

**REPORT
ON
INVENTORIZATION OF E-WASTE IN TWO CITIES
IN ANDHRA PRADESH AND KARNATAKA
(HYDERABAD AND BANGALORE)**



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Prepared by



EPTRI

**Environment Protection Training & Research Institute
Gachibowli, Hyderabad, Andhra Pradesh, India.**

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Dr. Razia Sultana
Project Coordinator

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Executive Summary

The growing dependency on information technology, the fast rate of technological changes and better standard of living has lead to the rapid obsolescence rate of electronic equipments causing generation of e-waste. This e-waste finds its way into the hands of un authorized scrap dealers and finally joins the waste stream causing human and environmental hazards. The e-waste scrap is managed through various management alternatives such as reuse of equipment from second hand dealers, back yard recycling (manual dismantling and segregation into plastic, glass and metal) and finally into the municipal dumping yard. Mostly children and women are involved in this work.

The present study has been carried out through field work in two cities Hyderabad and Bangalore. The total e- waste generated in Hyderabad, due to computers, printers, television and mobile phones usage by 246 surveyed samples is 36,027.90 Kg and in Bangalore by 148 surveyed samples is 48,254.55 Kg. The annual e-waste generation has been estimated for Hyderabad and Bangalore as 3,263.994 MT and 6,743.87 MT respectively from computers, printers, television and mobile phones. The projected e-waste generation restricting to above items from house hold sector alone is 95,120 MT in 2009 and expected to touch 1,07,886 MT in 2013 in Hyderabad and 1,21,410 MT in 2009 and expected to touch 1,30,383 MT in 2013 in Bangalore.

After the mid of 2009 one formal authorized recycler by name Earth Sense has established its recycling facility in Hyderabad in collaboration with already existing formal recycler, by name E- Parisaraa in Bangalore. Although these recyclers do exist but most of the waste finds its way into un authorized recycling centers / scrap dealers etc. for quick money. The workers are women and children in most of these units. On an enquiry they informed that there is no health problem but a study need to be taken up to find the actual pollution load generated and health problems among the workers.

Project Report on Inventorisation of E-Waste in Two Cities in Andhra Pradesh and Karnataka (Hyderabad and Bangalore)

1. Introduction

The largest and fastest growing manufacturing industry is the “electronic industry”. There is a tremendous growth in the field of information technology all over the world. The past two decades have seen an exceptionally strong growth in the electronic equipment market among which computers, mobile phones and televisions have shown strongest growth.

Mobile phones are not just tools of communication but have taken a new meaning altogether. They are used as cameras, recorders and computers. With the number of mobile phone users increasing, the problem of safe disposal of discarded mobile phones is becoming a troublesome task.

All electronic and electrical items such as computers, televisions, mobile phones etc. on completion of their useful life, are being discarded rapidly and contribute to the huge quantum of e-waste. The generation of this waste (e- waste) has grown manifold in the last two decades and would continue to accelerate at a fast pace.

E-waste is one of the fastest growing waste streams in India due to increasing “market penetration” in developing countries, “replacement market” in developed countries and “high obsolescence rate”. The composition of e-waste is very diverse and differs in products across different categories. It contains more than a 1000 different substances, which fall under “hazardous” and “non-hazardous” categories. Broadly, it consists of ferrous and non-ferrous metals, plastics, glass, wood and plywood, circuit boards, concrete and ceramics, rubber and other items. Iron and steel constitutes about 50% of the e-waste followed by plastics (21%), non ferrous metals (13%) and other constituents 16%. Non-ferrous metals consist of metals like copper, aluminum and precious metals like silver, gold, platinum, palladium etc. The presence of elements like lead, mercury, arsenic, cadmium, selenium, and hexavalent chromium and flame retardants beyond threshold quantities in e-waste classifies them as hazardous waste. E-waste dismantling

or incineration is considered toxic. They are targeted for reuse, recovery or hazardous waste disposal. The recovery of metals is a profitable business, which results in local, trans-boundary and global trade. Environmental issues and trade associated with e-waste has driven the definition of e-waste both at national and international level. In this context, it is important to understand the existing Waste Electrical and Electronic Equipment (WEEE) / e-waste definition and its evolution. E-waste, is an emerging problem as well as a business opportunity of increasing significance, given the volumes of e-waste being generated and the content of both toxic and valuable materials in them.

1.1 Definition of E-Waste:

Electronic Waste (E-Waste) comprises waste electronics / electrical goods that are not fit for their original intended use or have reached their end of life. This may include items such as computers, servers, printers, scanners, calculators, battery cells, mobile phones, televisions, refrigerators etc.

Public perception of e-waste is often restricted to a narrower sense, comprising mainly of end-of-life information & telecommunication equipment and consumer electronics. However, technically, electronic waste is only a subset of WEEE. According to the OECD any appliance using an electric power supply that has reached its end-of-life would come under WEEE.

Globally, WEEE / E-waste are most commonly used terms for electronic waste. There is no standard definition of WEEE / e-waste. A number of countries have come out with their own definitions, interpretations and usage of the term e-waste / WEEE.

The term e-waste refers to the technological characteristics and the hazardous materials incorporated in this waste. It refers to a broad range of electric and electronic goods which have outlived their use for producers and consumers, ready for disposal and contain chemical materials considered hazardous for humans and for our natural environment.

The Ministry of Environment and Forests (MoEF), Government of India has brought out

guidelines on e-waste management. According to this, e-waste is such waste comprises of wastes generated from used electronic devices and house hold appliances which are not fit for their original intended use and are destined for recovery, recycling or disposal. Such wastes encompasses wide range of electrical and electronic devices such as computers, hand held cellular phones, personal stereos, including large house hold appliances such as refrigerators, air conditioners etc.

1.2 E-Waste Generation International

S.No	Country	Total E-waste generated tones/Year	Categories of Appliances counted in e-waste	Year	Source
1	Switzerland	66,042(*)	Office & Telecommunications Equipment, Consumer Entertainment Electronics, Large and Small Domestic Appliances, Refrigerator, Fractions	2003	(1)
2	Germany	1,100,000	Office & Telecommunications Equipment, Consumer Entertainment Electronics, Large and Small Domestic Appliances, Refrigerator, Fractions	* Estimated in 2005	(2)
3	United Kingdom	915,000	Office & Telecommunications Equipment, Consumer Entertainment Electronics, Large and Small Domestic Appliances, Refrigerator, Fractions	1998	(3)
4	USA	2,124,400	Video Products, Audio Products, Computers and Telecommunications Equipments	2000	(4)
5	Taiwan	14,036	Computers, Home electrical appliances(Televisions, Washing Machines, Air Conditioners, Refrigerators)	2003	(5)
6	Thailand	60,000	Refrigerator, Air Conditioners, televisions, Washing Machines, Computers	2003	(6)
7	Denmark	118,000	Electronic and Electrical Appliances including Refrigerators	1997	(7)
8	Canada	67,000	Computer Equipment (computers, printers etc) & Consumer Electronics (Televisions)	*Estimated In 2008	

Notes:

Attention: The table above gives only an overview of the quantities of e-waste generated in different countries. It is difficult to make direct country to country comparisons regarding e-waste quantities, because each country has as different categories of appliances counted in e-waste and different methodologies of estimation.

(*) This is the quantity of e-waste generated in Switzerland that is physically weighed and accounted for. It is much more accurate measure of e-waste quantities than for other countries for which only estimates exist

Sources:

- (1) EMPA St. Gallen Technical Control Body for SWICO and <http://www.sens.ch> (in German French and Italian only) “ > SENS (2004)
- (2) ZEVI- Deutscher Zentralverband Elektrotechnik und Elektroindustrie, i.e. German electrical and electronic manufacture’s association.
- (3) UK Status Report on Waste from Electrical and Electronic Equipments Industries Council for Electronic Equipments Recycling (ICER), 2000.
- (4) Municipal Solid Waste in the United State: 2000 Facts in Figures. US EPA Office of Solid Waste and Emergency Response. June 2002, Pages 150-160.
- (5) Resource Recycling fund Management Committee, Environment Protection Administration, Taiwan, ROC.
- (6) Govt moves to stem tide of ‘e-waste’
- (7) Waste 21: Waste Management Plan 1998 – 2004 Denmark
- (8) Fact Sheet Proposed End-of-Life Information Technology Equipment and Consumer Electronics (e-waste) Recycling Program, Saskatchewan Environment, Environmental Protection Branch, Canada.

