PREFACE

Sri Lanka ratified the Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal in 1992 and we have taken many steps to fulfill the objectives of the Basel Convention since then. Efficient and effective implementation of the Basel Convention requires Parties to Control Transboundary Movements of Hazardous Wastes as well as to manage hazardous waste in the country in an environmentally sound manner.

At the sixth meeting of the Conference of the Parties to the Basel Convention (COP6), electrical and electronic wastes (e-waste) has been recognized as a priority issue which needs urgent attention especially in the Asia Pacific Region. The rapid advances of e-technology creates a rapid pace of electrical and electronic products becoming obsolete and at present countries are faced with problems related to the disposal of these items once it became waste.

While recognizing the importance of promoting e-technology and e-literacy that brings far away places together in the world, it is necessary to take precautions to prevent harmful impacts due to improper management of out-dated e-products. Most of the Electronic items contain hazardous material and haphazard disposal of these items poses high risk to the human health and to the environment. It is evident that e-waste is growing faster than that of other waste streams and it needs a priority attention for its environmentally sound management.

In this context I am happy to note the initiative taken by the Secretariat of the Basel Convention (SBC) in collaboration with the Government of Japan to develop a project proposal on environmentally sound management of e-waste to assist selected countries in the Asia and Pacific region. Sri Lanka is one of these countries selected.

The project proposal made by Sri Lanka encompasses six phases with a time span of four years. At present, Sri Lanka received financial assistance from the SBC with the donor funding from the Government of Japan, for the implementation of the first component covering; a desk study to review the present status and a field survey to prepare inventories of selected e-products. This report is an outcome of this exercise.

I would like to take this opportunity to extend our sincere gratitude to the Secretariat of the Basel Convention and to the Government of Japan for the initiative taken at regional level to strengthen the capacities of developing countries in the Asia Pacific Region on e-waste management and for the selection of the project proposal submitted by Sri Lanka for funding in particular.

I am pleased to note that we have already taken steps for the implementation of some of the recommendations made in this report. Private sector has also taken initiatives to establish collection systems for out-dated mobile phones under Extended Producer Responsibility.

Efficient e-waste management system needs effective legal systems coupled with incentive schemes followed by sound monitoring systems. We hope that we would be able to continue this project to further strengthen the capacity of Sri Lanka for the efficient management of e-waste.

M A R D Jayathilake
Secretary
Ministry of Environment and Natural Resources

FORWARD

This report is an outcome of the component one of a four year project on the "Development of a National Implementation Plan for Electrical and Electronic Waste Management in Sri Lanka". The project is part of a regional project initiated by the Secretariat of the Basel Convention in collaboration with the Government of Japan.

The project encompasses six phases; Preparation of an inventory of selected e-items, Training and awareness raising and, Implementation of three pilot projects in three provinces based on the outcome of the field survey. Component one broadly covers; Development of detailed inventory and Awareness raising.

The Central Environmental Authority assisted to conduct the survey by using its Divisional Environmental Officers scattered all over the country. Field survey studies were conducted through structured survey questionnaires covering; Government and Private Sector Institutions and, Household, Industry, Commercial, Service, and Repair & maintenance sectors. Seven provinces were covered under the survey out of nine provinces in the country. Three hundred and seventeen (317) Divisional Environmental Officers of the CEA attached to both local and central government authorities in the 17 districts were trained on key life cycle issues relating to e-waste management enabling them to conduct the survey efficiently and effectively.

The National Coordinating Committee for the Basel Convention acted as the steering Committee for the project. An expert committee with three members was set up to guide the activities of the Project. The draft report was reviewed by a review committee. A Stakeholder Workshop was conducted to review the findings of the survey further, and make conclusions and recommendations. This forum was also used to disseminate information gathered from the desk study and the field survey. The draft final report submitted by the review committee after the stakeholder workshop with conclusions and recommendations was finalized by the Ministry of Environment and Natural Resources in collaboration with the Central Environmental Authority.

Preparation of this report is a national, regional and an international effort involving many stakeholders. At the outset, we would like to extend our sincere gratitude to the Secretariat of the Basel Convention and to the Government of Japan for acceptance of our project proposal and the financial assistance provided for the implementation of the first component of the project.

We offer our grateful appreciation to all the members of the Project Team for their valuable contribution to complete this project, and finally we wish to record our appreciation for the assistance provided by numerous other ministries, provincial, district and local authorities and individuals who have assisted us in various ways in ensuring the successful completion of the component one of this project. Concerted efforts of all of us would lead to the environmental friendly management of e-waste at local, regional and global level.

L P Batuwitage
Director/Environment
Ministry of Environment and Natural Resources

Acknowledgement

First of all we would like to extend our sincere gratitude to the Secretariat of the Basel Convention and to the Government of Japan for acceptance of our project proposal, the continuous encouragement and the financial assistance provided for the implementation of the first component of the project.

Implementation of the project spanned across the tenure of two Ministers; Hon. Mithreepala Sirisena and our current Minister, Hon. Patali Champika Ranawake. The leadership provided by them for the implementation of component one as well as for the continuation of the project is highly commended.

Administrative arrangements made by Mr. Karunasena Hettiarachchi and Mr. Mervin Gunasena, the former Chairman and the former Director General of the Central Environmental Authority was very much useful to establish the Project Control Unit and conduct the survey. The valuable guidance, encouragement and the support given by Mr. Udaya Gammanpila, the present Chairman of CEA and Mr. Pasan Gunasena, the present Director General of the CEA was very much useful to finalize and complete the report. We offer our grateful appreciation to them for their tireless contribution to complete this project. The contribution extended by Mr. Lal Fernando, the Director of the Hazardous Waste Management Unit of the CEA from the inception of the project is immensely commended. Also, the continuous support given by Ms. Sarojini Jayasekara, Deputy Director of the Hazardous Waste Management Unit of the CEA is highly appreciated.

It is with deep gratitude that we place on record the valuable contribution extended by Dr. Wimal Wimaladasa, the Project Coordinator of the Project Control Unit and his professional staff in conducting the desk study and field survey. PCU staff comprised of Ms. Githanjali Amarasekara, Ms Upuli Indigahamadditha and Mr. Missaka Ranathunga. The report submitted by the PCU based on findings of the survey made the compilation of this report possible. The consultancy services provided by Prof. Janaka Ekanayake and Prof. R.O.Thattil to the PCU are also highly appreciated. We extend our sincere thanks for the Divisional Environmental Officers of the CEA for the support given to conduct the survey.

Valuable assistance given by Prof. Ajith de Alwis by extending services as an Expert Committee member and also as the head of the official review committee of the draft report is commended with deep appreciation. . The services rendered by Mr. Nimal Perera as an official reviewer is also highly commended.

The guidance and directions provided by, Mr. J. R. W. Dissanayake the former Secretary of the Ministry of Environment and Natural Resources and also the guidance, directions and unstinted support given by the present Secretary Mr. M A R D Jayathilake are deeply appreciated. Our special thanks are due to Mr. W. R. M. S. Wicremasinghe, the Additional Secretary of the Ministry of Environment for the directions and advices given throughout the project.

We offer our sincere thanks for the valuable contribution given by the National Coordinating Committee members of the implementation of the Basel Convention by steering the project.

The assistance given by Ms. Chandani Panditharathne, the Assistant Director, for monitoring of the project and also the continuous assistance given by Ms. Priyanga Senarathne for monitoring and compilation of the final report are highly commended.

Finally we wish to record our appreciation for the assistance provided by numerous other ministries, provincial, district and local authorities and individuals who have assisted us in various ways in ensuring the successful completion of the component one of this project. We look forward all of your valuable contribution for implementation of the other components of the project in near future.

L P Batuwitage
Director/Environment
Ministry of Environment and Natural Resources

Table of Contents

Abbreviations

Code	Description
BAT	Best Available Technology
BC	Basel Convention
BEP	Best Employed Practice
BOI	Board of Investment
BSI	British Standard Institute
B/W	Black & White
CA	Competent Authority
CEA	Central Environmental Authority
CFC	Chloro-Floro-Carbons
CP	Central Province
CRT	Cathode Ray Tube
DEO	Divisional Environment Officer
DS	Divisional Secretary
EU	European Union
FCCISL	Federation of Chambers of Commerce and Industry of Sri Lanka
FP	Focal Point
GA	Government Agent
GHG	Green House Gases
GN	Grama Niladhari
Govt.	Government
HARTI	Hector Kobbekaduwa Agrarian Research & Training Institute
HCFC	Hydro-Chloro-Floro-Carbons
HH	Household
HS	Harmonized Systems
HWM	Hazardous Waste Management
ICTA	Information & Communication Technology Agency of Sri Lanka
IEC	International Electric Commission
I/LNGO	International/Local Non Government Organizations
IT	Information Technology
kg	Kilograms
LCD	Liquid Crystal Display
L/C	Letter of Credit
LGA	Local Government Authorities
MC	Municipal Council
M&E	Monitoring & Evaluation
MENR	Ministry of Environment and Natural Resources
MOU	Memorandum of Understanding
NCC	National Coordinating Committee
NC	North Central
NIP	National Implementation Plan
NWP	North Western Province
PC	Personal Computers
PCB	Printed Circuit Board

Code	Description
PCU	Project Control Unit
PP	Pilot Project
PS	Pradeshiya Sabhas
RoHS	Restriction of Hazardous Substances
RRR	Re-use, Re-cycle, Reduce
SG	Sabaragamuwa Province
SLCVA	Sri Lanka Computer Vendors Association
SL	Sri Lanka
SP	Southern Province
SREAP	Southern Province Rural Economic Advancement Project
SSQ	Structured Survey Questionnaire
SWOC	Strengths, Weaknesses, Opportunities & Challenges
TV	Television
UC	Urban Council
WEEE	Waste Electrical and Electronic Equipment
WM	Washing Machine
WP	Western Province

Executive Summary

Sri Lanka ratified the Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal in 1992 and had taken many steps to ensure implementation of its provisions. As global economies and systems developed and expanded, new priorities have emerged. At the sixth meeting of the Conference of the Parties to the Basel Convention (COP6) Electrical and Electronic wastes (e-Wastes) was recognized as a priority issue requiring urgent attention. The need for action was considered especially important to the Asia-Pacific region. Over the past few years Sri Lanka has a significant growth in telecommunication penetration. Information and Communication Technology is especially promoted to bring about development of the economy.

The Secretariat of the Basel Convention (SBC) in collaboration with the Government of Japan initiated a project on environmentally sound management of e-Waste in the Asia Pacific Region. The Sri Lankan proposal to develop a National Implementation Plan for Electrical and Electronic Waste Management was included as a part of this regional project.

The project proposal submitted by Sri Lanka encompasses six phases with a time span of four years. This document reports on the first component of the project to which financial assistance was received from the Government of Japan through the Basel Convention Trust Fund. The first component broadly covers a desk study followed by a field survey to prepare inventories of selected e-products. Personal Computers, Printers, Televisions, Mobile Phones, Refrigerators, Washing machines, Photo copying machines, Air - conditioners and Batteries are the selected items. The main activities of component one includes; Establishment of a Coordination Mechanism, Establishment of a Project Control Unit (PCU), Preparation of a detailed Inventory for the selected e-items, Field survey, Awareness Raising Workshops, Stakeholder Consultation, and the Delivery of the Project Report.

The National Coordinating Committee set up for the implementation of the Basel Convention acts as the Steering Committee for this project. The National Coordinating Committee is chaired and convened by the Ministry of Environment and Natural Resources. Ministry of Environment and Natural Resources is the Focal point for the Basel Convention and the Central Environmental Authority (CEA) is the Competent Authority.

Ministry of Environment and Natural Resources as the Focal Point primarily liaises with other in-country subject ministries and foreign institutions (through Ministry of Foreign Affairs) regarding policy formulation and implementation including activities relating to the legal enactment. Pilot projects are developed and implemented by the Ministry in order to address priority issues which need urgent attention. The Central Environmental Authority (CEA) under the direction and supervision of the Ministry liaises with relevant subject and line ministries including

Government institutions, private sector and general public on key issues and concerns including law enforcement activities on e – Waste Management in the country. Key Institutions/stakeholders involved in the ***Coordination Mechanism*** are: 59 Subject Ministries; 511 Government Institutions covering Departments, Corporations, Boards, Security forces, Commissions, Banks and Financial Institutions, Healthcare Institutions, Commercial and Services and other Statutory Institutions, 07-Chief Secretariats, 17-District Secretaries, 243-Divisional Secretaries, 15-Municipal Councils, 30-Urban Councils, and 192-Pradeshiya Sabhas, and Private sector, Local & International Non Governmental Organizations, Diplomatic and Foreign missions, Foreign Investors and Collaborators and the General Public.

The project management team responsible for this output represented; Ministry of Environment and Natural Resources, National Coordinating Committee members, Expert Committee members, Hazardous Waste Management Division of the Central Environmental Authority, Project Control Unit Staff, and Key External Consultants. The study area covered 07 Provinces & 17 Administrative Districts, excluding Northern and Eastern Provinces in view of the current conflict situation.

Field Survey Studies were conducted by the Project Control Unit through Structured Survey Questionnaires (SSQs) for collecting data and information from the above stakeholders, Government and Private sector institutions, and Household, Industry, Commercial, Service, Repair and maintenance sectors. Three hundred seventeen (317) Divisional Environmental Officers (DEOs) of the CEA attached to both local and central Government authorities in the 17 districts were trained on key life cycle issues relating to E – Waste management particularly emphasizing on 3R concept. Twenty (20) separate workshops were held for this purpose. This capacity building program includes Compiling the National e – Waste Inventory; Conducting the Field Survey Study on Households and Repair & maintenance Sectors; and Collecting information on Industrial & Commercial/Services sectors. The sampling strategy was based on a multi-stratification procedure. The total No. of completed Household Survey Questionnaires received by the PCU was ***One Thousand Ninety Five (1095).*** A total of ***Five Hundred Forty Two*** (***542)*** Repair & Maintenance Centers provided the PCU with a very diverse and current situation of their repair and maintenance activities as per the format of SSQ provided by the PCU.

According to the desk study conducted by Project Control Unit, the current global situation reveals that e-waste is growing rapidly, mainly due to rapid development of electronic devices and decrease of their useful lifespan. In 2004, more than 180 million Personal Computers (PCs) were sold worldwide and in the same year, an estimated 100 million obsolete PCs entered into waste streams. Estimates show that 130 million mobile phones were disposed in 2005. Worldwide e-waste growth had been estimated to be in the range of 20 to 50 million tons per year.

There are about 350 – 400 IT Vendors operating in the country. However about 50 can be categorized as leading vendors. The balance 300 - 350 is dependents of the leading 50 IT agencies.

European Union (EU) designated e-waste as a priority waste stream, and in January 2003 the Waste Electrical and Electronic Equipment (WEEE) Directive came into force. A sister directive with the WEEE is the Restriction of Hazardous Substances (RoHS) directive, which limits the use of Lead (Pb), Cadmium (Cd), Mercury (Hg) and other toxic materials in new equipment sold after June 2006 by legislation. In USA, IEEE standard 1680 of 2006, which is the U.S. national standard on Computer recycling, requires RoHS compliance of computers and their peripherals. e-waste specific legislation, though not as widespread in the rest of the world as in Europe, has also been implemented in few other developed and developing countries.

The present study developed a life cycle diagram for each of the e-product stream. Generalized Key Life Cycle Issues, Concerns and Stages covered by the study included; stakeholders connected to locally manufactured finished-items and/or finished - components; Local Importers and/or Indenting Agents; Foreign Suppliers, Dealers and Manufacturers; Branding of Electrical and Electronic items at various overseas Exit/Entry Points; Bi-and Multi-lateral trade agreements, pacts, treaties, conventions etc.; Import and Export regulations covering: financial, technical, environmental, social, health & safety and, trading issues; Local and foreign banking relationships and transactions including regulatory issues; Opening of Letters of Credits (L/Cs) at local banking and financial institutions; Wholesale establishments; wholesale and retail sales outlets; Marketing & Sales and after sales warranty; End users; Repair and maintenance sectors; Re-users and collectors including transporters; Local Govt. Authorities responsible for waste management; and Environmental, Social, Health & Safety regulatory bodies. Probable Entry/Exit (EE) Points included: **01st** E/E Point: Overseas Ports to Local Sea and/or Air Ports; 02nd E/E Point: Local Ports to Go-downs: **03rd** E/E Point: Go-downs to Marketing; 04th E/E Point: Marketing to Sales; 05th E/E Point: Sales to Consumer; 06th E/E Point: Consumer/Repairs & Maintenance to Collector.

Chapter one of the report covers introduction of the project and Coordination Mechanism. Chapter 2 covers the program development and Methodology of the study and chapter 3 provides in detail the inventory development and analysis. Chapter 4 provides the details of the Stakeholder Workshop and developments. Chapter 5 provides Conclusions and Recommendations.

The summarized results for the 09 e-products are as follows:

These essentially followed from the analysis of the key sectors which included Household; Industrial; Commercial/Service Providers; Repairs & Maintenance; Locally sourced and /or available raw materials; imported finished-components for locally manufactured and/or assembled finished-items and/or components; and imported finished-items.

Personal Computers entered the Sri Lankan market beginning from mid 80s – late 80s with a hand full of brands with limited capacities and options. Current market size for PCs in the country is about 300,000 units per annum with about 30 % - Used,

20% - Branded and 50% - Assembled locally. Annual growth rate of PCs in the country is in the range of 08.0% - 10.0%.

Survey studies conducted by the Department of Census & Statistics revealed that as of 2007, 3.8 % of the Sri Lankan households do have a PC. The current ratio of PC: Notebook in the country is 12 -15: 1 and soon will reach 10: 1 as against 5: 1 in a developed country in South Asia.

Key components that can be extracted from an obsolete PC includes: Non Ferrous Metals (Copper/Aluminium) and Ferrous Metals (Steel/Iron); Plastics & rubber; Capacitors; Circuit boards (Cu, Ni, Pb, Ag, Au); External cables (Cu, Al); bearing; Hazardous materials such as phosphor powder on CRT's, leaded glass, circuit boards and cables; Liquid crystals from Liquid Crystal Display monitors and fluorescent tubes etc.,

The estimated Life time/Span of a Cathode Ray Tubes type: New PC is 8 - 10 years; and Old PC is 4 – 6 years. Estimated Life time/Span of a New Note Book is 2.0 - 4.0 years; and Old Note Book is 0.5 – 1.5 years.

Household survey study revealed that availability PCs in the 07 Provinces vary with Western Province- 20%, Central Province – 17%, Southern Province – 13%, North Western Province – 16%, Sabaragamuwa- 10%, Uva – 12% and North Central – 12% with majority of PCs are of PIII and P IV (74%), and are in the age group of 0.1 – 3.0 years old (75%). Majority (61%) of the PCs has been removed as donations and/or selling without repairs, while 26% had thrown away as E - Waste. Survey studies further revealed that availability of PCs under repairs at the Repair & Maintenance Centers is dominated with a 50% in the Western Province and predominantly with Processor Models of P 111 and P IV (78%) in all 07 provinces.

Printers initially emerged into Sri Lankan market with Dot Matrix, followed by Laser and Bubble Jet/Ink. Current market size is about 130,000 Printers per annum and about 5% of used Printers are being imported. Annual growth rate is about 05 %- 07%.

Current approximate ratio of PC: Printer is 5: 1 in the country, and this ratio is further reducing in view of the influx of cheaper and outdated models. Estimated Life Time/Span of a Printer can vary from 01 – 08 yrs depending on the type of Printer.

Key components that can be extracted from an obsolete Printer include: Non ferrous metals; Ferrous metals; Plastics; Clothing and Ribbon; Capacitors; Glass; Circuit boards; and External cables.

Household survey studies revealed that availability of household printers dominated in the Western Province with 24%, followed by North Western Province- 17%, and Central Province – 17%, Southern Province – 9% Sabaragamuwa – 8%, Uva

– 10% and North Central – 15% . Although ink/bubble jet Printers are dominated at 66%, laser printers are being emerged into the household sector and Dot matrix are in the decline. Survey studies further revealed that availability of Printers under repairs at the Repair & Maintenance Centers dominated in the Western Province with 41% and the rest of the Provinces stood at a range of 07% - 14%.

Televisions at commercial and household level emerged into Sri Lankan market along with the establishment of Television Channels: Independent Television Network and Rupavahini in early 1980s. Liquid Crystal Display and Plasma Type monitors reached the market in the recent past and the majority of the TV based e-waste is of Cathode Ray Tube type. According to World Development Indicators of World Bank, percentage of households with TV in Sri Lanka was stand at 32% in 2004. Current market size of TVs in SL amounts to 350,000 – 400,000 units per annum with annual growth rate of 6.0% - 8.0%.

The key components that can be extracted from a TV include: Glass; Metal (Cu, Fe, Al, Pb, Au, and Cr); Plastics; Silicon; and Polychlorinated biphenyls. Estimated Life time/span of a TV is 15 – 20 years.

