 50,000 liquid crystal substances are known, but only about 500 are key components for LCD

technology. Examples are MBBA (4-methoxy benzylidene-4-butyl aniline) and 5CB (4-penty1- 4-cyanobipheny1). Currently there appear to be no toxicological tests results on liquid crystal materials.

2.4.3 Components containing Plasticizers/Stabilizers

The concerns here include the use of Phthalate plasticizers and lead stabilizers in plastics and rubbers. For example, di-butyl phthalate and diethylhexy1 phthalate are considered “Toxic for Reproduction” at concentrations >=0.5%.

2.4.4 Circuit Boards

While most boards are typically 70% non metallic, they also contain about 16% copper, 4% solder and 2% nickel along with iron, silver, gold, palladium and tantalum. Approximately 90% of the intrinsic value of most scarp boards is in the gold and palladium content. Consequently, traditional reprocessing of circuit boards has concentrated on the recovery of metals values.

2.4.5 Flame Retardants

The circuit board laminate consists of a glass fiber reinforced epoxy and is likely to contain flame retardant substances at a level of about 15%. The main flame retardant material used in circuit boards is tetra bromo bis phenol-A (TBBPA). TBBPA is claimed to have a lower dioxin generation potential than PBDE (penta bromo di phenyl ether).

2.4.6 Lead

The typical Pb/Sn solder content in scrap of printed circuit boards ranges between 4-6%, consequently lead represents 2-3% of the weight of the original board. The concerns about lead in circuit appear to relate to the possibility of lead leaching from circuit boards disposed of in landfills.

2.4.7 Mercury

It is estimated that 22% of the yearly world consumption of mercury is used in electrical and electronic equipment (ex. in fluorescent lamps). Its use in electrical & electronic equipment has declined significantly in recent years. It has been used in thermostats, (position) sensors, relays and switches (ex. on printed circuit boards and in measuring equipment), batteries and

discharge lamps. Furthermore, it is used in medical equipment, data transmission, telecommunications, and mobile phones. The estimated concentration level of mercury in computers is 0.002%.

2.4.8 Beryllium

Copper beryllium alloys are used in electronic connectors where a capability for repeated connection and disconnection is desired, and thus where solder is not used to make a permanent joint. Such connectors are often gold plated, so that copper oxide is not created on their surfaces, and does not form a non-electrically conductive barrier between the two connectors. A second use of beryllium in the electronics industry is as beryllium oxide, or beryllia. Beryllia transmits heat very efficiently, and is used in heat sinks. These sinks project heat-generating devices by rapidly distributing their heat to a much larger volume and surface area, where it can be further safely discharged into a moving air stream. Beryllia heat sinks have been used in specific designed parts, which are attached to a heat source, and have also been built into specific microelectronic devices as integral parts of the substrates of those devices. Beryllium oxide (BeO) or beryllia is found in some power transistors, transistor and valve bases, and some resistors.

2.5 E-waste Generation

Recently, E-waste generation was found to be high and rapidly increasing. European studies estimated that the volume of E-waste is between 14-20 kg per person per year and it is increasing about 3 – 5% per year, which is almost three times faster than the municipal waste (Darby and Obara, 2005). In the UK in 1998, 6 million tons of E-waste was generated accounting for 4% of the municipal waste stream and reached 12 million tons by 2010 (Toner, 2012). The electronics industry had been recognized as the “clean” industry in the past but the reality is that it is one of the most polluting industries with the number of hazardous chemicals, materials, and process during the electrical and electronic equipments manufacturing. In United States, the United States Environmental Protection Agency (USEPA) found that 500 million computers became obsolete by 2005 (Hickle, 2005).

2.6 E-waste Inventory

The E-waste generation in the industrialized world is increasing rapidly. E-waste generation can be estimated in many different ways. There are many methodologies for E-waste

calculation which have been developed recently. The various methodologies have advantages and disadvantages. The review of different methodologies is as follows:

JETRO Methodology

The E-waste inventory from JETRO method is one way to estimate E-waste generation. Used in Thailand in 2004, this method collected the life-time of the product, percentage of recycling and number of sales for estimation. The life-time of each product was calculated by collecting the serial number of the appliances and sent to the manufacturers to get the production year (Table 2.3). The number of sales in the year used as the base of average life-time will be calculated to find the quantity of E-waste. The recyclable parts and non-recyclable parts are also calculated from the rate of recycling derived from the result of survey by separation of product's parts (Table 2.4).

Table 2-3: Life-time of electrical and electronic products as studied in Thailand

Type of Appliance	Life-time of Electronic Device(year)
TV	18.6
Refrigerator	15.1
Washing machine	11.9
Air conditioner	9.24
Computer	7
Computer monitor	9.27

Table 2-4: Summary of recycling from survey of the separation of parts

(by weight) Type of E-waste	Average weight (kg/unit)	Recyclable rate (%)	Non-recyclable rate (%)
TV	17.45	31	69
Refrigerator	40.37	92	8
Washing machine	45.48	71	29
Air conditioner	75.1	100	0
Computer	6.79	100	0
Computer monitor	13.61	100	0

2.7 Regulations on E-waste

2.7.1 Basel Convention / Basel Ban

The movement of hazardous waste across international boundaries has direct and significance effect to E-waste. The shipping of hazardous waste to developing countries and to Eastern Europe in the late 80s generated considerable public opposition and resulted in the Basel Convention adopted in 1989 (Banks and Brett, 2003). It is a global agreement that has been approved by 165 countries. This agreement requests for regulating the trans-boundary movement of wastes which are toxic, poisonous, explosive, corrosive, flammable, eco-toxic, or infectious, including E-waste.

The Convention's key principles are as follows:

- Transboundary movements of hazardous wastes should be reduced to a minimum consistent with their environmentally sound management.
- Hazardous wastes should be treated and disposed of as close as possible to their source of generation.
- Hazardous waste generation should be reduced and minimized at source.

These three principles interrupt the production and consumption of electrical electronic products and have been concerning the export of E-waste from the developed countries to Asian countries and other developing countries for low cost processing. However, this convention still allows the export of E-waste intended for recycling. Thus, this resulted in the cases of legally E-waste dumping.

In order to stop dumping of hazardous wastes, a new amendment known as Basel Ban was adopted in January 1998 by the agreement of Group of 77 countries and China (BAN, 2006b). All shipping of hazardous wastes from the Organization of Economic Cooperation and Development (OECD) to non-OEDC countries is banned even for recycling purposes.

2.7.2 RoHS Directive

The Restriction of Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive was passed into law by the E.U. It affects manufacturers, sellers, distributors and recyclers of electrical and electronic equipment containing lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl (PBB) and polybrominated diphenyl ethers (PBDEs). After July 1, 2006 the use of these materials was banned in new products sold in Europe. The RoHS Directive complements the WEEE Directive.

2.7.3 WEEE Directive

The Waste Electrical and Electronic Equipment Directive (WEEE) apply to companies that manufacture, sell, distribute, recycle or treat electrical and electronic equipment and to consumers in the EU. It covers all large and small household appliances, electronic equipment, radio, audio, electrical tools and telecommunications equipment.

The WEEE Directive aimed to reduce the waste arising from electrical and electronic equipments and to improve the environmental performance of all who involved in the life cycle of these products aiming to Extended Producers Responsibility (EPR).

2.8 Status of E-waste in International Scenario

Strict disposal laws in the developed countries ensure that e-waste does not flow into the general waste stream. Private companies and authorized agencies carry out e-waste collection, handling and recycling. Given the high wages, the cost of collection, handling and disposal makes it expensive operation. Unscrupulous agents take the easy way out by exporting e-waste to developing countries in the name of trade, charity, etc. The dumping of e-waste, especially computer waste by the United States of America and United Kingdom, on India, China and Pakistan has reached to an alarming proportion. The exporters of e-waste not only charge users in developed countries for so-called disposal, but also sell this e-waste to traders in developing nations, thus making substantial profit. According to the US-based Silicon Valley Toxics Coalition's study, it is ten times cheaper to export computer scrap than to recycle it within the developed countries. About 80% of the world's electronic trash is exported to Asia every year. India gets a decent share of this toxic pie.

2.8.1 Japan

In Japan, April 2001, collection and recycling of E-waste was started under the Electrical Household Appliance Recycling (EHAR) Law. The law is one of many new recycling laws issued to start a ‘‘Recycle-based society’’. Among these laws, EHAR law put into practice in the concept of EPR. This law forces manufacturers to take responsibility for recycling their own used product for the first time in Japan. Four products are specified as major targets: television sets with cathode ray tube, refrigerators, washing machines, and air conditioners. These products are called the ‘‘Four major products’’ because of their large product volume and large number of sales.

Before the law was passed, these four products were collected by a municipality, or were returned to retailers when a customer bought a new one. In both cases, the end of life products were shredded, and landfilled after minor recovery of metals. Unlike the European countries,

which exclude customers' fees for take back, Japan is permitting industry to cover its actual costs by charging customers for the service.

2.8.2 United States

In 1995, USEPA started to publish the Universal Waste Rule to exempt wastes that contain hazardous materials, such as thermostats and fluorescent lamps, from having to meet all hazardous waste requirements. The rule is intended to reduce hazardous waste in Municipal Solid Waste, increase recycling, proper disposal of certain hazardous wastes, and reduce the wastes which generates from the producers (USEPA, 2006). Some individual American states have started different approaches to managing E-waste. Massachusetts, the first state to do, banned the disposal to landfill of CRT from both televisions and computer monitors. The state of Minnesota is partnering with Sony Electronics, Panasonic, the Asset Recovery Group of Waste Management, and the American Plastics Council to review different methods for collecting and recycling scrap electronics.

2.8.3 China

China was one of the first countries in ratified with the Basel Convention and the Basel Ban. In the late 90s, China and Hong Kong became the countries that do not receive unwanted import of hazardous and other wastes from North America, Australia, and Europe. In 1996, China passed the Law on the Prevention and Control of Solid Waste Pollution to the Environment; (a) prohibits the import of solid wastes which are unusable as raw materials, and (b) strictly regulates the imports of solid wastes that can be used as raw materials. The law contains lists of wastes that are allowed or prohibited to import as raw material. As a result, many hazardous wastes are forbidden from being imported. E-waste is also forbidden to import for recycling in February 2000 when release the "Notification on Import of the Seventh Category of Wastes" (BAN and SVTC, 2002). In this notification for import shall not include the following:

- Computers, monitors, and CRT
- Copiers
- Microwave ovens
- Air conditioners
- Video cameras
- Electric cooking devices, rice cookers
- Telephones (except for pay-phones)

- Video games (except for processing for re-export)
- Televisions and picture tubes
- Refrigerators.

China is in the process of drafting a number of environmental regulations similar to the EU's RoHS and WEEE directives. The final draft of what is popularly referred to as "China RoHS" (officially known as "The Administration on the Control of Pollution Caused by Electronic Information Products"), is expected to be released in early January and is expected to be passed into law in July, 2006 (Arrow Electronics, 2006).

The different between China RoHS and EU's RoHS is that the open-ended wording and unspecified details put together by China's Ministry of Information Industry (MII). China's RoHS, for example, aims to restrict the same six banned substances the EU RoHS has covered, but it also includes a catch-all phrase "other toxic or harmful elements" to be determined by the state. In other words, China holds the option of going well beyond the scope of the EU's RoHS directive (Green Supply Line, 2006).

2.8.4 Indian Perspective

In India, e-waste has already been covered for recycling/reprocessing under the Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008. E-wastes covered in these Rules are components of waste electrical and electronic assembles comprising accumulators and other batteries included on list A, mercury-switches, activated glass cullets from cathode-ray tubes and other activated glass and PCB-capacitors, or any other component contaminated with schedule 2 constituents (e.g. cadmium, mercury, lead, polychlorinated biphenyl) to an extent that they exhibit hazard characteristics indicated in part C of this schedule. Separate Rules have recently been notified under Environment (Protection) Act, 1986, called E-waste (Management & Handling) Rules, 2011, which shall come into effect from 1st May, 2012. The Central Pollution Control Board has also brought out guidelines for Environmentally Sound Management of E-waste on March, 2008. E-waste Rules not only cover registration of recyclers but requirement of obtaining authorization by producers of electrical & electronic equipment as listed in schedule-I to channelize it after use for recycling and disposal as well as by bulk consumers of such equipment for channelization of e-waste generated by them to authorized collection centre(s) or registered dismantler(s) or recycler(s) or returning to the producer under the pickup or take back services. E-waste Rules

also cover the requirement of obtaining authorization by collection centre(s) of e-wastes for storing in secured manner till it is sent to registered dismantler(s) or recycler(s).

2.9 Nepalese Scenario and Current Status

E-waste management is still an issue not given a required priority by government in Nepal. In the recent years, the consumption of electronic items has significantly grown but due to the lack of guidelines and regulations regarding proper disposal of those electronic items after their lifetime is over, public remain vulnerable to the contamination caused by emissions from those devices and equipments. Some of the studies carried out previously on the status of e-waste management in Nepal have stressed the need for development of legislation on curbing the E-waste generation.

Kathmandu valley constitutes Kathmandu, Lalitpur and Bhaktapur districts. Kathmandu is the capital city of Nepal and the valley is inhabited by about 3 million people. Informal interviews carried out in different government offices concluded that there are no provisions of license to import electronic equipment; *i.e.* it can be imported for business purposes or they can also be imported by single persons. For imports individually for household purposes, an individual has to inform and pay the necessary custom tariff to the government by bringing an approval letter to Department of Commerce from the Ministry of Information and Communication. However, data were not available. No plan or activities towards environmentally sound management of e-waste were found via the contacted government officials from any concerned government authorities regarding e-waste and its management.

According to the study performed by CEPHED in 2011, the largest market of the EEE is Kathmandu, being the business center for the whole country. A market survey shows that business has decreased in comparison to past years, but the consumers have not stopped buying EEE. Like other places, the market of Kathmandu is also occupied by Chinese products. Besides Chinese, the electronic equipment found in Kathmandu is from India, Singapore, Japan, Malaysia and others.

Since large numbers of electronic devices are used in Kathmandu, large numbers come for repairing. But, like other places, the people involved in repair and maintenance have neither training of management of e-waste nor are they aware of the health hazards from e-waste. The one and only destination of discarded e-waste in Kathmandu seems to be *kawadiwalas,* and the other unsorted ones find their way to the general solid waste stream ended by the bank of rivers or temporary landfills sites. Kawadiwalas collect the remaining unused parts from repair and maintenance shops. It does not seem that there is a fixed price to buy e-waste in

Kathmandu, which entirely depends on the condition (whether it can be reused or it is of no use). As the metal recovery from these waste are completed, remaining parts go to places like Birgunj and Janakpur to be exported to the nearest Indian markets.

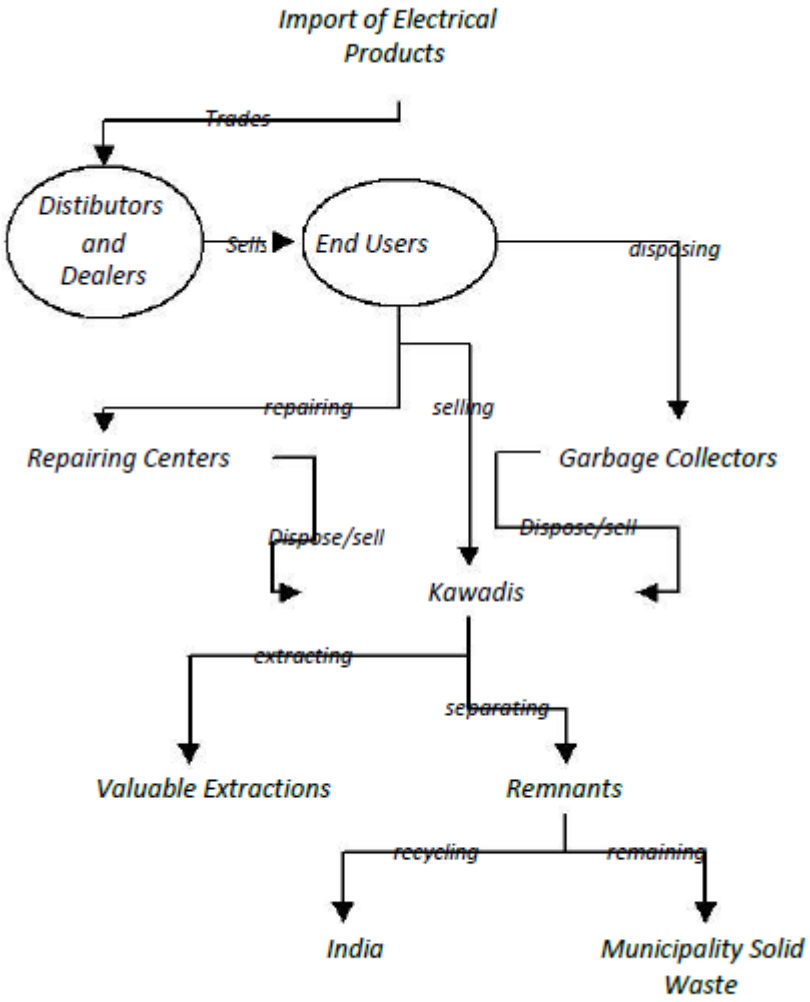

Figure 2.2: The flow of Electronic item and waste in Nepal

(Karmacharya & Basnet, 2010) performed the study on status of E-waste and potential mitigating measures using IT, where it was found that the e-Waste is sent to India for recycling but not proper laws, policies and reports is maintained to supervise flow of e-Waste. The flow of electronic items and waste is shown in the figure 2.2, where it is seen that the waste are collected at scrap dealers and after some valuable extractions are either transported to India or dumped at the municipal solid waste.

Previous study by then Ministry of Environment, Science and Technology in 2007 brought some statistics forward with the steady increase in the use of electronic equipments. It was suggested that due to hazardous nature, the e-waste should not be dumped together with

Municipal Solid Waste (MSW) and the proper initiatives for management of e-waste must be commenced before it was too late. In the same study it was forecasted that the number of mobiles would reach 1.7 million by 2007, which has been increased by many folds to this date.

Nepal's constitution has reserved the right to survive in a clean environment as fundamental right of any citizen. Section 30 about fundamental rights in the constitution has provisions for right to clean environment, whose sub-sections have following provisions:

> (1) Every citizen shall have the right to live in a clean and healthy environment.
>
> (2) The victim shall have the right to obtain compensation, in accordance with law, for any injury caused from environmental pollution or degradation.
>
> (3) This Article shall not be deemed to prevent the making of necessary legal provisions for a proper balance between the environment and development, in development works of the nation

As stated about the legislations on e-waste by Nepal Telecommunication Authority, The Environment Protection Act, 2053 (1997) has been formulated and implemented effective from the Jan 30, 1997 (17 Magh 2053 B.S). The preamble of the act is to expedite to make legal provisions in order to maintain clean and healthy environment by minimizing, as far as possible, adverse impacts likely to be caused from environmental degradation on human beings, wildlife, plants, nature and physical objects; and to protect environment with proper use and management of natural resources, taking into consideration that sustainable development could be achieved from the inseparable inter-relationship between the economic development and environment protection.

The act has provisioned for Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) to be performed by a proponent. The provision for prevention and Pollution control has been stated in the Act. The provision for the corresponding Environment Inspector with function, duties and powers has been defined in the Act. The GoN, Ministry of Environment Science and Technology has specified different 22 officials on 2069.01.14 comprising the expert from different entities of the GoN as Environment Inspectors to carry out the tasks specified in the section 8 of the Environmental protection . Protection of national heritage, environmental protection act, establishment of laboratory has been also provisioned in the Act. The power to constitute **Environmental protection council** has been also provisioned to provide policy guidance and suggestion to Government of Nepal with regard to

environment protection, and also to have coordination among different agencies at national level. The high level environmental protection council is formed on 2065.11.5 in the chairmanship of the Prime Minister of Nepal. The provision for compensation and fine up to one hundred thousand has been mentioned in the act instead of voidance of the Environmental protection Act. Power to formulate Guidelines and rules in connection with the followings has been provisioned by the GoN:

- Proposal
- Conduction of Initial Environmental Examination or Environmental Impact Assessment,
- Sources, standards, prevention and control of pollution,
- Biological diversity and the protection of National Heritage,
- Water, air, noise, soil pollution,
- Management and transportation etc. of wastes,
- Operation of the Environment Conservation Fund,
- Other necessary matters.

Although provisions are made to formulate guidelines and Rules as stated relating to the Environmental protection, it seems that there has not been any regulation, guidelines/directives in connection with the e-waste management.

Solid Waste Management Act, 2068 and the Solid Waste management Rule, 2070 have been effective from the date of publication in Nepal Gazette in respective times. In the solid waste management act, regulations on management of hazardous substances are mentioned. Unfortunately, both of the legislatives have not mentioned e-waste as a particular waste stream. Since the Basel convention treats electronic wastes as hazardous wastes, it can be said that the e-waste is shallowly mentioned in the Solid Waste Management Act. But since the hazardous waste category is a general category which contains fertilizers, pesticides among others, which have treatment process completely different than electronic waste, a specific regulation regarding e-waste is needed in Nepal.

3. STUDY DESIGN AND PROPOSED METHODOLOGY

3.1 Technical Approach

The main objective of this assignment is to prepare the inventory of E waste in Kathmandu Valley and then recommend adopting approaches for the proper management and control of the E-wastes to minimize their adverse impact to environment and human health considering present condition and future planning of the country. The e-waste in the country is increasing day and day due to rapid development in electrical and electronic field. The development and planning of the country in E-waste management is now not pace with the development of electrical and electronic goods and their import to the country. The technical approach to be adopted to address the problems faced today by the country was as follows:

a. Emphases to Interco-relation among the related ministries (Ministry of Environment, Ministry of Finance, Ministry of trade and commerce, ministry of Industry and National Planning Commission.)
b. Correct data and information collection in various sources including unofficial sources through informative questionnaires and competent enumerators.
c. Verification of primary data with prominent business sectors and individuals.
d. Strong recommendation to various ministries and organizations on proper management of e-waste of the Kathmandu valley.

To fulfill and achieve the objective of the study the following strategies and managerial approaches were followed during the study

Consultation Approach:

A regular consultation was maintained with the officials of DOE. To create the ownership of the outcomes of the assignment, wide consultations was done with all stakeholders and relevant organizations, institutions, expert individuals.

In depth study Approach:

In depth study of the various studies and reports already done by DOE in the past, and other organizations in this field and technical literatures was carried out before starting the study.

Interaction and Participatory Approach:

Meetings and Interaction programmes were organized with a view to involve participation of all concerned in achieving the mission of study. The issues raised in these programmes were taken into consideration to mould the outcome of study to make it as practicable as possible leading to higher level of acceptance among the people concerned.