1.3 E-Waste Scenario in India:

The Indian information technology industry has a prominent global presence today largely due to the software sector. More recently, policy changes have led to a tremendous influx of leading multinational companies into India to set up manufacturing facilities, R&D centers and software development facilities. The domestic market is getting revitalized due to buoyant economic growth and changing consumption patterns.

This growth has significant economic and social impacts. The increase of electronic products, consumption rates and higher obsolescence rate leads to higher generation of electronic waste (e-waste). The increasing obsolescence rates of electronic products added to the huge import of junk electronics from abroad create complex scenario for solid waste management in India.

At the consumer end disposal of e-waste or used product is a big issue. In India computers and peripherals are recycled / reused much more than they are in developed countries. Till the last decade affordability of computers was limited to only a socio-economically advantaged section of the population. Resale and reuse of computers

continues to be high as does dependency on assembled machines. No reliable figures are available as yet to quantify the e-waste generation. Increasingly as computers are becoming more affordable and there is greater access to technology, the turnover of machines could definitely be higher. Apart from the consumer end, another source of more obsolete computers in the market is from the large software industry where use of cutting edge technology, greater computing speed and efficiency necessarily increase the rate of obsolescence. In the same way as the standard of living is growing high / dealers are providing monthly payment/ installment facilities / banks are providing loans in a comparatively easy way, affordability of televisions, mobile phones and other house hold appliances are enormously increasing. As the consumption pattern increases, e- waste generation also increases. The top ten States and Cities in India generating e- waste are as follows.

E- Waste / WEEE Generation in Top Ten States

S. No.	States	WEEE (Tones)
1.	Maharashtra	20270.59
2.	Tamil Nadu	13486.24
3.	Andhra Pradesh	12780.33
4.	Uttar Pradesh	10381.11
5.	West Bengal	10059.36
6.	Delhi	9729.15
7.	Karnataka	9118.74
8.	Gujarat	8994.33
9.	Madhya Pradesh	7800.62
10.	Punjab	6958.46

Source: E-Waste Management in India- Consumer Voice, April 2009

E- Waste / WEEE Generation in Top Ten Cities

S.No.	City	WEEE (Tones)
1.	Ahmedabad	3287.5
2.	Banglore	4648.4
3.	Chennai	4132.2
4.	Delhi	9730.3
5.	Hyderabad	2833.5
6.	Kolkata	4025.3
7.	Mumbai	11017.1
8.	Nagpur	1768.9
9.	Pune	2584.2
10.	Surat	1836.5

Source: E-Waste Management in India- Consumer Voice, April 2009

From the above it is noted that Andhra Pradesh and Karnataka stands 3rd and 7th respective in the list among the e- waste generators. As regards to the cities, Bangalore is 2nd and Hyderabad is 5th in generation of e- waste. Northern India is not a leading generator, it happens to be the leading processing center of e-waste in the country. There are three formal recyclers in the South of India (at Chennai, Hyderabad and Bangalore) and one in Western India.

According to Manufacturer's Association for Information Technology (MAIT) report, India in 2007 generated 3,80,000 tones of e-waste from discarded Computers, Televisions and Mobile Phones. This is projected to grow to more than 8,00,000 tones by 2012 with a growth rate of 15 %. The estimate includes 50, 000 tones of such e-waste imported from developed countries as charity for reuse, which mostly end up in informal recycling yards either immediately or once the re-used product is discarded. This is a conservative and



restricted estimate. Complex, ambiguous definitions of second-hand electronic equipment has made it difficult for the customs department to trace, identify and stop the illegal inflow of e-waste.

The authorized e-waste recycling facilities in India capture only 3% of total e-waste generated, the rest makes its way to informal recycling yards in major cities like Delhi, Mumbai, Hyderabad and Bangalore. This is because businesses sell their discarded equipment to informal recyclers for quick money without realizing the hazardous

implications it causes to health and environment. E-waste contains over 1,000 different substances, many of which are toxic, and creates serious pollution upon disposal. Due to the extreme rates of obsolescence, e-waste produces much higher volumes of waste in comparison to other consumer goods. The increasingly rapid evolution of technology combined with rapid product obsolescence has effectively rendered everything disposable due to which e-waste is generated at alarming rates.

As regards to the take back policy in India, Apple, Microsoft, Panasonic, PCS, Philips, Sharp, Sony, Sony Ericsson and Toshiba observes take back option at their production plant. Samsung claims to have a take back service but only one collection point for the whole of India, other nine branded companies do not have take back service. Two brands stand out as having the best take back practice in India, HCL and WIPRO. Other brands that do relatively well are Nokia, Acer, Motorola and LGE. The details of availability of take back service , service on ground reality and accessibility of information on take-back service in India is as follows.

Availability of Take Back Service in India	
Available in India	Not Available in India
Acer , Dell* , HCL , Hewlett-Packard (HP)** , Lenovo, LG Electronics*^, Motorola, Nokia, WIPRO, Zenith and Samsung	Apple, Microsoft Panasonic PCS Technology, Philips, Sharp, Sony, Sony Ericsson and Toshiba

* Information regarding take-back in India is only available on global website

^ Take-back service is only available for Mobile Phone

** Take-back service is only available for corporate customers.

Source: *An Assessment of E-waste Take back in India-* , www.designouttoxics.org

Take Back Service on Ground in India		
Properly working	Partially Working	Not Working At All
Acer , HCL, WIPRO	LG Electronics Motorola and Nokia	Dell , Hewlett-Packard (HP), Lenovo and Zenith
Accessibility of Information on Take-Back Service in India		
Easily Accessible	Partially Accessible	Not Accessible
HCL and WIPRO	Acer, Lenovo, Motorola, Nokia	Dell , LG Electronics and Zenith

Source: *An Assessment of E-waste Take back in India-* , www.designouttoxics.org

The following three categories of E-Waste / WEEE account for almost 90% of the generation of waste.

1. Large household appliances, 42%,
2. Information and communications technology equipment, 33.9% and
3. Consumer electronics, 13.7%.

The waste thus produced goes into the hands of informal sector. Over 1 million poor people in India are involved in the manual recycling operations. Most of the people working in this recycling sector are the urban poor with very low literacy levels and hence very little awareness regarding the hazards of e-waste toxins. There are a sizeable number of women and children who are engaged in these activities and they are more vulnerable to the hazards of this waste.

1.4 Objective of Study:

The objective of this study is

- Inventorisation of E-Waste for the three electronic sub sectors namely personal computers including peripherals, mobile phones and television in two cities, one from Andhra Pradesh and one from Karnataka (Hyderabad & Bangalore).
- Source of generation / quantities and its classification according to possible future potential for reuse / recycle.
- Prepare the current status of E-Waste management systems in place as a baseline for future action plans.
- Future projection of E-Waste generation volumes and characteristics.

1.5 Methodology:

The methodology adopted for rapid assessment was primary data collection / research and interviews with the potential e- waste generators (bulk users, repairers and house holds), dealers and assemblers of equipments supported by secondary information. The detail interviews with the end-users like households and businesses, channel members like traders / scrap collectors, dismantlers etc. was on the basis of a structured discussion. The excerpts from the unstructured interviews of the informal sector, traders and

dismantlers helped in gaining understanding about the informal trade chain in place in Hyderabad and Bangalore. **The study was limited to three categories such as computers & printers, mobile phones and televisions for estimations and quantifications of e-waste produced.** The methodology adopted in executing the project is as follows.

Constitution of Committee: A committee was constituted to guide and to see the progress of work. Members were drawn from different organizations whose details are as follows.