Household survey revealed that the availability of number of Televisions in households in 07 provinces do not significantly differ and in a narrow range of 14 % - 16 %. On average each of the households in 17 districts has a TV and majority (71%) of the TVs are in the age group of 0.1 – 8.0 yrs old whilst majority (68%) of old TVs are sold without repairs. Availability of TVs under Repair & Maintenance Centers dominated in the Western Province with 28% and the rest of the provinces stood at a range of 9% -15%.

Mobile Phones entered the Sri Lankan market at commercial scale since early 90s and the current subscriber base is 5.413 million units amounting to 28% penetration. Estimates show that the penetration rate will reach 40% by the year 2009. Current market size is 1.0 – 1.2 million Mobile Phones per annum. Annual growth rate during the last 10 year period was phenomenal.

Key components that can be extracted from a Mobile phone include: Non ferrous metals; Ferrous metals; Plastics; Capacitors; Glass; Circuit boards; External cables; Re-chargeable battery; key board; phone housing; charger; and Liquid Crystal Display. In Sri Lanka, most of the parts required for repairing of mobile phones are readily available and is imported at large scale thus resulting in discharging a lot of E – Waste components into the environment. The estimated Life time/span of a Mobile Phone is 02 years.

Household survey studies revealed that availability of Mobile Phones in households in 07 Provinces are in a narrow range of 11% - 17 % and the availability of Mobile Phones at Repair & Maintenance Centers dominated in the Western Province with 64 %.

Refrigerators were imported to Sri Lanka at commercial level since post World War II, and with the introduction of the open economy in 1977, local manufacturing as well as imports of Refrigerators increased tremendously. Current market size of refrigerators is 250,000 – 275,000 units per annum and about 5% of the total imports are used refrigerators. Annual growth rate is 04 % - 06%. Estimated Life time/span of a refrigerator is 15 – 25 years.

Survey studies revealed that availability of Refrigerators in 07 provinces do not differ significantly and lies in a narrow range of 13% - 16% and the availability of Refrigerators under repairs at Service & Maintenance Centers dominated in the Western Province with 62 % and the rest of the provinces were in a range of 04% - 10%.

Air-Conditioners (A/C**)** vary with the types as Window or Split and categorized as industrial, commercial and domestic. Current market size is 40,000 – 50,000 units per annum and the annual growth rate is 04 % - 06%. The proportion of E -waste generated by an A/C is comparatively low in view of the fact that more than 95%of its content is metal. Estimated Life time/span of an A/C is 05 – 15 years.

Survey studies revealed that availability of Household A/Cs dominated in the Western Province with 31% and the availability under repair and Maintenance Centers dominated in the Western Province with 92%.

Photocopying Machines are widely used in the commercial and industrial sectors and the current market size is approx. 6000 units per annum with a slow annual growth rate of about 02 % - 04%.

Main waste products coming out of a photocopying machine is the toner consisting plastics, polyethylene; Ferric Oxide and Cadmium Sulfide. An obsolete photocopier consists of circuit boards, wires, motors, glass sheet, drum and ebonite rolls. Estimated Life time/span of a Photo Copying Machine is 05 – 10 years.

Survey studies revealed that availability of Photocopying Machines under repairs at the Repair & Maintenance Centers dominated in the North Central Province (35%) probably due to remoteness in view of availability of spare parts and the other provinces stood at a range of 3% - 21%.

Washing Machines market increased tremendously during last 5 – 7 years and the current market size of washing machines is 60,000–70,000 per annum and the annual growth rate is about 06% - 08%. Estimated Life time/span of a Washing Machine is 15 – 20 years.

Survey studies revealed that availability of Washing Machines in households were dominated in the WP and Central Province whilst other Provinces were in a narrow range of 10% - 15% and the availability of Washing Machines under repairs at Repair & Maintenance Centers dominated in the Western Province with 81%.

Batteries are broadly categorized as Auto, Domestics & Consumer and Industrial types. The market size of auto batteries is about 600,000 per annum with varying capacities from 35 A – 200A with an annual growth rate of around 04% - 06%.

Annual usage of Torch batteries and AA size is about 50 – 70 million and 24 – 36 million units per annum, respectively. Estimated modest life time/span for an auto battery is 02 years and the life time / span of domestic batteries depend on the usage and/or rate of discharge.

Obsolete batteries contain plastics, rubber, polymer, Lead (Pb), Sulphuric Acid, Paper, Glass, Carbon – Rods, Nickel (Ni), Cadmium (Cd), Lithium (Li), Zinc (Zn), Silicon (Si), Tin (Sn), Antimony (Sb), Manganese (Mn) and Paper.

Detailed National Inventory was compiled with the registered e–Vendors in 17 districts under Divisional Secretaries, Municipal Councils, Urban Councils and Pradeshiya Sabhas and the details covered the Registered Organization, Postal Address and Nature of e–Business. A total of ***8,253 e-Vendors*** from 07 Provinces under 12 different categories were compiled as controlled information to the Project Control Unit.

No. of e-Vendors distributed among 07 Provinces showed that Western Province (WP) is dominated with 38% of the registered e-Vendors whilst the distribution of e-Vendors in North Western Province – 18%, Southern Province – 15% and Central Province – 12 %.

Within the Western Province, district of Colombo dominated the registered e-Vendors with 56%, whilst district of Gampaha is having little less than half of Colombo (26%) and the least of 18% from the district of Kalutara. District of Galle dominated with 50% of registered e-Vendors in the Southern Province amongst Matara (38%) and Hambantota (12%). District of Kandy dominated with 68% of registered e-Vendors in the Central Province amongst Matale (20%) and Nuwara Eliya (12%).

Chapter 4 covers the final stakeholder workshop and its outcomes. The discussion points are included and inventory results as well as workshop outputs were used in formulating the conclusions and recommendations which are presented in Chapter 5.

Chapter 5 conclusions draw in from the discussions taken place during the Stakeholder Workshop as well as from the earlier situational analysis carried out in 2004. The recommendations are based on all these inputs. 06 recommendations have been forwarded and they are;

- **Policy and Guidelines on Managing e-waste**

  It is recommended to expedite the development of an e-waste set of guidelines and regulations. To sensitize the policy makers and the public alike it is also recommended having a national stakeholder

workshop along with a series of publications to the general public through media subsequent to the development of the guidelines.

- **e-Waste Management as an aspect of integrated solid waste management**

  e-Waste Management should be a part of the Integrated Solid Waste Management system in the country. At present one company has moved on with a system for collecting used mobile phones. This needs encouragement as well as developmental support. Regulations and guidelines coming into action will enable development of this type of initiative. All responsible parties joining hands to move forward Endeavour's of this nature should be looked into and state should explore means of program support.

- **Develop pilot schemes**

  It is recommended that few pilot projects be established in the provinces with the maximum potential density of e-products. Further the projects should be developed as Public Private Partnerships/ventures. The provinces selected are Western, North-Western, Southern and Central.

- **Customs and Import Controls**

  The relevant HS codes and suggestions for customs to take effective measures to control e-Waste have now being completed and await implementation. It is recommended that control measures are implemented without any further delay with necessary regulations.

- **E-Products and waste stream tracking system - HazNet**

  It is recommended that a MIS (Management Information System) be established in managing these waste streams. Further statistical analysis of data collected is recommended along with the use of earlier data. A subprogram of HazNet which is currently under development at CEA could serve as a useful e-waste tracking tool and is recommended for implementation.

- **Developing Recycling Operations and proper residual management**

  Development of recycling infrastructure is recommended. Environmental improvement schemes could be provided including ISO 14000 systems to recyclers and waste management groups. Small scale practitioners should be encouraged to form recycling cooperatives to bring-in economies of scale. In addition to these institutions there is a need for a proper collection mechanism coupled with a sound public awareness scheme.

List of Figures

List of Tables

List of Annexes

Annex No.	Title
01	SSQs - (Industries/Commercial/Services)
02	SSQ - Household
03	SSQ - Repair & Maintenance
04	09 Selected Electrical & Electronic Items identified for the component I of the e-Waste Management Project
05	Agenda of the final stakeholder Workshop
06	Questionnaire distributed among the stakeholders in the Final Stakeholder Workshop

Development of a National Implementation Plan (NIP) for e–Waste Management in Sri Lanka

Chapter 1

Introduction and Establishment of Coordination Mechanism

1.1. Introduction:

Sri Lanka's economy grew by 6.8% in the real GDP in 2007. This growth has been largely supported by the strong growth in exports, consumption and investment. With the economic growth, generation of e-waste from general consumption of the primary products such as computers and mobile phones also increased. The government has identified the need to develop the country's capacity in the information technology sector. Also many organizations support development of e-literacy of the whole population in many ways. With the new e-Sri Lankan initiative to take information technology to all corners of the island, there is a possibility of increasing growth in consumption and there by potential increases of generation of related e-wastes.

Internationally, the rapid advances of electrical technology have created a rapid pace of electrical and electronic equipment becoming obsolete and disposal of these items is becoming more problematic. Almost all the computers and their parts are imported into Sri Lanka and there is a tendency of spreading low cost versions and of second hand commuters and other units with very short life spans making use of the fact of need Vs ability to pay. This is true for mobile phones and other consumable items such as washing machines. During 2001, the cellular services expanded by 55% making the ratio of mobile phones to fixed access telephones to 81 (Central Bank 2002).

During the 6th meeting of the Conference of the parties to the Basel Convention (COP6), e-waste was considered as one of the main streams to be managed properly due to the fact that there are increasing quantities of e-wastes being exported from developed to developing countries where there is lack of legislation, enforcement capacity and also lack of infrastructure to handle these wastes in an environmentally sound manner. The parties also expressed the importance of the production of more environmental friendly products by changing the design of the products.

The Secretariat of the Basel Convention in collaboration with the Government of Japan in consultation with selected countries in the Asia Pacific region, and the Basel Convention regional centers in the region, developed a proposal for a pilot project on the environmentally sound management of e-waste. Sri Lanka is one of these countries selected. The project proposal submitted by the Ministry of Environment and Natural Resources has a four year time span. Government of Japan provided financial assistance for component one of the project through Basel Convention Trust Fund.

The component one includes the following activities;

1) Establishment of Coordination Mechanism
2) Establishment of Project Control Unit
3) Detailed Inventory
   3.1 Review and compilation of information (desk study)

4) Field Work

4.1 Prepare and carry out survey of used electrical and electronic wastes generators

4.2 Prepare and carry out survey of used electrical and electronic wastes collectors, storage, etc.

4.3 Plan and perform used electrical and electronic wastes collecting and recycling operations visits

4.4 Data analysis and report preparation

5) Awareness raising workshop

6) Stakeholder consultation

7) Delivery of project report

1.2. Establishment of Coordination Mechanism:

The National Coordinating Committee (NCC) set up for the implementation of the Basel Convention was entrusted with the task of steering the activities of this project as a steering committee. The NCC for the Basel Convention is chaired by the Secretary of MENR. The NCC comprised of representatives from the Central Environmental Authority, Sri Lanka Customs, Marine Pollution Prevention Authority, Industrial Technology Institute, Ministry of Healthcare and Nutrients, Ministry of Industry and Investment Promotion, Import and Export Control Department, Ports Authority, Board of Investment, National Cleaner Production Centre, Civil Aviation Authority, Federation of Chambers of Commerce and Industry of Sri Lanka (FCCISL). MENR is the Convener.

1.2.1 Initial Frame Work:

The initial framework developed for the implementation of component 1 of the project is given below.

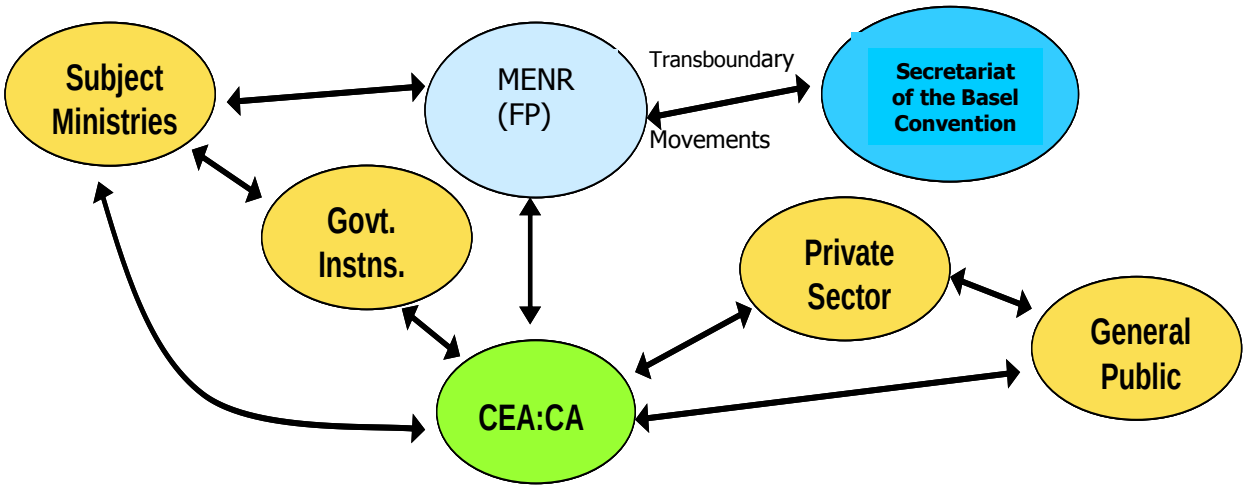


Table1: Functions related to the project

Institution	Functions related to the project
1. MENR Mandate: • Focal Point to Basel Convention • Key Subject Ministry of Sri Lanka for the subject of Environment management	• Liaise with Basel Convention (BC) related to the country subject to Foreign Diplomatic Relations & Protocols. • Conduct all meetings and reporting to BC related to e–Waste Management Project under the ***Transboundary Movements of Hazardous Wastes and their Disposal.*** • Key Contact Point for other Subject Ministries for the subject of Environment. • Delegate such powers and authorities expressly and explicitly to CEA as and when necessary and deemed necessary. • Monitoring and Evaluating overall management and operations of the e – Waste project. • Policy formulation and implementation including activities relating to legal enactment. • Identifying Key Subject Ministries represented by the NCC and conducting a SWOC – Situation Analysis, Gap Analysis, making recommendations to incorporate additional Ministries and their Line Institutions / Agencies covering Key Life Cycle issues to address e – Waste Management in the country. • Empowering CEA as the Competent Authority for Law Enforcement Activities in the country.
2. CEA Mandate: • Competent Authority • Law Enforcement Authority	• Assisting the MENR to implement the project and to conclude expected out puts as per the MOU signed and Formats provided by the Secretariat of the Basel Convention and/or MENR. • Drafting Guidelines/Regulations etc. including legal enactments and legal instruments in consultation with Legal Draftsman's Department. • As the Competent Authority exercise the powers vested in the National Environmental Act of 1980 and amendments made to the same thereafter in 1988 and 2000, respectively. Life Cycle issues of e – Waste Management in Sri Lanka related to legal enactment and legal instruments. • Assisting to initially identify 03 Sites in selected 03 Provinces to set up 03 Pilot Projects (PP) to establish e-waste recycling and recovery system. • Undertaking the promotional activities.

Institution	Functions related to the project
	• Develop regulations for e-waste management. • Develop an e–Waste tracking system and make the operation of the tracking system mandatory, through a well structured mechanism for collecting e–Waste

Other key Institutions

- National Coordinating Committee
- Local Authorities
- Provincial Councils

Other related institutions

- Balance 58 Subject Ministries (a total of 59);
- 511 Govt. Institutions covering Departments, Corporations, Boards, Security forces, Commissions, Banks and Financial Institutions, Healthcare Institutions, Commercial and Services and other Statutory Institutions
- Private sector;
- Local & International Non Governmental Organizations;
- Diplomatic and Foreign missions;
- Foreign Investors and Collaborators; and
- General Public.

MENR is the focal point to the Basel Convention and CEA acts as the Competent Authority. The Central Environmental Authority being an implementing agency functioning under MENR was requested to undertake the field survey through its field staff and assist the analytical work to prepare the inventory under the directions of MENR and NCC for the implementation of the Basel Convention. For this purpose a Project Control Unit (PCU) was set up in the Central Environmental Authority. PCU was supposed to report the progress time to time.

1.2.2. Technical Expert Committee of the NCC

A three member Expert Committee was appointed by the MENR to oversee the ***Modus Operandi*** of the PCU including successful conclusion of expected outputs of the Component 1of the project.

The Technical Expert Committee met frequently to evaluate the progress of the PCU and to provide guidance necessary to achieve expected output. Expert Committee also identified issues that have to be taken up at the National Coordinating Committee Meeting.

1.3. Establishment of a Project Control Unit (PCU)

Project Control Unit was established with four full time officers and other part time staff.

The activities of the field survey and the desk study was supervised by the Hazardous waste Management unit of the Central Environmental Authority.

National Co-coordinator for the e-Waste Project Control Unit Dr. Wimal Wimaladasa and the Key Consultant on Electrical & Electronic Prof. Janaka Ekanayake, jointly presented the detailed work plan including Activities and Tasks to be performed to the NCC on 26th January 2007 at 2.00 pm in the Conference hall of the MENR.

Fig. 1: Approach & Methodology Presentation to NCC on 26th January 2007 at 2.00 pm

NCC was jointly chaired by the Additional Secretary to the MENR Mr. M. Sumanadasa and Ms. Padmini Batuwitage, Director Environment of the MENR. NCC approved the Approach and Methodology presented by the PCU with a few minor comments and suggestions made therein. Participating agencies included: MENR; NCC members; Expert Committee members; CEA staff; PCU Staff; and Key External Consultants.

In addition, National Coordinator Dr. Wimal Wimaladasa made 02 Progress Review presentations to NCC on 16th March 2007 and 16th May 2007, respectively.

1.3.1. Procurement of Goods and Services:

PCUs procurement of goods and services were obtained under relevant Budget Lines: Consultancy; Salaries; Training Services; and Goods & Services as outlined in the MENR procurement of goods and services procedure through CEAs approved Work Plan and Budget.

Chapter 2

Program Development and Methodology

2.1 Project Period:

Total Project Period is 05 Calendar months commencing 15th December 2006 i.e. 15th December 2006 – 15th May 2007.

2.2 Detailed Work Plan:

PCU in consultation with the CEAs Project Director: Mr. Lal Fernando and CEAs officials attached to Hazardous Waste Management (HWM) Division finalized the clearly outlined Activities and Tasks to be performed over the planned 05 months period on monthly basis. The Work Plan was approved by the Board of Directors of the CEA.

2.3 Monthly Progress Reports and Progress Review Meetings:

Monthly Progress Reports for the following project months were submitted to Mr. Lal Fernando, Director/HWM Division of the CEA for onward transmission to Ms. Padmini Batuwitage as requested:

Project Month 01: 15th December 2006 - 14th January 2007;

Project Month 02: 15th January 2007 - 14th February 2007;

Project Month 03: 15th February 2007 - 14th March 2007;

Project Month 04: 15th March 2007 - 14th April 2007; and

Project Month 05: 15th April 2007 - 14th May 2007.

Subsequent to submitting the above mentioned Monthly Progress Reports, separate monthly Progress Review meetings were held immediately with Mr. Lal Fernando, Director, HWM Division of CEA along with the Staff members of the HWM Division.

2.4. Selected Provinces of Sri Lanka:

Studies relating to component 1 were confined to the following 07 Provinces of the country covering 17 Administrative Districts. Northern (05 administrative districts) and Eastern (03 administrative districts) Provinces were excluded in the current study relating to component 1, in view of the current conflict situation.

Table 2: Study Areas: Provinces and Districts of SL

Province	District
1. Central	1. Kandy 2. Matale 3. Nuwara-Eliya
2. North Central	4. Anuradhapura 5. Polonnaruwa
3. North Western	6. Kurunegala 7. Puttalam
4. Southern	8. Galle 9. Matara 10. Hambantota
5. Sabaragamuwa	11. Kegalle 12. Ratnapura
6. Uva	13. Badulla 14. Monaragala
7. Western	15. Colombo 16. Gampaha 17. Kalutara

2.5. Sri Lanka Government Subject Ministries and Institutions:

As per the Gazette of the Democratic Socialist Republic of Sri Lanka: Extraordinary – Part I : Section (I) – General of 29th January 2007, PCU collected data and information including field visits relating to Electrical & Electronic items and e–Waste scenarios in a Structured Survey Questionnaire (Annex 01) in respect of their own institutions and associated and/or regional offices:

- **59** - Subject Ministries;
- **511** - Central Government Institutions;
- **07** - Chief Secretariats to 07 Provinces;
- **17** - District Secretaries in 07 Provinces;
- **243** - Divisional Secretaries in 17 districts;
- **15** - Municipal Councils in 17 districts;
- **30** - Urban Councils in 17 districts; and
- **192** - Pradeshiya Sabhas in 17 districts

In addition, a large number of Senior, Middle, Supervisory and Lower level employees of above institutions were consulted/ interviewed during field and/or study visits undertaken during the implementation of component 1 regarding the e-Vendors and e-Waste scenarios in respective regions.