Situation Analysis:

Situation analysis is defined as a process that examines a situation, its elements, and their relations, and that is intended to provide and maintain a state of situation awareness for the decision maker and/or planner. This approach as therefore used particularly to data collection in the field.

Appreciative Inquiry:

Appreciative Inquiry (AI) is a methodology that builds on people's strengths and on what works. To understand the views of the stakeholders and beneficiaries, AI approach was adopted. The AI was used not only to bring important information to light, but also to make the groups to feel on what they do and think is significant

3.2 Methodologies

The methodology adopted took into consideration of severity of adverse impact of E-Waste to environment and human health. Utilizing the long years of experience of consultants in this field, the methodology developed played an important role to turn the approach taken into reality.

To fulfill the objectives of the assignment and following the TOR, PACE Nepal used the following methodology:

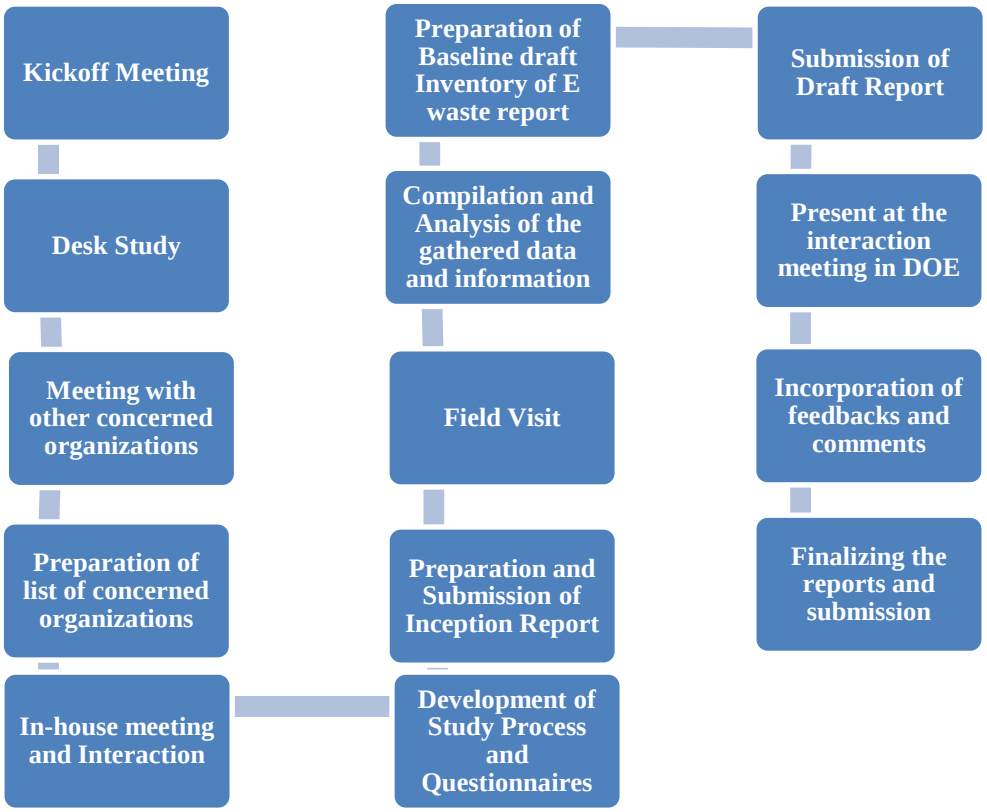

Figure 3.1: Proposed Methodology

The above mentioned methodology with inputs and outputs is presented as follow:

INPUTS		**MAIN TASK**		**OUTPUTS**
Team of PACE Nepal Consultant and DOE	→	Kickoff meeting	→	Clear understanding about Expectation of DOE and Objective and scope of work of the assignment.
		↓		
Internet search on related reports, documents. Review of literatures, related legal and MEAs documents and study reports and publications	→	Desk Study	→	Knowledge on the subject to the consultants for preparing questionnaires and materials for discussion with DOE
		↓		

Consultants and representatives of the organizations, inputs, feedback/suggestion from the service organization	Meeting with concerned ministries, organizations to have clear vision about the study and e-waste	Understanding of E waste by the concerned organizations and their requirements and expectation
	↓	
Consultants and inputs from the concerned organizations	Preparation of list of concerned organization	List of organizations to be visited during field visit.
	↓	
Involvement of Team members of consultants including enumerators	In-house meeting among the consultants	Sharing of knowledge and information about e-waste for planning
	↓	
Involvement of all consultants	Development of questionnaire for field visit	Questionnaires
	↓	
Involvement of Team members of consultants	Preparation of inception report and submission	Approved Inception report with **table of contents** for designing filed study report (Baseline Inventory report)
	↓	
Questionnaires for field visit, the work plan and consultants	Carry out field visit and collect data and observation, interview etc	Primary data and information for baseline report, pictures. Inputs in questionnaires and approached adopted etc
	↓	

Filled questionnaires, collected data, pictures information given by organizations, observations of the consultants	→	Compilation and analysis of findings and information	→	Information and materials on basic information of E-waste and their proper management
		↓		
Filled questionnaires, collected data, past Tea related reports and documents and consultants	→	Preparation of Baseline E-waste inventory Report	→	Draft Baseline e-waste inventory report
		↓		
Draft reports, Feedbacks from DOE and Consultants	→	Incorporation of feed backs and comments of draft E waste inventory reports from DOE	→	Feedbacks and comments incorporated draft report
		↓		
Feedback incorporated draft report with recommendation. Consultants and DOE	→	Finalization of draft report and submission of final report to DOE	→	Approved Final E-waste Inventory report
		↓		
		FINAL E-WASTE INVENTORY REPORT		

3.3 Questionnaire Design

Standardized questionnaire requesting for specific information about the electronic inventory on five different sectors namely, household, repair shops, dealers and retailers, scrap dealers and service sectors were prepared for the field visit. The questionnaires were made concise and relatively easier which helped facilitate easy data collection process. Details of questionnaire can be found in Annex A.

3.4 Size of sample

There are different techniques of sample size selection. These are strictly based on the nature of data .These formulae require knowledge of the variance or proportion in the population and a determination as to the maximum desirable error, as well as acceptable Type I error risk (Krejcie & Morgan, 1970)

$$\text{Sample size} n = \frac{\chi 2 * N * (1-P) * P}{e2 * (N-1) + (\chi 2 * P * (1-P))} \quad \text{.....Equation 1}$$

Where,

n =required sample size

χ^2 = the table value of chi-square for 1 degree of freedom at the desired confidence level.

N= the population size.

P= the population proportion (assumed to be 0.50 since this would provide the maximum sample size)

e= the degree of accuracy expressed as a proportion (0.1).

Table 3-1: Sample size determination for Household

Degree of accuracy=0.5	Confidence interval =95%
Population size	Sample size
3000000	384

Since the population size of households is very large, the sample size is calculated to be 384 from the equation above. But the same case is not valid for other sectors as due to time and resource limitations, sample size of sectors other than household are taken as shown in table 3-2.

Table 3-2: Sample size determination

Degree of accuracy=0.5	Confidence interval =95%
Sector	Sample size
Dealers and Retailers	25
Repair Shops	25
Scrap Dealers	10
Service Sectors	30

Secondary data were taken from Customs Department regarding the import of electronic goods.

3.5 Data collection

Both primary as well as secondary data was used during the study. All the primary data relating Inventory of electronic items were collected from the field visit; whereas the secondary data were collected from the following government bodies to cross validate the data.

- Customs Department
- Department of Commerce
- Department of Industry
- Department of Cottage and Small industries, District office Kathmandu, Lalitpur and Bhaktapur.

4. RESULTS AND DISCUSSIONS

The various factors which are specific to a location may affect E-waste generation, thus a location specific framework was developed for Kathmandu valley. The important factors used for developing such framework for quantification of E-waste includes retailer and dealer market status and trends, device usage chains, scale of use of devices on various sectors and repairing/maintenance trends. The change in average age of electronic devices, consumer behavior and consumption trend of city are the important factors need to be understood. The reasons of change of the average age of electronic items can further be attributed to day to day advanced technology, higher disposable income of people, model attractiveness (style/shape/color of electronic devices) and higher specification requirements. Different sectors are taken into consideration for framework development and the data were collected on each of them through interviews, questionnaire survey, household survey and secondary sources.

4.1. Computation of Primary data

The major sources of e-waste are categorized in sectors as household, repair shops, dealers and retailers, scrap dealers and service sectors for the primary data collection. These sectors cover almost all the electronic devices that can be envisaged of being used. Quantification of these sectors along with the detailed analysis on each sector is done on the sections below.

3.5.1 E-waste from Service Sectors:

The service sector is among the largest buyers of electronic and electrical equipments. Service sectors cover the large part of commercial and non-commercial sectors. It is assumed that this sector represents all the possible streams of service industry. In this study, different streams of service sector were considered for data collection with the samples mentioned in the table 4-1 below. For data collection 30 samples divided in different sub-categories were collected and the data obtained is tabulated in the table 4-1.

Table 4-1: Unused devices quantity from the Service sector

Items	Private Sector	Manpower/ Consultancy	Educational Sector, Computer Institute/ Cyber	Travel Agencies	Hotels and Resorts	Government Offices	Hospitals	Bank	Total
Mobile/ Telephones	35	0	0	0	37	15	37	0	124
Laptop	14	0	1	1	1	24	2	0	43
CRT Desktop	19	3	98	0	28	47	15	35	245
LCD Desktop	5	0	9	1	8	84	5	0	112
CRT Television	2	0	4	0	22	3	6	0	37
LCD Television	0	0	0	0	5	0	1	0	6
Refrigerator	2	0	3	0	4	1	6	0	16
Washing Machine	0	0	0	0	0	0	4	1	5

From the data above, it can be seen that there is substantial quantity of E-waste being generated in the service sector. The sectors considered above are the most prominent electronic device using sectors. The sectors have been identified proportionately to cover the usage of all possible electronic and electric equipments. Other than the mentioned devices, there are various other devices which could not be quantified for various reasons. The equivalent waste generation in weight from the service sector is tabulated in the table 4-2.

Table 4-2: Equivalent waste generation in weight

Items	Total Quantities	Equivalent Weight (kg)	Equivalent Waste Generation(tons)
Mobile/Telephones	124	0.175	0.0217
Laptop	43	4.5	0.1935
CRT Desktop	245	20.4	4.998
LCD Desktop	112	4	0.448
CRT Television	37	17.45	0.64565
LCD Television	6	8	0.048
Refrigerator	16	40.37	0.64592
Washing Machine	5	45.48	0.2274
Total			**7.22817**

From the above table, it is seen that the service sector generally produces 7.22 tonnes of e-waste. The quantity of e-waste generated from the service sector is managed on various ways which is shown in the figure 4.1.

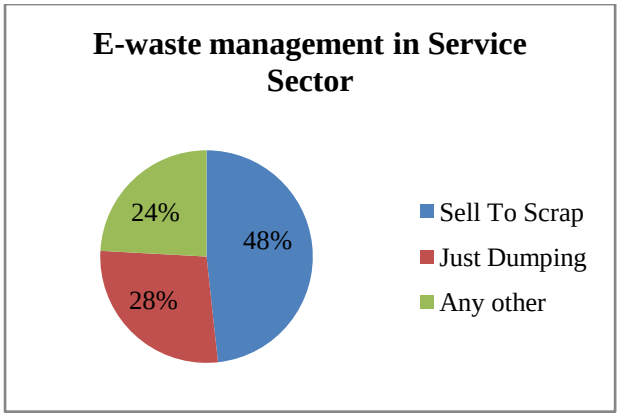

Figure 4.1: E-waste management in Service sector

The e-waste management of service sector can be outlined in three main options. Almost half of the unused devices are sold to the scrap whereas a quarter of the unused devices are just dumped in the offices. 24% of the unused devices are auctioned, donated to the schools after repairing, used in the training or returned to the supplier for exchange with new equipments or sold at low prices.

3.5.2 E-waste generated by Household Sector

Household sector is one of the most E-waste producing sectors as large quantity of obsolete devices among mobiles, computers and televisions are generated. These quantities are either sold to the repairing shops or scrap dealers, whereas there's also a possibility of exchanging with the new devices whenever the facility is available. Among the 396 household samples analysed, large portion of e-waste in the household sector however is found to be just dumped in the homes itself. The waste generation pattern of household sector is given in the table 4-3.

Table 4-3: Total e-waste generated from the household sector

Items	**Total Unused Units**	**Equivalent Weight (kg)**	**Waste Generation (tonnes)**
Mobile	609	0.175	0.106575
Laptop	71	4.5	0.3195
CRT Desktop	124	20.4	2.5296
LCD Desktop	54	4	0.216
CRT Television	140	17.45	2.443
LCD Television	30	8	0.24
Refrigerator	32	40.37	1.29184
Washing Machine	19	45.48	0.86412
Others	111	1.75	0.188
Total			8.2049

From the sample collection, the total e-waste collection from Kathmandu valley for sampled

numbers in a year was found out to be 8.20 tons per year. While considering the total population of households in Kathmandu valley, the annual e-waste generation becomes significantly higher. Based on the different literatures and the interviews, equivalent lifetime of these devices was determined as follows.

1. The lifetime of televisions was 8 years
2. The lifetime of mobile phones was mere 2 years.
3. The lifetime of Laptops were found to last for 4 years.
4. The lifetime of Computers generally lasted in operation for 8 years
5. The lifetime of Refrigerators and washing machines were lasted for 10 years.

The above figures can also be presented in Pie chart as given in figure 4.2.

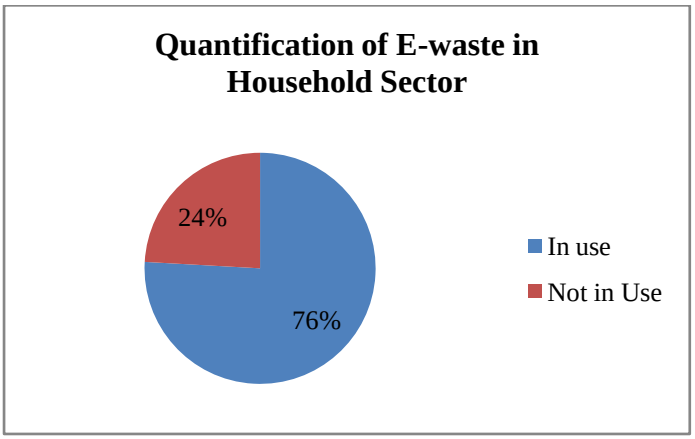

Figure 4.2: Quantification of unused and used items in household sector

From the figure 4.2, it is clear that significant amount of electronic and electric equipments are left unused in the household. The reasons for such a high amount of EEE's being left unused can be attributed to the recent advancements in technology, increasing life standard of people and the need to stay with the trend of modern generation.

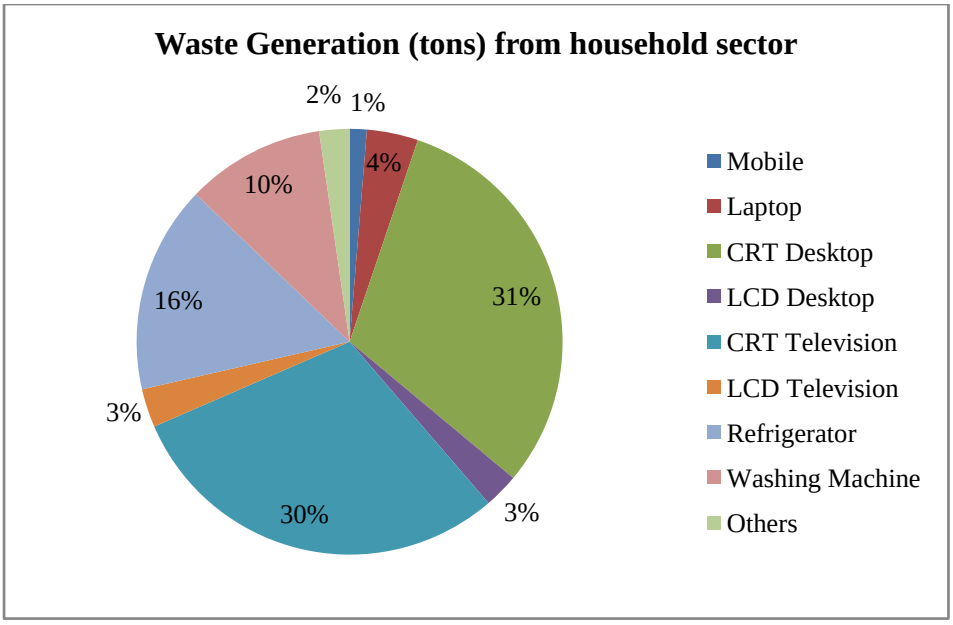

Figure 4.3: Waste Generation from household sector in tons

Figure 4.3 depicts the amount of e-waste generated from the household sector. As it can be seen in the graph, the highest category that supports the e-waste generation is CRT based desktops whereas the CRT based televisions and refrigerators are other major categories that generate high amount of e-waste. Due to the advancement of technology, introduction of energy efficient and light weight LED/LCD display devices, the CRT technology is on the verge of extinction globally. The effect of such trend can be seen in Kathmandu Valley too. Mobile phones generate high number of wastes in terms of quantity, but as the average weight of a mobile phone is only about 200gm, quantifying in terms of weight sees them being the least producer of electronic waste.

During the interview, people were asked about the causes of e-waste generation and the remedies that need to be done. The overriding opinion of the people was the availability of the new and advanced products in market as shown in the figure 4.4. Other significant opinion about the e-waste generation include the damaged electronic items, desire to be updated with the changing technology and use of cheap and low quality electronics. High repair costs and lack of public awareness about the hazards of e-waste are also known to be considerable factors assisting e-waste generation.

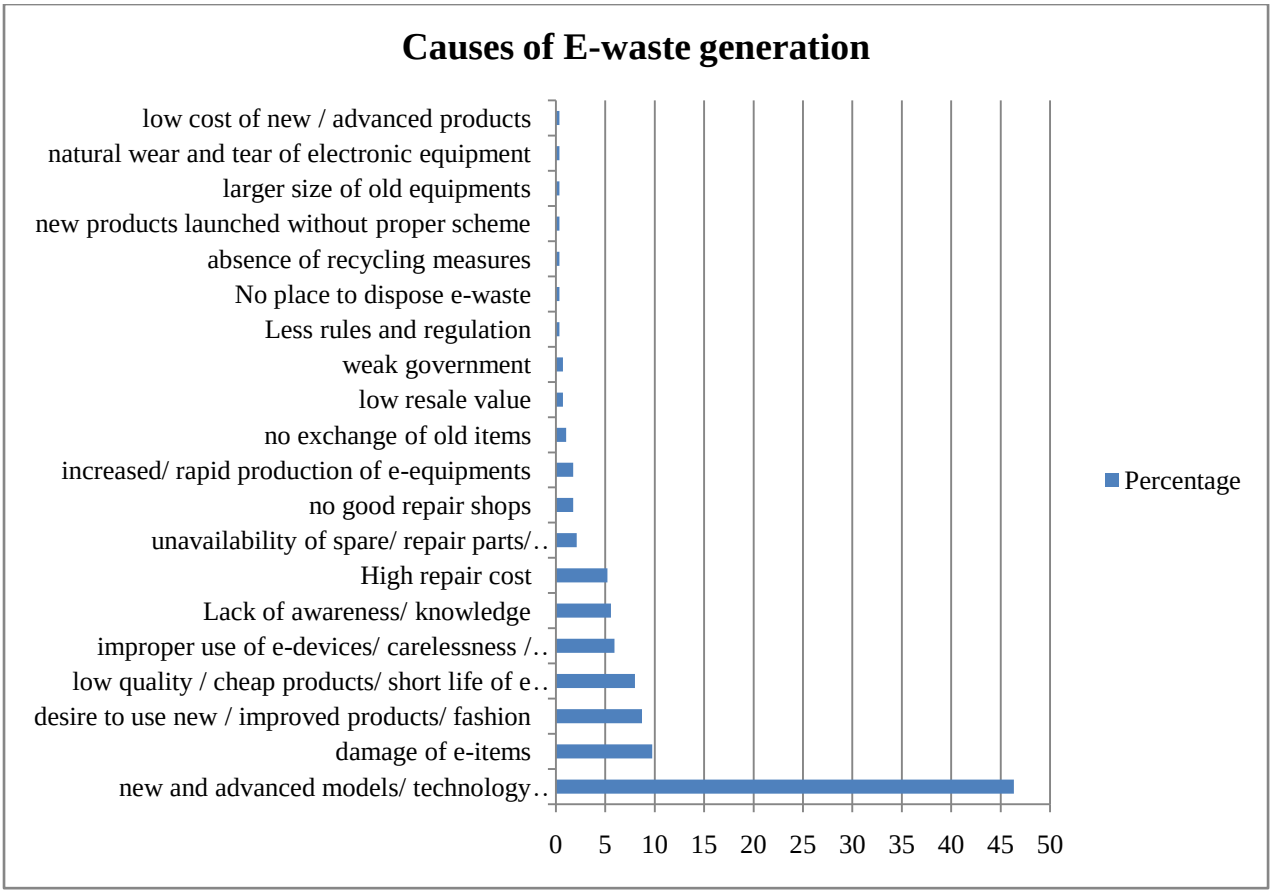

Figure 4.4: Public opinion on e-waste generation

During the same interview, people were asked about what could be the possible remedies to properly manage the e-waste. Many of the interviewees answered the need for recycle and reuse plants. Public awareness, proper policies, legislations and plans are thought to be the major factors to reduce the e-waste generation. Exchange offers and low pricing of the repaired high spec devices could be another option to minimize the production of e-waste. The fair share of opinion is towards the need for proper collections centers or disposal units where everyone can safely place the unwanted and unused devices. The quantification of the opinions is given in the figure 4.5.