1. Lt. Col.G. Chandrasekhar Rao, Joint Director (Infrastructure), Information Technology & Communication Department, A. P. Secretariat, Hyderabad.
2. Mr. B. Jyotirmoy., Wipro Technologies, Hyderabad.
3. Mr. Mohammed Hamed Hussain, Sony Electronics Service Center, Hyderabad.
4. Mr. John Robert, Senior Manager, Earth Sense Recycle Private Ltd., Hyderabad.
5. Addl. Commissioner (Health & Sanitation), Greater Hyderabad Municipal Corporation or Nominee and
6. Dr. Razia Sultana, Director (P), EPTRI, Hyderabad

The committee met two times during the project period (February and August 2009), provided valuable suggestions and felt that there is no need to meet again as draft report was also discussed during second meeting.

Literature Survey: Material available on internet / published books and papers from national and international seminars, print media etc. have been collected.

Exploratory survey: A reconnaissance survey to identify where e-waste is generated, handled sub sector wise namely Personal Computer (PC), Mobile Phone (MP), and Televisions (TVs) has been taken up. Questionnaires on e-waste generation, collection, handled, recycled and disposed off were designed and data collected. Conducted meetings / telephonic discussions / structured and unstructured interviews and collected random samples from assemblers, dealers / retailers, consumer / end users, service providers, recyclers etc. to get an information on generation, collection, recycling and management of e- waste.

Field study: A total of five samples have been analyzed for each sector (computer, television and mobile phone) to get an information on the status of e-waste generation, collection, treatment, recycle, movement and management. Major components in each sub sector has been identified and established its life, weight and major contents. Cross checking has been done by paying visits to municipal dumping places. Mapping has been done for these samples.

Analysis of data: The data thus collected from exploratory survey and field study has been estimated and analyzed.

Projection, conclusion and Recommendation: By using the data available / on the basis of findings, e-waste generation annually has been estimated taking into account waste generated from computer and printer, television and mobile phone. This projection is based on the exploratory study of consumers and repairers of electronic items (computer and printer, television and mobile phone), extrapolated to actual units exist. Under consumers, IT sectors, government organizations, house holds and other users (other users are schools, internet café and banks etc.) have been considered. For house hold consumption it has been extrapolated to population projection, 18% penetration rate and the size of the family as 5 persons per house hold. Population growth has been assumed as 32% and 18% based on the 1991 & 2001 census for Hyderabad and Bangalore respectively.

Future projection of waste generation for five years from 2009 to 2013 has been estimated based on findings from house hold data. After calculating the population growth year wise, penetration of assets , computer 18%, television 15%, and mobile phone 18% and the disposal rate year wise as 2 % on computer , 5 % on television, and 2% on mobile phones has been considered. (The guideline on the above assumptions have been taken from Study on Status of E-Waste in Karnataka and City of Bangalore by EMPRI and Study on E-Waste in Kolkata by Toxic Link, New Delhi with a little modification). Conclusion and recommendation has been presented.

1.6 Format of the Report:

The report has seven chapters. Chapter one is an introduction to e- waste, definition, its scenario in India, objective of the study, methodology and format of report and limitation

of the study. Literature survey has been mentioned in chapter two and regulatory framework covering international and national legislations is in chapter three. The fourth and fifth chapter deals with Hyderabad and Bangalore's analysis of exploratory survey and field study respectively. Projection has been done in chapter six and chapter seven represents conclusion and recommendation.

1.7 Limitations:

The concept of e-waste is still at a nascent stage specially in Hyderabad, Bangalore and in India as well. Hence, the study has the following limitations.

There is lack of awareness and absence of any policy in most organizations regarding e-waste. Hence, many organizations had no records and no response to questions regarding their end of life disposal procedures.

There is a lack of accurate data pertaining to e-waste, thus the assessment figures are approximate estimates based on limited information.

E-waste recycling, lately, has received a lot of media attention due to the hazardous nature of the activities. This has made the people in the informal recycling sector very cautious, which made it quite difficult to acquire detailed information about the areas of e-waste recycling and the recycling processes. In few places, there was no permission to enter into premises. In the places where permission was accorded, in few of such places they did not allow to take photographs.

E-waste comprises of many items but the study was **limited to three categories such as computers & printers, mobile phones and televisions** for estimations and quantifications of e-waste produced.

Data on the number of units existing in each sector has been collected from many sources, which are not available at one place and may have an error factor of 10 %. Sampled data will not give a correct picture but gives an indication of the E-waste generated.

2. Literature Survey

An extensive literature search has been done through internet, print media and publications. Information was also gathered by attending seminars. The detailed literature survey is at **Annex I**.

2.1 Components / Parts of Computer:

The various components / parts of computers are as follows.

Mother Board, SMPS (Switch Mode Power Supply), RAM (Random Access Memory), Hard Disk, Processors, Capacitors, IC's (Integrated Circuits), Main Board, Magnetic Touching Sheet, CD Drive, Floppy Drive and Diodes etc..

2.2 Components / Parts of Television:

The various components / parts of televisions are as follows.

Capacitors, Resistors, Transformers, STR(Supply Transformer Regulator), Integrated Circuits (IC's), LOT(Line output Transformer), Tuners, Condensers, CPT Socket (Colour Picture Tube), Zenor Diode and Normal Diode etc.

2.3 Components / Parts of Mobile Phone:

The various components / parts of mobile phones are as follows.

Lens, internal antenna, aerial, speakers, earpiece, microphone, microphone connectors, loud speakers, buzzers, ringers, charging blocks, system connectors, chassis, slide mechanism, ribbon cables, sim slot covers, readers, backup, battery, battery clip, covers, battery contacts, connectors and kea pad membrane etc.

2.4 E-Waste Composition:

The various parts / materials / composition of e-waste may be divided broadly into six categories such as

- Iron and steel, used for casings and frames
- Non-ferrous metals, especially copper used in cables, and aluminum

- Glass used for screens, windows
- Plastic used as casing, in cables and for circuit boards
- Electronic components
- Others (rubber, wood, ceramic etc.).

2.5 Hazardous Substances in E- Waste -Environmental and Health Effects:

E-waste is much more hazardous than many other municipal wastes because electronic gadgets contain thousands of components made of deadly chemicals and metals like lead, cadmium, chromium, mercury, polyvinyl chlorides (PVC), brominated flame retardants, beryllium, antimony and phthalates. Long-term exposure to these substances damages the nervous systems, kidney, bones, reproductive and endocrine systems. Some of them are carcinogenic and neurotoxic. A study conducted by Greenpeace in 2005 in electronic recycling yards in Delhi clearly indicates the presence of high levels of hazardous chemicals including dioxins and furans in the areas where this primitive / unauthorized recycling takes place. Disposal of e-wastes is a critical problem faced and poses a threat to both health and vital components of the ecosystem. There are number of channels through which e-waste goes to the environment. E-waste that is land filled produces contaminated leachates, which eventually pollute the groundwater. Acids and sludge obtained from melting computer chips, if disposed on the ground causes acidification of soil, leading to contamination of water resources. Incineration of e-wastes can emit toxic fumes and gases, thereby polluting the surrounding air.

Improper recycling and recovery methods can have major impacts on the environment. Crude forms of dismantling can often lead to toxic emissions, which pollute the air and there by also expose the workers to the harmful materials. The most dangerous form of recycling and recovery from e-waste is the open air burning of circuit boards (made of plastic) in order to recover copper and other metals. Extraction of metals through acid bath method or through mercury amalgamation also contributes to environmental degradation.

The toxic materials present in the equipments can be environmental as well as health

hazard. Mercury will leach when certain electronic devices, such as circuit breakers are destroyed. Not only does the leaching of mercury poses problems, the vaporization of metallic mercury and dimethylene mercury is also of concern. The same is true for polychlorinated biphenyls (PCBs) from condensers. When brominated flame retardant plastic or cadmium containing plastics are land filled, both polybrominated diphenyl ethers (PBDE) and cadmium may leach into the soil and groundwater. It has been found that significant amounts of lead are dissolved from broken lead containing glass, such as the cone glass of cathode ray tubes, gets mixed with acid waters and are a common occurrence in landfills.