2.6 Private Sector and General Public:

Separate, Structured Survey Questionnaires (SSQs) were developed for collecting data and information from Private Sector and General Public (***Annex 02***).

Private sector institutions were broadly categorized as:

- Industrial;
- Commercial;
- Services; and
- Repair and maintenance (***Annex 01 and Annex 03***)

Lists of Private sector institutions were largely collected from the Federation of Chambers of Commerce and Industry of Sri Lanka (FCCISL) and Sri Lanka Telecommunication (SLT) Directory. In addition e-Vendors lists obtained from Central Government Authorities such as District Secretaries (Govt. Agents), Divisional Secretaries (DSs) and Local Govt. Authorities (LGAs) such as Municipal Councils (MCs), Urban Councils (UCs) and Pradeshiya Sabahs (PSs) were used to identify and visits a few selected institutions from each of the 17 Districts.

2.7. Divisional Environmental Officers of the Central Environmental Authority of Sri Llanka

On the request of CEA and further in keeping with the expected outputs of component 1 above, Divisional Environmental Officers (DEOs) of the CEA assigned to: District Secretaries; Divisional Secretaries; Municipal Councils; and Urban Councils in each of the 17 above mentioned Administrative Districts were provided with extensive Training and Awareness through Training Workshops/Discussions/ Meetings on the expected outputs of component 1 along with Key e–Waste Management issues and/or concerns particularly emphasizing on RRR concept.

2.8. Training and Awareness Workshops for Divisional Environmental Officers (DEO)

An initial Inception Workshop was held on 30th January 2007 at HARTI Conference Hall, No. 114, Wijerama Mawatha, Colombo 07, SL from 9.00 am – 2.00 pm for selected 34 DEOs from the districts of: Puttalam; Gampaha; Colombo; Kalutara; Galle; Matara and Hambantota.

In addition, a total of 19 separate Training and Awareness Workshops were conducted in 17 district for DEOs attached to Central and Local Government Authorities in each of the 17 districts, in this regard.

Fig. 2 : Inception Workshop held on 30th January 2007

Subsequent to presenting the expected outputs of: Developing a National Implementation Plan of e-Waste Management in Sri Lanka – component 1, Divisional Environmental Officers were enlightened with Approach & Methodology of:

- Compiling the National e–Waste Inventory;
- Conducting the Field Survey Study on Households and Repair & maintenance Sector; and
- Collecting information on Industrial & Commercial/Services sectors.

Divisional Environmental Officers were provided with required number of Survey Study Questionnaires.

Table 3: District Level Training & Awareness Meetings/workshops Held:

District	Date	Venue
1. Puttalam	05. 01.2007	Divisional Secretariat, Wenappuwa
2. Colombo	06. 01. 2007	CEA, Battaramulla
3. Gampaha	06. 01. 2007	CEA, Battaramulla
4. Kalutara	07. 01. 2007	District Secretariat, Kalutara
5. Galle	08. 01. 2007	Municipal Council, Galle
6. Matara	08. 01. 2007	Municipal Council, Galle
7. Hambantota	09. 01. 2007	SREAP Office, Hambantota
8. Kandy	20. 02. 2007	CEAs Regional Office, Polgolla
9. Matale	20. 02. 2007	CEAs Regional Office, Polgolla
10. Nuwara Eliya	20. 02. 2007	CEAs Regional Office, Polgolla
11. Kegalle	22. 02. 2007	CEAs Regional Office, Kegalle
12. Kurunegala	22. 02. 2007	CEAs Regional Office, Kegalle
13. Ratnapura	23. 02. 2007	District Secretariat, Ratnapura
14. Badulla	09. 03. 2007	CEAs Regional Office, Badulla
15. Monaragala	09. 03. 2007	CEAs Regional Office, Badulla
16. Anuradhapura	13. 03. 2007	CEAs Regional Office, Anuradhapura
17. Polonnaruwa	13. 03. 2007	CEAs Regional Office, Anuradhapura

2.9. Press Conference:

A Press Conference for both Print & Electronic media was held on 22nd March 2007 at 10.00 am in the CEAs Auditorium, under the patronage of Hon. Minister of MENR: Mr. Patalie Champaka Ranawaka with a view to keeping the general public and all the other stakeholders aware of the on going e–Waste study along with expected out puts of-component 1 : Development of NIP on e–Waste Management in SL, particularly emphasizing on the support and co-operation of all the stakeholders, required for

successfully concluding the expected out puts of component 1 within the specified project period.

Same day as well as a few days later, Development of National Implementation Plan on e-Waste Management in Sri Lanka and the initial steps taken by the Project Control Unit were telecast over a few TV Channels and newscast over a few radio channels.

Chapter 3

National Inventory Development and Analysis

3.1 Detailed Inventory Compilation:

Detailed Inventory compilation is discussed under following sub-sections. Initially a desk study on global aspects on e-waste was carried out.

3.2. Desktop Studies: Global Situation of e-Waste:

E-waste is growing rapidly, mainly due to rapid development of electronic devices and decrease of their useful lifespan. In 2004, more than 180 million Personal Computers (PCs) were sold worldwide. In the same year, an estimated 100 million obsolete PCs entered waste streams [1]. Further it was estimated that 130 million mobile phones were disposed in 2005 [2]. Worldwide E-waste growth had been estimated to be in the range of 20 to 50 million tons per year.

At present developing countries are generating e-waste in large quantities. ***Fig. 03***, below shows the growth of PCs in different countries and the current data reveals that the PC growth per capita in Sri Lanka is relatively high. Since 1993, up to the year 2000 there had been a 17.5 times increase of PCs on per capita basis in Sri Lanka.

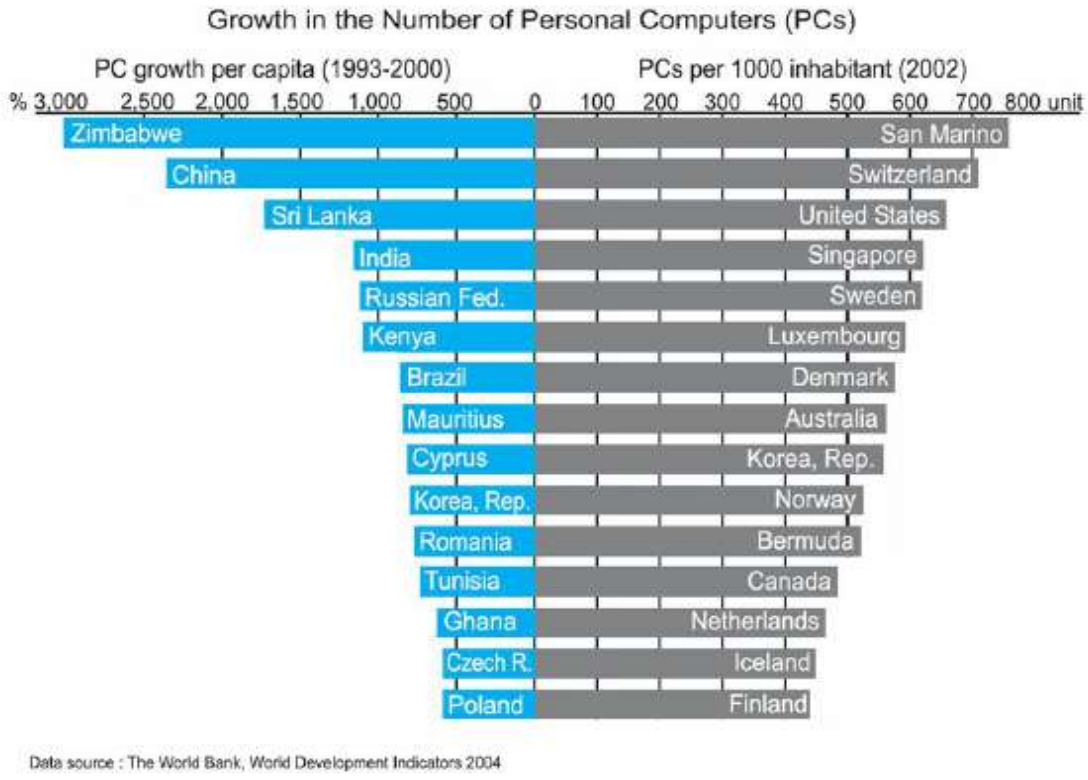


Fig. 3 : PC growth rate (left) and PC penetration rate (right) in different countries [3]

3.3. Desktop Studies: e-Waste Legislations:

The main objective of the legislations already imposed in the developed world are the prevention, reuse and recycling of E-Waste and to reduce the disposal of E-waste as unsorted municipal waste. The European standards making body and the British Standard Institute (BSI) have developed a standard EN 50419:2006 [4] which requires products to be marked with a crossed out wheeled bin symbol. This symbol will encourage end-users to discard waste EEE (WEEE) separately from other waste at the end of its life cycle.

European Union (EU) designated E-waste as a priority waste stream, and in January 2003 the Waste Electrical and Electronic Equipment (WEEE) Directive came into force [5]. It specifically states that "Member states shall encourage the design and production of electrical and electronic equipment which take into account and facilitate dismantling and recovery, in particular the reuse and recycling of WEEE, their components and materials." Further it states that "Member states shall adopt appropriate measures in order to minimize the disposal of WEEE as unsorted municipal waste and to achieve a high level of separate collection of WEEE.

A sister directive with the WEEE is the Restriction of Hazardous Substances (RoHS) directive, which limits the use of Lead (Pb), Cadmium (Cd), Mercury (Hg) and other toxic materials in new equipment sold after June 2006 by legislation. In USA, IEEE standard 1680 of 2006, which is the U.S. national standard on Computer recycling, requires RoHS compliance of computers and their peripherals [6]. E-waste specific legislation, though not as widespread in the rest of the world as in Europe, has also been implemented in few countries. A summery is given in the following table.

Table. 4 : e–Waste Specific Legislation in a Few Countries

Country	Legislation	Responsibility	In force since
Finland	Ordinance on Electrical and Electronic Waste[1]	Manufacturers / Importers	September 2004
Germany	Act Governing the Sale, Return and Environmentally Sound Disposal of Electrical and Electronic Equipment[2]	Manufacturers / Importers	March 2005
Ireland	SI 340 Waste Management Regulations[3]	Manufacturers / Importers	July 2005
Austria	Electro Ordinance[4]	Manufacturers / Importers	August 2005
Taiwan	Taiwan Waste Disposal Act[5]	Manufacturers / Importers	March 1998
Japan	Specified Home Appliances Recycling Law[6]	Manufacturers / Importers	April 2001
South Korea	Extended Product Responsibility System[7]	Manufacturers / Importers	January 2003
California	Solid Waste: Hazardous Electronic Waste	Manufacturers / Importers	September, 2004
India	Electronic waste is included under List-A and List-B of Schedule-3 of the Hazardous Wastes (Management and Handling) Rules[8]	-	1989

[1] Full text available at: http://www.environment.fi/download.asp?contentid=35670&lan=en
[2] Full text available at: http://www.bmu.de/files/pdfs/allgemein/application/pdf/elektrog_uk.pdf
[3] Full text available at: http://www.environ.ie/DOEI/DOEIPol.nsf/0/93a86f2137a4a2f380256f0f003bc84c/$FILE/SI%20340-2005%20WEEE.pdf
[4] The EAG superseded the Lamp Ordinance & Refrigerator Ordinance which covered a subset of WEEE products, and were in force since 1992. The full text is available at. http://www.umweltnet.at/article/archive/6932
[5] More information available at: http://ivy2.epa.gov.tw/out_web/english/EPM/issue9801.doc
[6] Full text available at: http://www.meti.go.jp/english/information/data/cReHAppre.html
[7] More information available at: http://eng.me.go.kr/docs/common/common_view.html?idx=51&av_pg=1&mcode=10&classno=12
[8] Deepali Sinha-Khetriwal, Philipp Kraeuchi, Markus Schwaninger, "A comparison of electronic waste recycling in Switzerland and in India", Environmental Impact Assessment Review 25 (2005) 492–504

3.4. Desktop Studies: Partitioning of Key Sectors:

Detailed desktop studies and multi-stakeholder consultations revealed the careful partitioning of Government sector and Private sector. In addition, following 04 Key Sub-sectors were identified for studying the expected outputs of component 1.

- Household;
- Industrial;
- Commercial/Service Providers; and
- Repairs & Maintenance

3.5. Desktop Studies: Generalized Key Life Cycle Issues, Concerns and Stages:

Generalized Key Life Cycle issues included:

- Locally manufactured finished -items and/or finished - components;
- Local Importers and/or Indenting Agents;
- Foreign Suppliers, Dealers and Manufacturers;
- Branding of E &E items at various overseas ***Exit/Entry Points;***
- Bi-and Multi-lateral trade: agreements; pacts; treaties, conventions etc.,;
- Import and Export regulations covering: financial; technical; environmental; social, health & safety and trading issues;
- Local and foreign banking relationships and transactions including regulatory issues;
- Opening of Letters of Credits (L/Cs) at local banking and financial institutions;
- Whole sale establishments, whole sale and retail sales outlets;
- Marketing & Sales and after sales warranty;
- End users, repair and maintenance sectors;
- Re-users and collectors including transporters;
- Local Govt. Authorities responsible for waste management; and
- Environmental, Social, Health & Safety regulatory bodies.

3.6. Desktop Studies: Probable Entry/Exit Points:

Probable Entry/Exit points include:

3.6.1. First Entry/Exit Point: Sea and/or Air Ports

Key issues include:

- Cargo handling at sea and air ports;
- Customs clearance at sea -ports and air-ports;
- Duty, Demurrage and other regulatory payments at Customs and Ports Authorities;
- Clearance and removal from sea harbor -ports and air-ports to initial go-downs;
- Other regulatory and law enforcement authorities and legal instruments;
- Responsible Party and /or Importer;
- Dealer;
- Indenting agent;
- Clearing & Forwarding agent;

- Pollution;
- Cleaning and other staff; and
- Transporters etc.,

3.6.2. Second Entry/Exit Point: Ports to Go-downs:

Key issues include:

- Loading into vehicles;
- Type of Transport – Vehicles;
- Environment, Health and Safety;
- Hazard Communication;
- Man made disasters/incidents;
- Natural disasters;
- Transport routes;
- Warehouses and stores including go downs;
- Industries and Households;
- Pollution;
- Cleaning and other staff; and
- Workers and general public.

3.6.3. Third Entry/Exit Point: Go-downs to Marketing:

Key issues include:

- Importers;
- Transporters;
- Cleaning and other staff;
- Promoters and/or exhibitors;
- Whole sale Agents and Sub - agents;
- Distributing agents;
- Dealers and Sub- Dealers;
- Retailers; and
- General Public and Consumers and/or users.

3.6.4. Fourth Entry/Exit Point: Marketing to Sales:

Key issues include:

- Warehouses;
- Show rooms and sales points/outlets;
- Workers/Staff and their health and safety;
- Advertising;
- Buy-back arrangements of used E & E items;
- Auctioning of used items at wholesale or retail level;
- Households; Industries; Commercial; and Service Sectors; and
- General Public and Consumers and/or users.

3.6.5 Fifth Entry/Exit Point: Sales to Consumer:

Key issues include;

- Usage and/or consumption;
- Re-sales and trading-in;
- Donation;
- Repair and Maintenance;
- Transportation;
- Extended Producer Responsibility (EPR) and Corporate Social Responsibility (CSR);
- Safe guards and Due diligence on: Environmental, Health & Safety, Financial, Corporate, and Global;
- Workers; and
- General Public and Consumers and/or users.

3.6.6. Sixth Entry /Exit Point : Consumer/Repairs & Maintenance to Collector:

Key issues include:

- Old and/or obsolete items collected by : Manufacturers (EPR); Suppliers; Dealers; Agents; Collectors; Re-users; Re-Cycling Facilitators; Exporters; Auctioneers;
- Transportation;
- Storage;
- Recovery of parts and components;
- Workers;
- e-Waste management;
- Legal enactment, Provision of law, Regulatory and law enforcement authorities and legal instruments;
- Sustainable development from the context of a ***"Sri Lanka being a Developing Nation";***
- Sri Lankas recently launched e- drives and e- initiatives towards e- literacy and e - development drives;
- Global and Regional: Agreements; Declarations; Conventions; Treaties; Signatories; Pacts; Protocols etc.,;
- Public Health and Quality & Standard of Life;
- Ecological concerns including Fauna and Flora Acts; and
- Key environmental concerns of: solid waste; wastewater; emissions; noise pollution; visual pollutions / impacts; unintended burnings (Persistent Organic Pollutants – POPs).

3.7. Desktop Studies: RRR (Re-use, Re-cycle and Reduce) and Life Cycle Modeling:

Although, to a greater extent there are ample opportunities and options available in Sri Lanka for RRR concept, e-Wastes derived from the selected 09 e-Items are not managed properly in keeping with the accepted norms being practiced in the developed world.

However, recycling is not an easy option due to advance and expensive technologies in the Sri Lankan context as at now. e-Waste generated from the 09 selected items including other e-products consist of different materials and/or components such as:

- Valuables;
- Hazardous;
- Recyclable; and
- Mixed.

3.7.1 Personal Computers:

Personal Computers (PCs) entered the Sri Lankan market beginning from mid 80s – late 80s with a hand full of brands with limited capacities and options as they were at infancy in terms of technology.

Current market size for PCs in Sri Lanka is about 300,000 units per annum with a breakdown of:

- Used - 30% (had entered the SL market largely about 7–9 years ago);
- Branded - 20%; and
- Assembled - 50%

The current ratio of PC : Notebook in Sri Lanka is 12-15 : 1 and according to a lot of market research done by Sri Lanka Computer Vendors Association (SLCVA) as well as by multi national PC Manufactures expecting the ratio reaching 10 : 1 soon, as against 5 : 1 in a developed country in South Asia.

In a recent survey study conducted by the SLCVA revealed that in Sri Lanka, there are about 350 – 400 IT Vendors in operation but only about 50 are leading or otherwise balance 300-350 are dependents of the leading 50 IT agencies.

Survey studies conducted by the Dept. of Census & Statistics as appeared in the Daily Mirror of 17th May 2007 parallel to Worlds Telecommunication Day revealed that as of 2007, 3.8 % of the Sri Lankan households do have a PC.

Current market research reveals that the annual growth rate of PCs in Sri Lanka is in the range of 08.0% - 10.0%

PCs are a dominant e-waste stream as its life time is relatively small and technology is changing rapidly. Following key components and/or materials can be extracted from an obsolete PC and its associated key items at the end of their life time/span:

- ***System Unit consists of:***

    1. Non Ferrous Metals (Copper / Aluminium) and Ferrous Metals (Steel/ Iron);
    2. Plastics (contaminated / clean) and Capacitors (DMF/DMAC/PCB filled);
    3. Circuit boards (Copper bearing / precious metal bearing – Cu, Ni, Pb, Ag, Au);
    4. External cables (Copper/Aluminium); and
    5. Precious metal bearing.

- ***Monitors consists of:***

1. Hazardous materials such as phosphor powder on CRT's, leaded glass, plastics, circuit boards and cables; and
2. Liquid crystals from LCD monitor fluorescent tubes etc.

- ***Keyboard / Mouse consists of:***

1. Plastics, rubber, circuit boards, cables

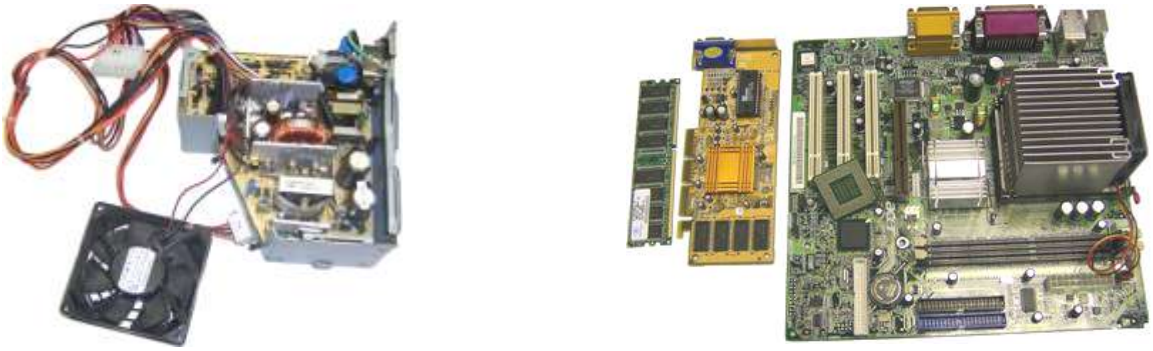


Fig. 4 : Some of the Key Components of a Personal Computer

Material wise E-waste from a computer is given in the following table [8]:

Table. 5 : Some of the e –Waste Material Derived from a computer

Material	Mass (kg)
Plastics	5.84
Lead	1.46
Cadmium	0.0028
Chromium	0.0018
Mercury	0.0006

Composition of a Cathode Ray Tube (CRT) type computer monitor is shown in the following **Table.6** . Due to the variety of size and composition of the monitors, a maximum value, a minimum value, and an average value is given in the table.