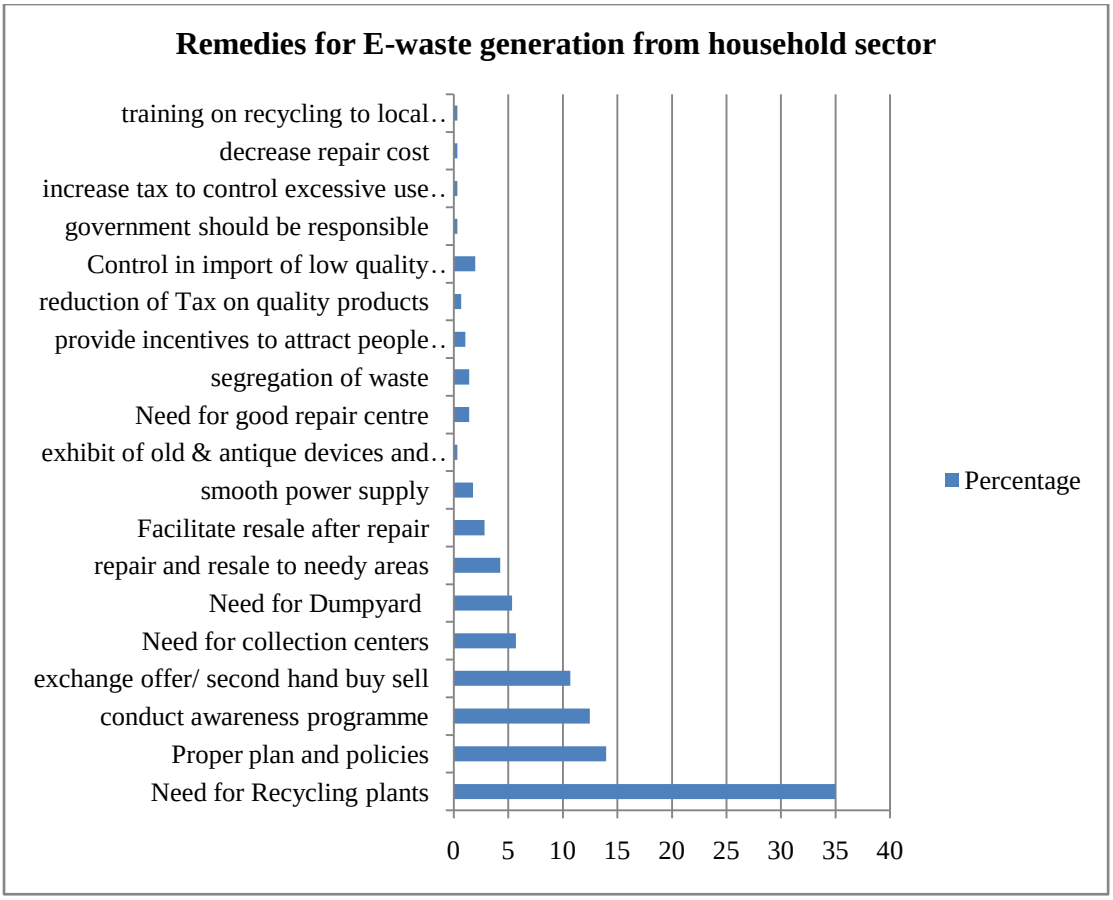

Figure 4.5: Remedies for E-waste generation from household sector

3.5.3 E-waste generated/collected by Repairing Shops

The repairing service providers generate/collect mostly the obsolete parts of the electronic and electric goods. Most of the obsolete parts are sent back to the manufacturers, if they have a business tie-up. In cases of independent repairing shops, the general stock of equipments to repair is low as they store the parts that could be used for replacement. Some of the repairing service providers sell scrap to scrap dealers and some give repaired items back to the other customers after repairing or replacing with new part. The e-waste generated in repairing shops are as given in table 4-4 below.

Table 4-4: E-waste generated/collected by Repairing Shops

Items	Total Quantity Collected	Equivalent Weight (kg)	Waste Generation (tons)
Mobile	488	0.175	0.0854
Laptop	400	4.5	1.8
CRT Desktop	2	20.4	0.0408
LCD Desktop	2	4	0.008
CRT Television	45	17.45	0.78525
LCD Television	0	8	0
Refrigerator	17	40.37	0.68629
Washing Machine	7	45.48	0.31836
Total	961		3.7241

Repair shops generate the least amount of electronic wastes in comparison to the other sectors. As the flow of electronic devices is pretty much low in this sector, they are mainly oriented towards repairing the malfunctioning devices. During the field visit, it was seen that unlike the dealers and retailers, the repairers had a very small stock of electronic items. The stock's purpose was generally to replace and repair the faulty components of an electronic item.

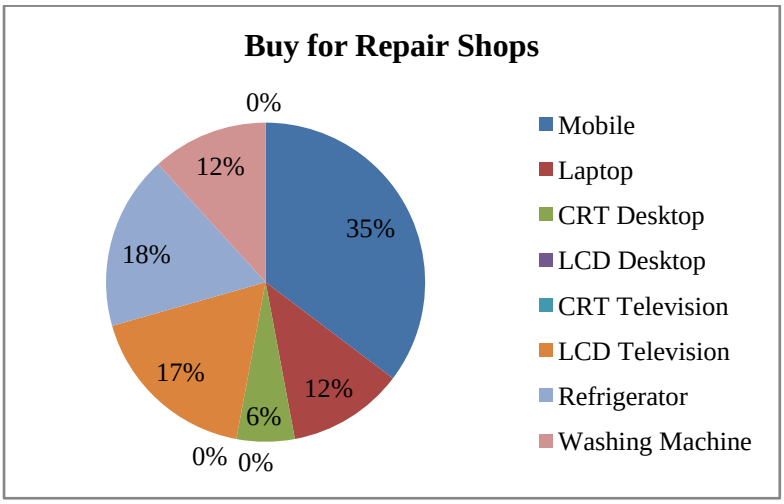

Figure 4.6: Buying quantity for the repairing shops

From the figure 4.6, it can be concluded that mobiles are the highest bought devices. Due to the high penetration of mobile phones in market, the need for repair of mobile phones is also high. During the survey it was found that many repairing shops buy the used or new mobile phones and provide the refurbished mobile phones on cheaper rate. This sometimes helps in preventing the new mobile phones to enter the market and ultimately reduce the potential of e-waste generation. Another significant statistics is about the CRT televisions as due to the technological advancements, their appeal has decreased significantly and with very low resale value, the repair shops don't buy the CRT Televisions anymore.

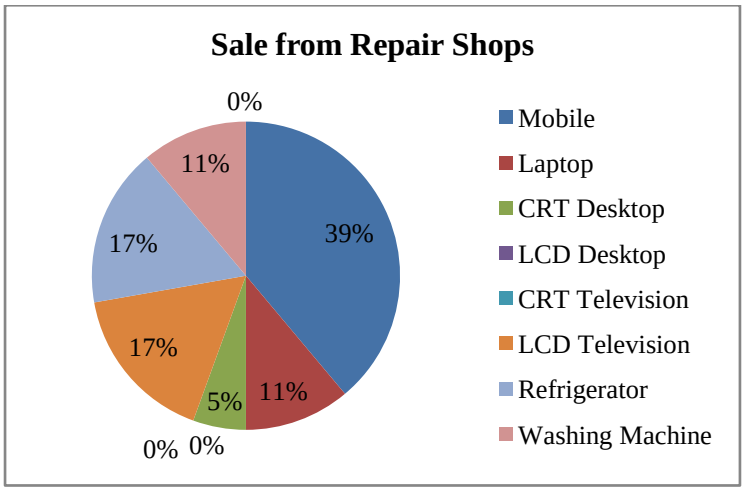

Figure 4.7: Sales quantification from the repair shops

The sales from repair shops are generally second hand and refurbished devices with a small amount being new ones. Since many people still can't afford new and branded electronic devices, the repaired items from these shops have become an attraction for most of the people. Unsurprisingly, mobile phones are the most sold devices too. During the field survey, It was found that people were attracted towards the refurbished mobile phones of recognized brands which is reflected on the figure 4.7. Sales of CRT based monitors and Televisions has almost vanished whereas the LCD Televisions and Refrigerators are widely sought devices after mobile phones.

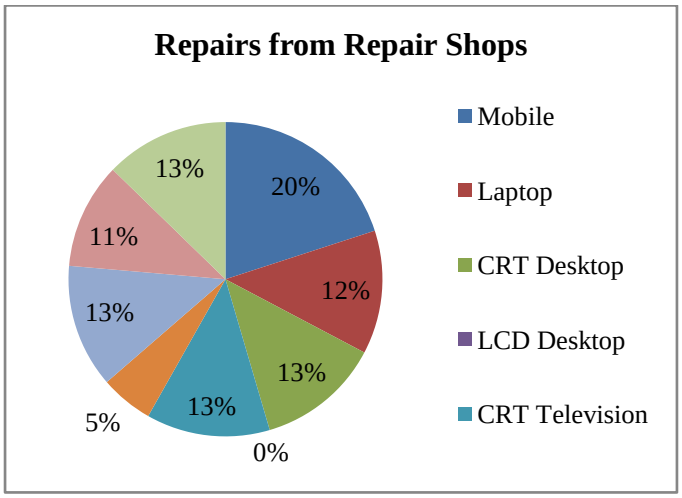

Figure 4.8: Repairing quantification for repair shops

Figure 4.8 shows a completely different data than that of the previous statistics. The repairing works can be seen equally distributed among all the devices. The relatively higher percentage of repairing needed for CRT based devices can be attributed to the ageing of devices and frequent need for servicing. Mobiles cover the highest percentage here too, which signifies the

annual quantities that are brought to the repair shops for maintenance and repair.

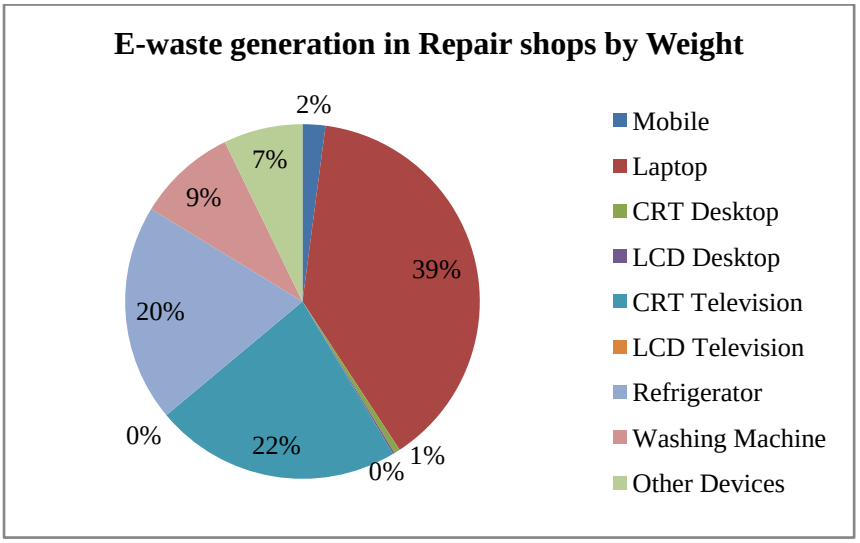

Figure 4.9: Quantification of e-waste generation in repair shops

From the figure 4.9, it is evident that, the highest amount of e-waste is generated by the laptops. Although the quantity of the repairing is high for the mobile phones, the equivalent weight is quite low. During the interview, the reason for CRT televisions and Refrigerators for having the high rate of repair and maintenance was found to be the customers desire to use these devices until they last following simple repair. The highest annual waste generation is recorded for laptops to be 1.8 tonnes whereas CRT television account for 785kg generation annually. Refrigerators also contribute highly with 686 kg annually.

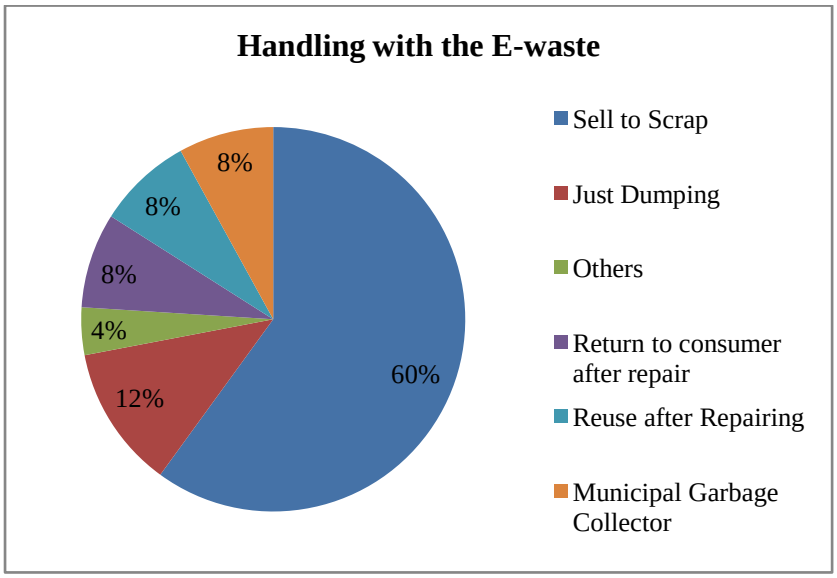

Figure 4.10: Management techniques of the e-waste generated from the repair shops

Figure 4.10 explains the different techniques applied by the repair and maintenance shops to

manage the e-waste. From the graph it can be seen that almost 60% of the waste generated is sold to the scrap dealers while the rest 40% are subject to different management techniques followed which include returning to the consumer after repair and reuse after repairing among others. This statistics also signifies the fact that the electronic waste reaches to scrap dealers ultimately.

3.5.4 E-waste generated by Retailers and Dealers

The retailers and dealers are another significant segment in the e-waste generation. Among the other sectors, retailers and dealers may not produce significant amount of e-waste, but nevertheless being one of the key sector in electronic item's inventory chain, they generate a fair share of their own. Retailers have the facility to return the unsold items to the upper entity in their supply chain while the dealers have the privilege to resend the returned item to other dealers. During the study, total 27 dealers and retailers were contacted and the data collected from them is tabulated in the table 4-5 below.

Table 4-5: Unsold quantity from the dealers and retailers

Items	Unsold Quantity	Equivalent Weight (kg)	Unsold Weight (tons)
Mobile	18660	0.175	3.2655
Laptop	3252	4.5	14.634
CRT Desktop	0	20.4	0
LCD Desktop	1056	4	4.224
CRT Television	0	17.45	0
LCD Television	1188	8	9.504
Refrigerator	0	40.37	0
Washing Machine	0	45.48	0
Total			31.6275

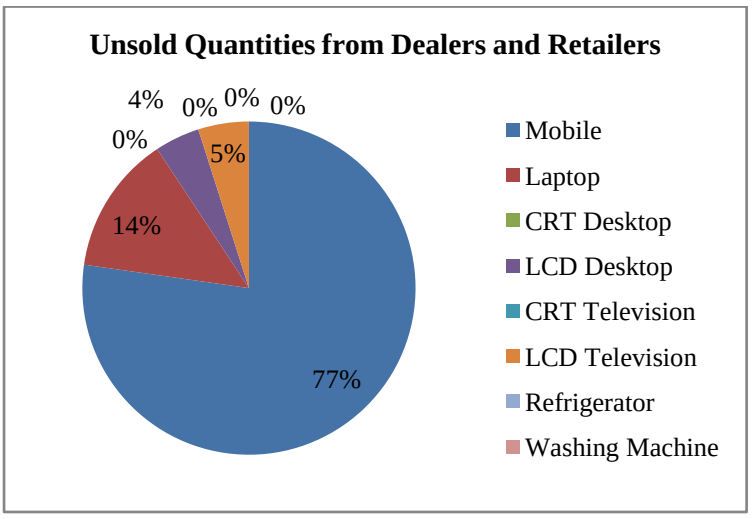

Figure 4.11: Quantification of unsold items from dealers and retailers

Among the unsold items that remain with the dealers and retailers, the management of those items was asked about the unsold items during the interview and the result is given in the figure 4.11. The quantity of unsold items is generally high for the mobile phones, which is also verified by the statistics achieved from Department of Customs, which denotes extremely high quantity of mobile phones being imported in comparison to other electronic devices. The high quantity of mobile phones being imported can be agreed to the fact that mobile phones are used individually whereas the other devices are generally owned in a family. The e-waste generation from dealers and retailers is the minimum one as the unsold items are re-introduced in supply chain in changing the locations or selling in the lower prices.

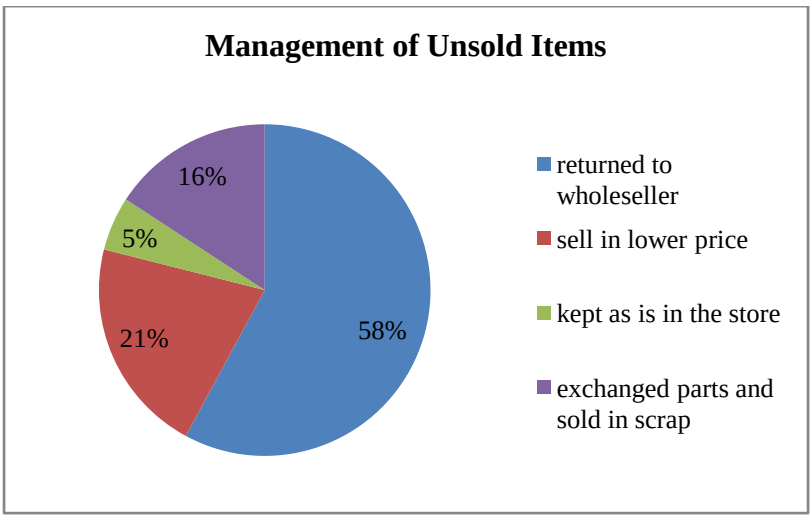

Figure 4.12: Management techniques of unsold items in dealers and retailers

In case of management of unsold items present in retailers and dealers, the most common technique applied is to return the unsold item to an upper body in the supply chain, as 58% of the unsold items are returned to wholesaler or dealer. During interview, it was found that the another technique for management of unsold items is to sell the items in lower price than the initially marked price, which helps the dealers and retailers to clear their stock and provide the opportunity to introduce the newer products. Some retailers tend to exchange the parts and ultimately sell the electronic devices in scrap value after a long period of dumping in their premises.

3.5.5 E-waste collected by scrap dealers

In Kathmandu valley, approximately 1200 authorized scrap dealers are present but there are no scrap dealers which exclusively collect e-waste. On an average a scrap dealer collects approx. one tons as scrap every month. According to Mr. Saroj Shrestha, president of All

Nepal Scrap Dealers Association in Kathmandu, maximum 10-15 tons of e-waste is generated and collected from a scrap dealer in Kathmandu every year. In Kathmandu valley, very limited segregation, treatment and recycling activity takes place. So, generally the whole unit is stored and transported to other areas for dismantling and recycling. According to Mr. Shrestha, the collected waste materials are generally transported to India for the further processing and recycling.

Table 4-6: Quantification of waste generation/collection from the scrap dealers

Items	Total Quantity Collected	Equivalent per piece Weight (kg)	Total weight (kg)	Recycled Quantity	Recycled Weight (Kg)	Waste Generation (tons)
Mobile	5582	0.175	976.85	5059	885.325	0.091525
Laptop	136	4.5		83.8	377.1	0.2349
CRT Desktop	1249	20.4		793	8.1	9.2943
LCD Desktop	40	10		40	400	0
CRT Television	598	17.45		74.4	49.45	9.08737
LCD Television	2	8		2	16	0
Refrigerator	383	40.37		218.4	2856	3.788902
Washing Machine	100	45.48		78.75	268	0.69845
Total	8090			6349.35	3181.55	23.195447

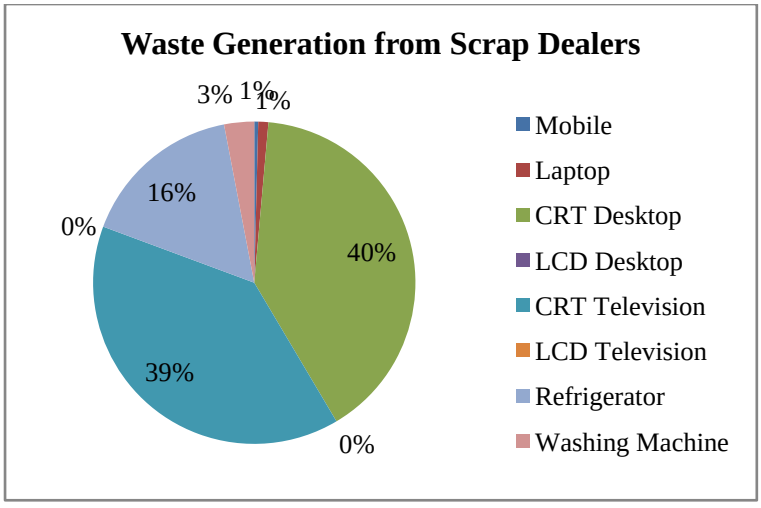

Figure 4.13: Waste generation/collection from scrap dealers

Scarp dealers are the last block in the value chain of electronic items. The unused and damaged items which are ultimately sold, reach the scrap dealers. From the interview with scrap dealers it was known that scrap dealers don't recycle the waste as they sell the total units to the scrap dealers from India. Statistics show that the major e-waste generated is from the

CRT Desktops and CRT televisions. E-waste generation from CRT technologies is due to the high replacement rate of those devices from LED and LCD technologies.

4.2. Computation of Secondary Data

The e-waste inventory management is mostly related to the no. of imports of the electronic devices in a country. For this reason, the annual import of different electronic devices for the last five years of different items as obtained from Department of customs is given in the table 4-7.

Table 4-7: Import Quantity for electronic items for last 5 fiscal years

	Year of Import				
Items (Units)	**2068/69**	**2069/70**	**2070/71**	**2071/72**	**2072/73**
Telephones	1936695	2193549	3171985	3353009	4990487
Televisions	138154	102202	140888	114642	71424
Computer	84779	87901	108007	88337	129041
Laptops	234540	142545	114815	68389	168280
Washing Machine	14327	16145	23134	18083	26636
Refrigerators	199696	148246	162198	241529	244856

4.2.1 Mobile Phones

Telephones at the early stages were confined to the wired ones. But as the technology grew, the wired ones converted into cordless phones and finally transformed into the wireless cellular ones. Today, mobile phones are the most commonly used electronic equipment all around the world and Nepal can't be an exception. Today, the number of mobile subscriptions has outnumbered Nepal's population. With a single person subscribing to more than one service, the mobile service penetration rate has hit 105.15 percent of the population, according to the latest report of Nepal Telecommunications Authority[1].