The rapid growth and faster change in modules of computers, cell phones and consumer electronics becomes major issue that enhances the amount of e-waste generation. Hazardous substances their occurrences and impact on environment and human health is as follows.

Hazardous Substances, their Occurrence and Impacts on Environment and Human Health		
Substance	Occurrence in e-waste	Environmental and Health relevance
PCB (polychlorinated biphenyls)	Condensers, transformers	Cause cancer, effects on the immune system, reproductive system, nervous system, endocrine system and other health effects. Persistent and bioaccumulataion
TBBA (tetrabromo-bisphenol-A) • PBB (polybrominated biphenyls) • PBDE (polybrominated diphenyl ethers)	fire retardants for plastics (thermoplastic components, cable insulation) TBBA is presently the most widely used flame retardant in printed wiring boards and covers for components	can cause long-term period injuries to health acutely poisonous when burned
Chlorofluorocarbon (CFC)	Cooling unit, insulation foam	Combustion of halogenated substances may cause toxic emissions.
PVC (polyvinyl chloride)	cable insulation	High temperature processing of cables may release chlorine, which is converted to dioxins and furans.
Arsenic	small quantities in the form of gallium arsenide within light emitting diodes	acutely poisonous and on a long-term perspective injurious to health
Barium	Getters in CRT	may develop explosive gases (hydrogen) if wetted

Beryllium	power supply boxes which contain silicon controlled rectifiers, beamline components	Harmful if inhaled
Cadmium	rechargeable NiCd-batteries, fluorescent layer (CRTscreens), printer inks and toners .	acutely poisonous and injurious to health on a long-term perspective
Chromium VI	data tapes, floppy-disks	acutely poisonous and injurious to health on a long-term perspective causes allergic reactions
Gallium arsenide	light-emitting diode (LED)	injurious to health
Lead	CRT screens, batteries, printed wiring boards	causes damage to the nervous system, circulatory system, kidneys causes learning disabilities in children
Lithium	Li-batteries	may develop explosive gases (hydrogen) if wetted
Mercury	is found in the fluorescent lamps that provide backlighting in LCDs, in some alkaline batteries and mercury wetted switches	acutely poisonous and injurious to health on a long-term perspective
Nickel	rechargeable NiCd-batteries or NiMHbatteries, electron gun in CRT	may cause allergic reactions
Rare earth elements (Yttrium, Europium)	fluorescent layer (CRT-screen)	Irritates skin and eyes
Zinc sulphide	is used on the interior of a CRT screen, mixed with rare earth metals	toxic when inhaled
Toxic organic substances	condensers, liquid crystal display	
Toner Dust	toner cartridges for laser printers / copiers	Health risk when dust is inhaled risk of explosion

(Source: Report on Assessment of Electronic Wastes in Mumbai-Pune Area- MPCB, March 2007)

2.6 Initiatives in E Waste Management:

The Secretariat of the Basal Convention (SBC) has taken a number of initiatives in e-waste management. A pilot project on e-waste management in the Asia and the Pacific Region has been supported by SBC in which India is participating. SBC has also facilitated a Mobile Phone Partnership Program (MP3) with public private partnership. The MP3 has evolved guidelines for environmentally sound management and transboundary movement of mobile phones.

GTZ and MAIT carried out two studies on E- Waste Generation, Disposal and Recycling of Electronic Waste in Delhi and also in other parts of India.

The Department of Information Technology has implemented a project on “Environmental Management in Semiconductor and Printed Circuit Board Industry in India” in association with United Nations Environment Program (UNEP). The electronic production processes were evaluated to explore environmental implications, promote cleaner production technologies and reduction of hazardous substances in the electronic products.

The Central Pollution Control Board (CPCB) with the help of IRG-Systems South Asia Private Limited (IRGSSA) prepared a status report on “ Management, Handling and Practices of E Waste Recycling in Delhi” during 2004- 2005. Based on these studies it was realized that guidelines for Environmentally Sound Management (ESM) of E-Waste is very much essential. As a first step towards ESM, guidelines have been published.

The Hazardous Waste (Management and Handling) Rules, 1989 and amended in 2000 and 2003. These rules have been notified under Environment (Protection) Act, 1986 which talk about e-waste also.

The Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008 has been notified under Environment (Protection) Act, 1986. This rule also deals with e-waste.

3. Regulatory Framework

Currently Indian legislation does not have a separate and specific act or rule to tackle down e-waste in India. But there exist environmental acts like the Water Act, Air Act and the Environmental Protection Act which regulate the environmental impact related to any waste management and should be considered when setting up a proper disposal system for any waste. There is mention of e-waste management in Hazardous Waste (Management, Handling and Transboundary Movement) Rule 2008, under EP Act, 1986.

3.1 E-Waste - International Legislation:

Basal convention is the United Nations Environment Program (UNEP) Convention on the control of transboundary movement of hazardous waste and their disposal. There are 32 countries (or regions) that have ratified the Basel Convention among 46 countries (or regions) in Asia-Pacific Region as of July 2008. The Basel Convention defines waste by disposal destination or recovery processes. These various processes are listed in Annex IV of the Convention. For example, virtually any material that will be recycled or processed in order to reclaim a metal, or to reclaim an organic or inorganic substance for further use, is deemed a waste.

The convention has provided two lists. List A found in Annex VII is presumed to be hazardous and thus covered by the Basel convention; and list B, found in Annex IX, is presumed to be non-hazardous and thus not subject to Basel convention. The waste listed in list A is waste that poses serious threats to environment and human health. As a result of their adverse effects these substances require special handling and disposal processes.

The Basel Annex-VII hazardous waste, lists the following applicable entries to e-waste:

A1010 Metal wastes and waste consisting of alloys of any of the following: antimony, arsenic, beryllium, cadmium, mercury, selenium, tellurium, thalium. .

A1020 Waste having as constituents or contaminants, excluding metal waste in massive form, any of the following: antimony compounds, beryllium, beryllium compounds, cadmium, cadmium compound, lead, lead compounds, selenium, selenium compounds, tellurium, tellurium compound. .

A1030 Wastes having as constituents or contaminants any of the following: arsenic, Arsenic compounds, mercury, mercury compound, thallium, thallium compounds.

A1160 Waste lead-acid batteries, whole or crushed.

A1170 Unsorted waste batteries excluding mixtures of only list B batteries. Waste batteries not specified on list B containing Annex I constituents to an extent to render them hazardous. [Note: List B batteries include: waste batteries conforming to a specification, excluding those made with lead, cadmium or mercury].

A1180 Waste electrical and electronic assemblies or scraps containing components such as accumulators and other batteries included in list A, mercury- switches, glass from cathode ray tubes and other activated glass and PCB- capacitors, or contaminated with Annex 1 constituents (e.g. cadmium, mercury, lead, polychlorinated biphenyl) to an extent that they exhibit hazard characteristics contain in Annex III.

A2010 Glass waste from cathode ray tubes and other activated glass destined for direct reuse and not for recycling or final disposal.

It is also important to note that the Basel convention's list B includes:

B1110 Electrical and electronic assemblies (including printed circuit board, electronic components and wires) destined for direct reuse and not for recycling or final disposal.

From the above we can conclude that at the very least, circuit board, CRTs, and other electronic boards or components and assemblies containing lead based solders and copper beryllium alloys (which include computer circuit boards and much other electronic equipment), are indeed hazardous wastes according to Basel convention. Likewise, whole, used, discarded computers, printers, and monitors that contain such circuit boards or CRTs that are not to be reused directly are to be considered as hazardous waste and subject to the Basel convention.