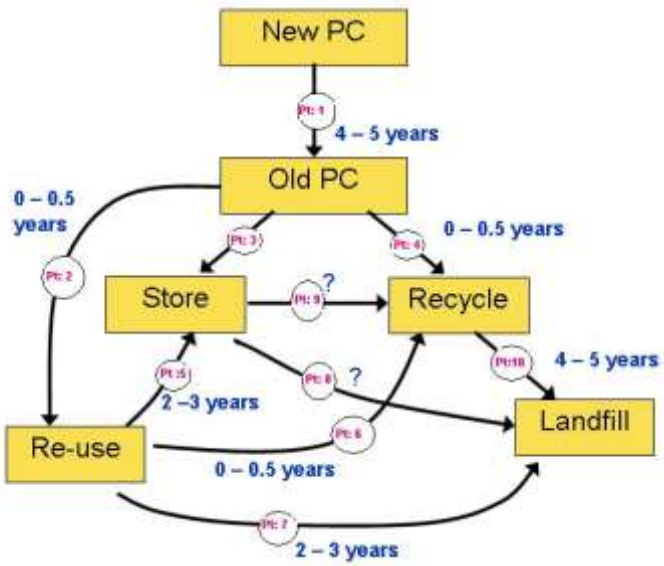
Table.6: Some of the e –Waste Material Derived from a CRT Type Monitor

Components	Minimum value (kg)	Maximum value (kg)	Average Value (kg)
Plastics	2.599	2.607	2.603
Copper	0.892	0.892	0.892
Ferro	1.324	1.324	1.324
Aluminum	0.049	0.238	0.144
PCBs	0.385	1.385	0.885
Gun	0.028	0.028	0.028
CRT	8.428	9.392	8.910
Front glass	5.619	6.261	5.940
Funnel glass	2.809	3.131	2.970
Neck glass	0.045	0.045	0.045
Solder	0.045	0.045	0.045
Total weight	13.705	15.866	14.786

A CRT Type PC - Life Cycle Model developed:

1. CRT : New PC is 8 - 10 yrs; and
2. CRT : Old PC is 4 – 6 yrs

Life-Cycle of a Computer



However, the Notebook Type PC - estimated Life Span / Time is:

1. New Note Book is 2.0 -4.0 yrs; and
2. Old Note Book is 0.5 – 1.5 yr

3.7.2 Printers:

Parallel to entering of PCs to Sri Lankan market, Printers emerged initially with Dot Matrix, followed by Laser and Bubble Jet/Ink.

Current market size is about 130,000 Printers per annum with varying types and models entering into SL market. Within this market size about 5% of used Printers are entering into the SL market.

Annual growth rate is 05% - 07%.

As per many survey studies and statistics, it had been revealed that current approx. ratio of PC : Printer is 5 : 1 in Sri Lanka, and this ratio is further reducing in view of the influx of cheaper and outdated models of printers.

Key components /materials that can be extracted from an obsolete Printer include:

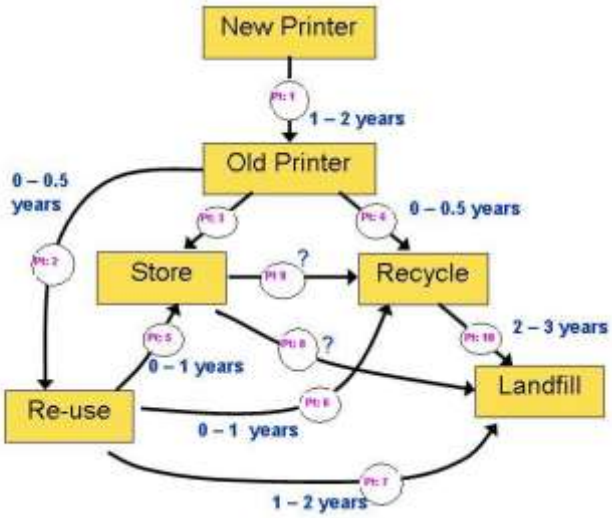
- Non ferrous metals;
- Ferrous metals,;
- Plastics;
- Clothing and Ribbon;
- Capacitors;
- Glass;
- Circuit boards; and
- External cables.

Printer cartridge is the first and foremost e-Waste stream that can be generated due to its shorter life span. Printer cartridges are of a complicated assembly of mixed plastics, metal, toner powder, ink, foam and rubber. Most of toner dusts contain hazardous materials. Inkjet inks can also contain a range of chemicals that are harmful to the environment.

Although, these hazardous chemicals/materials pose no danger/threat as long as they are intact within the cartridge, refilling and recycling operations can cause tremendous damage to the environment It was found that refilling especially ink-jet cartridges are now becoming popular in Sri Lanka. As a Black and White cartridge can be refilled for about Rs. 100/-, many users now tends to go for refilling. According to a small shop situated in Kandy city, they are refilling about 30 - 50 cartridges per month.

As per the below given Life Cycle Model, the Life Span/Time of a Printer can vary from: 01 – 08 years depending on the type of Printer.

Life-Cycle of a Printer



3.7.3 Televisions:

Televisions at commercial and household level emerged into SL market along with the establishment of Sri Lanka's TV Channels: ITN and Rupavahini in early 1980s. Liquid Crystal Display (LCD) and Plasma Type monitors reached the market in the recent past. It is anticipated that majority of the TV based e-waste are of CRT type.

Although the initial market was dominated by Black and White (B/W) predominantly with 14" Screen, 14" Screen with a mix of B/W and Colour dominated for some 15 – 20 years, and suddenly shifted to 21" Colour screen during last couple of years. Interestingly, since of late 2000, market is being shifting towards 21" Colour TVs with Flat Screen. Currently, there are no B/W TVs imported to Sri Lanka as per the Customs and Market Research data available.

Current market size of TVs in Sri Lanka amounts to 350,000 – 400,000 units per annum with about annual growth rate of 06.0% - 8.0%.

According to World Development Indicators of World Bank, percentage of households with TV in Sri Lanka was stand at 32% in 2004.

Televisions that are available in the market are mainly based on 03 different technologies:

- Cathode Ray Tube (CRT) type;
- Liquid Crystal Display (LCD) type; and
- Plasma type.

Volume of basic waste materials presents in a typical 21" television based on the technology is given in the following table.

Table. 7 : Volume of Basic e - Waste Materials Present in a typical 21″ TV

TV Type	Material Content (kg)				
	Glass	Metal	Plastic	Silicon	Total
CRT	37.0	4.2	8.0	4.4	53.6
LCD	3.6	8.4	15.0	9.6	36.6
Plasma	14.8	12.4	10.9	8.6	46.7

Composition of a CRT type TV is shown in the ***Table. 8,*** below. Due to the variety of size and composition of the monitors, a maximum value, a minimum value, and an average value is given in the table.

Table. 8 : Composition of Different Substances / Elements of a CRT Type TV

Components	Minimum value (kg)	Maximum value (kg)	Average Value (kg)
Plastics	4.851	5.940	5.396
Copper	1.155	1.353	1.254
Ferro	1.221	1.353	1.287
Aluminum	0.099	0.264	0.181
PCBs	1.848	1.848	1.848
Gun	-	-	-
CRT	19.570	23.760	21.665
Front glass	13.275	16.155	14.715
Funnel glass	6.120	7.605	6.863
Neck glass	0.090	0.090	0.090
Solder	0.090	0.090	0.090
Total weight	**28.744**	**34.518**	**31.631**

Fig. 5 : below, shows the relationship of weight, diameter and volume of currently (2006) sold TVs, Here diameter refers to diagonal distance of the screen.

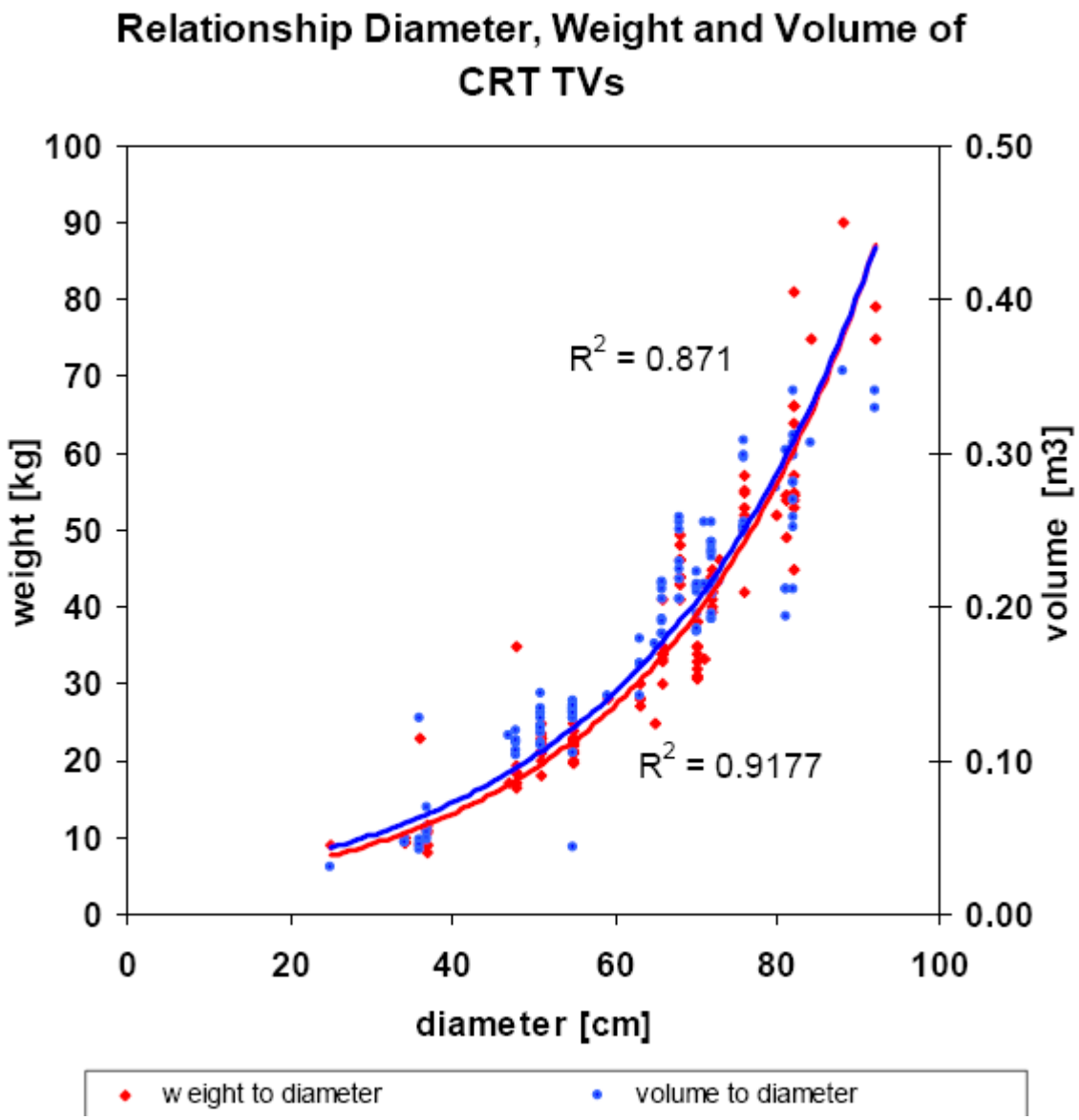
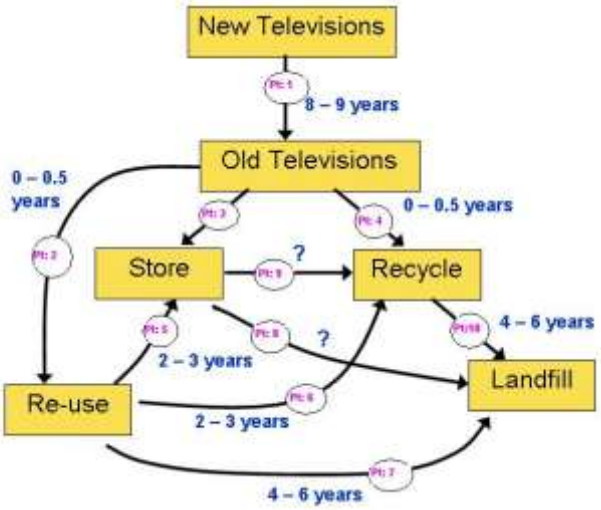


Fig. 5 : Relationship of weight, diameter and volume of currently (2006) sold TVs .

As per the below given Life Cycle Model, Lifespan / time of a TV has been estimated for 15-20 years.

Life-Cycle of a Television



3.7.4 Mobile Phones:

Current Mobile Phone subscriber base in Sri Lanka is 5.413 million units amounting to 28% penetration. Market research revealed that the penetration will reach 40% by the year 2009. Current market size is 1.0 – 1.2 million Mobile Phones per annum. The growth rate during last 10 years had been phenomenal.

Sri Lankan Customs imports statistics account for only 438,000 units during the year 2006 while the balance 50% - 60% had been imported irregularly or otherwise.

Key components/materials that can be extracted/recovered from a Mobile phone include:

- Non ferrous metals;
- Ferrous metals,;
- Plastics;
- Capacitors;
- Glass;
- Circuit boards; and
- External cables.

The rechargeable battery and other components such as the LCD display have toxic components.

In developing countries, old phones are used for different purposes. For an example, a scheme to reuse mobile phones as personal safety alarms is being promoted by Victim Support Southwark in association with Southwark Borough Council in the UK and with the support of T-Mobile. The ***fones4safety*** scheme takes old mobiles, reconfigures them to provide one-touch dialing to a 999 operator and distributes them to victims of violent crime.

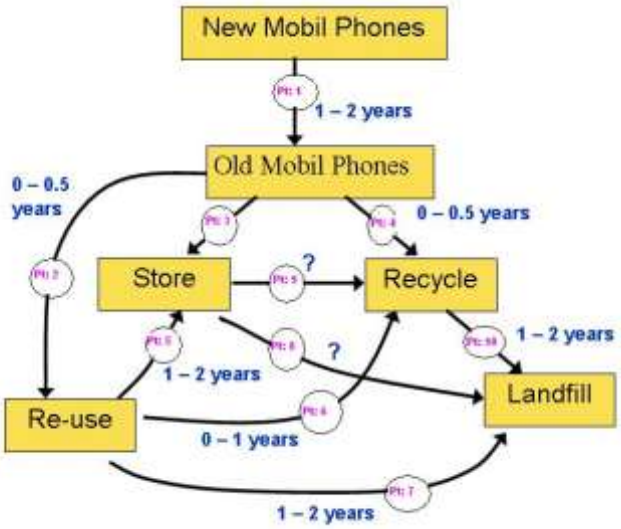
Primary re-usable components include:

- Key board;
- Display;
- Phone housing;
- Charger; and

In the country, most of the parts required for repairing of mobile phones are readily available and are imported at large scales thus resulting in discharging a lot of e–Waste components into the environment.

As per the below given Life Cycle Model, Lifespan/time of a Mobile Phone has been estimated for 02 years.

Life-Cycle of Mobile Phones



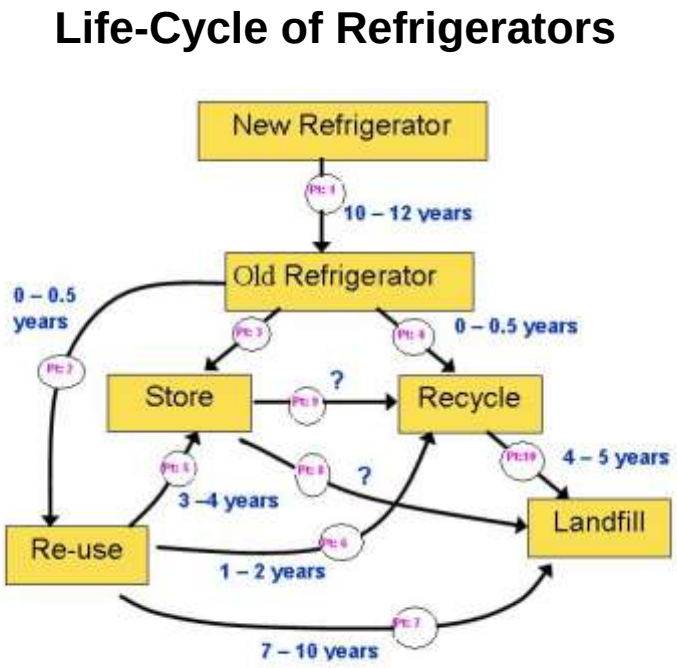
3.7.5 Refrigerators:

Refrigerators were imported to the country at commercial scale since post World War II, and with introduction of the open economy in 1977, local manufacturing as well as imports of Refrigerators increased tremendously. Current market size of refrigerators is 250,000 – 275,000 units per annum and the annual growth rate is 04 % - 06%. Statistics and market research revealed that importation of used refrigerators amounts to about 05% of the total imports. Buy back arrangement of used refrigerators is very common in Sri Lanka.

Most of the old refrigerators entering SL until late 1990s contained Chloro–Floro-Carbons (CFCs) and Hydro- Chloro-Floro-Carbons (HCFCs) as the coolant and insulating agents and both these gases are catagorised as Green House Gasses (GHGs) causing tremendous damage to the Ozone layer leading to global climate changes.

The volume and the mass of a refrigerator depends on its capacity and model and in general plastic: metal is 3 : 1by mass.

As per the below given Life Cycle Model, Lifespan/time of a refrigerator has been estimated for 15 – 25 years.



3.7.6 Air-Conditioners:

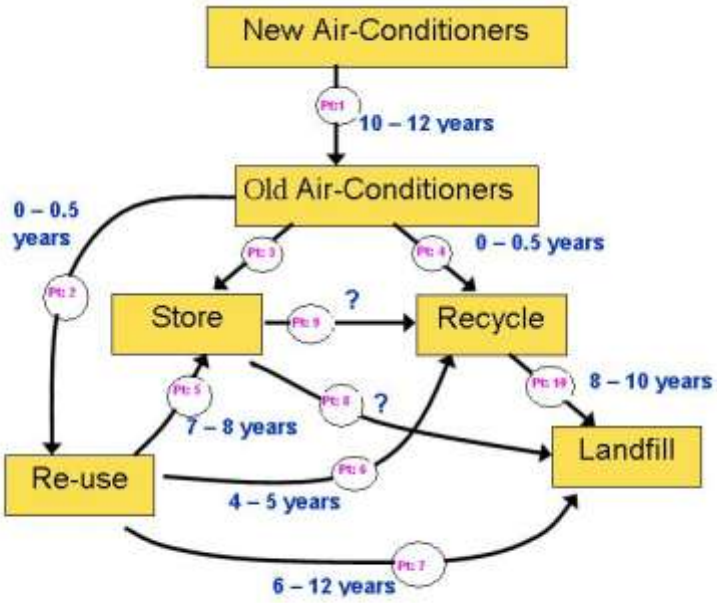
Broad categorization of Air Conditioners include: Industrial; Commercial; and Domestic. The common Commercial and Domestics models vary with either Window/Split type. Currently, the split type market is dominating as against Window type as witnessed with import and market research data.

Current market size is 40,000 – 50,000 units per annum, dominated in the City of Colombo and in urban cities. The annual growth rate is 04 % - 06%.

The proportion of E -waste generated by an air-conditioner is comparatively low in view of the fact that more than 95% is metal. Some times, in addition to plastics, repair and maintenance sector recover the coolant as well for re-use. The quantities of metal that can be re-cycled depend on the size and the gross weight of an obsolete Air–Conditioner and mostly re-cycled by the scrap steel manufacturers.

As per the below given Life Cycle Model, Lifespan/time of a Air - conditioner has been estimated for 05 – 15 years.

Life-Cycle of Air Conditioners



3.7.7 Photocopying Machines:

Current market size of photocopiers amount to approx. 6000 units per annum with a slow annual growth rate of about 02 % - 04%, including importation of used machines as well. Sri Lanka does have a market for used and/or repaired photocopiers in view of its longer lifespan/time coupled with availability of parts and/or components for repair & maintenance.

Main waste products coming out of a photocopying machine is the toner. Toner consists of:

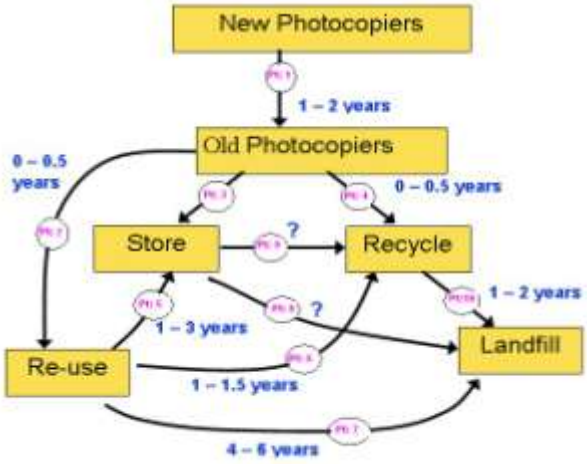
- Plastics;
- Polyethylene,;
- Ferric Oxide; and
- Cadmium Sulfide.