[1] <<http://kathmandupost.ekantipur.com/news/2016-06-14/mobile-subscriptions-outnumber-population.html>> accessed on 2 June, 2017

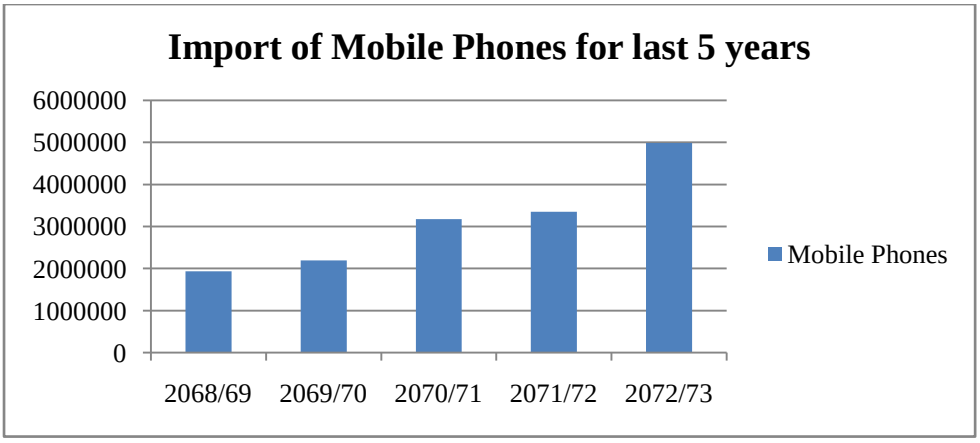

Figure 4.14: Import of mobile phones for last 5 fiscal years

From the figure 4.14, it is evident that the growth of mobile phone import is rapidly increasing. From this it is safe to assume the e-waste generation from mobile phones is also in rise as the effective life period of mobile phones is found to be 2 years from different literatures and even from the interview with the consumers.

4.2.2 Televisions

Televisions are mainly imported in Nepal as a single unit or assembled after import of the necessary parts. There are some assembling industries that work on producing television sets. Those type of industries generally import the parts. The graph for imports for last five years from 2068/69 to 2072/73 is given below in figure 4.15. Unlike the mobile phones, the fluctuating pattern is evident in case of television import. The least amount of import in the fiscal year 2072/73 could be due to the various disturbances caused in Nepalese economy by April 2015 earthquake and the economic blockade by India.

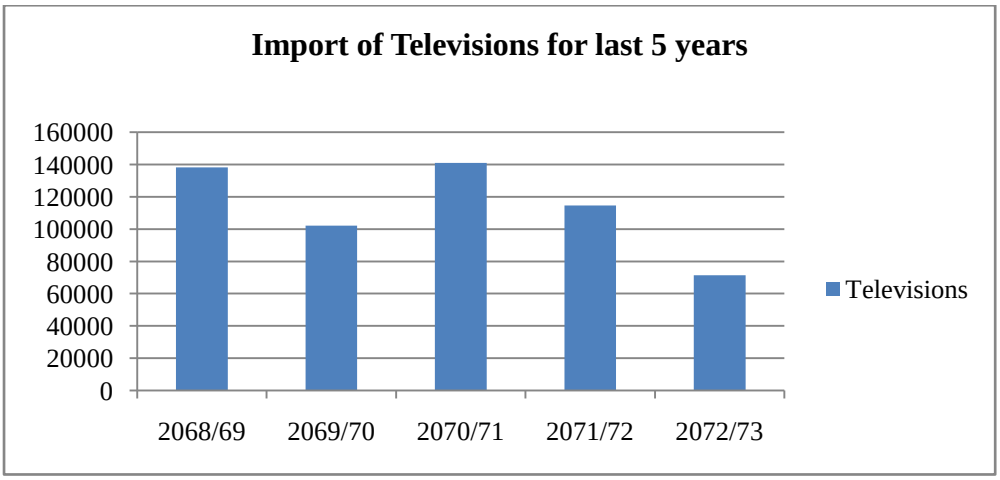

Figure 4.15: Import of Televisions for last 5 fiscal years

4.2.3 Laptops

Demand and usage of Laptops is the rapidly growing. Being portable and energy efficient, the popularity of laptops has soared in the recent years with the technological advancements and the drop in prices. The trend of import for laptops is shown in the table 4-7 and in figure 4.16, where we can see the decreasing trend starting right from the fiscal year 2069/70. The import of laptops is seen to gradually decrease until the fiscal year 2072/73 where there is seen an upturn in the imports. The general lifetime of a laptop is found out to be 4 to 5 years in Nepal from various interviews during primary data collection. Due to this fact the e-waste generation from laptops is found significantly higher from repair and maintenance shops as the lifetime of the laptops imported in fiscal year 2068/69 is nearing the end.

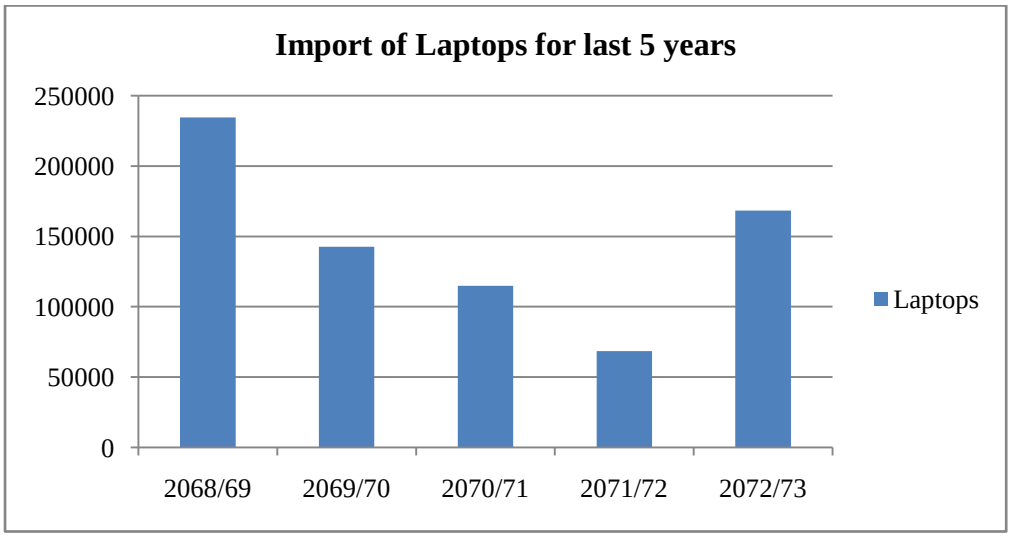

Figure 4.16: Import of Laptops for last 5 fiscal years

4.2.4 Computers

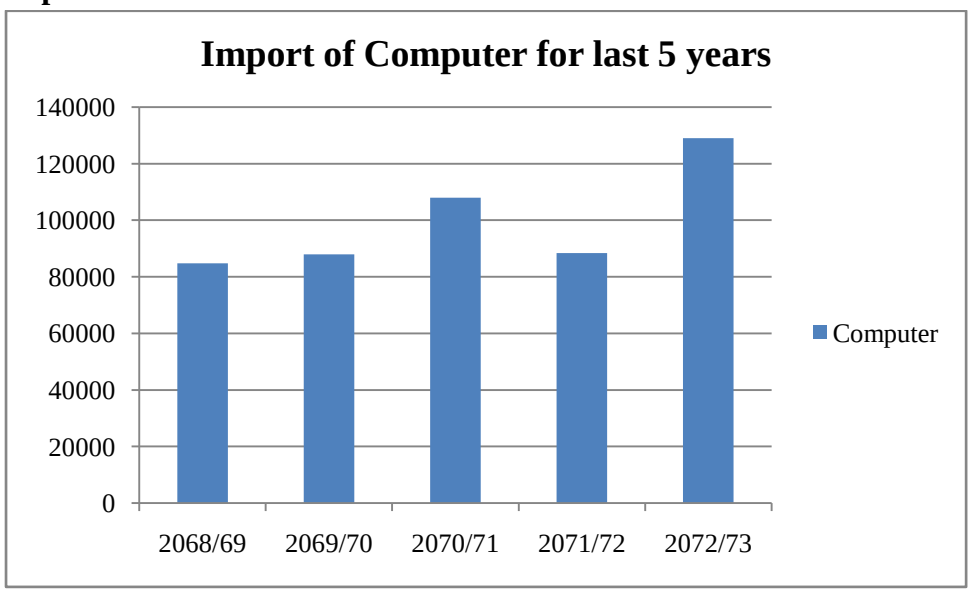

Figure 4.17: Import of Computers for last 5 fiscal years

Demand and usage of computers is the steady as seen from the graph. Computers are generally imported as single units or assembled after the import of the parts. The trend of import for laptops is shown in the table 4-7 and in figure 4.17, where we can see the steady trend over the every fiscal year and a slight increase in the fiscal year 2072/73. The import of computers presented in the figure is an average from the import of three different parts, display units, memory devices and I/O devices. The general lifetime of computers is found out to be around 8 years in Nepal from various interviews during primary data collection. The e-waste generation from computers is found significantly higher because of the fact that CRT monitors are outdated and are being rapidly replaced from all the sectors.

4.2.5 Washing Machines

Due to the advancements in technology and increase in quality of life, need for sophisticated electronic devices for household use has increased which is signified by the increasing trend of imports for washing machines depicted in figure 4.18. Washing machines are imported to be used in household sector, in the service sector mainly hotels and resorts and the commercial sector like laundry shops.

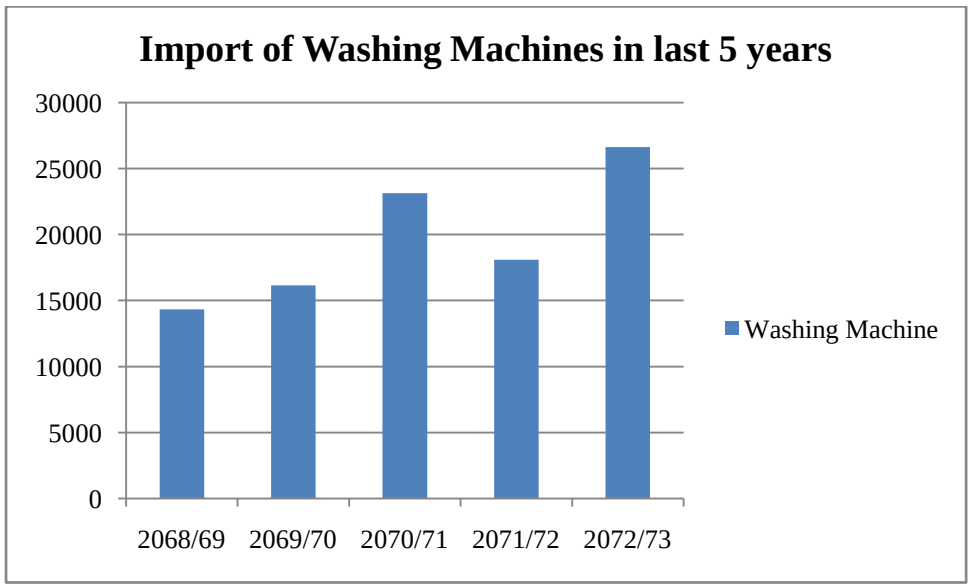

Figure 4.18: Import of Washing machines for the last 5 fiscal years

4.2.6 Refrigerators

Refrigerators are generally used in households, commercial sectors like cafes and restaurants, hotels and resorts. These devices are another sign of increment of quality of life. Refrigerators are imported from various countries and the trend of import is seen to rise in the last two fiscal years of 2071/72 and 2072/73 BS. The units of refrigerators imported vary in size and the

applications. Generally, the refrigerators used for household purpose are simple and energy efficient while the refrigerators used in cold stores, departmental stores and other commercial areas are high energy consuming devices and use up a large area.

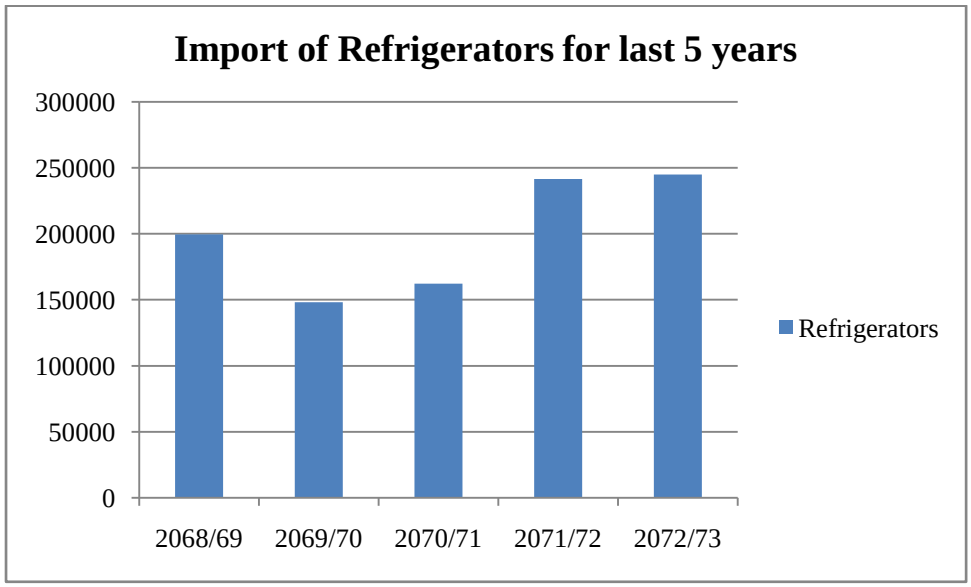

Figure 4.19: Import of Washing machines for the last 5 fiscal years

4.3 Data from other secondary sources

Various government bodies were also contacted for the secondary data other than the Department of customs. Department of Industry was contacted for the data regarding number of industries registered to manufacture the electronic items included in our study. Office of Small and Cottage industries in three districts of Kathmandu valley were also contacted for the data regarding industries registered to manufacture and assemble the electronic items. The data regarding the number of repairing and retailer/dealer shops in Kathmandu valley was obtained from the Department of Commerce. All the data obtained from those government bodies are enlisted in the table 4-8.

Table 4-8: Secondary data received from the various government bodies

S.N.	Name of Body	Type of data	Data obtained
1	Department of Industry	Electronic Industries registered in Kathmandu Valley	31 industries for Mobiles, 6 industries for TV, 15 industries for Computers
2	Department of	Electronic	Around 1017

	Commerce	dealers/retailers and Repairers in Kathmandu Valley	Shops working as dealers and
3	Office of Small and Cottage Industries	Electronic assemblers and Repairers in Kathmandu Valley	106 Offices registered in Kathmandu, 32 in Lalitpur and data unavailable for Bhaktapur

4.4 Quantification of the e-waste based on the Population

The quantity of electronic waste generated in the Kathmandu valley is based on the sample sizes taken during the period of study. Hence for the quantification of the E-waste for a year is done on the basis of total population of the different sectors. The table 4-9 shows the quantification of electronic waste from various sectors. Population of households is based on the population growth rate for Kathmandu valley from population census 2011. The individual population of households for Kathmandu, Lalitpur and Bhaktapur were taken from the census, projected individually according to their growth rates and finally added. The e-waste generated from the household is generally found to be dumped in the house itself, i.e. very low amount of the waste comes to the scrap dealers and according to the majority opinion in interviews, very small percentage of such waste is sold into scrap market each year. The number of retailers and dealers, repairing shops is taken from the secondary sources whereas the numbers of offices in service sector is assumed to be 2500 in the valley. Thus, we can assume 20% of the e-waste to be available on the market each year from household.

Table 4-9: Quantification of E-waste inventory with respect to population size.

S.N.	Sector	Sample Size	Yearly E-waste generation (tons)	Population size	Total Predicted E-waste inventory
1	Household	396	8.20	765824.2	15857.90
2	Service	32	3.46	2500	270.31
3	Retailers and Dealers	27	5.05	1017	190.2167
4	Repair Shops	25	3.72	138	20.5344
5	Scrap dealers	20	23.19	1200	1391.4
Total					17730.44

The e-waste inventory in Kathmandu valley can thus be calculated as the sum of waste produced in different sectors and the quantity that remains dumped in the various locations. Thus the e-waste inventory for Kathmandu valley was found to be 17730.44 tons for 2017 AD. If proper management and legislations are put forward than the generation of e-waste can be slowed down otherwise the explosion rate of e-waste could be harmful to the relatively developing country like Nepal.

E-WASTE MANAGEMENT

The theme of waste management is the need for minimal processing such that there is almost no environmental pollution. The strength of proper waste management lies in identifying who needs the components most and what best could be the use for various parts of e-waste. For example, a cooler fan in CPU may be used as such by the computer service center. If the same fan is broken it sells for a lesser value as metal and plastic. Every screw or bolt if segregated properly can be reused at appropriate place. Following are the steps involved in e-waste handling:

5.1 Collection

Scrap dealers informally collect the large quantity of e-waste from different source points in form of obsolete PC's. There is no proper estimation that how much scrap is collected from various sources by scrap dealers. The old PC's are also taken back by the distributors and at time of supply of upgraded or latest model of PC's which is either passed on to scrap dealers or the working obsolete computers are sold to into market as second hand PC's.

5.2 Storage

Scrap dealers collect the obsolete PC's from different sources and store at their respective local scrap yards.

5.3 Dismantling & Segregation

Scrap dealer after collection and identifying the part or PC's, dismantle and segregate the different parts of computers and sell them into markets. Dismantling is carried out to extract plastics, iron and copper. Open burning is carried out by the scrap dealers to extract important metal such as copper releasing the poisonous gases into the atmosphere. In Goa no such activity takes place. The whole unit is stored and transported to other cities for dismantling and recycling.

5.4 Recycling/ Recovery

The composition of e-waste consists of diverse items like ferrous and non-ferrous metals, glass, plastic, electronic components and other items and it is also revealed that e-waste consists of hazardous elements. Treatment of e-waste is to reduce the concentration of these

hazardous chemicals and elements through recycle and recovery. In the process of recycling or recovery, certain e-waste fractions act as secondary raw material for recovery of valuable items. The recycle and recovery includes the following unit operations.

(i) Dismantling: Removal of parts, containing dangerous substances (CFC's, switches, PCB); removal of easily accessible parts containing valuable substances (cable containing copper, steel, iron and precious metals).

(ii) Segregation of ferrous & non-ferrous metals & plastic: This separation is normally done in a shredder process.

(iii) Refurbishment and reuse: Refurbishment and reuse of e-waste has potential for those used electrical and electronic equipment which can be easily refurbished to put to its original use.

(iv) Recycling/ Recovery of Valuable materials: Ferrous metals in electrical are ferrous, non-ferrous metals in smelting plants, precious metals in separating works.

(v) Treatment/Disposal of dangerous materials and waste: Shredder light fraction is disposed of in landfill sites or sometimes incinerated, CFC's are treated thermally, PCB is incinerated or disposed off in underground storages, Hg is often recycled or disposed off in underground landfill sites.

5.5 Treatment & Disposal

The presence of hazardous elements in e-waste offers the potential of increasing the intensity of their discharge in environment due to land filling and incineration. The potential treatment disposal options based on the composition are given below:

5.5.1 Land filling:

Degradation process in landfills are very complicated and run over a wide time span. Landfills contain mixtures of various waste streams and emission of pollutants from landfills can be delayed for many years.

5.5.2 Incineration:

Advantage of incineration of e-waste is the reduction of waste volume and the utilization of the energy content of combustible materials. By incineration some environmentally hazardous organic substances are converted into less hazardous compounds. Disadvantage of

incineration are the emission to air of substances escaping flue gas cleaning and the large amount of residues from gas cleaning and combustion. Waste incineration plants contribute significantly to the annual emissions of cadmium and mercury. In addition, heavy metals not emitted into the atmosphere are transferred to exhaust gas residues and can re-enter the environment on disposal. Therefore, e-waste incineration will increase these emissions, if no reduction measures like removal of heavy metals are taken.

5.6 Different scenarios used Worldwide for E-waste management

Most environmental damage and health impacts related to e-waste arise from improper collection and treatment approaches. Four typical disposal scenarios for the collection, trade and treatment of e-waste practiced worldwide are summarized.

5.6.1 Official take-Back systems

In this scenario, usually under the requirement of national e-waste legislation, e-waste is collected by designated organizations, producers and/or by the government. This happens via retailers, municipal collection points and/or pick-up services. The final destination of e-waste is state-of-the-art treatment facilities, which recover the valuable materials in an environmentally-sound way and reduce the negative impacts. In the European Union, roughly 40 per cent of annually generated e-waste is reportedly treated in this manner; in the United States and Canada, the level is around 12 per cent; for China and Japan, it is around 24 to 30 per cent and in Australia, is around 1 per cent. That said, the scope of collected products differs among the countries, depending on the priority setting at the national level. Usually, product categories with significant potential for resource recovery or those containing significant amount of toxic elements are collected, such as temperature exchange equipment (cooling and freezing equipment), screens and monitors, lamps, large equipment and small IT and telecommunication equipment. This disposal scenario exists in both developed and developing countries.

5.6.2 Disposal of e-waste in mixed residual waste

In this scenario, consumers directly dispose of e-waste through the normal dustbins together with other types of household waste. As a consequence, the disposed of e-waste is then treated with the regular mixed waste from households. Depending on the region, it can either be sent to landfill or municipal solid waste incineration with a low chance of separation prior to these destinations. Neither of these two destinations is regarded as an appropriate

technique to treat e-waste, because it leads to resource loss and has the potential to negatively impact the environment. The e-waste in a landfill can lead to toxin leaching and if e-waste is incinerated, emissions into air occur. This disposal scenario exists in both developed and developing countries. Products commonly thrown away in dustbins include small equipment, small IT equipment and lamps.

In most developing countries, valuable e-waste is hardly seen in dustbins, but invaluable e-waste like lamps and small products can be easily disposed of in dustbins and then sent to landfill or incinerator. There are no official statistics in countries about the quantity of e-waste that is disposed with mixed waste in dustbins. For all data that was found, about 1 to 2 kg per inhabitant was disposed in the waste bin in Europe. This represents roughly 8 per cent of the total European e-waste generation.

5.6.3 Collection of e-waste outside official take-back systems in developed countries

In developed countries, e-waste is also collected by individual waste dealers or companies and then traded through various channels. Possible destinations for e-waste in this scenario include metal recycling, plastic recycling, specialized e-waste recycling and also export. Usually, e-waste handled in this scenario is not reported ƒas part of the official treatment amount by established take-back systems (Scenario 1). E-waste categories that are typically handled by the informal collection are temperature exchange equipment, large equipment, screens and IT products.

The main feature of this scenario is that e-waste is traded freely, and usually, its quantity is not systematically documented or reported to authorities, due to lack of specific reporting framework or requirements. In this scenario, e-waste is often not treated in the state-of-the art facilities, and there is a potential that e-waste is shipped off to developing countries. There is a substantial amount of e-waste being collected in developed countries and then traded to developing countries for further treatment. The demand for inexpensive second-hand equipment and raw materials in less-developed regions is the biggest driver for the interregional and global trade of e-waste.

Trading of second hand equipment is legal only if it is allowed by both sending and receiving countries. However, the dumping of waste occurs exists in practice, is illegal. If the exporting country has ratified the Basel convention, exports of hazardous waste must comply with the Basel Convention. The Basel Convention is meant to prevent developed countries from

illegally dumping waste in developing countries, where recycling infrastructure is typically absent.