3.1.1 The Council of the European Union:

The Council of the European Union promulgated Directive 2006/12/EC of 5 April 2006 on waste. In its Article 1, 'waste' shall mean any substance or object in the categories set

out in Annex I which the holder discards or intends or is required to discard. The European Union promulgated Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment. In which, 'waste electrical and electronic equipment' or 'WEEE' means electrical or electronic equipment which is waste within the meaning of Article 1(a) of Directive 75/442/EEC, including all components, subassemblies and consumables which are part of the product at the time of discarding.

Regulation (EC) No 1013/2006 of 14 June 2006 on shipments of waste was also promulgated subsequently, which establishes procedures and control regimes for the shipment of waste, depending on the origin, destination and route of the shipment, the type of waste shipped and the type of treatment to be applied to the waste at its destination. The regulation (1013/2006/EC) was amended and regulation 1418/2007/EC), which provides control measures for the export of green list waste and came into force on 29 November 2007. Amendment was also made in July 2008 by the regulation EC 740/2008. Under its annex ('GREEN' LISTED WASTE), some wastes were listed which should be subject to the general information requirements laid down in its article 18, including electrical assemblies consisting only of metals or alloys, electronic scrap (e.g. printed circuit boards, electronic components, wire, etc.) and reclaimed electronic components suitable for base and precious metal recovery.

3.1.2 Australia:

Australia published the fourth edition of its "Information Paper No 2 Distinguishing Wastes from Non-Wastes under Australia's Hazardous Waste Act" in 2001 to provide guidance to industry and organizations intending to export, import or transit hazardous or other wastes, in which, Organization for Economic Co-operation and Development (OECD) definition and criteria on distinguishing waste and non-waste was introduced and several typical examples were brought forward for reference. Under 'the Hazardous Waste (Regulation of Exports and Imports) Act 1989', Wastes are substances or objects that are to be disposed of by recycling or final disposal; hazardous wastes are wastes listed in the Basel Convention and other international agreements. Used electronic

equipment proposed to be exported or imported may be considered a hazardous waste. The Act regulates the export and import of hazardous wastes, including: waste electrical and electronic assemblies or scrap containing components such as accumulators and other batteries, mercury switches, glass from cathode ray tubes and other activated glass and polychlorinated biphenyl capacitors, or contaminated with constituents such as cadmium, mercury, lead, or polychlorinated biphenyl to an extent that they possess any hazardous characteristics.

3.1.3 Germany:

Electrical and Electronic Equipment Act – ElektroG implements Directive 2002 / 96 / EC on waste electrical and electronic equipment (WEEE) and Directive 2002 / 95 / EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS). The objectives and contents of the Act governs the sale, return and environmentally sound disposal of electrical and electronic equipment. The obligation to take on responsibility for treatment, recovery or disposal of WEEE, aims to compel producers to incorporate the entire life cycle of their products into their calculations.

3.1.4 Canada:

In Canada, international obligations under the Basel Convention are met through its Import and Export of Hazardous Waste and Hazardous Recyclable Material Regulations (EIHWHMR) pursuant to the Canadian Environmental Protection Act 1999 (CEPA 1999). An onus is placed on Canadian exporters and Canadian importers to ensure compliance with this regulation. Definitions for hazardous waste and hazardous recyclable material are identified in Section 1 and Section 2 of the EIHWHMR respectively. In general, hazardous waste and hazardous recyclable material includes waste or material that:

- (a) Is destined for disposal operations or recycling operations;
- (b) Produces leachant exceeding prescribed limits for various substances (determined in accordance with US EPA SW-846, Test Method 1311, Toxicity Characteristic Leaching Procedure);
- (c) Meets hazard classes as prescribed under the Canadian federal Transportation of

- Dangerous Goods Regulations (e.g. flammable, corrosive);
- (d) Meets additional criteria for hazardous waste or hazardous recyclable materials as prescribed in various Schedules of the EIHWHRM; or
 - (e) According to information Canada has received from the USA or in accordance with the Basel Convention, is defined to be hazardous under the laws of the receiving country and is prohibited for entry by that country.

In addition, exclusions under the EIHWHRM exist for the following types of hazardous waste and hazardous recyclable material:

- (a) anything that is exported, imported or conveyed in transit in a quantity of less than 5 kg or 5 L per shipment or, in the case of mercury, in a quantity of less than 50 mL per shipment, other than anything that is included in Class 6.2 of the Transportation of Dangerous Goods Regulations is destined for disposal operations or recycling operations;
- (b) Anything that is collected from households in the course of regular municipal waste collection services.
- (c) Anything that is part of the exporter's or importer's personal effects or household effects not resulting from commercial use.

Additional exclusions under the EIHWHRM also exist for hazardous recyclable material that is exported to, imported from, or conveyed in transit through a country that is a party to OECD Decision C(2001)107/Final.

In general, used and waste electrical and electronic equipment are not subject to control under Canada's EIHWHRM, unless the following conditions are met:

- (a) It is physically broken, shredded or reduced in size, and thereby may produce a toxic leachant subject to the regulations;
- (b) It contains used batteries or broken leaded glass;
- (c) It contains excessive amounts of other controlled substances (e.g. PCB, mercury).

3.1.5 China:

China has banned the import of WEEE since 2002. On July 3, 2002, the Ministry of Foreign Trade and Economic Cooperation, Customs General Administration and State Environment Protection Administration (SEPA) jointly issued Notice No. 25 which lists

types of goods prohibited for import. The list contains 21 kinds of e-wastes banned for import, including large house appliances, information and communication technologies and consumer electronics. In 2008, the Notice No. 25 was replaced by the Catalogue of Solid Waste Forbidden to Import in China (Announcement No. 11, 2008), which prohibits the import of waste mechanical and electronic apparatus (including their parts and components, scraps, unless exempted by other laws). All Used Electronic and Electrical Equipments (UEEE) with the exception of used television is allowed for import to China. But, all imported UEEE must undergo inspection after arriving at the port of China and require 3C certification (to certify that the equipment is comparable to brand new EEE) from General Administration of Quality Supervision, Inspection and Quarantine. The General Administration of Customs of China and General Administration of Quality Supervision, Inspection and Quarantine is identified as the Competent Authority for UEEE in China.

3.1.6 Japan:

There is no specific definition of WEEE/ E-waste as defined in the regulatory system. E-waste is covered under laws to promote recycling within Japan. The two major laws covering broad range of E-waste items are “The Law for Recycling of Specified Kinds of Home Appliances (Home Appliances Recycling Law)” enacted in 1998 and “The Law for Promotion of the Effective Utilization of Resources” enacted in 2000. In “The Law for Recycling of Specified Kinds of Home Appliances (Home Appliances Recycling Law)”, E-waste is referred as “Used Consumer Electric Goods Discarded by Consumers”. This law covers television, refrigerators, washing machines and air conditioners. “The Law for Promotion of the Effective Utilization of Resources”, E-waste is covered under “Used goods and by-products” which have been generated and their large part is discarded. This law covers personal computers (home and office) and other electronic items. According to this law “Used goods” means any articles that are collected, used or unused, or is disposed off (except radioactive materials or those contaminated thereby). “By-product” means any articles obtained secondarily in the process of manufacturing, processing, repair or sale of the product; in the process of supply of energy; or in the process of construction pertaining to architecture and civil

engineering (hereinafter referred to as “construction work”) except radioactive materials or those contaminated thereby.

3.1.7 Malaysia:

Malaysia has formulated and enforced the Environmental Quality Act, 1974 (EQA 1974). Under this Act, several regulations for the control of scheduled wastes (hazardous wastes) management in Malaysia were enacted. The guidelines for the classification of WEEE entered into force in January 2008, which prohibits the import of WEEE and export for the purpose of disposal. Waste generators are allowed to export waste for recycling, recovery or treatment provided prior written consent are obtained from the importing state.

3.1.8 New Zealand:

There is no legislation, which defines WEEE/ E-waste in New Zealand. However, Imports and Exports (Restrictions) Order (No 2) 2004 defines WEEE / E-waste. It states that “Electronic Waste” covers electronic items, which are to be disposed of by recycling or final disposal. Such equipment includes computer equipment including monitors and printers, mobile and land line telephones, fax machines, photocopying equipment, television sets, video recorders, printed circuit boards and equipment containing cadmium, mercury or lead batteries.