Depending on the model, a toner could last for 3000 – 9000 A4 size copies. In addition, drum of a photocopier needs to be replaced from time to time (after 30,000 – 150,000 A4 size copies). The drum comes out as an E – Waste, contains Aluminum metal (roller) and Cadmium Sulfide.

An obsolete photocopier consists of circuit boards, wires, motors, glass sheet, drum and ebonite rolls.

As per the below given Life Cycle Model, Lifespan/time of a Photo Copying Machine has been estimated for 05 – 10 years.

Life-Cycle of Photocopiers



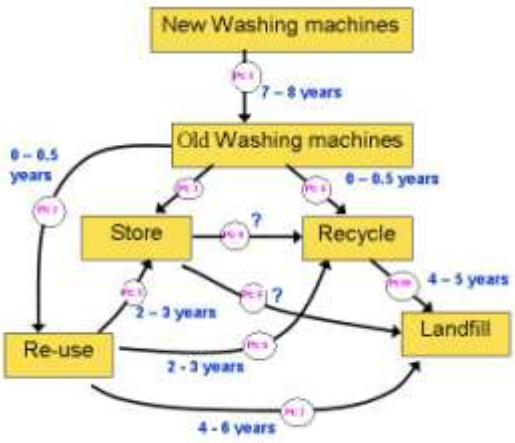
3.7.8 Washing machines:

Washing machine market increased tremendously during last 5 – 7 years, and currently ***Damro*** assemble domestic washing machines in SL and by mass it is dominated by plastics as against other imported models.

Current market size of washing machines is 60,000 – 70,000 per annum and the annual growth rate is about 06% - 08%. Although there is a small market for used washing machines, collectors dismantle the units for components/parts and recover metals.

As per the below given Life Cycle Model, Lifespan/time of a Washing Machine has been estimated for 15 – 20 years.

Life-Cycle of Washing Machines



3.7.9 Batteries:

Types of batteries include:

- Auto;
- Domestics and Consumer; and
- Industrial

The market size of auto batteries is about 600,000 per annum with varying capacities from 35 A – 200A with an annual growth rate of around 04% - 06%, while the annual usage of D Type (Torch) batteries and AA size amount to 50 – 70 million and 24 – 36 million units per annum, respectively.

Table. 9 : IEC Designation of Domestic Batteries and Formula

IEC Designation	Size	Type	Formula
R20 S	D	Torch	Ammonium Chloride
R20 C	D	Heavy Duty	Ammonium Chloride
R20 P	D	Super Heavy Duty	Zinc Chloride
R6 P	AA	Super Heavy Duty	Zinc Chloride
LR6	AA		Alkaline
LR03	AAA		Alkaline

Estimated modest lifespan/time for an auto battery is 02 years and the lifespan/time of domestic batteries depends on the usage and/or rate of discharge.

Sulphuric acid volume in an auto battery varies from 3.0 – 13.5 liters depending on the size and the capacity. It is a common practice in SL that the sulphuric acid is often discarded to the open environment and the obsolete batteries have a lucrative market by the local battery manufacturers and 02 other Lead (Pb) recovering plants situated in Mirigama and Kuliyapitiya.

Empty battery containers are recycled at cottage industry level to manufacture low cost plastic ware and the users are unaware of the traces of toxic substances contained in the raw materials used.

Obsolete batteries contain plastics, rubber, polymer, Lead (Pb), Sulphuric Acid, Paper, Glass, Carbon – Rods, Nickel (Ni), Cadmium(Cd), Lithium (Li), Zinc (Zn), Silicon (Si),Tin (Sn), Antimony(Sb), Manganese (Mn) and Paper.

Current trend is that the consumption of domestic batteries are either static or in the reducing trend in view of high cost and the availability of rechargeable batteries at affordable cost.

3.8. Compilation of Detailed National Inventory:

As per the agreed upon Approach & Methodology, PCU developed the following "Format" for extracting registered e–Vendors from:

- Divisional Secretaries;
- Municipal Councils;
- Urban Councils; and
- Pradeshiya Sabhas

in 17 administrative districts of the 07 Provinces described above.

Registered Organization	Postal Address	Nature of e - Business

PCU has received a total of ***8,253 e-Vendors*** from 07 Provinces under the categories of:

1. Export;
2. Import;
3. Marketing & sales;
4. Repair & Maintenance;
5. Promotion;
6. Storage;
7. Collection;
8. Buy- back;
9. Re – use;
10. Re-cycled;
11. IT and Computer Training & Education; and
12. Photocopying and Communication facilities

as programmed in the computer data entry system.

No. of e-Vendors distributed among 07 Provinces are given in the ***Fig. 6,*** below and clearly shows that Western Province (WP) is dominated with 38% of the registered e -Vendors whilst the distribution of e -Vendors in North Western Province (NWP), Southern Province (SP) and Central Province (CP) are: 18%; 15%; and 12%, respectively.

Fig. 6: Distribution of Inventory (Nos.) of Registered e-Vendors on Provincial Basis

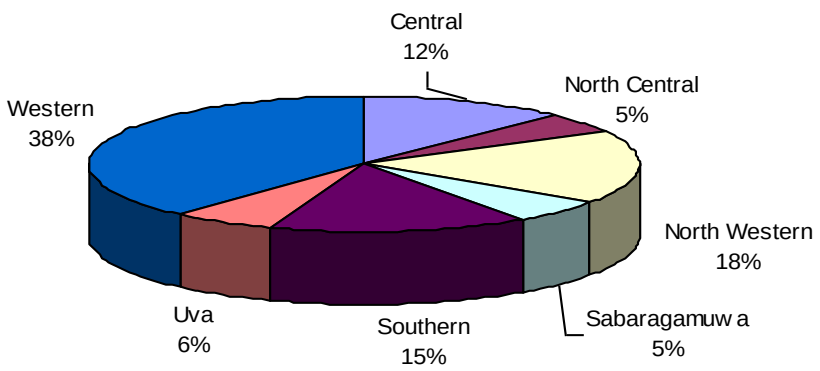


Fig. 7: Distribution of Inventory (Nos.) of Registered e-Vendors in Western Province

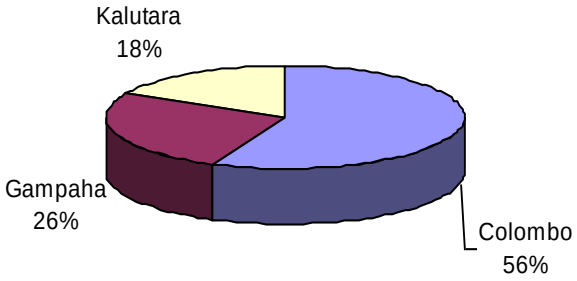


Fig. 7 above, clearly shows that of the WP, district of Colombo dominates the registered e - Vendors with 56%, which is proportional to e –Waste generation, whilst district of Gampaha is having little less than half of Colombo and the least of 18% from the district of Kalutara.

Fig. 8: Distribution of Inventory (Nos.) of Registered e-Vendors in the North Western Province

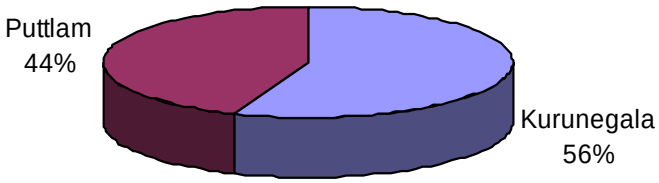


Fig 8 above shows that the district of Kurunegala is dominated with 56% of registered e-Vendors in the North Western Province.

Fig. 9: Distribution of Inventory (Nos.) of Registered e-Vendors in the Southern Province

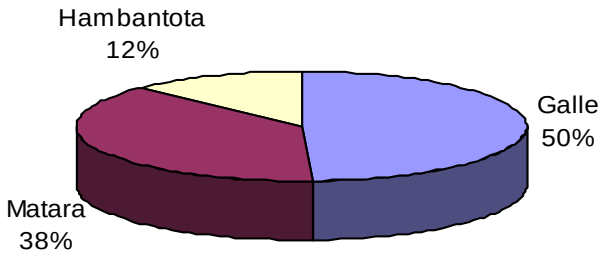


Fig 9 above shows that district of Galle is dominated with 50% of registered e-vendors in the SP.

Fig. 10: Distribution of Inventory (Nos.) of Registered e-Vendors in the Central Province

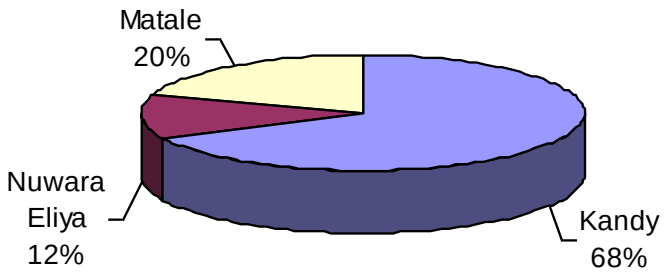


Fig 10 above shows that district of Kandy is dominated with 68% of registered e - Vendors in the CP.

3.9. Consultations, Field & Industrial Visits:

Consultations, field and industrial visits undertaken by the PCU during the study period are discussed below.

3.9.1. Consultations and Field Visits:

PCU along with Key External Consultants visited all 17 districts during the study period and had 1 to 1 consultations/discussions /meetings with heads and relevant officials with a view to understanding the distribution of e-Vendors in the respective regions along with social and socio- economic indicators including current methods of e–Waste Management Practices. PCU often observed in respect of 09 e-Items, to a greater extent that e-Vendors are familiar with Re- Use and Re- Cycle operation, yet they are unaware of the consequences regarding reach of ultimate e–Waste in to the landfill.

- Provincial offices;
- District Secretaries;
- Divisional Secretaries;
- Municipal Councils;
- Urban Councils; and
- Pradeshiya Sabahs

In addition, PCU made several consultations with;

- Govt. Ministries;
- Govt. Institutions;
- Police and Military Forces;
- NGO Secretariat;
- Parliament of Sri Lanka;
- Department of Census and Statistics;

- Sri Lanka Customs;
- Ports Authority;
- Aviation Authority of Sri Lanka;
- Universities;
- Ceylon Electricity Board;
- Private and Public Schools;
- Telecommunication Regulatory Commission of Sri Lanka;
- Information and Communication Technology Agency;
- Technical Colleges;
- Universities; and
- Open University of Sri Lanka etc.,

3.9.2. Industrial Visits:

Selected detailed industrial visits-undertaken by the PCU include:

Industry	Institutions
1. Personal Computers	PC House (Pvt.) Ltd, IDM Computers and several PC Vendors in almost all the districts
2. Printers	PC House (Pvt.) Ltd, John Keels, Metropolitan Computers and several other Printer Vendors in almost all the districts
3. Mobile Phones	Soft Logic Communications (Pvt.) Ltd, Dialog, Hutch, Togo and Mobitel including several Mobile Phone importers, whole sale agents/dealers/retailers including repair and maintenance shops
4. Televisions	Abans (Pvt.) Ltd, Singer Sri Lanka (Pvt.) Ltd, Sinhagiri (Pvt.) Ltd, and several other TV importers, retail and whole sale agents and dealers, sales outlets including repair and maintenance shops
5. Air- Conditioners	Civi Mech (Pvt.) Ltd and several other Air Condition importers and related Vendors
6. Washing Machines	Abans (Pvt.) Ltd, Singer Sri Lanka (Pvt.) Ltd and several Washing Machine repair and maintenance shops;
7. Photocopying Machines	John Keels (Pvt.) Ltd, Office Shop (Pvt.) Ltd and several other E Vendors
8. Refrigerators	Abans (Pvt.) Ltd, Singer Sri Lanka (Pvt.) Ltd and several other E Vendors
9. Batteries	Associated Battery Manufacturers (Pvt.) Ltd and Laxapana (Pvt.) Ltd including several battery sales centers including inhabitants in various districts

3.10. Field Survey Studies:

Field Survey Studies were conducted for: Household (***Annex 02***); Repair & Maintenance (***Annex 03***): and Industrial, Commerce & Service (***Annex 01***) sectors.

3.10.1. Household Survey and Sampling Strategy:

A Structured Survey Questionnaire (SSQ) was developed for collecting Electrical & Electronic related information from Households (***Annex 02***) through the 317 Divisional Environmental Officers (DEOs) of the CEA. Depending on the population density of the Administrative district, sample size was decided and based on: Urban: Rural: Plantation sector communities.

The sampling strategy was based on a multi-stratification procedure. All districts except Northern and Eastern Provinces were taken into consideration. The number of DSs to be sampled was decided by the population within the district. From each DS, Grama Niladhari (GN) Divisions were selected randomly based on the population size of each of the 17 districts. Within each of the randomly selected GN, a total of 06 Households were selected from a randomly selected cluster point. The main city of each of the 17 districts covering the respective DS was included in the sample survey.

The total No. of completed Household Survey Questionnaires received by the PCU as at ***30th April 2007*** was ***One Thousand Ninety Five (1095).***

3.10.2. Availability of Household Personal Computers:

Fig. 11, below shows the availability of PCs in Households (%) on Provincial basis and the ***Table 10***, below, provides the No. of PCs per Households in each of the district with 95% Confidence Level.

Fig. 11 : Availability of Personal Computers in Households (%) on Provincial Basis

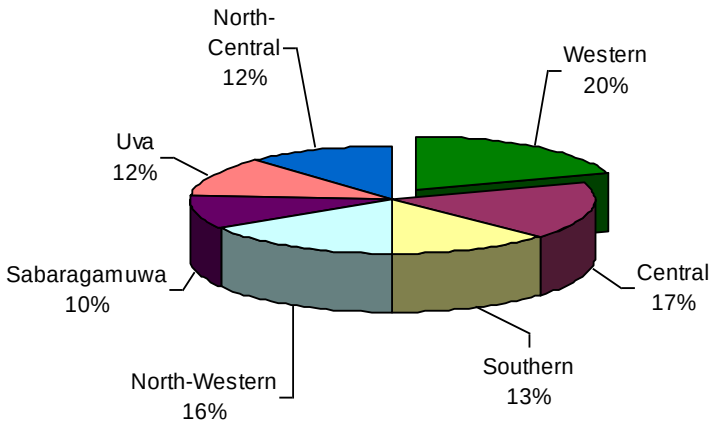
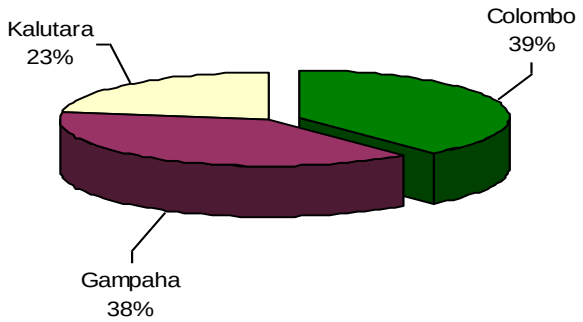


Table 10 : Number of Personal Computers Per Household (HH) & Confidence Value

Province	District	No. of PCs per HH	Confidence Value(95%) ±
Western	Colombo	0.54	0.13
	Gampaha	0.52	0.13
	Kalutara	0.32	0.12
North-Western	Kurunegala	0.37	0.10
	Puttlam	0.40	0.16
Southern	Galle	0.31	0.12
	Matara	0.31	0.11
	Hambantota	0.29	0.13
Central	Kandy	0.48	0.13
	Matale	0.27	0.11
	Nuwara Eliya	0.43	0.16
North-Central	Anuradhapura	0.29	0.15
	Polonnaruwa	0.27	0.12
Uva	Badulla	0.29	0.14
	Monaragala	0.26	0.13
Sabaragamuwa	Ratnapura	0.25	0.10
	Kegalle	0.24	0.11

Fig 12, below shows the availability of PCs in Households (%) in the Western Province.

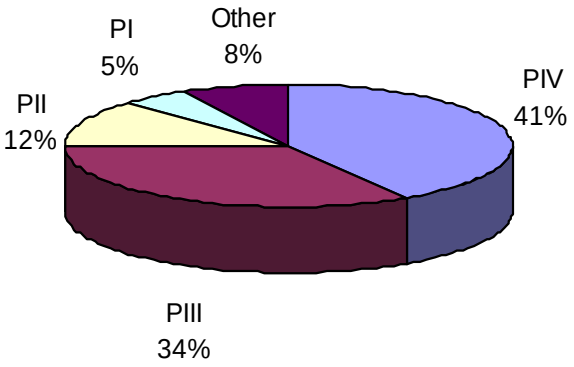
Fig. 12 : Availability of Personal Computers in Households (%) in the Western Province



3.10.3. Types of PCs used in Households:

Fig 13, below shows that majority of PCs used in households are PIII and P IV amounting to 75%.

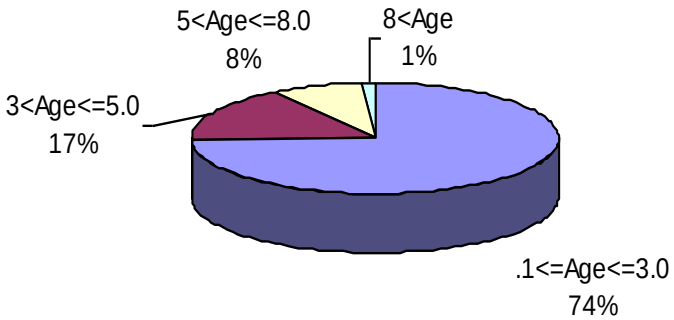
Fig. 13 : Availability of Household Personal Computers with Varying Processor Models



3.10.4. Age of Household Computers:

Fig 14, below shows that majority (74%) of the PCs are in the age group of 0.1 – 3.0 years old.

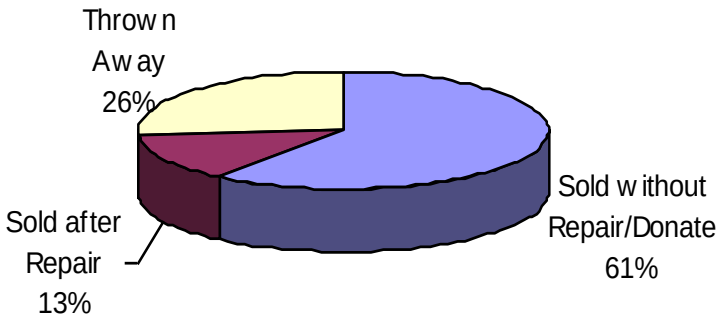
Fig. 14 : Age Groups Analysis (years) of Household Personal Computers



3.10.5. Method of Removal of PCs from Households:

Fig 15, below shows that majority (61%) of the Household PCs have been removed as donations and/or selling without repairs, while 26% had thrown away as e -waste.

Fig. 15 : Method of Removal of Used Household Personal Computers



3.10.6. Availability of Printers in Households (%) on Provincial Basis

Fig 16, below shows that availability of household printers dominated in the WP with 24%, followed by NWP- 17%, and CP – 17%, and the ***Table 11,*** below provides the No. of Printers per household including Confidence Level.

Fig. 16: Availability of Printers in Households (%) Provincial Basis

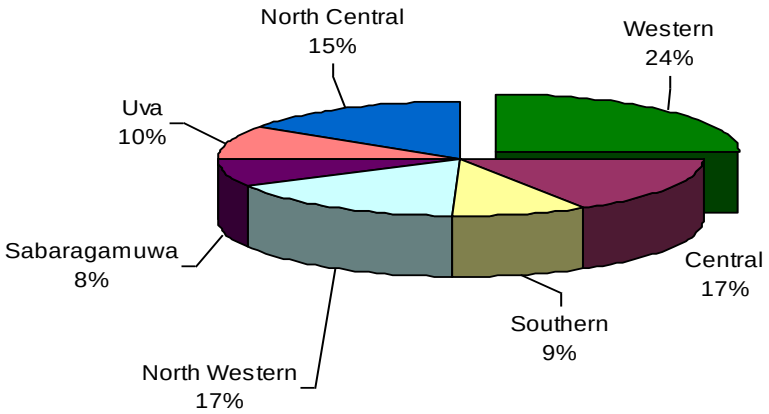


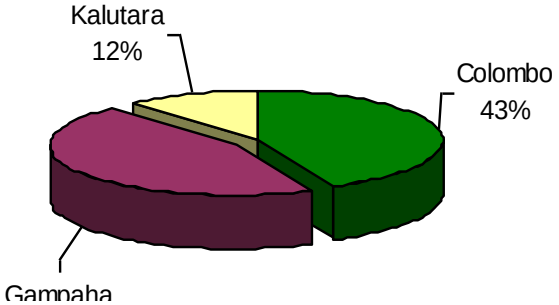
Table 11: Number of Printers Per Household (HH) and Confidence Value

Province	District	No. of Printers per HH	Confidence Value(95%) ±
Western	Colombo	0.30	0.11
	Gampaha	0.32	0.10
	Kaluthara	0.08	0.06
North-Western	Kurunegala	0.15	0.07
	Puttlam	0.18	0.13
Southern	Galle	0.07	0.07
	Matara	0.10	0.07
	Hambantota	0.09	0.08
Central	Kandy	0.21	0.09
	Matale	0.13	0.09
	Nuwara Eliya	0.14	0.11
North-Central	Anuradhapura	0.25	0.14
	Polonnaruwa	0.06	0.06
Uva	Badulla	0.13	0.09
	Monaragala	0.07	0.07
Sabaragamuwa	Ratnapura	0.08	0.06
	Kegalle	0.07	0.06

3.10.7. Availability of Printers in Households (%) in the Western Province:

Fig 17, below shows that districts of Colombo and Gampaha dominated with 43% and 45% of Printers in the WP followed by Kalutara (12%).