5.6.4 Informal collection and recycling in developing countries

In most developing countries, there are an enormous number of self-employed people engaged in the collection and recycling of e-waste. They usually work on a door-to-door basis to buy e-waste from consumers at home, and then they sell it to refurbishers and recyclers. These types of informal collection activities provide the basic means necessary for many unskilled workers to pay for their living. Apart from domestic collection, the demand for inexpensive second-hand goods and secondary materials is an incentive of to import e-waste from developed countries (as explained in Scenario 3). After informal collection, when electronic products do not have any reuse value, they are mostly recycled by through "backyard recycling" or substandard methods, which can cause severe damage to the environment and human health. Such substandard treatment techniques include open burning to extract metals, acid leaching for precious metals, unprotected melting of plastics and direct dumping of hazardous residuals. Lacking legislation, treatment standards, environmental protection measures and recycling infrastructure, are the main reasons that e-waste is recycled in a crude manner. Typical e-waste categories handled by the informal collection include temperature exchange equipment, large equipment, screens and IT products.

CONCLUSION AND RECOMMENDATIONS

Electronic products use and hence imports are rising fast in Nepal as well. Although the defectives are found to be repaired till they are repairable and due to lower purchasing power, the obsolescence rate in Nepal is expected to be much lower than developed countries and other more prosperous developing countries, the e-waste will continuously increase also in Nepal. However, the low purchasing power in Nepal also has another effect that the imports are of low quality with higher chances of failure. From the field investigations it is revealed that e-waste is transported to India for further processing due to unavailability of such processing plants in Nepal. Study shows that obsolescence rate of cellular phones, PC, TV, Washing machines and refrigerator in the region is 2 years, 4 years for Laptop, 8 years for PC and TV and 10 years each for Washing machines and refrigerators. The total e-waste inventory was found to be 17730.44 tons for the year 2017 AD. This amount is a huge one considering the size of market and the buying capacity of people. With the large quantity of import comes the need for proper management of those devices. Unfortunately, no clear definition of WEEE/ E-waste exists in the existing regulatory regime in Nepal. There is no organized mechanism for collection, transportation and disposal of e-waste in Kathmandu valley and no mechanism exists in the capital to monitor and track its inventory, collection, transportation and disposal.

Due to hazardous nature, the e-waste should not be dumped together with Municipal Solid Waste (MSW). Before it is too late, initiatives for proper management of e-waste must be commenced in the country.

Recommendations

In order to ascertain proper management of e-waste in Nepal, it is recommended that the following actions must be taken.

- No mechanism exists in the state to collect, transport, dismantle and dispose e-waste. Hence a proper of institutional mechanism to look explicitly into e-waste trade chain is needed.
- No scientifically designed facility exists in the state for its safe dismantling and disposal. A segregating, dismantling and recycling plant is needed inside the country such that the potential environmental risks could be minimized at the earliest and income generation and job opportunities can be developed.

- Increasing public awareness on the potential hazards of e-waste and the ways to minimize the generation can be done on the national level.
- Formulation of policy by involvement of all stakeholders: government, NGOs, Waste dealers, and Producers/suppliers of Electronic Products
- Define hazardous materials and e-waste under Environment Protection Act and Environment Protection Regulation
- Developing countries are suffering from the fact of being dumping ground of second hand electronic devices. Hence, government should employ strict rules of prohibiting the import of second hand, refurbished items and electronic waste's.
- Promotion and registration of e-waste dealers and assisting the licensee in proper storage, possible recycling and proper disposal. Levi on the taxes related to e-waste could be another idea to attract more people towards the business of e-waste.
- Requiring waste dealers to furnish information on e-waste generation, storage, transportation and disposal
- Ban on outdated recycling technologies such as open burning, simple incineration, rough extraction of metals from e-waste using acids
- Promotion of Cleaner production and 3R in Electric and Electronic Equipment Manufacturing/ assembling units to reduce the use of hazardous materials as well as raising the awareness to consumers about the benefits of 3R.
- Promotion of environment friendly devices that seamlessly adjust to the environment, which are easily degradable and durable.
- Requesting the Central Bureau of Statistics to include information on producers of Electrical and Electronic Equipment in the regular Census of Manufacturing Establishment and to cover information on e-waste in population census;
- Requesting the Department of Customs to improve the data on imports of electronic products and CKD assemblies imported by assembly units
- Networking with international and regional agencies for improving knowledge base and for capacity building

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ANNEX-I: Persons Contacted during the Study

S.N.	Name	Designation	Office
1	Sharada Sharma	Statistics Officer	Department of Customs
2	Jitendra Kumar Sharma	Mechanical Engineer	Department of Industry
3	Chudamani Neupane	Computer Operator	Department of Industry
4	Arun Pokharel	Chief Industry Officer	Small and Cottage Industries Development Office, Kathmandu District
5	Sumitra Shrestha	Computer Officer	Small and Cottage Industries Development Office, Lalitpur District
6	Krishna Prasad Paudel	Section Officer	Department of Commerce
7	Sagar Kumar Saud	IT Officer	Department of Commerce

ANNEX-II: Sample of Questionnaires

Questionnaire for Dealers and Retailers

Name of Firm: **Location**:

Name of Respondent:

1. **What are the electronic devices you sell?**
   □Mobile □Laptop □TV
   □Computer □Refrigerator □Washing Machine
   □Any other

2. **How many items do you sell per month?**

Items	Mobile	TV		Computer			Refrigerator	Washing Machine	Any other
		CRT	LCD	Laptop	PC With CRT	PC With LCD			
Quantity									

3. **How many unsold items do you have?**

Items	Mobile	TV		Computer			Refrigerator	Washing Machine	Any other
		CRT	LCD	Laptop	PC With CRT	PC With LCD			
Quantity									

4. **And what do you do with those items?**
   - Sell in Scrap
   - Return to the Whole seller
   - Any other……

5. **Do you exchange the old item with new ones? If yes how many per month?**

Items	Mobile	TV		Computer			Refrigerator	Washing Machine	Any other
		CRT	LCD	Laptop	PC With CRT	PC With LCD			
Exchange									
Quantity									

6. **What you do with the exchanged items?**
   - Sell in Scrap
   - Return to the Wholesaler
   - Any other……

7. **How many of similar Shops exist in your district?**

Questionnaire for Households

Name of the Respondent: **Location:**

1. **Are you staying with family in Kathmandu Valley?**

   ☐ **Yes** ☐ **No**

2. **Which Equipments do you have in your household?**

Items	Mobile	TV		Computer			Refrigerator	Washing Machine	Any other
		CRT	LCD	Laptop	PC With CRT	PC With LCD			
Quantity									

3. **How many of these equipments are in use in your household?**

Items	Mobile	TV		Computer			Refrigerator	Washing Machine	Any other
		CRT	LCD	Laptop	PC With CRT	PC With LCD			
Quantity									

4. **How many of these equipments are not in use in your household?**

Items	Mobile	TV		Computer			Refrigerator	Washing Machine	Any other
		CRT	LCD	Laptop	PC With CRT	PC With LCD			
Quantity									

5. **What is the size of these equipments in your household?**

Items	TV		Computer			Refrigerator	Washing Machine	Any other
	CRT	LCD	Laptop	PC With CRT	PC With LCD			
Size								

6. **In your view, what are the causes for E- waste generation? What should the government do to properly manage the E-waste?**

Questionnaire for Repair Shops

Name of Firm: **Location:**

Name of Respondent:
(Should be the repairing person)

1. **What are your shop activities?**

Type of products	Repairing	Buy	Sale
Television			
Desktop Computers			
Laptops			
Mobiles			
Refrigerators			
Washing Machines			

2. **What are the quantities of Buy, Repair and Sale performed per month?**

Type of products	Repairing (Pcs)	Buy (Pcs)	Sale (Pcs)
Television			
Desktop Computers			
Laptops			
Mobiles			
Refrigerators			
Washing Machines			

3. **How much E-waste is generated from your shop? (kg/month)**

Items	Mobile	TV		Computer			Refrigerator	Washing Machine	Any other
		CRT	LCD	Laptop	PC With CRT	PC With LCD			
Quantity									

4. **How do you handle with the wastes?**
   - Sell in Scrap
   - Just Dumping
   - Any other……

5. **What do you suggest to properly manage the E-waste?**

6. **How many of similar Shops exist in your district?**

Questionnaire for Scrap Dealers

Name of the Scrap Dealer: **Location:**

1. **How much quantity of following items collected per month?**

Items	Mobile	TV		Computer			Refrigerator	Washing Machine	Any other
		CRT	LCD	Laptop	PC With CRT	PC With LCD			
Quantity									

2. **What is done with the E-waste?**

Items	Mobile	TV		Computer			Refrigerator	Washing Machin	Any other
		CRT	LCD	Laptop	PC With CRT	PC With LCD			
Opinion									

3. **How much products are sold to recycling purpose and how much quantity is dumped?**

Items	Mobile	TV		Computer			Refrigerator	Washing Machine	Any other
		CRT	LCD	Laptop	PC With CRT	PC With LCD			
Recycling Quantity									
Dumping Quantity									

4. **How many of such scrap dealers exist in your district in your opinion?**

Questionnaire for Service Sector

Name of the Office: **Location:**

Type of Service Sector:

□Hotel or Resort □Bank □Hospital
□Travel Agencies □Government Office □ Educational Institution
□Manpower Agencies □ Private Office □ Computer Institute and Cyber

1. **Which Equipments do you have in your office?**

Items	Mobile	TV		Computer			Refrigerator	Washing Machine	Any other
		CRT	LCD	Laptop	PC With CRT	PC With LCD			
Quantity									

2. **How many of these equipments are in use in your office?**

Items	Mobile	TV		Computer			Refrigerator	Washing Machine	Any other
		CRT	LCD	Laptop	PC With CRT	PC With LCD			
Quantity									

3. **How many of these equipments are not in use in your office?**

Items	Mobile	TV		Computer			Refrigerator	Washing Machine	Any other
		CRT	LCD	Laptop	PC With CRT	PC With LCD			
Quantity									

4. **What do you do with those items?**
   - Sell in Scrap
   - Just Dumping
   - Any other……

5. **What is the size of these equipments in your office?**

Items	TV		Computer			Refrigerator	Washing Machine	Any other
	CRT	LCD	Laptop	PC With CRT	PC With LCD			
Size								

ANNEX-III: Data for Household Sector

SN	Name of Respondent	Location	Mobile		Computer												TV						Washing Machine			Iron			Vaccum Cleaner				Rice Cooker		Induction Cooker			Refrigerator			Usage Quantity	Ewaste Quantity	Total Usage units
					Laptop		Desktop/CRT			Desktop/LCD			LCD			CRT																											
			In use	Not in Use	In use	Not in Use	In use	Not in Use	Size	In use	Not in Use	Size	In use	Not in Use	Size	In use	Not in Use	Size	In Use	Not In Use	Size	In Use	Not in Use	Size	In Use	Not in Use	Size	In Use	Not in Use	Size	In Use	Not in Use	Size	In Use	Not in Use	size	Usage Quantity No.s	Ewaste Quantity No.s	No.s
1	Krishna Bhattarai	Thankot, Kathmandu	4	1	1	0	0	0		0	0		1	0		0	0		0	0																	1	0		7	1	8
2	Parashar Kumar deo	Kathmandu 23	1	1	3	0	0	0		0	0		1	0		1	0		1	0																	1	0		8	1	9
3	Durga B. Karanjit	Gatthaghar, Madyapur Thimi-15, Bhaktapur	5	5	2	1	1	1		0	0		1	0		1	1		1	1																	2	1		13	10	23
4	sarita Poudyal	sana Gaucharan, Maligaun, Kathmandu	2	3	1	2	0	0		0	0		1	0		0	2		1	0																	1	0		6	7	13
5	Deepsikha Byanju	Anamnagar	5	3	4	0	0	1	14"	0	1	17"	1	0	32"		1	17"	0	0																	1	0		11	6	17
6	Padam Wagle	Satdobato, Lalitpur	4	0	2	0	0	0		1	0		0	0		1	1		0	0																	1	0		9	1	10
7	Ravi Timalsina	Basundhara	3	0	1	0	0	0		1	0		1	0		0	0		1	0																	1	0		8	0	8
8	Suvit Kayastha	Bhaktapur , Nepal	10	0	3	1	0	0		0	0		1	0		1	0		0	0																	1	0		16	1	17
9	Susan Maleku	Pulchowk, Lalitpur	9	2	4	1	0	1		0	0		3	0		3	2		1	0																	2	0		22	6	28
10	suman shrestha	galkopakha, thamel	9	0	2	0	0	0		0	0		3	3		0	1		1	0																	1	0		16	4	20
11	Yogesh Shrestha	Hattiban, Lalitpur	10	0	6	2	0	0		0	0		1	0		1	1		1	0																	1	0		20	3	23
12	Bikash Jha	Dhapakhel, Lalitpur	4	0	3	0	1	0		0	0		0	0		1	0		0	0																	1	0		10	0	10
13	Ajaya Maharjan	Mahalaxmi-7, Lalitpur	3	1	0	0	0	0		1	1		0	0		1	0		0	0																	0	0		5	2	7
14	Aseem Baidya	Suryabinayak, Bhaktapur	8	2	2	0	0	0		1	1		1	0		1	0		1	0																	1	0		15	3	18
15	Bikesh Kayastha	Bhaktapur	4	2	1	0	0	1		0	0		1	0		1	0		1	0																	1	0		9	3	12
16	Bikash Shilpakar	Suryabinayak, Bhaktapur	10	2	2	0	0	1		1	0		1	0		1	0		0	0																	1	0		16	3	19
17	Sajan Rajbhandari	Babarmahal,Ktm	5	2	1	0	0	0		1	0		0	0		3	1		0	0																	0	0		10	3	13
18	Pravin Tripathi	Kalanki	5	0	2	0	0	0		0	0		1	0		0	0		0	0																	1	0		9	0	9

19	Sunny Shrestha	Dillibazar	5	3	1	1	0	1		1	0		1	0		1	1		1	0														1	0		11	6	17
20	Raj Kumar Dhital	Hattiban, Lalitpur	4	0	1	0	0	0		0	0		0	0		1	0		0	0														0	0		6	0	6
21	Anupa Ghimire	Kathamandu	5	2	3	0	5	2		2	1		1	1		1	1		1	1														1	1		19	9	28
22	Rishi Ram Pudasaini	Kageshwori Manahara Municipality, Ward - 04, Kathmandu	5	4	4	0	0	0		1	0		1	0		1	0		1	0														1	0		14	4	18
23	Keshab Paudel	Kirtipur-18, Kathmandu	4	2	1	1	0	1		1	0		1	0		1	0		1	0														1	0		10	4	14
24	Lakparinji Sherpa	Boudha, Kathmandu	2	2	2	0	0	0		0	0		1	0		1	0		0	0														1	0		7	2	9
25	Sanjaya Neupane	Khumaltar-15	6	2	2	0	0	0		1	0		0	0		3	0		0	0														1	0		13	2	15
26	Santoshi pandey	Basundhara 10	4	2	1	1	0	0		0	0		1	0		0	0		0	0														0	0		6	3	9
27	Umesh timilsina	Lalitpur metro. Tutepani - 14	6	1	2	0	0	2		0	0		2	0		2	0		0	0														2	0		14	3	17
28	Sushila wagle	Satungal,kathmandu	5	0	2	0	0	0		1	0		1	0		0	0		0	0														1	0		10	0	10
29	hari bahadur shahi	lalitpur 14 nakhipot	4	0	2	0	0	0		0	0		1	0		0	0		0	0														1	0		8	0	8
30	Birat Ghimire	Tarkeshwor-10, Kathmandu	5	5	2	2	0	0		1	1		0	0		1	0		0	0														1	1		10	9	19
31	samrat kc	new baneshor,ktm	4	0	1	0	1	0		0	0		1	1		1	1		1	0														1	1		10	3	13
32	Jeevan Maharjan	Banglamukhi,Patan	4	0	1	0	0	0		0	1		0	0		1	0		0	0														1	0		7	1	8
33	rakesh munikar	Ratopul	4	4	0	0	1	1		1	1		4	4		4	4		0	0														2	2		16	16	32
34	Anjali Shrestha	Dhapashi	5	2	1						1	13"	1		40"				1		9 kgs													1		150 l	9	3	12
35	Sabbu Thapa	Pulchowk	4		1											2	1	21"																			7	1	8
36	Maya Shrestha	Thimi, Bhaktapur	6		1											1	1	21"	1		8 kgs													1		150 l	10	1	11
37	Pratap Rai	Nakhipot, Lalitpur	3	2	2								1			1																		1			8	2	10
38	Chhetra Gopal Pradhan	Maitidevi, Kathmandu	7	3	3					1	1	14"				1		21"	1		7 kg	1			1			1						1		180 l	17	4	21
39	Anup K.C.	Basundhara	4	1	3	1								1								1															8	3	11
40	Najar Basnet	Dhobighat	2		1		1															1															5	0	5
41	Santhosh Malla	Koteshwor	6		2			1	18"				1		40"	1		14"	1		8 kgs													1	1	180 l	12	2	14
42	Kamlesh Ratna Konaju	Sanepa	3	1	2	1										1		30"													1			1		150 l	8	2	10
43	Nabaraj Thapa	Kalanki	7		1		1				1	14"	1		24"	2		14" and 21"																1		220 l	13	1	14

44	Binu Rajbanshi	Thankot, Kathmandu	4	4	1			1	21"		1	18"	1		22"	1		17"																1		18 0 l	8	6	14
45	Sanjay Khanal	Maharajgunj, Ktm	3	2	1						1	17"	1		32"		1	14"																1		20 0 l	6	4	10
46	Rejin Shrestha	Chabahil, Ktm	2	2	2											1		21"	1		7 kgs				1									1		18 0 l	8	2	10
47	Srijana Neupane	Baneshwor, Ktm	2	2	1								1		42"		1	21"																1		15 0 l	5	3	8
48	Hari Prasad Neupane	New Baneshwor,ktm	6	1	1	1		1	14"				1		21"	1		13"	1		10 kgs													1		18 0 l	11	3	14
49	Bibek Thapa Magar	Baneshwor, ktm	5	2	2								1		21"																						8	2	10
50	Rajesh Twn	Bhaktapur	5	2	3					1			2		17"		2	14"																1		20 0 l	12	4	16
51	Gopal Krishna Shrestha	Patan, Kusunti	4		2		1		17"				1				1	14"													1			1		18 0 l	10	1	11
52	Rajeev Bista	Dakshinkali	5	2	1	1							1		32"	2		20"				1												1		18 0 l	11	3	14
53	Priya Shrestha	Koteshwor, kathmandu	5	3	3			1	14"	1		17"	1		32"		1	14"																1		20 0 l	11	5	16
54	Rita Khanal	Kupondole	3										1		21"																						4	0	4
55	Suresh Bdr. Pandey	Handigram, Kathmandu	5		1					1						1		21"																1		12 5 l	9	0	9
56	Keshab Sigdel	Kirtipur, Ktm	3																																		3	0	3
57	Sabin Rajbhandari	Kuleshwor	4	2	1								1		42"	1		21"	1		7 kgs	1												1	1	15 0 l	10	3	13
58	Laxmi Lama	Lalitpur	3		1					1		17"				1						1												1		18 0 l	8	0	8
59	Kriti Pradhan	Patan	6		3	1										2		21" and 15"	1		7 kgs													1		18 0 l	13	1	14
60	Sakuntala Rai	Ghattekulo	4	3	1					1		21"	1		21"		1	21"		1	7 kgs													1		20 0 l	8	5	13
61	Santosh Poudel	Anamnagar	4		2			1	17"				1		22"		1	8"										1	1					1	1	19 0 l	9	4	13
62	Rameshwor Parajuli	Pepsicola, Ktm	4	2									1		17"	1		15"											1								6	3	9
63	Rumi Dangol	Sanepa	4	4	1	0	0	0		1	0	19"	0	0		1	0	21"	0	0		1	0											1	0	22 0 ltr	9	4	13
64	Salina Maharjan	Kalanki	3	1	0	0	0	0		1	0	19"	1	0	21"	0	0		0	0														1	0	22 1 ltr	6	1	7
65	Akash Kumar Shah	Gugingal,Lalitpur	3	3	1	0	0	0		0	0		0	0		1	0	17"	0	0		1	0					1	0					0	0		7	3	10
66	Sangita Regmi	Dhungedhara	4	2	1	0	0	0		0	0		0	0		1	1	17"	0	0														0	0		6	3	9
67	Dammar Nath Gupta	Swoyambhu	7	3	1	0	0	1	14"	0	0		0	0		1	1	17"	0	0														0	0		9	5	14