The electronic equipment is also considered to be “Waste” if it has any of the following:

- (a) A defect that materially affects its functionality. e.g. it does not power up; or
- (b) Physical damage that impairs its functionality or safety e.g. the screen is broken or cracked; or
- (c) A faulty hard disk drive, or RAM or video card; or
- (d) Batteries containing lead, mercury or cadmium or liquid cathodes that are unable to be charged or to hold power; or
- (e) Insufficient packaging to protect it from damage during transport.

3.1.9 Republic of Korea:

Act for Resource Recycling of Electrical and Electronic Equipment and Vehicles adopted on 2 April 2007, Article 2 of this Act defines “Waste Electrical and Electronic Equipment” as electrical and electronic equipment, which is classified as “waste” in accordance with Article 2, Section 1 of the Waste Management Act. “Electric and Electronic Equipment” means equipment or device (including components and parts thereto) operated by electric currents and electromagnetic fields.

3.1.10 Thailand:

Both Used Electronic and Electrical Equipment (UEEE) and Waste Electronic and Electrical Equipment (WEEE) are controlled under Hazardous Substance Act B.E. 2535 in Thailand. UEEE can be imported only under a subordinate law for import control of UEEE. Import of UEEE in Thailand is allowed only for activities of reuse, repair / refurbish as its original purposes, disassembly and recycle / recovery with different conditions from Parties. 32 items of UEEE require import permits from Ministry of Industry. WEEE can be imported and exported under a subordinate law and Basel procedures.

3.1.11 USA:

According to USEPA, electronic products that are “near” or at the “end of their useful life” are referred to as “e-waste” or “e-scrap.” Recyclers prefer the term “e-scrap” since “waste” refers only to what is left after the product has been reused, recovered or recycled. However, “E waste” is the most commonly used term.

3.1.12 Cyprus:

Administrative Act No 668 of 2004, published in Official Gazette No 3888, Annex III (I), on 30/07/2004.

3.1.13 Czech Republic:

Act No. 7/2005 Coll., amending Act 185/2001 Coll. (the general waste management law of the Czech Republic) published on 06/01/2005. Decree 352/2005 published on 15/09/2005.

3.1.14 Denmark:

Statutory order No. 591 of 9 June 2006 and Statutory order no. 873 of 11th August 2006.

3.1.15 Finland:

Act 452/2004 amending the Waste Act (1072/1993) adopted on 04/06/2004 and Government Decree on Electrical and Electronic Waste 852/2004 adopted on 09/09/2004.

3.1.16 Sweden:

Swedish Code of Statutes 2005:209, "Ordinance on producer responsibility for electrical and electronic products" Published: 26 April 2005

3.1.17 Singapore:

In Singapore, export, import or transit waste requires a permit from the Pollution Control Department (PCD) of Singapore. According to the provisions of the 'Hazardous Waste (Control of Export, Import, and Transit) Act', import and export of waste should follow the following procedures. A person who has one or more import/export proposals in relation to hazardous or other waste may apply to the Director for a permit authorizing the import/export of the waste. The application shall be in the form approved by the Director and set out, or be accompanied by; such information related the proposals as is required by the form. The application may deal with 2 or more import/export proposals in relation to hazardous or other waste only if the following matters are common to each proposal:

- (i) Physical and chemical characteristics of the waste.
- (ii) The route over which the waste is to be transported. and
- (iii) The sender/receipt of the waste. Import/export of UEEE are allowed if there are documents to support appliances are in working condition and suitable for reuse. Export

of UEEE that are not suitable for re-use are prohibited. Import of UEEE for the purpose of dismantling and re-export of the dismantled components are prohibited.

3.1.18 Vietnam:

In January 2006, Vietnam promulgated the Implementation Rules for the Law on Trade (No.12/2006/ND CP) and ban on import of waste materials, toxic chemical substances and second-hand commodities, including electronic, cooling and home appliances. In Circular No. 12/2006/TT-BTNMT, export of hazardous waste shall follow Basel Convention procedure. In 2006, the Vietnamese Ministry of Post and Telecommunications issued a decree, banning the import of seven categories of second hand electronic and communications products, including computers, CD duplicators and copiers, data processors, calculators, ticket issuing equipments, automatic data processing devices and other intelligence devices, transmitting devices for wireless telephones, telegrams and audiovisuals, cameras and voice recorders. The decree also prohibits the import of spare and component parts for the aforesaid products.

3.1.19 Indonesia:

WEEE is only allowed for export but prohibited for import in Indonesia. To address UEEE, the Minister of Industry and Trade of Indonesia issued the ‘Decree No. 756/MPP/Kep/12/2003 on Import of Non-new Capital Goods’ and ‘Decree No. 610/MPP/Kep/10/2004 Regarding Amendment of No. 756/MPP/Kep/12/2003’. The non-new capital goods listed in its annex are prohibited for import in Indonesia, including refrigerators, washing machines, Television, phones, air conditioners, printed circuit, valve and thermion tube, cold cathode or photo cathode tube, etc. Import of used EEE and e-waste for direct (individual) consumption by consumer is prohibited.

3.1.20 Hong Kong Special Administrative Region (HKSAR):

HKSAR has begun its waste import and export control through the ‘Waste Disposal Ordinance (WDO)’ since 1996. Import and export of hazardous waste, including waste electrical and electronic appliances containing hazardous constituents or components, are

controlled through a permit system. For genuine secondhand electrical and electronic appliances which are imported / transshipped for direct re-use are not subject to the permit control. In light of the global concern of illegal transboundary movements of electronic waste, the Environment Protection Department (EPD) of Hong Kong has been exercising stringent import/export control on such waste in recent years. Suspected waste cargoes coming to or leaving Hong Kong will be fully inspected and offenders of the WDO will be prosecuted. Importers and exporters of used electrical or electronic appliances with hazardous components or constituents are advised to confirm whether their shipments will require a waste import / export permit from the EPD before shipment. However, importers and exporters are strongly advised to take the following measures before importing or exporting into / from Hong Kong any such appliances to facilitate the import/export compliance checking:

(i) Select only those used appliances of reasonably new models and ages with genuine demand in the second-hand market of the importing countries. In any case, it is advisable to avoid any unit with over 5 years from the date of manufacturing.

(ii) Arrange examination, repairing, retrofitting and testing of the used computer monitors and televisions to ensure that these used appliances are in good conditions meeting both the technical specifications and safety standard of the destined countries and suitable for reuse as such direct by consumers before they are exported. In any case, no damaged or non-working items should be allowed in the shipment.

(iii) Properly record the examination, repairing and testing results of each of the used appliances, which should include their brand names, models and serial numbers, years of manufacturing, problems/damages found and fixed, dates and results of compliance testing conducted. Testing should be done not more than 2 years before shipment to the importing country. All the above information should be made available to the concerned control authority for inspection and checking upon request.

(iv) Provide proper and sufficient individual protective packaging to each of the used appliances to protect the whole unit from damage during transportation and the associated loading and unloading operations. There should not be any direct physical contact between each unit and the packaging should be able to withstand the weight of the units placed on it. There should be legible labels or signs (e.g. with unique serial numbers) on

the packaging to identify each item. The photos of the packaging should be provided, if considered necessary, to the relevant control authority for advice; and

(v) Make prior contractual arrangement with concerned parties in the importing countries to secure proper second-hand outlet. Confirm with the control authorities of the importing countries on whether import of used appliances is allowable and whether the consignee or buyer is permitted to import them for sale as second-hand commodities.

3.1.21 The Philippines :

In the Philippines, Department of Environment and Natural Resources (DENR) Administrative Order (DAO) 94-28 “Interim Guidelines for the Importation of Recyclable Materials Containing Hazardous Substances” allows the import of electronic assemblies and scrap with the condition that residuals from recycling of materials which contain hazardous substances without any acceptable method of disposal in the Philippines must be shipped back.