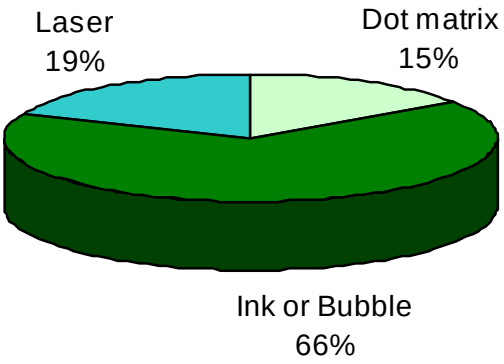
Fig. 17: Availability of Printers in Households (%) in Western Province



3.10.8. Types of Printers in Households:

Fig 18, below shows that although ink/bubble jet Printers are dominated at 65%, laser printers are being emerged into the household sector and Dot matrix are in the decline.

Fig. 18: Type Analysis of Household Printers



3.10.9. Availability of Televisions in Households (%) on Provincial Basis:

Fig 19, and *Table 12,* below show that availability of No. of TVs in households amongst 07 provinces do not significantly differ and on average each of the household has 01 TV.

Fig. 19: Availability of Televisions in Households (%) Provincial Basis

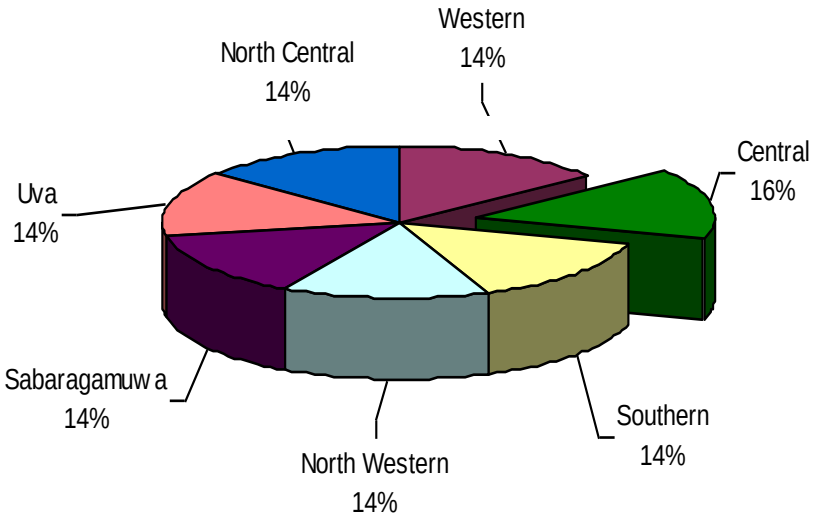


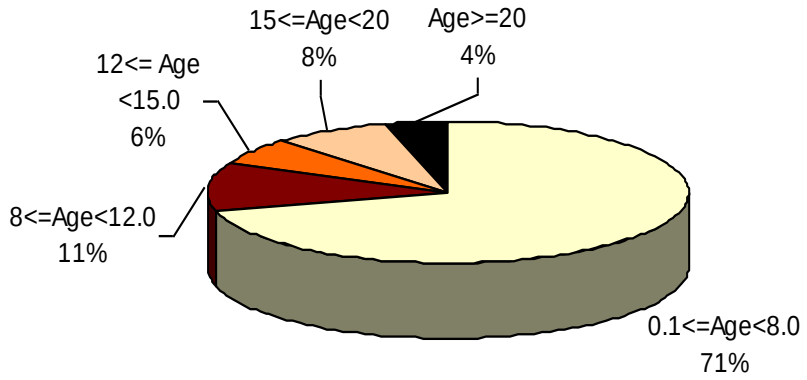
Table 12 : Number of Televisions Per Household (HH) and Confidence Value

Province	District	No. of TVs per HH	Confidence Value(95%) ±
Western	Colombo	1.11	0.07
	Gampaha	1.08	0.06
	Kaluthara	1.01	0.07
North-Western	Kurunegala	1.07	0.06
	Puttlam	1.05	0.09
Southern	Galle	1.07	0.07
	Matara	1.01	0.05
	Hambantota	1.07	0.07
Central	Kandy	1.16	0.09
	Matale	1.19	0.11
	Nuwara Eliya	1.05	
North-Central	Anuradhapura	1.08	0.07
	Polonnaruwa	1.02	0.07
Uva	Badulla	1.07	0.08
	Monaragala	1.02	0.07
Sabaragamuwa	Ratnapura	1.06	0.07
	Kegalle	1.00	0.05

3.10.10. Age of TVs in Households:

Fig 20, below shows that majority (71%) of the TVs in households are in the age group of 0.1 – 8.0 years.

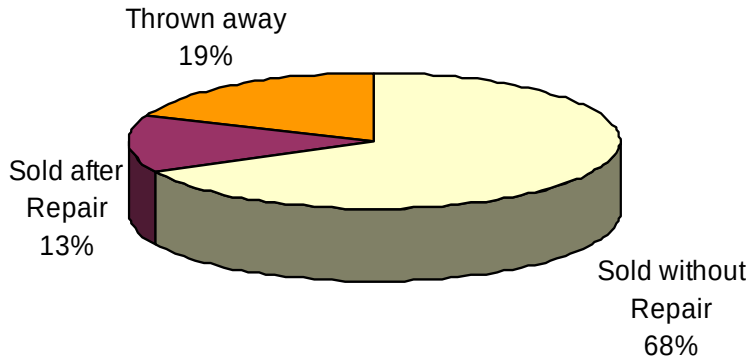
Fig. 20: Age Groups Analysis (years) of Household TVs



3.10.11. Method of Removal of TVs from Households:

Fig 21, below shows that majority (68%) of old TVs are sold without repairs.

Fig. 21 : Method of Removal of Used Household Televisions



3.10.12. Availability of Mobile Phones in Households (%) Provincial Basis

Fig. 22 and *Table 13*, below show that availability of Mobile Phones in households in WP, NWP, CP and SP are in a narrow range of 15% - 17 %.

Fig. 22: Availability of Mobile Phones in Households (%) Provincial Basis

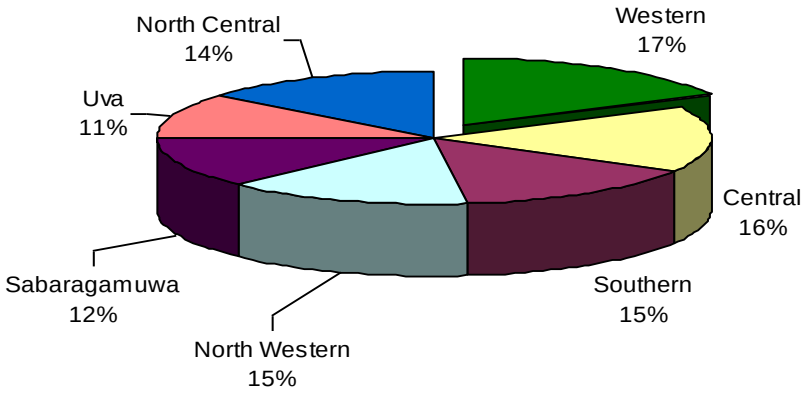


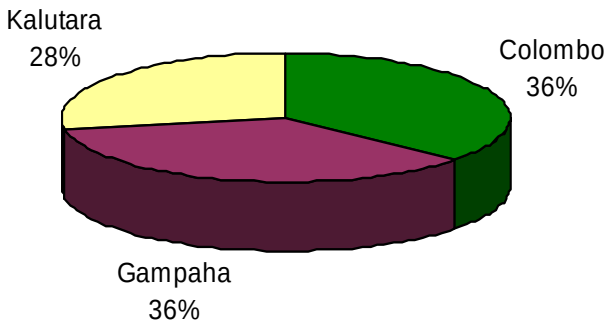
Table 13 : Number of Mobile Phones Per Household (HH) and Confidence Values

Province	District	No. of M / Phones per HH	Confidence Value(95%) ±
Western	Colombo	1.38	0.24
	Gampaha	1.35	0.22
	Kaluthara	1.05	0.23
North-Western	Kurunegala	0.97	0.18
	Puttlam	1.20	0.28
Southern	Galle	1.04	0.26
	Matara	1.15	0.27
	Hambantota	1.02	0.28
Central	Kandy	1.25	0.21
	Matale	1.03	0.24
	Nuwara Eliya	1.05	0.32
North-Central	Anuradhapura	1.23	0.32
	Polonnaruwa	0.81	0.19
Uva	Badulla	0.82	0.19
	Monaragala	0.76	0.23
Sabaragamuwa	Ratnapura	0.75	0.20
	Kegalle	1.12	0.24

3.10.13. Availability of Mobile Phones in Households (%) in the Western Province

Fig. 23, below shows that availability of Mobile Phones in the districts of both Colombo and Gampaha are 36% whilst a lower value of 28% was in the district of Kalutara.

Fig. 23 : Availability of Mobile Phones in Households (%) in the WP



3.10.14. Availability of Refrigerators in Households (%) on Provincial Basis:

Fig. 24 **and** *Table 14,* below show that availability of Refrigerators in each of the 07 provinces do not differ significantly and lies in a narrow range of 13% - 16%.

Fig. 24 : Availability of Refrigerators in Households (%) – Provincial Basis

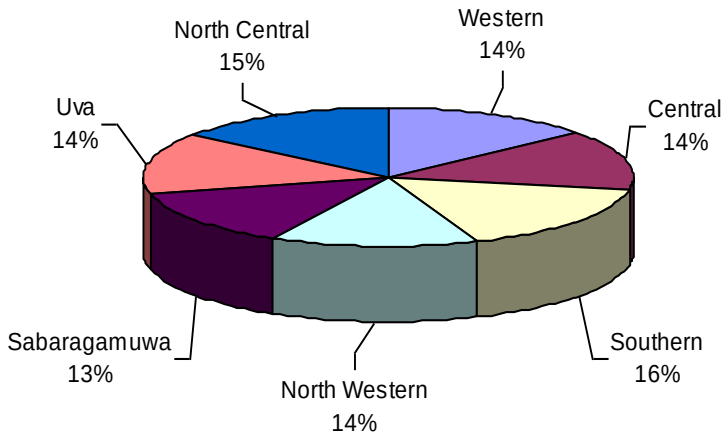


Table 14 : Number of Refrigerators Per Household (HH) and Confidence Values

Province	District	No. of Refg. per HH	Confidence Value(95%) ±
Western	Colombo	0.91	0.11
	Gampaha	0.79	0.09
	Kaluthara	0.88	0.09
North-Western	Kurunegala	0.87	0.08
	Puttlam	0.80	0.12
Southern	Galle	1.18	0.56
	Matara	0.85	0.11
	Hambantota	0.96	0.12
Central	Kandy	0.97	0.25
	Matale	0.74	0.12
	Nuwara Eliya	0.86	0.15
North-Central	Anuradhapura	0.92	0.14
	Polonnaruwa	0.90	0.20
Uva	Badulla	0.79	0.20
	Monaragala	0.74	0.13
Sabaragamuwa	Ratnapura	0.73	0.10
	Kegalle	0.95	0.29

7.10.15 Availability of Air-Conditioners in Households (%) on Provincial Basis

Fig. 25 and *Table 15*, below show that the availability of Air- Conditioners dominated in the Western Province with 31%.

Fig. 25: Availability of Air-Conditioners in Households (%) - Provincial Basis

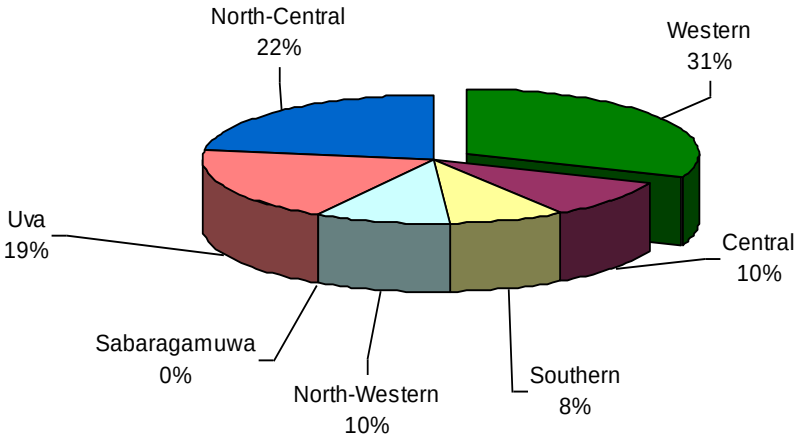


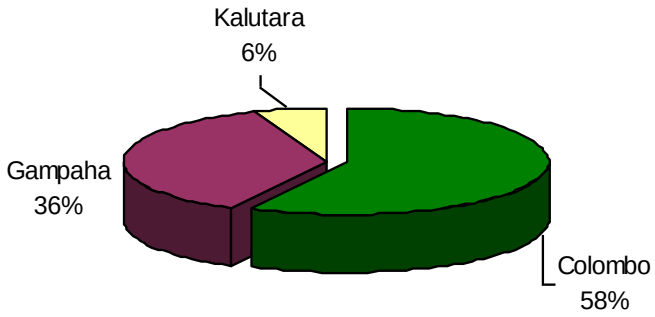
Table 15 : Number of Air conditioners Per Household (HH) and Confidence Values

Province	District	No. of ACs per HH	Confidence Value(95%) ±
Western	Colombo	0.13	0.12
	Gampaha	0.08	0.06
	Kaluthara	0.01	0.03
North-Western	Kurunegala	0.01	0.02
	Puttlam	0.05	0.07
Southern	Galle	0.01	0.03
	Matara	0.01	0.03
	Hambantota	0.04	0.05
Central	Kandy	0.02	0.04
	Matale	0.04	0.08
	Nuwara Eliya	0.00	-
North-Central	Anuradhapura	0.06	0.11
	Polonnaruwa	0.06	0.06
Uva	Badulla	0.02	0.03
	Monaragala	0.09	0.13
Sabaragamuwa	Ratnapura	0.00	-
	Kegalle	0.00	-

3.10.16. Availability of Air-Conditioners in Households (%) in the Western Province

Fig. 26, below clearly shows that availability of household Air – Conditioners dominated in the district of Colombo with 58%, followed by Gampaha with 36% and Kalutara with mere 06%.

Fig. 26: Availability of Air-Conditioners in Households (%) in the Western Province



3.10.17. Availability of Washing Machines in Households (%) on Provincial Basis

Fig. 27 and *Table 16,* below show that availability of Washing Machines in households were dominated in the WP and CP whilst other Provinces were in a narrow range of 10% - 15%.

Fig. 27 : Availability of Washing Machines in Households (%) on Provincial Basis

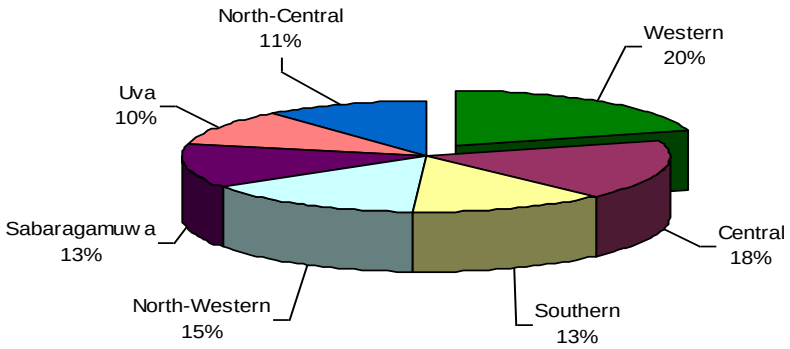


Table 16 : Number of Washing Machines (WM) Per Household (HH) and Confidence Values

Province	District	No. of WM per HH	Confidence Value(95%) ±
Western	Colombo	0.54	0.12
	Gampaha	0.54	0.09
	Kaluthara	0.45	0.13
North-Western	Kurunegala	0.33	0.09
	Puttlam	0.47	0.13
Southern	Galle	0.34	0.11
	Matara	0.32	0.11
	Hambantota	0.33	0.15
Central	Kandy	0.47	0.11
	Matale	0.47	0.14
	Nuwara Eliya	0.32	0.15
North-Central	Anuradhapura	0.29	0.14
	Polonnaruwa	0.27	0.12
Uva	Badulla	0.30	0.12
	Monaragala	0.22	0.12
Sabaragamuwa	Ratnapura	0.30	0.10
	Kegalle	0.37	0.13

3.11. Repair & Maintenance:

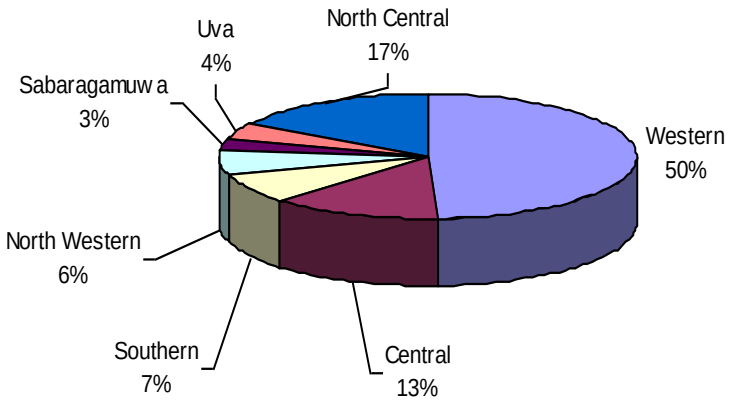
A Structured Survey Questionnaire (SSQ) was developed for collecting Electrical and & Electronic related information from the Repair & Maintenance sector (***Annex 03***) through the 317 Divisional Environmental Officers (DEOs) of the CEA. .

A total of ***542*** Repair & Maintenance Centers provided the PCU with a very diverse and current situation of their repair and maintenance activities.

3.11.1 Availability of Personal Computers under Repairs at the Repair & Maintenance Centers:

Fig. 28, below shows that availability of PCs under repairs at the Repair & Maintenance Centers is dominated with a 50% in the WP.

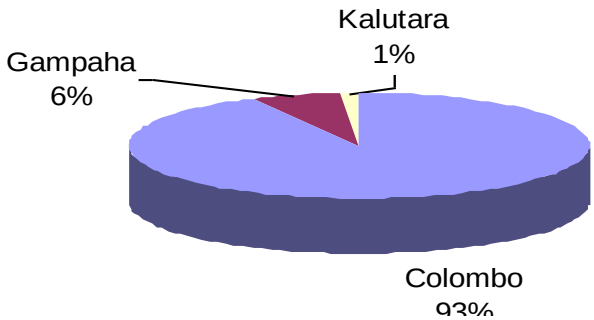
Fig. 28 : Availability of Personal Computers Under Repairs at the Repair & Maintenance Centres - Provincial Basis



3.11.2 Availability of PCs under Repairs at the Repair & Maintenance Centers in Western Province

Fig. 29, below shows that district of Colombo is dominated with 93% of availability of PCs under repairs in the WP followed by Gampaha with 06% and Kalutara with 01%.

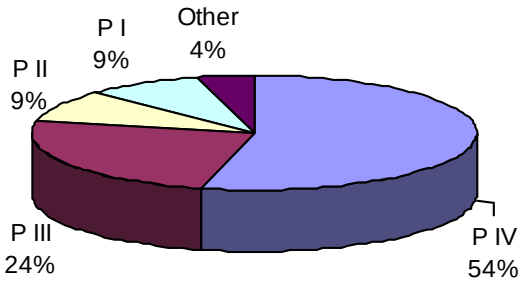
Fig. 29 : Availability of Personal Computers Under Repairs at the Repair & Maintenance Centre in Western Province



3.11.3 Availability of PCs under Repairs at Repair & Maintenance Centre by Processor Model:

Fig. 30, below shows that availability of PCs under repairs at Repair & Maintenance Centers by Processor Model dominates with P 111 and P IV with a total of 78%.

Fig. 30 : Availability of Personal Computers Under Repairs at Repair & Maintenance Centres by Processor Model



3.11.4 Availability of Printers under Repairs at the Repair & Maintenance Centers on Provincial Basis:

Fig. 31 and *Table 17,* below show that availability of Printers under repairs at the Repair & Maintenance Centers dominated in the WP with 41% and the rest of the Provinces stood at a range of 07% - 14%.