68	Loknath Sharma	Anamnagar	4	3	1	0	0	0		0	0		0	0		2	0	21"																1	0	18 0 l	8	3	11
69	Anshuila Dangol	Nakhipot	5	1	1	0	0	0		1	0	17"	0	0		1	2	24"																1		18 0 l	9	3	12
70	Ravi Prakash Sharma	Imadole	3	3	2	0	0	1	14"	0	0		1	0	24"	0	1	17"																			6	5	11
71	Neelam Labh	Imadole	3	1	1	0	0	0		1	0	17"	0	0		0	0														1			1		19 0 l	7	1	8
72	Nilu Chawrasia	Bhaktapur	4	2	2	0	0	0		0	0					1	1	14"																1	0	18 0 l	8	3	11
73	Krishna Mohan Jaiswal	Sitapaila	8	3	1	0	0	0		0	0		1	0	17"	0	0																	0	0		10	3	13
74	Dipendra Dutta	Lokanthali	5	2	2	0	0	0		0	0		1	0	24"	0	0																	0	0		8	2	10
75	Anish Nidhi	Gusingal,Lalitpur	6	2	3	0	0	0		1	0	17"	0	0		0	0																				10	2	12
76	Puja Bharti	Kuleshwor	2 2	4	4	0	1	0	14"	0	0		1	0	48"	2	0	21"	1	0	8 kg													1	0	22 0 l	32	4	36
77	Yermi Rana	Mangal Bazar	4	2	1	0	0	0		0	0		1	0	32"	0	0					0	1											0	0		6	3	9
78	Binod Babu Kumal	Kupandole	3	0	2	0	0	0		1	0	17"	1		21"	0	0											1	0					0	0		8	0	8
79	Harshikesh Karna	Sanepa	6	1	1	0	0	0		1	0	17"	1	0	17"	0	0					1	0					1	0					0	0		11	1	12
80	Anushka Pal	Sundhara	4	1	1	0	0	1	14"	0	0		1	0	42"	0	1	21"	0	0														1	0	18 0 l	7	3	10
81	Kundan Dutta	Koteswor	4	3	1	0	0	0		0	0		1	0	36"	0	1	21"	0	0								1	1					1	0	18 0 l	8	5	13
82	Mallika Shrestha	new baneshor,ktm	3	2	2	0	0	0		0	0		0	0		0	0		0	0		1	0											0	0		6	2	8
83	Amit Shah	Sanepa	4	0	2	0	0	0		0	0		0	0		1	0		0	0		1	0					0	1					0	0		8	1	9
84	Balmukunda Karanjit	Gothaghar, Thimi	3	1	1	0	1	1	14"	0	0		0	0		0	1	21"	0	0														1	0	12 0 l	6	3	9
85	Malika Prabhananga	Bagdol, Patan	4	1	1	0	0	0		0	0		1	0	32"	0	1	21"	1	0	6 kg													1	0	14 0 l	8	2	10
86	Basu Dev Karanjit	Thimi	5	1	0	2	0	0		0	0		0	0		1	0	21"	0	0														1	0	10 0 l	7	3	10
87	Suresh Shrestha	Gothaghar, Thimi	2	2	1	0	1	0		0	0		0	0		1	0	21"	0	0														1	0	12 0 l	6	2	8
88	Shankar Karanjit	Gothaghar, Thimi	5	2	1	0	0	1		0	0		1	0	32"	1	0	21"	1	0	6 kg							1	0		1	0		1	0	16 0 l	12	3	15
89	Divakar Vaidya	Lagankhel	3	0	2	2	0	1	14"	0	0		1	0	32"	0	0		1		7 kg				1	0		1	0					1	2	12 0 l	10	5	15
90	Paran Karanjit	Mitrapark,Kathmandu	3	1	1	0	0	2	14"	0	0		0	0		1	0	21"	1	0	5 kg										0	1		1	0	12 0 l	7	4	11
91	Arjun Bhatta	Bishal nagar	3	0	0	1	0	1	14"	0	0		1	0	32"	0	1	21"	1	0	6 kg													1	0	14 0 l	6	3	9
92	Prem lal Shrestha	Bansbari	4	2	0	1	1	0	14"	0	0		1	0	32"	0	0		1	0	6 kg							0	2		0	1		1	0	16 0 l	8	6	14
93	Anna Chetri	Bagdol, Patan	2	2	2	0	0	0		0	0		1	0	32"	0	1	21"	1	0	6 kg													1	0	16 0 l	7	3	10
94	Anara	Lazimpat	4	3	1	0	0	1	14"	0	0		1	0	32"	1	0	21"	0	1	5										1	0		1	0	16	9	5	14

	Shrestha																				kg															0 l			
95	Govinda Sharma	Kalikasthan, Kathmandu	2	0	1	0	0	0		0	0		0	0		0	0		1	1	7 kg				1	0		1	0					2	0	16 0 l	8	1	9
96	Manish Oli	Kapan	4	0	2	0	0	0		0	0		0	0		1	0	21"	1	0	5 kg				1	0		1	0					1	0	80 l	11	0	11
97	Binod Gautam	Bhaisipathi	2	2	2	0	0	0		0	0		1	0	32"	1	0	24"	1	0	7 kg													1	0	16 0 l	8	2	10
98	Samikshya Khanal	Gatthaghar-15	5	1	1	0	0	0		0	0		0	0		1	0	14"	0	0					1	0					1	0		0	0		9	1	10
99	Bhakta Bdh. Karanjit	Gatthaghar,Thimi	4	4	2	0	0	0		0	0		0	0		1	0	21"	1	0	6 kg													1	0	14 0 l	9	4	13
100	Guna Shrestha	Gatthaghar,Thimi	2	3	0	0	0	0		0	0		2	0	42",14"	0	0		0	0														1	0		5	3	8
101	Shiva Kumar Malla	Gatthaghar	3	0	1	0	0	0		1	0	18"	2	1	42",26"	1	0	21"	0	0														1	0		9	1	10
102	Prabin Chandra Gharti	Bhaktapur	3	0	1	0	0	0		0	0		1	0	32"	0	0		0	0														0	0		5	0	5
103	Sailesh Budhathoki	Lagankhel	4	1	2	0	0	0		1	0		1	0		0	1	14"	1	0		1	0											1	0		11	2	13
104	Nirala Kayastha	Jhochen	5	0	2	0	0	0		0	0		2	0		1	0		1	0														1	0		12	0	12
105	Sanjay Byanjakar	Chyasal, Lalitpur	3	0	1	0	0	0		0	1	17"	2	0		0	0		0	0														1	0		7	1	8
106	Lumanti Maharjan	Mangal Bazar	5	4	1	1	0	0		0	0		0	0		0	1	21"	0	0														0	0		6	6	12
107	Vivekananda Mishra	Jorpati	4	4	4	1	2						1			1		40"	2		10 kgs							2			1						17	5	22
108	Ajaya Ghimire	Imadol, Patan	2	2	1	1							1						1		10 kgs													1		22 0 l	6	3	9
109	Ramesh Gautam	Lagankhel	2	1									1																								3	1	4
110	Netra Dahal	Patan	7	3			2		21"																												9	3	12
111	Pankaj Chaudhary	Patan	2	1		1	1		14"							1		19"																			4	2	6
112	Kashika Chaudhary	Kuleshwor	3	1	1					1		19"	1	1	24"				1		8 kgs	1									1	1		1	1	19 0 l	10	4	14
113	Sanjiv Deo	Kuleshwor	3	1	2					1		19"	1		28"	1	1	21"	1		8 kgs							1				1		1		19 0 l	11	3	14
114	Tulkant Dev	Kupondole	3	3	3		1		14"				1		21"													1	1		1	1		1		20 0 l	11	5	16
115	Gauri Shankar Yadav	Balkumari	2	1	1								1		28"		1	14"														1					4	3	7
116	Kaushik Kumar	Kupondole	4	5	2			1	14"				1		21"	2		21"										1	1			1		1	1	19 0 l	11	9	20
117	Roshan Dev	Sankhamul	4	2	1						1	19"	2	1	28"		1	21"										1	1		1			1		23 5 l	10	6	16
118	Bikash Sha	Sanepa	5	2	2			1	21"				2		41"		1	21"													1						10	4	14

119	Prakash Dev	Kupondole	3	2	1						1	19"	1		24"		1	14"										1				1		1		190 l	7	5	12
120	Priyanka	Sanepa	3	3									1		21"													2	1						1	190 l	6	5	11
121	Rupak Maharjan	Kirtipur	5	3	3	1		1	14"							2		20"	2		6 kg													1		180 l	13	5	18
122	Sudeep Panta	Bishal nagar	3		2								1		21"										1									1		190 l	8	0	8
123	Ushma Gyawali	Sitapaila	7	1	4								4		32"				1		8 kgs				1									1		220 l	18	1	19
124	Bishnu Pd. Thapaliya	Koteshwor	2		2			1	14"		1	19"	1		22"					1	6 kgs													1		190 l	6	3	9
125	Sita Devi Khattri	Gongabu	4		2					1		19"				1		21"	1		7.5 kgs													1		180 l	10	0	10
126	Prabin Subedi	Baneshwor, ktm	2		1								2		27"		1	21"																1		180 l	6	1	7
127	Ramesh Basnet	Koteshwor	5	2	1		1	1	14"				1		42"				1		8 kgs		1						1					1		165 l	10	5	15
128	Ajay Bhakta Mathema	Hattigauda	1		3								2		32"		2	14" & 20"		2	5 kgs								1					2		180 l	8	5	13
129	Tek Bam	Lagankhel	2	4	1																								1								3	5	8
130	Pranjal Sigdel	Kathmandu	4		1					1		21"	1		21"																			1		180 l	8	0	8
131	Saraj Raj	Sanothimi	4		3								1		40"					1	7 kgs													1		180 l	9	1	10
132	Pratima Poudel	Kathmandu	3		2		1		14"				1		21"																						7	0	7
133	Sonu Bohara	Talchikhel	8	0	1	0	0	0		0	0		1	1	22"	1	0																	2	0		13	1	14
134	Sonu Dhakal	New Baneswor	2	0	1	1	0	0		0	0		1	0	21"	0	0					1	0											0	0		5	1	6
135	Naina Shrestha	Chabahil, Ktm	5	2	2	0	0	0		0	0		1	0	24"	0	0		1	0	1m	1	0											1	0		11	2	13
136	Anmol Pokhrel	Dhapakhel	2	1	2	0	0	1	14"	0	0		1	0	25"	0	0																	1	0		6	2	8
137	Abhisekh Sunuwar	Bhaktapur	4	1	1	0	0	0		0	0		0	0		0	0																	1	0		6	1	7
138	Ganesh Adhikari	Kathmandu	3	0	1	0	0	0		1	0		1	0	21"	0	0																	1	0		7	0	7
139	Sahishnu Sharma Acharaya	Imadole	2	1	1	0	0	0		0	0		0	0		1	0	20"																1	0		5	1	6
140	Bharat Thapa Magar	Balajutar	2	2	2	0	0			0	0		0	0		1	0	21"																			5	2	7
141	Yogendra Mahato	Ghattekulo	8	2	1	0	0	0		1	0	20"	1	0	15"	1	0	22"																1	0		13	2	15
142	Tilak Prasad Dulal	Pepsicola, Ktm	10	0	2	0	0	0		0	0		1	1	22"	0	0																	1	0		14	1	15
143	Sujal Shrestha	Balkhu	4	3	1	0	0	0		1	0		2	0		2	0		1	0														1	0		12	3	15
144	Suyog Raj Dhamala	Koteshwor	1	1	1	0	0	0		1	0	17"	1	0	42"	0	0											1	0		1	0		1	0		7	1	8
14	Niraj	Ranibu, Ktm	1	1	1	0	0	0		0	1	15"	0	1	20"	0	0		1	0														1	0		4	3	7

5	Bhandari																																								
146	Susim Rokaya	Baneswor	10	0	1	2	0	0		0	0		1	0	24"	0	1	21"									1	0					1	0	220l	14	3	17
147	Sumit Subedi	Talchikhel	5	1	3	0	0	0		3	1	15"	0	1	21"	1	0									1	0					1	0		14	3	17
148	Pushkar Joshi	Saatdobato	5	1	3	0	0	2	15"	0	0		0	0		1	0	22"														0	0		9	3	12
149	Satrughan Sah	Balaju	9	2	1	0	0	0		0	0		1	0	32"	0	0														1	0		12	2	14
150	suman shrestha	Satungal	4	2	2	0	0	1	14"	0	0		0	0		1	0	21"														1	0		8	3	11
151	Shreeyash Acharaya	Basundhara	4	2	2	1	0	0		0	0		0	0		1	0															1	0		8	3	11
152	Subash Tamang	Manamaiju,ktm	4	1	1	0	0	0		0	0		0	0		1	1	21"														1	0		7	2	9
153	Amitman Tuletha	Mastodevi	8	2	2	0	0	1	14"	1	0		1	0	32"	1	0	21"	1	0							1	0					2	1	200l	17	4	21
154	Shubham Upreti	Gwarko	2	0	1	0	0	1	14"	0	0		0	0		1	0	21"														1	0		5	1	6
155	Saugat Shrestha	Kupondole	5	2	1	0	0	0		0	0		1	0		2	1	21"	1	0												1	0		11	3	14
156	Raju Subedi	Balaju	3	0	1	0	0	1	14"	1	1	21"	1	0		1	0	21"														0	0		7	2	9
157	Sujan Ghimire	Godawari	4	1	1	0	1	0	14"	0	0		0	0		1	0	14"				1	0				1	0					1	0		10	1	11
158	Nishant Rimal	Baghdole	5	1	1	0	0	0		0	0		1	0	21"	0	0															1	0		8	1	9
159	Sanjay Luiltel	Manamaiju,ktm	2	1	1	0	0	1	14"	1	0	19"	0	0		1	0	14"	1	0												2	0		8	2	10
160	Ganga Dahal	New Baneshwor	8	2	1	0	0	1	14"	0	0		1	0		0	0															1	0		11	3	14
161	Diva Pradhan	Baneswor	1	0	1	0	0	0		0	0		0	0		1	1	21"	1	0												1	0		5	1	6
162	Baral SR	Kalanki	3	0	3	2	0	0		0	0		1	0	32"	0	1	21"														1	0		8	3	11
163	Roshan Srivastav	Khumaltar	4	2	2	0	0	1	14"	0	0		2	0	36"	0	1	21"	1	0												1	0		10	4	14
164	Sujit Kumar Jha	Godawari	4	0	2	0	0	1		0	0		0	0		1	0	14"														1	0		8	1	9
165	Sanish Shorchan	Santinagar	4	2	1	0	0	0		1	0		0	0		0	0															1	0		7	2	9
166	Rakesh Sah	Mahalaxmi-5	8	0	2	0	0	0		0	1		1	0		3	0															1	0		15	1	16
167	Santosh K Bhagat	Jadibuti	3	2	1	0	0	0		0	0		0	0		1	0	14"														0	0		5	2	7
168	Pariksham P Gupta	Gatthaghar	2	0	1	0	0	0		0	0		1	0	32"	0	1	21"														0	0		4	1	5
169	Lata Neupane	Syuchatar	4	3	3	0	0	1		0	0		1	0	24"	0	0		1	0												1	0		10	4	14
170	Sumi Rai	Bhaisipathi	4	2	1	0	0	0		0	0		0	0		1	0	21"														1	0		7	2	9
171	Nirmal Thapa	Maharajgunj, Ktm	3	0	2	1	0	0		1	0		1	0	21"	0	0					1	0									1	0		9	1	10
172	Punam Thapa	Koteshwor	6	2	4	0	0	0		1	0		2	1	34"	0	0		1	0												2	0		16	3	19

173	Rabin Basnet	Khumaltar	6	1	3	0	0	0		0	0		1	0		0	1	14"																1	0		11	2	13
174	Ananta Karki	Thapathali	4	2	2	1	0	0		1	1	15"	2	0		0	0		1	0	3.5"													1	0	4"	11	4	15
175	Damodar Dhital	Dhulikhel	7	0	2	0	0	1	14"	1	0		1	0					1	0														1	0	190 l	13	1	14
176	Prabita Makaju	Kalanki	4	2	1	0	0	1	14"	0	0		0	0		1	0																	0	0		6	3	9
177	Pratima Thapa	Balaju	6	3	3	1	1	0	15"	0	0		2	0	32"	1	1	21"	1	0	8 kg													2	0		16	5	21
178	Pratibha Bastola	New Baneswor	5	2	3	1	0	0		0	0		1	0	32"	1	0	14"	1	0														1	0		12	3	15
179	Ajaya Ghimire	Imadol, Patan	2	2	1	1							1						1		10 kgs													1		220 l	6	3	9
180	Kamala Shrestha	Naya baneshwor	4	2	1	0							1	0	18"	1		21"											1					1			8	3	11
181	Santa Shrestha	Gwarko	4	2																														1			5	2	7
182	Anjali Rana	Godawari	5	2	1		1		14"																									1		120 l	8	2	10
183	Mina kc	Pepsicola, Ktm	1	2	1											1		21"											1					1		120 l	4	3	7
184	Rabindra Bajracharya	Sankota	5	2						1		14"	1		32"	2	1	14",21", 5"																1	1	100 l,50 l	10	4	14
185	Suresh Karajit	Kalopul	3	2			1		21"	1		17"				1		21"				1							1					1	1	160 l, 160 l	8	4	12
186	Tiluta Chitrakar	Bhimsensthan, Ktm	1	1	1								1	1	32",21"														1					1		100 l	4	3	7
187	Krishna Chitrakar	Thimi, Bhaktapur	2							1		21"				1		14"							1				1					1			6	1	7
188	Ramesh Karanjit	Gathaghar	3	1	1			1	14"				1		32"	1		21"											1					1		120 l	7	3	10
189	Mingma Dorge Sherpa	Chabahil, Ktm	4		2			1			1			1		1																					7	3	10
190	Raju Tamang	Godawari	2	1	1					1		19"	1		32"																						5	1	6
191	Vidya Jha	Koteshwor	6		1					1			1		22"																			1			10	0	10
192	Nitu Parajuli	Satungal	4		1					1			1		21"													1						1			9	0	9
193	Rubi Bhandari	Koteshwor	7		1					1			1															1						1			12	0	12
194	Surendra Purbey	Dhapakhel	1	1	1																																2	1	3
195	Gyan Prasad Khanal	Thasikhel	1																	1																	1	1	2
196	Eshan Ansari	Kathmandu	6		1								1			3	2	14"													1						12	2	14
197	Chiranjivi Shrestha	Kathmandu	2		1			1	21"		1											1															4	2	6
198	Bishnu Prasad Neupane	Kalanki	1	1	1						1			1																							2	3	5

199	Sunil Bikram Sharma	Koteshwor	1			1											1																					1	2	3
200	Ramu Bhurtel	Bansbari, Ktm	1	1																																	1	1	2
201	Astha Gurung	Lagankhel	4	2	1											2						1						1			1				1			11	2	13
202	Dhan Prasad Phuyal	Satungal, Ktm	5	4	2					1		17"	1		27"		1	21"	1		6.5 kgs	1			1							1		1		18 0 l	13	6	19
203	Bivek Wagley	Matatirtha	2	3							1	21"	1		43"	1		21"				1												1		18 0 l	6	4	10
204	Himal Sharma Bhandari	Satungal, Ktm	5	3	2					1						1		21"				1												1		18 0 l	11	3	14
205	Om Prakash Mahoto	Satddobato	3		1								1		32"																						5	0	5
206	Govinda Dhakal	Kathmandu	3	2	1								1		36"	1		21"				1												1		22 0 l	8	2	10
207	Damodar Adhikari	Kalanki	2		1											1																		1			5	0	5
208	Sujan Wagley	Satungal	5	2	2						1	21"	1		40"	1		21"				1								1				1		20 0 l	12	3	15
209	Sanat Dhakal	Satungal, Ktm	3	1	1	1					1	21"	2		32" &49"				1		7.5 kg												1		22 0 l	8	3	11
210	Salin Shrestha	Satdobato, Lalitpur	2	1	2								1		43"							1													1	20 0 l	6	2	8
211	Archana Pradhanga	Sanepa	4	1	2					1		22"							1		7 kg												2			26 0 l and 10 0 l	10	1	11
212	Thakur Neupane	Satungal , Ktm	4	2	1		1		21"	1		19"				1		21"															1			18 0 l	9	2	11
213	Krishna Pokharel	Satungal , ktm	3	1	1											1		14"				1															6	1	7
214	Sushil Lal Amatya	Kupondole	4		2								1		22"	1																	1			20 0 l	9	0	9
215	Bhushan Pradhan	Balkhu, Ktm	2	2						1		17"				1		21"																			4	2	6
216	Prajwal Ojha	Sinamangal, Ktm	3	2	1	2				1		15"	1		32"	1		29"	1		8 kgs												1	1		22 0 l	9	5	14
217	Tulsi Ram Vaidya	Sanepa, Lalitpur	2										1		32"				1		7 kgs	1											1			26 0 l	6	0	6
218	Bhim Koirala	Satungal	3	1	1					1		29"	1		32"	1		29"																1		18 0 l	8	1	9
219	Bishnu Prasad Sharma	Matatirtha, Kathmandu	6	3	2											1		21"				1												1		18 0 l	11	3	14
220	Bal Krishna Wagle	Satungal, Ktm	2	2	1		1		16.5"							1		21"																1		18 0 l	6	2	8
221	Bal Krishna Bhusal	Baneshwor, ktm	2	1	1						1	19"		1	21"								1													3	4	7