3.1.22 Cambodia:

Cambodia currently does not manufacture EEE products. The import of both new EEE and UEEE is allowed for import to Cambodia for domestic consumption. Under the provisions of ‘Sub-Decree on Solid Waste Management’, the export of the household waste and hazardous waste from the Kingdom of Cambodia to abroad could not be conducted unless there are approval from the Ministry of Environment, and export license from the Ministry of Trade, and permit from the import country; the importation of the household waste and hazardous waste from abroad to the Kingdom of Cambodia shall be strictly prohibited.

3.2 E-Waste - National Legislation:

India is a signatory to Basel Convention on the control of trans-boundary movement of Hazardous Wastes and Disposal. There is no specific act or rule on e-waste management. However e-waste is governed by the following rules under E(P)Act.

- i. Hazardous Waste (Management and Handling)Rule 1989 and Amendment
- ii. Batteries (Management and Handling) Rules, 2001

iii. Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008

3.2.1 Hazardous Waste (Management and Handling) Rule 1989 and Amendment:

The Hazardous Wastes (Management and Handling) Rules, 1989 were introduced under Sections 6, 8, and 25 of the Environment (Protection) Act of 1986. The Rules provide for the control of generation, collection, treatment, transport, import, storage and disposal of wastes listed in the schedule annexed to these rules. The rules are implemented through the State Pollution Control Boards and Pollution Control Committees in the states and union territories. There were a few inherent limitations to the implementation of the Rules and amendments to this Rules were introduced in 2000, 2002 and 2003, widening the definition of hazardous waste and harmonizing the hazardous waste list with that of the Basel Convention.

The Hazardous Waste (Management and Handling) Rules and its amendment in 2003, includes e-waste in schedule 1, schedule 2 as constituents and contaminants and List A and B of schedule 3.

Schedule 1, which is the list of hazardous waste, includes electronic industry at S.No. 31, along with identified wastes. The activities of electronic industry come under the purview of this rule and these industries are required to obtain authorization from the State Pollution Control Boards. Schedule 2 contains list of hazardous substances that can occur as constituents or contaminants that are applicable if these exceed the prescribed threshold. Schedule 3 which contains the list of hazardous wastes to be regulated by the Ministry for the purpose of imports and exports also includes e-waste both under list A (A1180) and list B (B1110). The import of this waste requires permission of the Ministry of Environment and Forests. Electrical and electronic assemblies are covered under category B-1110 of Schedule 3 of the Hazardous Waste (Management & Handling) Rules 2003.

3.2.2 Batteries (Management and Handling) Rules, 2001:

Apply to every manufacturer, importer, re-conditioner, assembler, dealer, recycler,

auctioneer, consumer and bulk consumer involved in manufacture, processing, sale, purchase and use of batteries or components thereof. These rules confer responsibilities on the manufacturer, importer, assembler and re-conditioner. They govern the registration of importers, the customs clearance of imports of new lead acid batteries, procedures for registration / renewal of registration of recyclers and also the responsibilities of consumer or bulk consumer and responsibilities of auctioneers.

3.2.3 Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008:

The objective of this rule is to put in place an effective mechanism to regulate the generation, collection, storage, transport, import, export, recycling, treatment and disposal of hazardous materials and hazardous waste destined for disposal. This rule has come into force in exercise of the powers conferred by section 6,8 and 25 of the Environment (Protection) Act, 1986 and in supersession of the Hazardous Waste (Management and Handling) Rules, 1989. Electrical and Electronic assemblies have been categorized under B1110.

4. Exploratory Survey and Analysis

To assess the amount of e-waste generated, restricting to computer, printer, television and mobile phones in Hyderabad and Bangalore different categories of generators were contacted to find out their disposal rates and patterns. Five categories were identified for the study and data collection, they are

- a) Assemblers.
- b) Dealers.
- c) Consumers / Users of Electronic Items in Bulk (IT Sectors, Government offices. Colleges, University, MNCS).
- d) Repairers / Service Organizations and
- e) House Holds.

One to one interaction was conducted in most of the cases and interviews were based on general questions. Data on computer and its peripherals, television and mobile phones usage, their repairs and mode of disposal of e-waste has been gathered from different categories of users. The knowledge on the health hazards due to improper handling of e-waste from computer, mobile phone and television was also investigated.

Exploratory surveys and unstructured interviews were conducted mainly to identify which item, how many items are in use and how much e-waste is generated from each category. Areas where e-waste is handled / recycled was also explored. Informal discussions were carried out followed by investigating the areas of such activities. The recycling areas / units were surveyed to assess the conditions of recycling both from an environmental as well as occupational health perspective.

4.1 E-Waste Generation in Hyderabad:

To collect information on generation of e-waste due to computers, printers, mobile phones and televisions, a total of 357 units were approached out of which 246 responded and 111 have not responded. The details of exploratory survey conducted in Hyderabad for three sub sectors computers and printers, mobile phones and television from assemblers, dealers, consumers / users of electronic items in bulk , repairers / service

organizations and house holds are depicted at **Tables I to XV**. There is no e- waste generation from assemblers and dealers of computers, printers, television and mobile phone. The total e-waste generated due to computers, printers, television and mobile phones usage by 246 surveyed samples is 36,027.9 Kg/year. The break up is e-waste due to computers and printers generated by 88 sampled survey is 28,758.5 Kg/year and 1,655.8 Kg/year respectively. E-waste due to television and mobile phones are 5,377.2 Kg/year and 236.4 Kg/year from 92 and 66 sampled survey respectively. The details of e-waste generation from different categories of generators is as follows.

4.1.1 Assembling of Computers:

A total of 36,816 computers are assembled by twenty surveyed companies. They informed and also observed during field visit that no e-waste is generated while assembling the computers. It is interesting to note that most of the assemblers are dealers of various companies. **Table I** represents the total number of computers assembled by twenty surveyed companies.

4.1.2 Dealers of Computers and Printers:



Computer Dealers in Hyderabad

The dealers are responsible for the sale of computers and printers. 29 dealers were approached and 19 have responded. To obtain information on sales of branded (Samsung, HCL, Lenova, Sony, IBM) and un branded companies and on e-waste generation, approached various dealers. It was observed that no e-waste is generated during this activity (dealing / sales). On an average per year 7,788 computers and 1,908 printers are sold. The detailed sales of computers and printers per year dealer wise and company wise is presented at **Table II**.

4.1.3 E-Waste Generation Due to Users / Consumers of Computers and Printers in Bulk Quantity:

Out of Twenty six organizations surveyed a total of fifteen have responded. These fifteen organizations are using 14,293 computers and 1,475 printers. They are discarding 750 computers and 205 printers yearly. Total e-waste generated from these two items is

23,225 Kg (22,200 Kg of computer waste and 1,025 Kg of printers waste). **Table III** represents the waste generation from computers and printers usage in bulk quantities by multi national companies, banks, universities, colleges, schools, government and private organizations in Hyderabad. (Assuming an average weight of personal computer is 29.6 Kg. and of printer is 5 Kg as per E-Waste Volume I, Inventory Assessment Manual UNEP & Report on Study on E Waste in Kolkata)

Exploratory Survey of Hyderabad		
Table I : Assembling of Computers Per Year		
S.No.	Assemblers	Computers Assembled
1	Kopal Computers	1296
2	Jeevraj Computers	1524
3	P.L. Computers	1800
4	Vinayak Computers	1680
5	Vandana Computers	984
6	R.S. Computers	1320
7	Shweta Computers & Peripherals	2976
8	Sri Babosa Computers	1908
9	Sri Sai Shanmukha Agencies	1392
10	Sri Techno System	2712
11	Systron System	2160
12	Arun Computers	1620
13	Obel Computers Pvt. Ltd.	1536
14	Computer Centre	1140
15	LAX Info Solutions	2184
16	Global India	3300
17	Computer Bazar	2820
18	Devi Computers	2100
19	Compare Data Products	1164
20	Keerthi Communication	1200
	Total	36,816