Fig. 31 : Availability of Printers Under Repairs at the Repair & Maintenance Centres on Provincial Basis

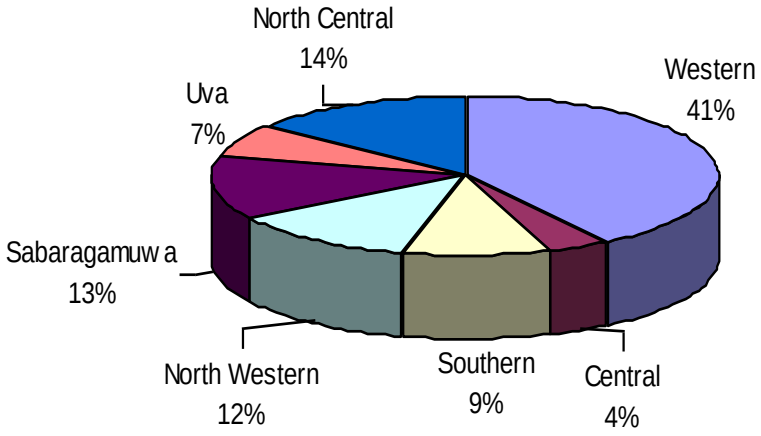


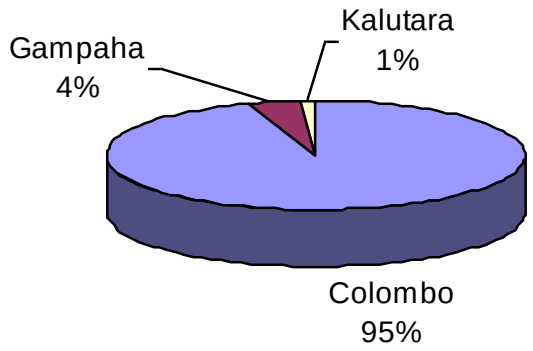
Table 17: Availability of Printers Under Repairs at the Repair & Maintenance Centres on Provincial Basis and Confidence Values

Province	District	Mean	Confidence Value(95%) ±
Western	Colombo	6.21	11.70
	Gampaha	0.27	0.20
	Kaluthara	0.07	0.14
North-west	Kurunegala	0.70	0.66
	Puttlam	0.13	0.26
Southern	Galle	0.59	0.69
	Matara	0.38	0.43
	Hambantota	0.07	0.09
Central	Kandy	0.13	0.18
	Matale	0.35	0.50
	Nuwara Eliya	0.05	0.09
North-central	Anuradhapura	0.87	0.70
	Polonnaruwa	0.21	3.34
Uva	Badulla	0.46	0.66
	Monaragala	0.07	0.15
Sabaragamuwa	Ratnapura	0.84	1.17
	Kegalle	0.00	-

3.11.5 Availability of Printers under Repairs at the Repair & Maintenance Centers in the Western Province:

Fig. 32, below shows that availability of Printers under Repair & Maintenance Centers dominated in the Colombo district.

Fig. 32 : Availability of Printers Under Repairs at the Repair & Maintenance Centres in the Western Province



3.11.6 Availability of TVs under Repairs at the Repair & Maintenance Centers on Provincial Basis

Fig. 33 and *Table 18,* below show that availability of TVs under Repair & Maintenance Centres dominated in the WP with 28%.

Fig. 33 : Availability of Televisions Under Repairs at the Repair & Maintenance Centres on Provincial Basis

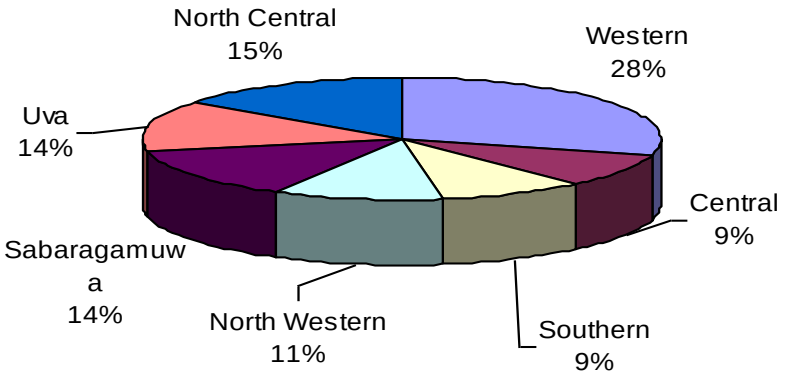


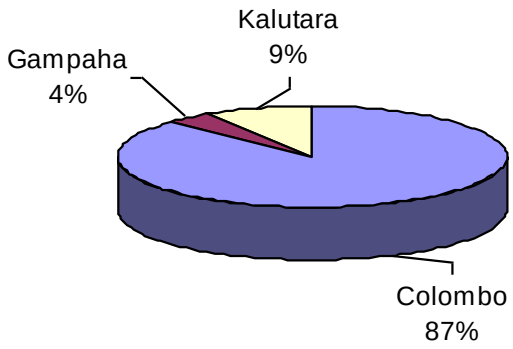
Table 18 : Availability of Televisions Under Repairs at the Repair & Maintenance Centres on Provincial Basis and Confidence Values

Province	District	Mean	Confidence Value(95%) ±
Western	Colombo	49.27	87.60
	Gampaha	2.13	0.90
	Kaluthara	5.07	2.60
North-west	Kurunegala	4.15	2.15
	Puttlam	6.65	6.53
Southern	Galle	3.38	1.85
	Matara	4.12	3.81
	Hambantota	5.52	1.98
Central	Kandy	2.78	1.57
	Matale	4.90	3.23
	Nuwara Eliya	8.71	5.16
North-central	Anuradhapura	6.23	2.70
	Polonnaruwa	7.75	3.44
Uva	Badulla	9.64	6.12
	Monaragala	3.11	1.35
Sabaragamuwa	Ratnapura	4.46	1.68
	Kegalle	5.07	4.89

3.11.7 Availability of Televisions Under Repairs at the Repair & Maintenance Centres in the Western Province:

Fig. 34, below shows that availability of TVs under Repairs & Maintenance Centers dominated in the district of Colombo with 87% in the WP.

Fig. 34 : Availability of Televisions Under Repairs at the Repair & Maintenance Centres in the Western Province



3.11.8 Availability of Mobile Phones Under Repairs at Repair & Maintenance Centers Provincial Basis:

Fig. 35 and *Table 19,* below show that availability of Mobile Phones at Repair & Maintenance Centers dominated in the WP with 64 %.

Fig. 35 : Availability of Mobile Phones Under Repairs at Repair & Maintenance Centres on Provincial Basis

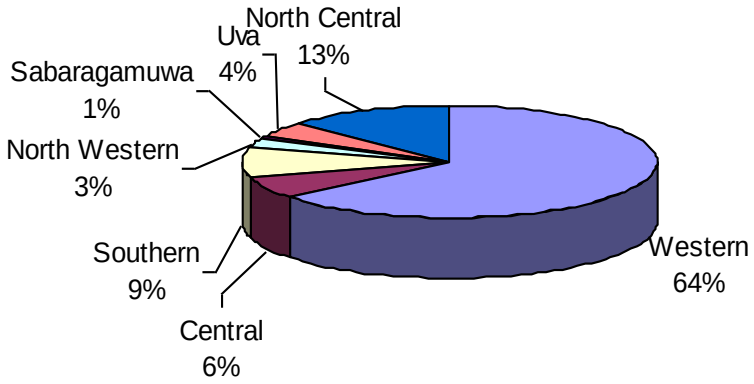


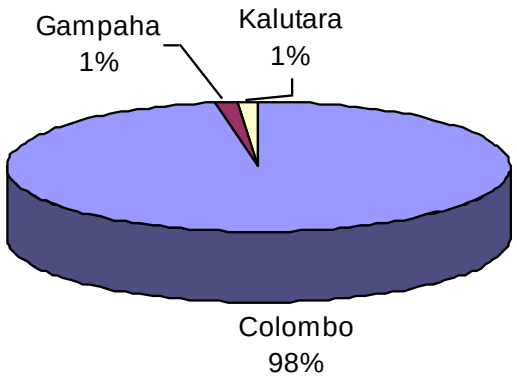
Table 19 : Availability of Mobile Phones Under Repairs at Repair & Maintenance Centres on Provincial Basis and Confidence Values

Province	District	Mean	Confidence Value(95%) ±
Western	Colombo	135.35	166.84
	Gampaha	2.08	1.57
	Kaluthara	1.96	2.20
North-west	Kurunegala	1.85	1.74
	Puttlam	1.13	1.13
Southern	Galle	1.51	1.11
	Matara	7.74	11.79
	Hambantota	4.72	2.66
Central	Kandy	4.72	5.17
	Matale	1.50	2.02
	Nuwara Eliya	1.48	1.93
North-central	Anuradhapura	4.77	4.42
	Polonnaruwa	9.50	2.84
Uva	Badulla	2.43	4.19
	Monaragala	1.89	1.24
Sabaragamuwa	Ratnapura	0.38	0.39
	Kegalle	0.70	0.90

3.11.9 Availability of Mobile Phones Under Repairs at Repair & Maintenance Centers in Western Province:

Fig. 36, below shows that availability of Mobile Phones under Repair & Maintenance Centers in the district of Colombo dominated with 98%.

Fig. 36: Availability of Mobile Phones under Repairs at Repair & Maintenance Centres in Western Province



3.11.10. Availability of Refrigerators Under Repairs at Service & Maintenance Centers on Provincial Basis:

Fig. 37 and *Table 20,* below show that availability of Refrigerators under Repairs at Service & Maintenance Centers dominated in the WP with 62 %.

Fig. 37 : Availability of Refrigerators Under Repairs at Service & Maintenance Centres on Provincial Basis

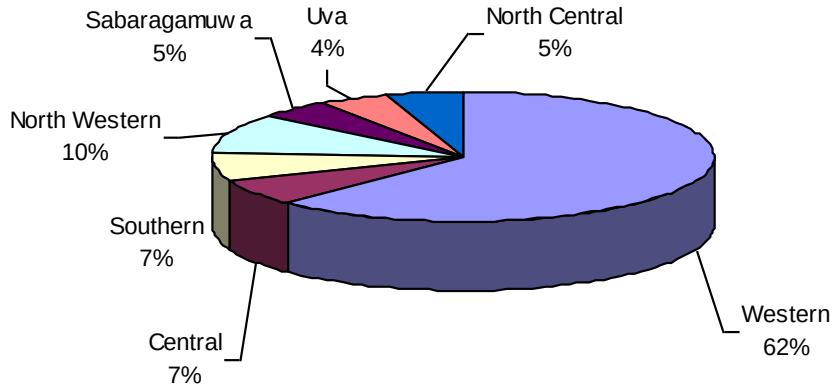


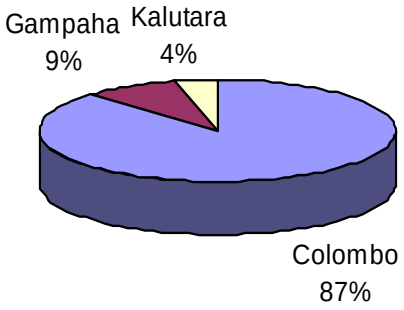
Table 20 : Availability of Refrigerators Under Repairs at Service & Maintenance Centres - Provincial Basis and Confidence Values

Province	District	Mean	Confidence Value(95%) ±
Western	Colombo	45.82	87.75
	Gampaha	4.57	5.02
	Kaluthara	1.96	1.29
North-west	Kurunegala	1.78	1.33
	Puttlam	2.65	2.19
Southern	Galle	1.24	1.11
	Matara	2.03	1.89
	Hambantota	1.59	2.16
Central	Kandy	1.63	1.34
	Matale	0.70	0.75
	Nuwara Eliya	1.76	1.66
North-central	Anuradhapura	1.42	1.23
	Polonnaruwa	0.71	2.12
Uva	Badulla	0.36	0.50
	Monaragala	1.63	2.55
Sabaragamuwa	Ratnapura	0.97	1.25
	Kegalle	1.22	1.43

3.11.11. Availability of Refrigerators Under Repairs at Repair & Maintenance Centers in Western Province:

Fig. 38, below shows that availability of Refrigerators under repairs at Repair & Maintenance Centers in the district of Colombo dominated with 87% in the WP.

Fig. 38 : Availability of Refrigerators Under Repairs at Repair & Maintenance Centres in Western Province



3.11.12. Availability of Air Conditioners Under Repair at Repair & Maintenance Centers on Provincial Basis:

Fig. 39, and ***Table 21***, below show that availability of Air- Conditioners under Repair and Maintenance Centers dominated in the WP with 92%.

Fig. 39 : Availability of Air Conditioners Under Repairs at Repair & Maintenance Centres on Provincial Basis

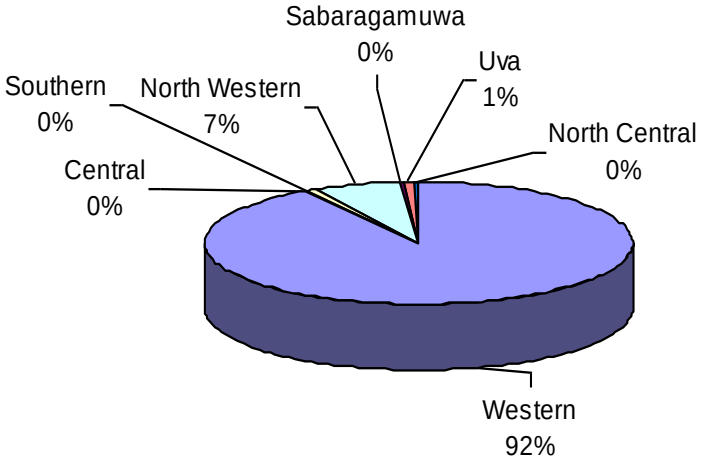


Table 21 : Availability of Air Conditioners Under Repair at Repair & Maintenance Centres on Provincial Basis and Confidence Values

Province	District	Mean	Confidence Value(95%) ±
Western	Colombo	106.27	204.78
	Gampaha	0.39	0.34
	Kaluthara	0.14	0.17
North-west	Kurunegala	0.28	0.34
	Puttlam	4.65	4.99
Southern	Galle	0.08	0.09
	Matara	0.18	0.25
	Hambantota	0.10	0.15
Central	Kandy	0.10	0.17
	Matale	0.00	-
	Nuwara Eliya	0.00	-
North-central	Anuradhapura	0.06	0.13
	Polonnaruwa	0.04	1.87
Uva	Badulla	0.00	-
	Monaragala	0.59	0.89
Sabaragamuwa	Ratnapura	0.00	-
	Kegalle	0.04	0.09

3.11.13. Availability of Photocopying Machines under Repairs at the Repair & Maintenance Centers Provincial Basis:

Fig. 40 and ***Table 22,*** below show that availability of Photocopying Machines under repairs at the Repair & Maintenance Centers dominated in the NCP probably due to remoteness in view of availability of spare parts.

Fig. 40 : Availability of Photocopying Machines Under Repairs at the Repair & Maintenance Centres on Provincial Basis

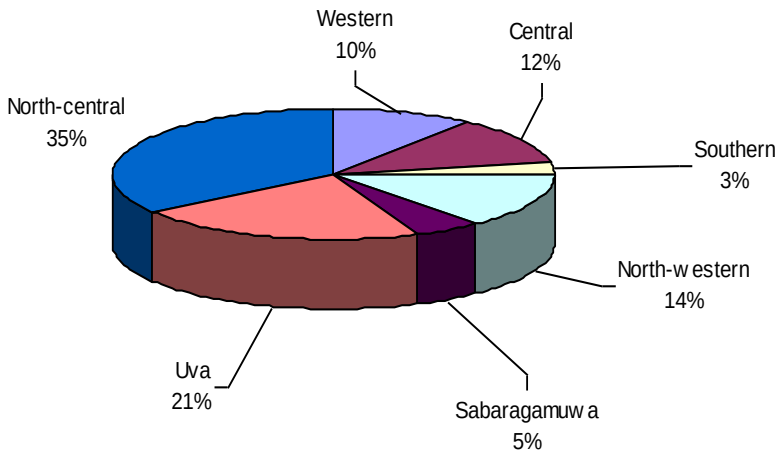


Table 22 : Availability of Photocopying Machines Under Repairs at the Repair & Maintenance Centres on Provincial Basis and Confidence Values

Province	District	Mean	Confidence Value(95%) ±
Western	Colombo	0.03	0.06
	Gampaha	0.05	0.10
	Kaluthara	0.00	-
North-west	Kurunegala	0.03	0.05
	Puttlam	0.09	0.17
Southern	Galle	0.00	-
	Matara	0.00	-
	Hambantota	0.03	0.07
Central	Kandy	0.07	0.13
	Matale	0.00	-
	Nuwara Eliya	0.00	-
North-central	Anuradhapura	0.23	0.34
	Polonnaruwa	0.00	-
Uva	Badulla	0.00	-
	Monaragala	0.15	0.29
Sabaragamuwa	Ratnapura	0.03	0.05
	Kegalle	0.00	-

3.11.14. Availability of Washing Machines Under Repairs at Repair & Maintenance Centers on Provincial Basis:

*Fig. 41*and *Table 23*, below show that availability of Washing Machines under Repairs at Repair & Maintenance Centers dominated in the WP with 81%.

Fig. 41 : Availability of Washing Machines Under Repairs at Repair & Maintenance Centres on Provincial Basis

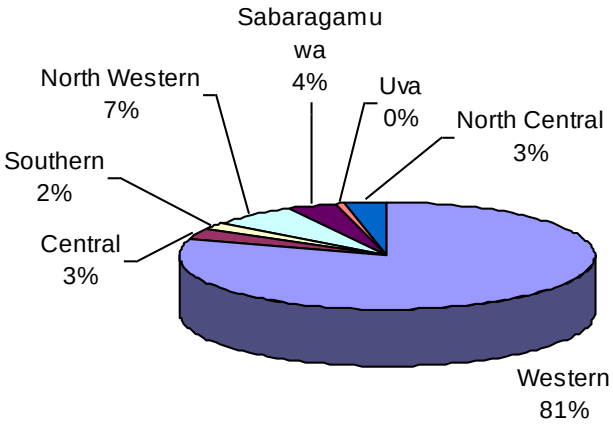


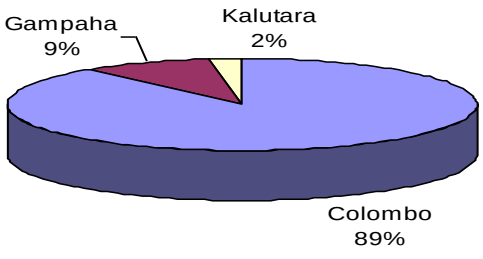
Table 23 : Availability of Washing Machines Under Repairs at Repair & Maintenance Centres on Provincial Basis and Confidence Values

Province	District	Mean	Confidence Value(95%) ±
Western	Colombo	30.73	58.49
	Gampaha	3.01	4.49
	Kaluthara	0.75	0.70
North-west	Kurunegala	0.55	0.54
	Puttlam	1.17	1.22
Southern	Galle	0.27	0.21
	Matara	0.15	0.17
	Hambantota	0.41	0.49
Central	Kandy	0.42	0.33
	Matale	0.15	0.21
	Nuwara Eliya	0.19	0.22
North-central	Anuradhapura	0.35	0.37
	Polonnaruwa	0.39	2.06
Uva	Badulla	0.00	-
	Monaragala	0.11	0.16
Sabaragamuwa	Ratnapura	0.30	0.31
	Kegalle	0.70	0.87

3.11.15. Availability of Washing Machines under Repairs at Repair & Maintenance Centers in Western Province:

Fig. 42 shows that the availability of Washing Machines under repairs at Repair & Maintenance Centers dominated in the district of Colombo with 89% followed by Gampaha with 09% and Kalutara with 02%.

Fig. 42: Availability of Washing Machines Under Repairs at Repair & Maintenance Centres in Western Province



Chapter 4
Chapter4

Stakeholder Workshop and Related Developments

4.1 Introduction

It was important to communicate the outcome of the inventory preparation and results to the wider stakeholder community. The final Stakeholder workshop was conducted accordingly on 26th February 2008 in order to create awareness and to evaluate the draft report developed by Project Control Unit. An important cross section of people participated in the stakeholder consultation workshop. Thirty nine (39) attended the workshop from 15 governmental, university and non governmental organizations.

4.2 Workshop methodology

Central Environmental Authority (CEA) presented the report section by section to the invited audience and after each presentation, the audience was expected to discuss as well as present their views and comments in writing. Annex 05 and 06 presents the agenda for the workshop as well as the session feedback form template.

The final compilation of all these outputs was used as inputs to this chapter.

4.3 Workshop discussion summary

Remarks from the Stakeholder meeting and the Discussion;

1. The survey has targeted 09 electrical and electronic items; personal computers, printers, televisions, mobile phones, refrigerators, washing machines, photocopying machines, air-conditioners and batteries.