222	Meenu Amatya	Mangal Bazar	5	4	2			1	17"				2		32"	1	1	21"	1		7 kgs								1				1		19 0 l	12	7	19
223	Keshav Mangal Joshi	Kathmandu	4	1	3	1	1		17"				1		21"	1	1	17"	1		8 kgs							1					1		18 0 l	13	3	16
224	Jyoti Amatya	Mangalbazar, Lalitpur	3	1	1			1	17"				1		29"	1	1	21"											1			1	1		19 0 l	7	5	12
225	Jibgar Joshi	Tahachal, Ktm	2	1	1					1		17"				1		17"				1							1			1	1		18 0 l	7	3	10
226	Jay Shrestha	Kantipur	10	2	3			1	17"				2		24"	1		17"	1		7 kgs								1			1	1		19 0 l	18	5	23
227	Indira Joshi	Chakupat, Lalitpur	3		1						1	19"	1		32"	1		17"		1	6 kgs								1				1		19 0 l	7	3	10
228	Hasana Shakya	Sunakothi, Lalitpur	4	2	2			1	17"	1		19"	1		29"		1	17"	1		7 kgs							1					1		18 0 l	11	4	15
229	Nirmala Shrestha	Sunakhoti, Lalitpur	4	4	3			1	17"				2		27"		1	17"	1	1	7 kgs							1					2		18 0 l	13	7	20
230	Guna Raj Shrestha	Sundhara, Ktm	5	2	5	1		1	17"				3		27"	1	1	17"	2		7 kgs								1		1		2		18 0 l	19	6	25
231	Gayatri Karki	Gothaghar, Thimi	4	1	4			1	17"				1		27"	1		17"				1							1		1		1		18 0 l	13	3	16
232	Euneka Joshi	Kupondole, Lalitpur	2	2	1		1		17"				1		27"	1		17"	1		7 kgs	1									1		1	1	18 0 l	9	4	13
233	Elisa Dangol	Lagankhel, Lalitpur	5	2	2			1	17"				1		32"		1	17"	1		8 kgs												1		19 0 l	10	4	14
234	Dipesh Prasain	Tinkune	2	1	1								1	1	27"							1											1		18 0 l	6	2	8
235	Cheki Sherpa	Boudha, Kathmandu	3	1	1			1	17"				1		27"		1	17"	1		7 kgs	1							1				1		18 0 l	8	4	12
236	Bishnu Hari Mangal Joshi	Sotha, Lalitpur	8	3	3			1	17"				3		32"	1	1	21"	2		7 kgs	1	1					1			1		3		18 0 l	23	6	29
237	Bishow Raj Devkota	Baneshwor, ktm	2	1	1								1		27"							1							1		1		1		18 0 l	7	2	9
238	Bina Nemkul	Sanepa, Lalitpur	3	2	2			1	17"				1		32"	1	1	21"	1		8 kgs	1						1			1		1		19 0 l	12	4	16
239	Bimal Upadhya ya	Ghattekulo	3	1	2		1		19"				1		23"		1	17"				1						1				1	1		18 0 l	10	3	13
240	Bikash Bolakhe	Kalanki	5	1	1			1	17"				1		27"																	1		18 0 l	8	2	10
241	Bishnu Thakali	Bansbari	4	1	2						1	19"	1		29"		1	21"										1			1		1		19 0 l	10	3	13
242	Bigee Malla	Kupondole	4	2	2					1	1	17"	2		32"	1	1	19"	1		7 kgs	1						1				1	1		18 0 l	14	5	19
243	Barsha	Tinkune, Kathmnadu	5	2	2						1	17"	1		24"		1	17"	1		7 kgs	1						1				1	1		18 0 l	12	5	17
244	Bandana Karmach arya	Sunakothi, Lalitpur	7	2	4						1	17"	3		27"		1	17"	1		7 kgs	1						1				2		18 0 l	19	4	23
245	Babita Manandh ar	Patandhoka, Lalitpur	5	1	2			1	17"				1		27"	1	1	21"	1		7 kgs	1							1				1		18 0 l	12	4	16
246	Anita Neupane	Hadigaun	5	2				1	17"	1		19"	2		27"		1	21"	1		7kgs	1						1	1		1		1		19 0 l	13	5	18
247	Trishna Bajrachar	Sundhara	2	2	0	0	0	0		1	0		1	0		0	0		1	0		2	0					1	2		1	0		1	0		10	4	14

	ya																																									
248	Mukunda Bhakta	Sobhahiti	4	2	2	0	0	0		0	0		1	0		0	0		1	0		2	0					0	2		0	1		1	0		11	5	16
249	Amita Maharjan	Lalitpur	3	2	1	0	0	0		0	0		0	0		1	0		0	0		1	0					0	1		0	1		1	0		7	4	11
250	Pramila Bajracharya	Mahapal	5	2	3	0	0	0		2	0		1	0		2	0		0	0		2	0					1	2		1	0		2	0		19	4	23
251	Kailash Shrestha	Thimi, Bhaktapur	4	0	1	0	1	0		0	0		2	0		0	1		0	0		1	0					2	1		1	0		1	0		13	2	15
252	Laxmi Thapa Magar	Kusunti	7	0	2	0	0	0		0	0		2	0		1	0		1	0		1	0					1	0		0	1		1	0		16	1	17
253	Suresh Amatya	Mahapal	5	5	2	0	0	1		0	0		3	0	24"	0	1	36"	0	0		2	0					1	1		0	0		1	0		14	8	22
254	Shristi Maharjan	Mangal Bazar	6	0	2	0	0	0		3	0	21"	0	0		1	0	24"	0	0														1	0		13	0	13
255	Mamta KC	Sanepa	4	2	2	0	0	1		2	0		2	0		0	1		1	0		1	0					0	1					1	0		13	5	18
256	Kriti Shrestha	Ghattekulo	5	0	2	0	0	1		0	0		1	0		1	0		1	0								0	1		0	1		1	0		11	3	14
257	Manoj MC	Jawalakhel	1	1	1	0	0	0		0	0		0	0		0	0		0	0														0	0		2	1	3
258	Nilendra Raj Shrestha	Nakhu	2	3	1	0	0	1		0	0		1	0		0	1		1	0								0	1		1	0		1	0		7	6	13
259	Padma Sundar Joshi	Tinkune	3	2	0	0	0	1		0	0		2	0		0	1		1	0		1	0					1	1					2	0		10	5	15
260	Sauvee Pokharel	Bhaktapur	6	2	2	0	0	1	17"	0	0		1	0	36"	0	1	32"	1	0	8 kg				1	1							1	0		12	5	17
261	Rajita Gautam	Baneswor	5	1	2	0	0	1		0	0		1	0		0	1		0	0		1	0		1	0		0	1					0	0		10	4	14
262	Rasmi Dangol	Gabahal	7	2	2	0	0	1		0	0		2	0		1	0		1	0					1	0		0	1					1	0		15	4	19
263	Ritu Sharma	Hadigaun	5	2	2	1	0	1		0	0		1	0		1	0		1	0					1	0		0	1		0	1		1	0		12	6	18
264	Shekhar Thokar	Baneswor	5	1	1	0	0	1		0	0		2	0		0	1		0	0								1	0					1	0		10	3	13
265	Subina Shrestha	Sundhara	4	2	2	0	0	1		0	0		2	0		1	1		1	0					1	0		0	1					1	1		12	6	18
266	Suprim Shrestha	Purano Thimi	5	2	2	0	0	1		0	0		1	0		0	1											0	1					1	0		9	5	14
267	Yogesh Pradhan	Balaju	5	1	3	0	0	1		0	0		1	0		1	0		1	0					0	0		0	1					1	0		12	3	15
268	Astha Adhikari	Balaju	4	4	2	0	0	1		0	0		2	0		0	2		1	0								0	1					1	0		10	8	18
269	Sudhishya Chalaugain	Chobar	5	0	1	0	1	0		0	0		1	0		0	1		0	1		1	1					1	0		0	1		1	0		11	4	15
270	Trilochan Subedi	Kathmandu	1	1	1	0	0	1		0	0		1	0		0	0		0	0		1	0					0	1					1	0		5	3	8
271	Alisha Bajracharya	Mangal Bazar	4	2	1	0	0	1		0	0		1	0		1	0		0	0		1	0					0	1					1	0		9	4	13
272	Aasish Shrestha	Banglamukhi	3	2	1	0	0	1		0	0		1	0		1	0		1	0		1	0					1	1					1	0		10	4	14

273	Rambika Pradhan	Sanepa	4	2	3	0	0	1		0	0		3	0		1	0		1	0		1	0					1	1		1	0		1	0		16	4	20
274	Kushal Shrestha	Mangal Bazar	4	2	2	0	1	1		0	0		1	0		0	1		1	0		1	0					1	1		1	0		1	0		13	5	18
275	Nikita Shrestha	Imadole	3	0	1	0	0	1		0	1		1	0	32"	1	1	24"	1	0												1	0		8	3	11
276	Binisha Padrabansha	Mangal Bazar	4	4	1	1	0	0		0	0		0	0		1	1	14"	0	1												1	0		7	7	14
277	Geeta Rajbhandari	Dillibazar	4	5	3	0	0	0		0	0		2	0	42"	2	0	32"	2	0		3	1					2	1				2	0		20	7	27
278	Sunita Shrestha	Kumaripati	4	4	1	1	0	0		0	1		1	0	32"	3	1	21",24", 32"	1	1								2	3		1	0		2	1		15	12	27
279	Sandesh Joshi	Purnachandi	3	3	1	0	0	2		0	0		0	0		1	1		0	0		1	0					0	2				1	0		7	8	15
280	Govind Raj Bhatta	Karyabinayek	2		2								1		42"																	1		150 l	6	0	6
281	Apremaya Khakurel	Sukedhara	5	3	2						1	15"				2		24"	1		7 kgs	1						1				1		180 l	12	5	17
282	Neela Pradhan	Sanepa, Lalitpur	5	1	2			1	17"				1			1			1		7 kgs	1			1			1				1		190 l	13	3	16
283	Nilesh Pradhan	Maru, Ktm	3	2	3			1	17"				2		32"		1	21"	1		8 kgs	1			1			1	1			1		200 l	13	6	19
284	Harihar Sapkota	Sankhamul, Ktm	4	3	1			1	19"				1		32"	1	1	24"	1		7 kgs	1						1	1			1		180 l	11	6	17
285	Prakteek Amatya	Mahapal, Lalitpur	6	2	3			1	19"				1		32"	2			1		7kgs	1									1	1		180 l	15	4	19
286	Alina Bajracharya	Sotha, Lalitpur	4	2	2			1	17"				1		32"	1		24"	1		6kgs	1						1		1		1		190 l	12	4	16
287	Barsha Jha	Lokanthali	5	4	1					1	1	21"	1		32"				1		7 kgs							1				1		180 l	10	6	16
288	Pradeep Bhattarai	Golfutar	3	1	1					1		21"																							5	1	6
289	Shusil Pandit	Jhamsikhel	3	1	2			1	14"				1		36"		1	24"														1		180 l	7	3	10
290	Bharat Chalise	Satdobato, Lalitpur	6	2	2	1							2		32"																	1		200 l	11	3	14
291	Bimala Bade	Gathhaghar	4		2								1		32"																	1		100 l	8	0	8
292	Surendra Shrestha	Kalanki	2	1	1		1		17"							1		18"																		5	1	6
293	Niraj Ayedi	Sinamangal, Ktm	2	1	2																															4	1	5
294	Lila Devi Bhattrai	Pepsicola, Ktm	4	1	2											1		25"														1		100 l	8	1	9
295	Januka Kandangwa	Balkot	2	1	2											1		14"																		5	1	6
296	Ram Singh Thakunna	Gokarna	1	1	1																															2	1	3
297	Aparajita Gautam	Bhaisepati	2	1	2								1		32"																	1		170 l	6	1	7

298	Bal Krishna Manandhar	Sanepa, Lalitpur	3	3	1		1		14"							1	1	27'																	1		200 l	7	4	11
299	Ishwor Shah	Lokanthali	6	1	4	1				1			1	1	32"	2	1	28"	1	1	7 kgs															1	1	200 l	16	6	22
300	Pushpa Raj Panthi	Lagankhel	3	1	2			1	14"				1		32"		1	24"	1		7 kgs															1		200 l	8	3	11
301	Monica Shah	Jadibuti	4	1	2	1				1		18"	1		24"	1	1	18"	1		7 kgs															1		180 l	11	3	14
302	Nabin Paudel	Pulchowk	3	2	2	1							1		24"																					1		150 l	7	3	10
303	Sabindra Shrestha	Thimi	4	3	3	1	1		14"				2		22"																					1		200 l	11	4	15
304	Ganesh Poudel	Jadibuti	2	1	1								1		17"																								4	1	5
305	Min Thapa	Koteshwor	3	1			1		14"				1		32"																								5	1	6
306	Dipu Chapagain	Pepsicola, Ktm	6	2	3	1		1	14"				2			1		19"	1		7 kgs															1		150 l	14	4	18
307	Ashik Khadka	Minbhawan	2	1	2								1		24"																					1		150 l	6	1	7
308	Rajkumar Trikhatri	Balaju	4	1	1											1		32"																					6	1	7
309	Prakriti Rajbhandari	Lazimpat, Ktm	5	3	2			1	14"		1	19"				1		21"		1	7 kgs	1			1				1							1		200 l	11	7	18
310	Milan Poudel	Kalanki	2	1	2			1	14"																														4	2	6
311	Raju Maharjan	Chundevi	2	1	1	1										1		17"																		1		150 l	5	2	7
312	Sabin Pandey	Kathmandu	4	1	1																															1		180 l	6	1	7
313	Roja Pradhananga	Duwakot, Bhaktapur	5	2	1																															1		170 l	7	2	9
314	Shruti Malla Thakuri	Jawlakhel	5	1						1		17"																								1		180 l	7	1	8
315	Laxman Tako	Dillibazar	2	2	2					1	1	19"				1		21"																					6	3	9
316	Nishwarth Mahat	Kalanki	3		1								1		32"		1	21"																		1		180 l	6	1	7
317	Prakash Chhetri	Kapan	4		1	1					1	24"	2	1	40"				1		8 kgs															1		180 l	9	3	12
318	Yural Maskey	Dillibazar	4	1	3								2		43"	1		21"	1		7 kgs															1		190 l	12	1	13
319	Sumeet Pokharel	Gwarko, Lalitpur	5		2								1		32"		1	21"	1		7 kgs															1		180 l	10	1	11
320	Sajal Gautam	Babarmahal,Ktm	5		2						1	21"				1		24"																		1		180 l	9	1	10
321	Santosh Pokharel	Mahalaxmi-3, Lalitpur	4	2	1	1		1	15"							1		17"																		1		180 l	7	5	12
322	Rajat	Dillibazar	8		4			1	14"		1	17"	1		32"	1		21"																		1		190 l	15	2	17
323	Pratik Karki	Lalitpur	5		3			1	14"	1		17"		1	27"	2		21"	1		7 kgs															1		180 l	13	2	15

324	Manshi Karna	Ekantakuna	6	1	3	0	0	1	14"	1	0	19"	0	0		1	0	48"	0	0								0	1					1	0	190	12	3	15
325	Saroj Tanawasu	Bhaktapur	5	2	2	0	0	1		0	0		1	0	42"	2	1	14"	1	0								2	0		0	1		1	0	180	14	5	19
326	Nabina Paudel	Budhanilkantha	4	3	1	0	0	0		0	1	17"	1	0	32"	0	1	21"	1	0	7 kg	2	0					0	1		1	0		1	0	190	11	6	17
327	Krishna karna	Sanepa	8	3	2	0	0	0		0	0		1	0	32"	1	0	48"	1	0											0	1		1	0		14	4	18
328	Biswanath Bhatta	Budhanagar	6	2	2	0	0	0		0	0		1	0	32"	0	0		0	0		2	0					2	1		1	0		1	0		15	3	18
329	Arbind kumar Karna	Kuleshwor	5	2	2	0	0	1		0	0		1	0	32"	0	0		1	0		1	0					0	2		1	0		1	0		12	5	17
330	Reshma Munankarmi	Teku	4	2	1	0	0	1		0	0		1	0	28"	0	0		0	0														1	0		7	3	10
331	Anu Dewla	Kalimati	6	2	2	0	0	0		0	0		1	0	42"	0	1	21"	0	0								1	0		1	0		1	0		12	3	15
332	Surendra Mahato	Sanepa	4	1	2	0	0	0		0	0		0	0		1	0	42"	0	0		1	1											1	0		9	2	11
333	Sadish Shrestha	Dhungedhara	4	1	2	0	0	1		0	0		1	0	42"	0	0		0	0														1	0		8	2	10
334	Menaka Karki	Sankhamul	5	2	3	1	0	0		1	0	17"	1	0	32"	0	0		0	0		2	1											1	0		13	4	17
335	Kanchan Bohara	Balaju	7	2	4	0	0	0		0	1	17"	2	0	42"	0	0		1	0														1	0		15	3	18
336	Monika Basnet	Tangal	10	4	3	1	0	0		0	0		2	0	19"	0	0		0	0		2	0					1	1					1	0		19	6	25
337	Priti Paudyal	Koteshwor	7	2	3	0	0	0		0	0		2	1	32"	0	0		1	0		0	0								0	1		2	0		15	4	19
338	Rajesh Agrwal	Soltimode	16	4	6	0	0	1		0	0		4	0	42"	0	1	32"	1	0	8 kg												2	1		29	7	36
339	Bharat Pandey	Kalanki	4	2	3	0	0	1		0	0		2	0	17"	0	0		1	0													1	0		11	3	14
340	Ishwor Raj Joshi	New Baneswor	1	1	1	0	0	0		0	0		0	0		0	0		0	0														0	0		2	1	3
341	Pratik Munankarmi	Basundhara	4	2	2	0	0	0		0	1	17"	2	0	32"	0	1	19"	1	0														1	0		10	4	14
342	Kriti	Kathmandu	5	3	1					1		17"	1		32"	1																		1		180l	10	3	13
343	Pranay Shah	Thimi	6	2	1					1		17"	1		48"		1	19"																2		180l	11	3	14
344	Srijana Shrestha	Thimi	5	2	2			1	14"	1	1	17"	1		17"		1	17"	2		7 kgs													1	1	170l	12	6	18
345	Keshav Kumar Saraf	Baneshwor, ktm	5	2	1		1		14"	1	1	17"	1			1																		1		180l	11	3	14
346	Binod Ghimire	Bhaktapur	4	1	1								1		32"		1	14"	1		7 kgs													1		180l	8	2	10
347	Saras Karanjit	Baneshwor, ktm	4	5	2	2		1	14"							1																		1	1	170l	8	9	17
348	Akriti Thapa	New Baneshwor	3		1								1		40"		1	21"																1		170l	6	1	7
349	Sudina Karanjit	Kalopul	4	2						1		17"	1																					1	1	170l	7	3	10
350	Sagar Tamang	ktm	4		3								1		17"	1	1	17"																1		180l	10	1	11

351	Prasansha Pokharel	Koteshwor	4	2	2												1	14"																1		180 l	7	3	10
352	Sujata Khatri	Golfutar	4	3	1								1			1																		1		170 l	8	3	11
353	Manoj Rayamajhi	Koteshwor	3	1	1	1							1		42"		1	24"																1	1	150 l	6	4	10
354	Nirdeshika	Gyaneshwor	5	1	2						1	17"	1			1																					9	2	11
355	Supriya	Bhaktapur	4	3	2			1	14"					1	17"	2																		1		180 l	9	5	14
356	Manoj	Kathmandu	2	2	1											1	1	19"																1		170 l	5	3	8
357	Ashish Dahal	Pepsicola, Ktm	2	2	1																																3	2	5
358	Sejal Adhikari	Ratopul	5	2	2					1		17"	1		38"	1	1	17"																1		180 l	11	3	14
359	Srijana Dahal	Bhaktapur	4		1		1	1	14'	1	1	17"	1		19"	2	1	21"																1		170 l	11	3	14
360	Sudesh	Kadaghari	3		1			1	14"							1																		1	1	170 l	6	2	8
361	Krisha Neupane	Balaju	4	1	1					1		17"	1		21"		1	21"																1		170 l	8	2	10
362	Suresh Ghalyan	Lalitpur	3	1	1			1	14"							2																		1		180 l	7	2	9
363	Nischal Sharma	Kathmandu	4	2	2					1		19"	1			1	1	21"																			9	3	12
364	Sabai	Ktm	6	2	2																																8	2	10
365	Anshuman Mishra	Ktm	4	2	2								1		24"	1			1		7 kgs													1		180 l	10	2	12
366	Rosina Pandit	Bansbari	5	2	1	1				1							1	17"	1		7kgs													1		190 l	9	4	13
367	kanchan Puri	Kritipur	3	1	1	1	1	1	14"	1	1	17"	1		17"		1	14"	1	1	7 kgs													1	1	180 l	9	7	16
368	Ramesh	Ktm	1	3	1			2	14"	3		17"		1	17"	1			1		7 kgs													1		190 l	8	6	14
369	Salifa Bogati	Ktm	3	1	1			1	14"	1		19"	1				2	21"																1		180 l	7	4	11
370	Kajal Puri	Kritipur	5	3	1					1		17"	1			1																		1		170 l	10	3	13
371	Sagar Shrestha	Baniyatar, ktm	5	2	1	1							1			1	1	21"																			8	4	12
372	Rohit BK	Dallu, Ktm	1	2	1								1																					1		180 l	4	2	6
373	Prajwal Khatiwoda	Baneshwor, ktm	3	1	1	1							2			2	1	17"																1		180 l	9	3	12
374	Saraswati	Raniban	7	3	3	1	2		14"	2	1	17"	1	1	17"		1	14"	1	1	8 kgs													2	1	170 l	18	9	27
375	Ramesh	Ktm	2	2	1		1		14"							1			1		7 kgs													1		180 l	7	2	9
376	Rachika	Gathhaghr	5	2	2			1	14"	2		17"	1																					1		170 l	11	3	14
377	Govinda thakur	Baneshwor, ktm	7	2	4					3		17"	1						1		7 kgs													1		180 l	17	2	19
378	Akshay Kumar	Sanepa, Lalitpur	3	1	2			1	14"	1		17"	1			1			1		6 kgs													1		150 l	10	2	12
37	Asma	Satdobato,	5	2	2			1	14"				2		21"				1		6													1		18	11	3	14

9	Basnet	Lalitpur																			kgs															0 l			
380	Sushmita	Ktm	10		4	1							2			1			1		7 kgs													1		170 l	19	1	20
381	Krishna Jaishi	Putalisadak	5	3	1										17"																			1		170 l	7	3	10
382	Ritesh Joshi	new baneshor,ktm	4	3	1	1		1	14"				1			1		17"	1															1			9	5	14
383	Saroj Basnet	Kadaghari	4	1	1								1				1	14"																1		180 l	7	2	9
384	Rajin Shrestha	Samakhushi	7	3	4					2		17"	1			1	2	17"	1		7 kgs													1		190 l	17	5	22
385	Suraj Maharjan	Lalitpur	1	1	1		1			1			1		36"	1		14"	1		8 kgs													1		160 l	8	1	9
386	Priyanka Prajapati	Suryabinayek , Bhaktapur	6	2	3					1		17"				1	1	21"																1		180 l	12	3	15
387	Anup Shrestha	Imadol, Lalitpur	4		2								1		14"		1	17"																1		170 l	8	1	9
388	Mohan Maharjan	Mangal bazar	3	1	1			1	14"				1		17"		1	14"	1		7 kgs													1		180 l	7	3	10
389	Rupesh Maharjan	Patan	4	2				1	14"				2		28", 14"	1	1	20"	1		6 kgs													2		190 l	10	4	14
390	Amar Bahadur Manandhar	Bansbari, Ktm	3	3	2	0	1	1	21 inch	0	0	no	1		32 inch	0	0	no	0		no													1	0	165 lit	4	4	8
391	Yuma Pradhan	Khumaltar, Lalitpur	5	0	1	0	1	0	15"	0	0	17"	1		32"	1	0	21"	1		6.5 kg													1	0	190 l	0	0	0
392	Lasata Manandhar	Chhaunu	3	3	2	0	0	0	-	1	1	large	0		-	1	0	21"	1		7 kgs													1	0	190 l	4	4	8
393	Govinda Tiwari	Lalitpur	3	1	3	0	1	1	1	1	1	15 inches	1		42 inches	1	1	21 inches	1		2 kg													1	1	300 litres	5	5	10
394	Buddha Singh Thakuri	Mahalaxmisthan, Lalitpur	5	3	3	1	0	1	14'	1	0	14'	1		19'	1	0	21'	0		0'													1	0	180 l	5	5	10
395	Chhabi Adhikari	Budhanilkantha	5	2	3	0	0	0	0	1	1	14"	0		n/a	1	0	21"	0		N/A													1	0	190 l	3	3	6
396	Abhishek Dhakal	Balaju	4	3	3	1	0	0	0	1	0	17 inch	0		0	2	1	21 inch	1		8 kg													1	0	200 l	5	5	10

Data for Retailers and Dealers

SN	Name of Firm	Respondent	Location	Equipments Sold																		What is done with the unsold item?			Is there Facility for Exchange?																	
				Mobile		Laptop		Desktop/ CRT		Desktop/ LCD		LCD TV		CRT TV		Washing Machine		Refrigerator		Any Other		Sell To Scrap	Return to Whole seller	Any other	Mobile		Laptop		Desktop/ CRT		Desktop/ LCD		LCD TV		CRT TV		Washing Machine		Refrigerator		Any other	
				Sales per month	Unsold Quantity	Sales per month	Unsold Quantity	Sales per month	Unsold Quantity	Sales per month	Unsold Quantity	Sales per month	Unsold Quantity	Sales per month	Unsold Quantity	Sales per month	Unsold Quantity	Sales per month	Unsold Quantity	Sales per month	Unsold Quantity				Exchange	Quantity	Exchange	Quantity	Exchange	Quantity	Exchange	Quantity	Exchange	Quantity	Exchange	Quantity	Exchange	Quantity	Exchange	Quantity	Exchange	Quantity
1	Ola Electronics Pvt. Ltd.	Yasoda Karki	Putalisadak, Ktm	100	1 per year	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			sent to other showrooms	N																
2	Mobile Store Pvt. Ltd.	Sabin Shrestha	Putalisadak, Ktm	180	20 per yr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			returned to wholeseller	N																
3	BT Planet Pvt. Ltd.	Kamal Bhandari	Putalisadak, Ktm			150	3 per yr.			13										Printer -13				sell in lower price			N				N								N	
4	Ritika International Pvt. Ltd	Sailendra Adhikari	Putalisadak, Ktm			10				5	1 per yr									Printer -8				sell in lower price			N				N								N	
5	IT Shop Pvt. Ltd.	Sujan Dhakal	Putalisadak, Ktm			30	1 per yr			3													A	returned to wholeseller			N				N									
6	Bigbyte IT World	Navaraj Chhetri	Putalisadak, Ktm			35				2												A		exchanged parts(after repairment) sold in scrap																	
7	E Machine Pvt. Ltd.	Bidhur Pokharel	Putalisadak, Ktm			12			22	25												A																			

8	Samsung Plaza	Diwa Dangol	Sundhara, Ktm	20								5				3		6																										
9	Electronics Hub	Kripa Awale	Kupondole									4				4		4																										
10	Imagine World	Bhupendra	Suryabinayek, Ktm									20				18		50		Fan - 10 per day				damaged items returned to the company (2 per yr)																				
11	Him Electronics Pvt. Ltd.	Siru KC	Bhaktapur	33								8				10		8		Vacuum Cleaner- 12 Oven - 5				sent to other showrooms																				
12	Bajra Electronics	Albert	Sallaghari, Bhaktapur	8	5													3						kept as is in the store																				
13	Microland International	Ramesh	Kupondole			30	5																A				Y / sell at lower price	5																
14	The Mobile Store	Chandra Man Shrestha	New Road	300	30																		A																				
15	Binayek Emperior	Dinesh Kumar Dahal	New Road									20				4		25						sell to customer at low cost																				
16	RNB2 Mobile	Amit Shah	New Road	60	10																		√																				
17	Samridhi Tradelink Pvt. Ltd.	Sudharshan Poudel	New Road	350	0																																						
18	Sony Centre	Nabin KC	Kumaripati	28						38																																		

19	The Mobile Store	Rakshya Shrestha	Pulchowk	100	2																			returned to dealers																		
20	Prime Store	Diyana Shrestha	Pulchowk	175																					Y/ resold to customer	25																
21	New Shiva Electronics	Tulsi Devi Shrestha	Pulchowk									5				5		10		Fan-15 Vacuum -12				if damaged, returned to the dealers																		
22	Reewas Mobile Home	Suman KC	Pulchowk	55																				return to dealer																		
23	Digital Gadgets Home	Rekha KC	Pulchowk	300																					Y/ resold to customer	7																
24	LG Lifestyle Shoppe	Niraj Thakur	Minbhawan, Ktm	5								12				12		12			DVD players-2			sell in liquidated price																		
25	Click Solution Centre	Niraj	Pulchowk, Patan			3	1																	returned to wholeseller																		
26	CG Digital Pvt. Ltd.	Shankar	Jawlakhel	3								10				9		15						if damaged, returned to the dealers (1 per year)																		
27	Jain Electronic Center	Gopal	Tokha Road, Ktm			1				2		15				5		20															Y/sell in sceap	10					Y/ sell in scrap	10		

Data for Scrap Dealers

SN	Name of Respondent	Location	Collection of Items per month																		Recycilng and Dumping Quantity																	
			Mobile		Laptop		Desktop/ CRT		Desktop /LCD		LCD TV		CRT TV		Refrigerator		Washing Machine		Any Other		Mobile		Laptop		Desktop/ CRT		Desktop /LCD		LCD TV		CRT TV		Refrigerator		Washing Machine		Anyother	
			Collection quantity	What is done with it?	Collection quantity	What is done with it?	Collection quantity	What is done with it?	What is done with it?	Collection quantity	Collection quantity	What is done with it?	Collection quantity	What is done with it?	Collection quantity	What is done with it?	Collection quantity	What is done with it?	Collection quantity	What is done with it?	Recycling Quantity	Dumping Quantity	Recycling Quantity	Dumping Quantity	Recycling Quantity	Dumping Quantity	Recycling Quantity	Dumping Quantity	Recycling Quantity	Dumping Quantity	Recycling Quantity	Dumping Quantity	Recycling Quantity	Dumping Quantity	Recycling Quantity	Dumping Quantity	Recycling Quantity	Dumping Quantity
1	Sanjeev Kumar Gupta	Baneshwor, Kathmandu	-		-		5 per month	sold as a whole to another party					2 per month	broken and sold	1 in 3 months	parts separated and sold			Volt guard - 150	sold as a whole					5 pcs per month						iron and plastic	glass	iron , copper	remaining parts of the fridge			150 volt guards per month	
2	Satendar Chaudhary	katyani chowk, baneshwor, Kathmandu	-		-		3 per month	broken and sold					2 per month	broken and sold	2 in 3 months	parts separated and sold									iron , plastic	glass					iron and plastic	glass						
3	Adesh Shah	Baneshwor, Kathmandu					2 per month	broken and sold					3 per month	broken and sold	-										iron , plastic	glass					iron and plastic	glass						
4	Bibek Chaudhary	Baneshwor, Kathmandu	45 per month	sold as a whole			2 per month	sold as a whole to another party					3 per month	broken and sold	4	parts separated and sold			Fan- 4 per month Rice Cooker- 45 per month	Fan and rice cooker - broken and sold	45 per month				2 per month						iron and board	glass and plastic	iron and copper	remaining parts of the fridge			Fan- Iron and Copper Rice cooker- Iron, Silver	remaining parts of fan and rice cooker
5	Achhelal Betha	Anamnagar, Kathmandu	10 per month	board sold, remaining part dum			11 per month	broken and sold					2 per month	broken and sold							board (10 mobile per	remaining parts of mobile			Iron , Plastic , board	glass					iron, board , plasti	glass						

				ped																		mo nth										c									
6	Rabindra Prajapati	Bhaktapur	18 per month	board sold, remaining part dumped	2 per year	sold as a whole	6 per month	sold as a whole to another party					4 per month	sold as a whole	1 till date	sold as it is	1 till date	sold as a whole	oven - 1 per yr.	sold as a whole	board (18 mobile per month	remaining parts of mobile	2 whole laptop per yr.		6 per month	-					4 per month	-	1 till date		1 till date		oven- 1 per yr.	
7	Ayush Shrestha	Anamnagar, Kathmandu	100 per month	sold as a whole to different party			16 per month	broken and sold					5 per month	broken and sold	5 per month	broken and sold			Volt guard and Inverter - 50	sold as it is	100 per month				iron, plastic	glass					iron, plastic	glass	iron, copper	remaining parts of the fridge			Voltguard+Inverter - 50	
8	Ram Babu Yadav	Anamnagar, Kathmandu	20 per month	sold as a whole to different party	1 in 6 month	sold as a whole	6 per month	sold as a whole to another party					5 per month	broken and sold	5 per month	broken and sold	2	sold as a whole	Iron - 10	sold as a whole	20 per month		sold as a whole		sold as a whole						iron, board	glass, plastic	iron, copper	foam and other parts	sold as a whole		10 iron per month	
9	Bhagwati	Sanepa	800 per yr	sold as a whole to different party	25 per yr	dissemble and sell	80 per yr	sold as a whole to another party	25 per yr	sold as a whole to another party			15 per yr	broken and sold	25 per yr	broken and sold	10 per yr	sold as a whole	Printer- 200 per yr Photo copy machine- 7 per yr	broken and sold	800 per yr				80 pcs per yr		25 pcs per yr				300 gm per TV		15 kg per fridge	10 kg per fridge	10 pcs per yr		90%	10%
10	Pashupati	Sanepa	1000 per yr	sold as a whole to different party	5 per yr	dissemble and sell	5 per yr	sold as a whole to another party					25 per yr	broken and sold	20 per yr	broken and sold	3 per yr	sold as a whole	Printer-10	broken and sold	1000 per yr		board only	2 kg per laptop	5 pcs per yr						400 gm per TV	15 kg per TV	25 kg per fridge	14 kg per fridge	3 pcs per yr		3 kg per printer	2 kg per printer

11	Binod Prasad Chaudhary	Jhamsikhel	40 per yr (telephone set)	broken and sold	5 per yr	dissemble and sell	15 per yr	sold as a whole to another party	15 per yr	sold as a whole to another party	2 per yr	broken and sold	10 per yr	broken and sold	10 per yr	broken and sold	4 per yr	sold as a whole	Photocopy-4 per yr Printer-10 per yr	broken and sold	200 gm per mobile	400 gm per mobile	board only	5.5 kg per laptop	15 pcs per yr		15 pcs per yr		board only	5.5 kg per TV	300 gm metal per TV	6.5 kg per Tv	20 kg	12 kg	4 pcs per yr		Photocopy - 40 kg Printer-1.5 kg	Printer -2 kg
12	Ajay Kumar	Balkhu	16 per yr	broken and sold			28 per yr	sold as a whole to another party					5 per yr	broken and sold	15 per year	broken and sold	12 per year	sold as a whole	Photocopy-5 per yr Printer- 25 per yr	broken and sold	200 gm per mobile	500 gm			28 pcs per yr						250 gm	10 kg	15 kg per fridge	12 kg	12 pcs per yr		Photocopy - 10 kg Printer- 2 kg	Printer -2 kg
13	Bikki Kumar	Creel Line	100 per yr	broken and sold			20 per yr	sold as a whole to another party					12 per yr	broken and sold	7 per yr	broken and sold					600 gm	100 gm			20 pcs per yr						250 gm	10 kg	20 kg	10 kg			
14	Sachin	Dallu	15 per month	sold as a whole to different party	2 per year	sold as a whole	5 per month	sold as a whole to another party					10 per month	broken and sold	2 per month	broken and sold	4 per yr	broken and sold	telephone-50 per month	sold as a whole	15 per month		2 pcs per yr		5 pcs per month						250 gm	10 kg	20 kg	12 kg	7 kg		50 pcs telephone per month	
15	Dakshinkali Scrap dealer	Sanepa	25 per month	sold as a whole to different party	10 per yr	dissemble and sell	80 per year	sold as a whole to another party							12 per yr	broken and sold	10 per yr	sold as a whole	photocopy-10 printer-25	broken and sold	25 pcs per month		mother board and plastic	remaining parts	80 pcs per yr								18 kg	11kg	10 pcs per yr		plastic body - 15 kg	

16	BinodChaudhary	Kupondole	15 per year	sold as a whole to different party	4 per month	sold as a whole	200 per year	sold as a whole to another party									2 per month	broken and sold	photo copy- 10 per yr Printer- 15 per yr	broken and sold	15 pcs per yr		4 pcs per month		200 pcs per yr											90%	10%	90%	10%
17	Braj Kishore Choudhary	Balkhu	80 per yr	50% sold to other party 50% broken and sold	10 per yr	50% sold to other party 50% broken and sold	90 per yr	broken and sold					15 per yr	broken and sold	10 per yr	broken and sold	15 per yr	broken and sold	printer- 70 per yr photo copy- 15 per yr	broken and sold	40 %	60%	40 %	60%	50 %	50 %					30 %	70 %	60 %	40%	85 %	15 %	50%	50%
18	Indra Maya Enterprise	Swyambhu	10 per month	sold as a whole to different party			3 per month	sold as a whole to another party					2 per month	sold as a whole	3 per month	broken and sold			photo copy- 5 per yr	broken and sold	10 pcs per month				2 pcs per month						2 pcs per month		20 kg	20 kg			10 kg	3 kg
19	Ram Pabresh Prasad	Teku	30 pcs per yr	broken and sold	3 per yr	broken and sold	20 per yr	broken and sold					5 pcs per yr	broken and sold	2 pcs per yr	broken and sold	3 pcs per yr	broken and sold	printer- 10 pcs per yr	broken and sold	50 %	50%	60 %	40%	40 %	60 %					10 %	90 %	70 %	30%	80 %	20 %	60%	40%
20	Lakhan Sahani	Tokha	35 pcs per month	broken and sold	2 pcs per month	sold as a whole	3 pcs per yr	broken and sold					2 pcs per month	broken and sold	14 pcs per yr	broken and sold	12 pcs per yr	broken and sold			mother board only	remaining parts of mobile	2 pcs per month		200 gm from monitor, 2.5 kg from CPU	3.5 kg					200 gm	10 kg	15 kg	15 kg	20 kg			

Data for Service Sectors

SN	Name of Office	Service Sector	Location	Mobile / Telephone			Computer												TV								Washing Machine				Refrigerator				Any Other				How do you handle with those items?			Ewaste Quantity
							Laptop			Desktop/CRT				Desktop/LCD					LCD				CRT																				
				Total Quantity	In use	Not in Use	Total No.s	In use	Not in Use	Total No.s	In use	Not in Use	Size	Total No.s	In use	Not in Use	Size		Total No.s	In use	Not in Use	Size	Total No.s	In use	Not in Use	Size					Total No.s	In Use	Not in Use	size	Total No.s	In Use	Not in Use	size (not in use)	Sell To Scrap	Just Dumping	Any other	No.s
1	SEED Nepal	Private Office	Anamnagar Kathmandu	5		5	3	3		2		2	14"	2	1	1	19"																	5	2	3	printer-3		√		11
2	SEA Gate	Computer Institute and Cyber	Kupondole Patan	4	4									28	24	4	18"																	7	7			√			4
3	Department of Soil Conservation & Watershed Management	Government Office	Babarmahal, Kathmandu				6	4	2					6	4	2	14"	1	1		32"	2	1	1	24"					1		1	180l	4	4			√	√		6
4	Kathmandu Pharma Vet. Pvt. Ltd.	Private Office	Teku				1	1		2		2	14"	2	2		17"															2		2	180l and 168l	5	3	2	heater-2		√		6
5	Info Developers Pvt. Ltd.	Private Office	Sanepa				20	20		7		7	14"	50	50		17"															1	1		180l	5	5			√	√		7
6	Hotel Greenwich	Hotel or Resort	Bakhundole, Lalitpur				1	1		5	2	3		7	7			25	25			7	5	2	21"					4	4			2	1	1	vaccum cleaner	√	√	Maintainance	6
7	Hotel Saptarangi Pvt. Ltd.	Hotel or Resort	Sundhara, Ktm															17	17			15		15	17"					2	1	1	201l	21	15	6	vaccum cleaner-1 fan-5		√		22
8	Himalayan Bank Pvt. Ltd.	Bank	Kamaladi, Ktm	10	10		40	40		60	25	35	14"	200	200			20	20											8	8		180l	15	15				√	computers distributed to schools	35
9	Rex Travels	Travel Agencies	Kumaripati	1	1		1	1						8	8																			4	4						0

10	Prasana International Education	Manpower Agencies / Consultancy	Jawlakhel, Lalitpur											4	4		14"													1	1		180 l					√			0
11	Green Apple International Education Foundation	Manpower Agencies / Consultancy	Kumaripati, Lalitpur				1	1		3		3	14"																												3
12	Madan Bhandari Memorial College	Educational Institution	Anamnagar				2	2		35		35	14"	60	60		17"	1	1											1		1	180 l	14	14				√	auction and sell	36
13	Raj Technical Institute	Educational Institution, Computer Institute and Cyber	Baneshwor, Ktm	4	4		1	1		4	1	3	14"	1	1			1	1			2		2	21"					4	2	2	200 l	30	30					use in training	7
14	Saathi Travels	Travel Agencies	Putalisadak, Ktm	2	2		4	3	1					2	2		17"																	1	1		desktop -1		√		1
15	Sky Buzz Travel and Tours	Travel Agencies, Computer Institute and Cyber	Putalisadak, Ktm				2	2						6	5	1	17"																								1
16	Summit Hotel	Hotel or Resort	Kupondole Height	200	150	50	5	4	1	15		15	14"	20	17	3	19"	16	16		32"	70	65	5	21"	1	1		9 kgs	23	20	3	190 l	100	88	12	printer-9 AC-3	√			89
17	Himalayan Hotel	Hotel or Resort	Pulchowk, Lalitpur	150	125	25	5	5		10		10	15"	50	45	5	19"	130	125	5	31"					2	2		9 kgs	5	5		230 l	180	150	30	Printer-5 AC- 25	√			75
18	Amazing Cyber	Computer Institute or Cyber	Gusingal				2	2						14	14		17"																	2	1	1	printer 1			returned to supplier	1
19	Nepal Electricity Authority	Government Office	Durbar Marg, Ktm	80	70	10	120	100	20	230	200	30	17"	580	500	80	19"	10	10		21"	4	2	2	21"					2	2		190 l	125	100	25	printer-25	√		sell by auction	167

20	Department of Electricity Development	Government Office	Thapagaun, Anamnagar	95	95		13	12	1	17		17	19"	80	80		19"														1	1		1801	84	65	19	printer-17 photocopy machine-2	√			37
21	Vehicle Fitness Test Centre	Government Office	Teku	12	7	5	4	3	1					9	7	2	19"	1	1		26"													8	7	1	printer-1		√	store in office	9
22	Ram Raj Engg. Pvt. Ltd.	Private Office	Balkumari	50	25	25	37	25	12					6	6		15"																	3	3					returned to supplier	37
23	Santosh Kishore & Associates	Private Office	New Baneshowr, Ktm	8	8		7	6	1	4		4	15"	3	2	1	18"																	5	4	1	printer 1		√	stored in office	7
24	Dhurbatara Investment Group Pvt. Ltd.	Private Office	Bijulibazar	3	3									1	1		18"																	1	1						0
25	Beam Consultant Pvt. Ltd.	Private Office	Sanepa	15	10	5	10	9	1	4		4	14"	20	17	3	19"	1	1		42"	2		2	14"					1	1		3001	16	12	4	printer-4	√			19
26	Nepal Medical College	Hospital / Educational Institute	Jorpati				200	200		5	1	4	14"	7	7		17"	5	5			10		10		4		4	12 kgs	11	8	3	2201	6	6				√		11
27	Nightangle School	Educational Institution	Kupondole				5	4	1	60		60	14"	105	100	5	19"	3	3		29"	2		2	21"									10	9	1	photocopy machine-1	√			69
28	Kathmandu Valley Hospital	Hospital	Sundhara, Ktm	30	30		1		1	7	4	3	14"	8	8		19"					1		1	14"	2	2		11 kgs	3	2	1	2351	5	5				√		6
29	Megha Hospital Pvt. Ltd.	Hospital	Dhobighat	17	10	7	3	3		7	3	4	15"	6	6		19"	2	2		29"									4	4		1901	22	13	9	printer-4 AC-5	√			20
30	Alka Hospital	Hospital	Lalitpur, Pulchowk	80	50	30	3	2	1	5	1	4	15"	35	30	5	19"	15	14	1	22"	10	5	5	15"					15	13	2	1801	50	45	5	printer-5	√			53
31	Prabhu Bank	Bank	Anamnagar, Ktm	300	300		30	30						210	210		18"	10	10		42"					1		1	15 kgs	5	5		301								1
32	NCC Bank	Bank	Kumaripati				1	1						5	5		17"																									0

Data for Repair Shops

SN	Name of Respondent	Location	Mobile			Computers									TV						Washing Machines			Refrigerators			E-waste generated per month									How do you handle with the waste?		
						Laptop			Desktop/CRT			Desktop/LCD			LCD			CRT																				
			Buy Qty	Sale Qty	Repair Qty	Buy Qty	Sale Qty	Repair Qty	Buy Qty	Sale Qty	Repair Qty	Buy Qty	Sale Qty	Repair Qty	Buy Qty	Sale Qty	Repair Qty	Buy Qty	Sale Qty	Repair Qty	Buy Qty	Sale Qty	Repair Qty	Buy Qty	Sale Qty	Repair Qty	Mobile	Laptop	CRT Desktop	LCD Desktop	LCD TV	CRT TV	W Machine	Refrigerator	Any Other	Sell To Scrap	Just Dumping	Any other
1	Karna Lal	Kupondole													5	5				18			2									15 pcs			Fan-5 pcs	√		
2	Gokul Panthi	Anamnagar	12	12	50																						15										Municipal garbage collecter
3	Astha Bahadur Tandukar	Kupondole	5	5	20																						100									√	
4	Tara Prasad Panthi	Thapathali	30	30	300																						150									√	
5	Subash Chapagain	Anamnagar				10	10	15	10	10	30															2		500 gm	10 kg							√		
6	Microland International	Kupondole				30	30	100			30																		10 kg							√		
7	Ashok Adhikari	Bijulibaar			10																						150										√	
8	Surendra Pratap Rana	Baneshwor																		3						5						3 pcs				√		
9	Subash Sharma	Baneshwor		30	30																						2									√		
10	Bhupendra Sunar	Shantinagar	30	30	50																						50											Reuse for repairing
11	Prem Rai	Natole, Lalitpur	2	2	100			2																			1000									√	
12	Mahesh Karki	Manbhawan																								15							5			√	
13	Rajeesh Maharjan	Jawalakhel																		60						15						2		Fan-15	√		
14	Sidhhi Maharjan	Gabahal																					3			3							3	4	Oven - 4	√		
15	Saraswati	Manbhawan						3			3																	10 kg										unused battery taken by customer

16	Arun	Nakhu									2										2			2 per year							10					√	Municipal garbage collecter
17	Arjun Chettri	Putalisadak						300			20																20		400							project or-15			Reuse for repairing
18	Shrivendra Kumar Thakur	Kupondole													2	2				5	2	2	4	√								15	4	8		√		
19	Ganesh Budha	Makhan			150			10									30																					Return to the consumer
20	Dinesh Shrestha	Kamal Pokhari			60			5			10						20									4			2 pcs	2 pcs								Return to the consumer
21	Sapna	Tokha																			2 per year	2 per year	2	✓										10 kg		√		
22	Om sai	Syambhu													2 per year	2 per year	15 per month						10	✓							2 kg				√		
23	Electric and Electronics	Dallu			4															4											2kg				√		
24	Saroj Kumar kuswaha	Thapagaun																		7						6 per day					5 pcs				√		
25	Kishor prajapati	Suryabinayak	30	30	20																						10								√(only plastic)		