2. The objective of the stakeholder meeting was to discuss and comment on the output from the field survey/study covering the central and local government authorities including household, maintenance sectors. The output available is a national inventory covering the 09 e-streams in these sectors.

3. Field survey studies have been conducted through a structured survey questionnaire with a sampling strategy based on multi-stratification procedure. Actual survey had been completed utilizing the services of the Divisional Environmental Officers (DEO) of CEA guided by the expertise available with the PCU.

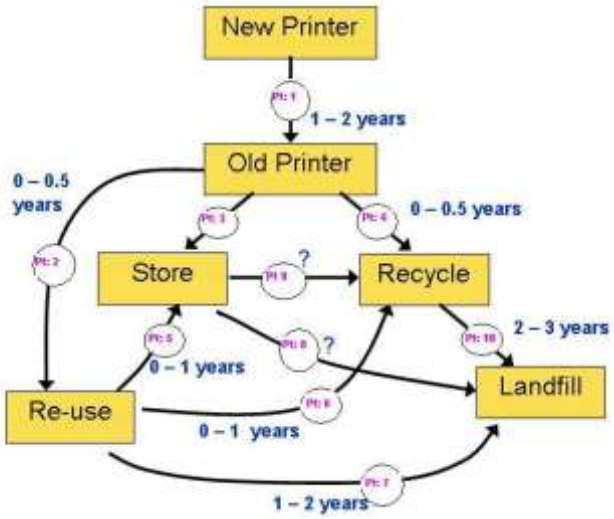
4. The field survey preparation has also resulted in training of 317 Divisional Environmental Officers to some limited extent on e-waste management with emphasis on 3R concept. This development is useful in future activities.

5. The report appears to have not considered the preliminary survey and the situational analysis report of e-waste prepared for the Ministry (check references and contents). It was recommended to bring some of the earlier recommendations made in the preliminary situational analysis to the final set of recommendations.

6. CEA has already initiated setting up of a committee drawing expertise from Customs, Sri Lanka Standard Institute (SLSI) and universities to develop specifications and guidelines for importation of used computers and accessories. Already a preliminary document has been completed (ie with objective of prohibiting importation of PI and PII or equivalents to the country) and has been circulated for discussion.

7. The following life cycle diagrams presented for all 09 streams were subjected to discussion. The final label was disputed – ie landfill. Need for more analysis was suggested.

Life-Cycle of a Printer



8. In some categories the sample size could be questioned as an identical pattern has emerged in all areas of Sri Lanka. These perhaps could be tested and validated with further data analysis and keeping the data acquisition process live.

9. It was suggested that Telecommunication Regulatory Commission should participate as a member in this committee.

10. It was noted that majority of repair shops are located in the western province and special attention to be given to improve the system in the Western Province.

11. There is a need to cover other generators such as Hospitals and hotels with respect to e-waste generation.

12. A comment noted from mobile sector was that today there are significant illegal imports as well as those who actually sell mobiles by weight! to Sri Lanka. (ie 500 kg of mobiles for 500 $ etc.)

13. Considering the short period of the survey the data collected was considered acceptable and the process commended in general.

14. The presentation made by Mr. D. Thilakarathne, Coordinator, Dialog Telecom on their initiative to establish a end of life mobile phone collection system was commended and importance of strengthening of the collection system was highlighted.

15. Harmonized system (HS) codes have already been developed to control imports and exports of e-waste and regulations are to be developed to strengthen the efficiency of e-waste management.

16. Under the field survey 8253 of e-venders were identified. These should be compiled into an organized database with PCU for further development.

Fig.43.The final Stakeholder Workshop of the e-waste Management Project held on 26th February 2008

Ten Salient points discussed

1. Sri Lankan existing life cycle for e-waste should be changed as the situation is simply disposal rather than to a landfill or controlled disposal route. This needs to be addressed quickly. Use of Market based instruments (MBIs) would be a strategy that can be used to support establishment of necessary infrastructure facilities.

2. There is a collection system for mobile phones in place initiated by Private Sector. Mechanism for recycling to be established. A collection mechanism has been initiated by private sector under corporate social responsibility regime. Further developments in this area are quite important.

3. E-waste needs to be specifically included into the regulatory framework to facilitate as effective E-Waste Management System. It is necessary to develop regulations with proper understanding of the emerging regulations such as WEEE (Waste Electrical and Electronic Equipment) directive, RoHS (Restriction of hazardous Substances) initiative and Extended Producer Responsibility schemes.

4. Data collection system could be further analyzed beyond what is presented to include trends of generation etc. for decision making and/or planning process.

5. Customs at present have no mechanism to control waste movements. In this regard entire hazardous waste streams need to be addressed and e-waste can be an element under those provisions. It is noted that HS codes have already been developed for E-Waste and E-products.

6. In managing the issue of e-waste generation, prioritization is important considering the major sectors such as Telecom, IT etc.

7. Establishment of infrastructure facilities should be given priority to ensure an effective E-waste Management System.

8. Sri Lanka should not be a recipient nor should be an end destination for out-dated, problematic electrical and electronic equipment from elsewhere. The receipts even in the form of gifts should be brought under control. This will be an effective preventive strategy in E-waste generation in the country.

9. There is a need to expand the list to cover more E-items than covered with the report. There are several other items in use with potential to generate E-waste (eg. CDMA phones, toys, communication hardware items etc.)

10. There is a need for greater awareness among all stakeholders as it appears that there is still a considerable lack of awareness.

Chapter 5

Conclusions and Recommendations

5.1. Conclusions

Two important steps have been concluded under the program of developing e-waste management strategy for Sri Lanka.

(a). Development of an inventory and life cycle analysis of 09 e-items considered initially to be the priority items (The current Project).

(b). Situational Report on E-waste – this report also covered waste management issues which surfaced under disaster conditions (Tsunami of 2004). *This report enabled the development of the project proposal made to Secretariat of the Basel Convention.*

The essential output from the inventory study with respect to the 09 e-products is as follows;

Personal Computers

1. Personal Computers (PCs) entered the Sri Lankan market beginning from mid 80s to late 80s with a hand full of brands with limited capacities and options. Current market size for Personal Computers in the country is about 300,000 units per annum with about 30 % - Used, 20% - Branded and 50% - Assembled locally. Annual growth rate of Personal Computers in Sri Lanka is in the range of 08.0% - 10.0%.

2. Survey studies conducted by the Department of Census & Statistics revealed that as of 2007, 3.8 % of the Sri Lankan households do have a PC. The current ratio of PC : Notebook in Sri Lanka is 12 -15 : 1 and soon will reach 10 : 1 as against 5 : 1 in a developed country in South Asia.

3. Key components that can be extracted from an obsolete PC includes: Non Ferrous Metals (Copper/Aluminium) and Ferrous Metals (Steel/Iron); Plastics & rubber; Capacitors; Circuit boards (Cu, Ni, Pb, Ag, Au); External cables (Cu, Al); bearing; Hazardous materials such as phosphor powder on Cathode Ray Tubes (CRT), leaded glass, circuit boards and cables; Liquid crystals from Liquid Crystal Display monitors and fluorescent tubes etc.,

4. The estimated Life time/span of a CRT type: New PC is 8 - 10 yrs; and Old PC is 4 – 6 yrs. Estimated Life time/Span of a New Note Book is 2.0 - 4.0 yrs; and Old Note Book is 0.5 – 1.5 yrs.

5. Household survey study revealed that availability of PCs in the 07 Provinces vary with Western Province- 20%, Central Province – 17%, Southern Province – 13%, North Western Province – 16%, Sabaragamuwa Province- 10%, Uva – 12% and North Central – 12% with majority of PCs are of PIII and P IV (74%), and are in the age

group of 0.1 – 3.0 years old (75%). Majority (61%) of the PCs have been removed as donations and/or selling without repairs, while 26% had thrown away as E - Waste. Survey studies further revealed that availability of PCs under repairs at the Repair & Maintenance Centres is dominated with a 50% in the WP, and predominantly with Processor Models of P 111 and P IV (78%) in all 07 provinces.

Printers

6. Printers initially emerged into Sri Lankan market with Dot Matrix, followed by Laser and Bubble Jet/Ink. Current market size is about 130,000 Printers per annum and about 5% of used Printers are being imported. Annual growth rate is about 05 %-07%.

7. Current approximate ratio of PC: Printer is 5: 1 in the country, and this ratio is further reducing in view of the influx of cheaper and outdated models. Estimated Life Time/Span of a Printer can vary from 01 – 08 years depending on the type of Printer.

8. Key components that can be extracted from an obsolete Printer include: Non ferrous metals; Ferrous metals; Plastics; Clothing and Ribbon; Capacitors; Glass; Circuit boards; and External cables.

9. Household survey studies revealed that availability of household printers dominated in the Western Province with 24%, followed by North Western Province- 17%, and Central Province – 17%, North Western Province- 17%, Southern Province – 9% Sabaragamuwa – 8%, Uva – 10% and North Central – 15% . Although ink/bubble jet Printers are dominated at 66%, laser printers are being emerged into the household sector and Dot matrix are in the decline. Survey studies further revealed that availability of Printers under repairs at the Repair & Maintenance Centers dominated in the WP with 41% and the rest of the Provinces stood at a range of 07% - 14%.

Televisions

10. Televisions at commercial and household level emerged into Sri Lankan market along with the establishment of TV Channels: ITN and Rupavahini in early 1980s. Liquid Crystal Display and Plasma Type monitors reached the market in the recent past and the majority of the TV based E-waste are of Cathode Ray Tube type. According to World Development Indicators of World Bank, percentage of households with TVs in Sri Lanka was stand at 32% in 2004. Current market size of TVs in Sri Lanka amounts to 350,000 – 400,000 units per annum with annual growth rate of 6.0% - 8.0%.

11. The key components that can be extracted from a TV include: Glass; Metal (Cu, Fe, Al, Pb, Au, and Cr); Plastics; Silicon; and PCBs. Estimated Life time/span of a TV is 15 to 20 years.

12. Household survey revealed that the availability of number of TVs in households in 07 provinces do not significantly differ and in a narrow range of 14 % - 16 %. On average each of the households in 17 districts has a TV and majority (71%) of the TVs are in the age group of 0.1 – 8.0 yrs old whilst majority (68%) of old TVs are sold without repairs. Availability of TVs under Repair & Maintenance Centers dominated in the Western Province with 28% and the rest of the provinces stood at a range of 9% -15%.

Mobile Phones

13. Mobile Phones entered the Sri Lankan market at commercial scale since early 90s and the current subscriber base is 5.413 million units amounting to 28% penetration. Estimates show that the penetration rate will reach 40% by the year 2009. Current market size is 1.0 – 1.2 million Mobile Phones per annum. Annual growth rate during the last 10 year period was phenomenal.

14. Key components that can be extracted from a Mobile phone include: Non ferrous metals; Ferrous metals; Plastics; Capacitors; Glass; Circuit boards; External cables; Re-chargeable battery; key board; phone housing; charger; and Liquid Crystal display. In Sri Lanka, most of the parts required for repairing of mobile phones are readily available and are imported at large scale thus resulting in discharging a lot of E – Waste components into the environment. The estimated Life time/span of a Mobile Phone is 02 years.

15. Household survey studies revealed that availability of Mobile Phones in households in 07 Provinces are in a narrow range of 11% - 17 % and the availability of Mobile Phones at Repair & Maintenance Centers dominated in the Western Province with 64 %.

Refrigerators

16. Refrigerators were imported to Sri Lanka at commercial level since post World War II, and with the introduction of the open economy in 1977, local manufacturing as well as imports of Refrigerators increased tremendously. Current market size of refrigerators is 250,000 – 275,000 units per annum and about 5% of the total imports are used refrigerators. Annual growth rate is 04 % - 06%. Estimated Life time/span of a refrigerator is 15 – 25 yrs.

17. Survey studies revealed that availability of Refrigerators in 07 provinces do not differ significantly and lies in a narrow range of 13% - 16% and the availability of Refrigerators under repairs at Service & Maintenance Centers dominated in the Western Province with 62 % and the rest of the provinces were in a range of 04% - 10%.

Air-Conditioners

18. Air-Conditioners (A/C) vary with the types as Window or Split and categorized as industrial, commercial and domestic. Current market size is 40,000 – 50,000 units per annum and the annual growth rate is 04 % - 06%. The proportion of E -waste generated by an A/C is comparatively low in view of the fact that more than 95%of it's content is metal. Estimated Life time/span of an A/C is 05 – 15 yrs.

19. Survey studies revealed that availability of Household A/Cs dominated in the WP with 31% and the availability under repair and Maintenance Centers dominated in the WP with 92%.

Photocopying Machines

20. Photocopying Machines are widely used in the commercial and industrial sectors and the current market size is approximately 6000 units per annum with a slow annual growth rate of about 02 % - 04%.

21. Main waste products coming out of a photocopying machine is the toner consisting plastics, polyethylene; Ferric Oxide and Cadmium Sulfide. An obsolete photocopier consists of circuit boards, wires, motors, glass sheet, drum and ebonite rolls. Estimated Life time/span of a Photo Copying Machine is 05 – 10 yrs.

22. Survey studies revealed that availability of Photocopying Machines under repairs at the Repair & Maintenance Centers dominated in the North Central Province (35%) probably due to remoteness in view of availability of spare parts and the other provinces stood at a range of 3% - 21%.

Washing Machines

23. Washing Machines market increased tremendously during last 5 – 7 yrs and the current market size of washing machines is 60,000 – 70,000 per annum and the annual growth rate is about 06% - 08%. Estimated Life time/span of a Washing Machine is 15 – 20 yrs.

24. Survey studies revealed that availability of Washing Machines in households were dominated in the Western Province and Central Province whilst other Provinces were in a narrow range of 10% - 15% and the availability of Washing Machines under repairs at Repair & Maintenance Centers dominated in the Western Province with 81%.

Batteries

25. Batteries are broadly categorized as Auto, Domestics & Consumer and Industrial types. The market size of auto batteries is about 600,000 per annum with varying capacities from 35 A – 200A with an annual growth rate of around 04% - 06%.

26. Annual usage of Torch batteries and AA size is about 50 – 70 million and 24 – 36 million units per annum, respectively. Estimated modest life time/span for an auto battery is 02 years and the life time/span of domestic batteries depend on the usage and/or rate of discharge.

27. Obsolete batteries contain plastics, rubber, polymer, Lead (Pb), Sulphuric Acid, Paper, Glass, Carbon – Rods, Nickel (Ni), Cadmium (Cd), Lithium (Li), Zinc (Zn), Silicon (Si), Tin (Sn), Antimony (Sb), Manganese (Mn) and Paper.

The summary of vendor distribution in the study area

28. Detailed National Inventory was compiled with the registered E–Vendors in 17 districts under Divisional Secretaries, Municipal Councils, Urban Councils and Pradeshiya Sabhas and the details covered the Registered Organization, Postal

Address and Nature of E – Business. A total of ***8,253 E-Vendors*** from 07 Provinces under 12 different categories were compiled.

29. Number of E-Vendors distributed among 07 Provinces showed that Western Province (WP) is dominated with 38% of the registered E-Vendors whilst the distribution of E-Vendors in North Western Province – 18%, Southern Province – 15% and Central Province – 12 %.

30. Within the Western Province, district of Colombo dominated the registered E-Vendors with 56%, whilst district of Gampaha is having little less than half of Colombo (26%) and the least of 18% from the district of Kalutara.

31. District of Galle dominated with 50% of registered E-Vendors in the Southern Province amongst Matara (38%) and Hambantota (12%).

32. District of Kandy dominated with 68% of registered E-Vendors in the Central Province amongst Matale (20%) and Nuwara Eliya (12%).

Some salient points to note from data collected

33. There are a number of organizations dealing with providing computers and related services in the country with specific concentration in Colombo.

34. Most organizations are involved in providing reconditioned computers and accessories to the market imported from countries such as Korea and Japan. In some cases the origin is not known.

35. Old outdated computers such as P1's are still advertised and sold at prices around Rs 3600/= (US $36) with one year warranty period.

36. There are exchange mechanisms in place for TV sets and mobiles by some major players in the retail market (ie Singer TV exchange program)

37. Some computer service providers have grouped themselves as affordable computer users association to provide a reliable service. Their advertisements on paper specifically informs on alerting the customers to fraudulent practices.

38. Reconditioned electrical and electronic appliances are also entering the Sri Lankan market to service the needs of those who cannot afford brand new items (fax machines, photo copiers etc.)

39. Items like mobiles are entering the market without getting exactly getting accounted by customs and the numbers identified are less than what is presently in the country.

40. Examples of extended producer responsibility is absent at present when considering published information and the data available.

As indicated with respect to computers, the IT literacy in Sri Lanka is 9.7% and there are major differences between provinces. With the general literacy in 90's there is definitely the potential for people seeking improvements in this regard and thus the growth of the basic requirements to achieve these are almost a certainty. The penetration of four streams

(personal computers, Cathode Ray Tubes, TV sets and mobile phones) that could lead to the generation of e-waste within the socio-economic classes is poor. Thus the potential quantities at present could be stated to be small.

Sri Lankan survey on e-waste as per the agreed format revealed several interesting facts. The issues to be faced from an environmental aspect appears to be minimal at present with most material being brought in as imports and then most part of the generated waste also leaving the shores for recycling operations elsewhere. The main issue perhaps is the economic impact of bringing low quality, used materials to the country and then proving to be a problem to many people who purchase these at low cost hoping for major benefits. The units and accessories in most situations will not provide an acceptable service. Also noted were that there are stocks of materials piled up and kept in places awaiting a proper way of disposal. This is true with most state sector organizations.

There is a greater tendency among the population to keep this type of materials in service for a long period or even after its useful life with them without disposal. The principles of 5S if implemented within local households could lead to a mini 'tsunami' of waste quantities, with e-waste included. Articles of some value do get into the informal collection mechanism – again a poor system compared with the neighboring India.

Whatever waste that enters the collection stream is destined for recycling operations overseas and India dominate among the destinations. This is not quite formal as all these will leave Sri Lankan shores as scrap metal exports. Compacting and baling takes place and then loaded into containers, which will be shipped to India from the Colombo harbor. As shown in the Figure 44 there is no strict differentiation between wastes when exporting is intended.

Fig. 44 Mixed waste awaiting export in a yard of a scrap metal dealing unit – Colombo, Sri Lanka

It is also explained that the regulatory mechanism to be quite poor with respect to Solid and Hazardous wastes in the country. The regulatory framework is adequate and is available though specific e-waste regulations are absent could be added on quite easily into the framework. HS codes for E-Waste and products have already been developed to facilitate implementation of E-Waste Management System.

Sri Lanka has not encouraged setting up of factories for recycling operations with imported e-waste and this is quite appropriate. There is also a functioning mechanism for the process of technical evaluation of waste flows under Basel regulations. It is important that this aspect of waste import watch is maintained as e-waste is a stream that is expected to have

the most significant growth in terms of solid waste. Sri Lanka has adopted the Basel definition and has totally banned List A substances being imported. The old computer imports had been rejected taking the view that waste electrical and electronic assemblies or scrap (A1180 in List A) is not acceptable as the national decisions on a total ban on List A items.

5.2 Recommendations

The following recommendations cover Policy, Import control and Customs, Tracking System, Integrating with solid waste management practices, Pilot projects and recycling infrastructure.

1. ***Policy and Awareness:*** *The state policy should be clearly documented and published. It is recommended to expedite the development of an e-waste set of guidelines and regulations. To sensitize the policy makers and the public alike it is also recommended having a national stakeholder workshop along with a series of publications to the general public through media subsequent to the development of the guidelines.*

2. ***Integrating with Solid Waste Management Strategy:*** *e-waste management should be part of integrated waste management program of the country. At present one company has moved on with a system for collecting used mobile phones. This needs encouragement as well as developmental support. Regulations and guidelines coming into action will enable development of this type of initiative. All responsible parties joining hands to move forward Endeavour's of this nature should be looked into and state should explore means of program support.*

3. ***Launch Pilot Projects****: It is recommended that few pilot projects be established in the provinces with the maximum potential density of e-products. Further the projects should be developed as Public Private Partnerships/ ventures.*

4. ***Import Control and Customs:***
   There is a need to implement specific HS codes for the following streams.
- *Used computers and accessories*
- *Used telecommunication equipment*
- *Used electronic appliances other than computers and telecommunication equipment*
- *Used electronic toys and games*

   The relevant codes and suggestions have now being completed and await implementation. It is recommended that this is implemented without any further delay.

5. ***Data Base Management and Tracking****: Further statistical analysis of data collected is recommended along with the use of earlier data. A subprogram of HazNet could serve as a useful e-waste tracking tool and is recommended for implementation.*
- *What is it?*
- *Where is it?*
- *How much is there?*
- *Who owns it?*

6. ***e-waste specific Recycling Infrastructure****: Development of recycling infrastructure is recommended. Environmental improvement schemes could be*

provided including ISO 14000 systems to recyclers and waste management groups. Small scale practitioners should be encouraged to form recycling cooperatives to bring-in economies of scale.

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