Exploratory Survey of Hyderabad

Table II : Dealers of Computers and Printers – Sale Figures Per Year

S.No	Dealers	Sale of Computers Company Wise							Sale of Printers
		Sansumg	HCL	Lenova	Sony	IBM	Others	Total PCs	Printers
1	Kopal Computers	120	60	60	0	0	72	312	180
2	Jeevraj Computers	180	120	180	84	0	108	672	0
3	P.L. Computers	132	0	180	0	72	48	432	216
4	Vinayak Computers	0	0	168	60	0	36	264	168
5	Vandana Computers	120	0	120	0	192	24	456	0
6	R.S. Computers	60	36	60	36	0	0	192	0
7	Shweta Computers & Peripherals	96	0	108	36	120	24	384	240
8	Sri Babosa Computers	60	60	120	72	120	84	516	0
9	Sri Sai Shanmukha Agencies	120	0	120	60	72	60	432	0
10	Sri Techno System	120	36	180	72	96	96	600	228
11	Systron System	60	48	108	48	0	0	264	168
12	Arun Computers	48	36	120	60	180	24	468	0
13	Obel Computers Pvt. Ltd.	60	120	156	72	48	60	516	192
14	Computer Centre	120	24	96	24	120	84	468	168
15	LAX Info Solutions	72	48	120	120	96	96	552	0
16	Global India	84	48	36	72	60	12	312	216
17	Computer Bazar	48	60	60	0	36	0	204	132
18	Devi Computers	48	96	120	0	48	24	336	0
19	Compare Data Products	120	0	120	0	96	72	408	0
	Total	1668	792	2232	816	1356	924	7788	1908

Exploratory Survey of Hyderabad							
Table III : Consumers / Users of Computers and Printers in Bulk Quantities – E –Waste Generation Kg Per Year							
S.No.	Name of Company	Computers			Printers		
		Used	Discarded / Yr	E-Waste	Used	Discarded / Yr	E-Waste
1	CMC Limited	1200	120	3552	50	0	Nil
2	Wipro Limited	3900	100	2960	30	0	Nil
3	Wipro(SEZ)	3000	150	4440	31	0	Nil
4	Satyam Limited	1500	110	3256	-	0	Nil
5	Corporation Bank	20	3	88.8	5	0	Nil
6	Hifi Internet café	6	2	59.2	1	0	Nil
7	Sifi Iway (satyam Internet)	10	2	59.2	1	0	Nil
8	Princess Asian Girls High School	24	1	29.6	7	0	Nil
9	ANGRA University	500	Nil	Nil	100	0	Nil
10	G.N. I Technology	850	Nil	Nil	6	0	Nil
11	Perfect business Solutions	160	2	59.2	10	0	Nil
12	Millennium Stars School	14	1	29.6	2	0	Nil
13	EPTRI	93	9	266.4	26	5	25
14	G.J. Multiclave	16	Nil	Nil	6	0	Nil
15	Andhra Pradesh Secretariat	3000	250	7400	1200	200	1000
	Total	14,293	750	22,200	1,475	205	1,025

4.1.4 E- Waste Generation Due to Repairs of Computers and Printers:

Approached twenty five repairers and only eight repairers responded. As regards to computers, 2,618 were repaired and 215 discarded as a whole. A total of 344 printers were repaired and 107 were discarded. E-waste generation from repair of computers and discarded of whole computers is 6,545 Kg per year. Generation of e-waste from printer repair and discard of printers is 625.8 Kg. The details are presented at **Table IV**.



Computer Repairer in Hyderabad

The items/parts of computers which have been repaired by individual companies are as follows.

S.No.	Repairers	Parts Repaired
1	Windeal System Services	Printers, Scanners, Mother Board, SMPs, UPS, CPUetc.
2	Keerthi Communications	Hard Ware, Mother Board, SMPs, UPS, CPU etc.
3	EPTRI	Entire System, Mother Board, LAN Cards, Hard Disk .
4	Systron System	All computer parts and peripherals like mother board, key board, CPU etc.
5	Shweta Computers & Peripherals	All computer parts
6	Global Technologies Pvt. Ltd.	All computer parts
7	Sunbeam Technologies	All computer parts and peripherals like mother board, key board, CPU etc.
8	L.V.S. Technologies	Mother boards, Hard disk, Laptops, HOD, Monitor, Printers, SMPs, CD roms etc.

Exploratory Survey of Hyderabad

Table IV: Repairs of Computers and Printers – E- Waste Generation Kg / Year

S.No	Repairers	Computers				Printers			
		Repair /Yr	E-Waste	Discarded / Yr	E-Waste	Repair/Yr	E-Waste	Discarded	E-Waste
1	Windeal System Services	300	19	23	680.8	72	6	25	125
2	Keerthi Communications	456	30	42	1243.2	36	3	10	50
3	EPTRI	72	12	3	88.8	12	0.96	0	0
4	Systron System	324	22	25	740	60	4.92	18	90
5	Shweta Computers & Peripherals	336	25	25	740	96	8	43	215
6	Global Technologies Pvt. Ltd.	450	28	38	1124.8	30	30	7	35
7	Sunbeam Technologies	366	30	32	947.2	21	21	3	15
8	L.V.S. Technologies	314	15	27	799.2	17	16.92	1	5
	Total	2618	181	215	6364	344	90.8	107	535

(Assuming an average weight of personal computer is 29.6 Kg. and of printer is 5 Kg as per E-Waste Volume I, Inventory Assessment Manual UNEP & Report on Study on E Waste in Kolkata).

4.1.5 E- Waste Generation Due to Households Using Computers and Printers:

A total of 26 houses were surveyed to know the trend of usage of computers, printers and e-waste generation. A total of 26 computers and 3 printers are in use by 26 house holds. The discarded computer parts are 20 and one printer per year. Total e-waste generated from these two items is 13.5 Kg of computer waste and 5 Kg of printer waste. In most of the houses the computers and printers are in good condition, how ever if any trouble arises, they get it repaired either from service centers or a person from service centers visits and rectify the items. In few cases the computers which needs repair are either repaired and stored in houses or donated to other family members or are being replaced by a new one. The details are presented at **Table V**.

Exploratory Survey of Hyderabad								
Table V : Households Using Computers and Printers – E- Waste Generation Kg Per Year								
S.No.	Items	Households Surveyed	Items used	Disposal Methodology				E-Waste
				Discard Item / Parts / Yr	Donate / Yr	Store / Yr	Sell / Replace / Yr	
1	Personal Computer	26	26	20	2	0	2	13.5
2	Printer		3	1	0	0	0	5
	Total	26	29	21	0	0	2	18.5

E-waste generated from usage of computers and printers from sampled survey is 30,414.3 Kg/year (users / consumers in bulk quantities 23,225 Kg, repairers 7170.8 Kg and house holds 18.5 Kg).

4.1.6 Assembling of Television:

A total of 4,560 televisions are assembled by twelve surveyed companies. They informed and also observed during field visit that no e-waste is generated while assembling the television. The details of number of televisions assembled is presented at **Table VI**.

4.1.7 Dealers of Television:



Television Dealer in Hyderabad

24 dealers were approached and 15 responded. The dealers are responsible for the sale of television. To obtain information on sales of branded (Samsung, BPL, Philips, Sony and LG) and unbranded companies and also on e-waste generation, approached various

dealers. It was observed that no e-waste is generated during this activity. The detail of sales of television is presented at **Table VII**. It is observed from Table VII that 4,824 televisions were sold by fifteen sampled survey.

4.1.8 E- Waste Generation Due to Consumers / Users of Televisions in Bulk Quantities:

Hotels, multistoried buildings and travel companies uses televisions in bulk quantities. Out of twenty five surveyed a total of twelve have responded. These 12 organizations are using 362 televisions yearly, discarded and replaced are 51. Total e-waste generated is 1,846.2 Kg/year. **Table VIII** gives the details of unit wise usage of televisions and e-waste generation.(Assuming an average weight of television 36.2 Kg as per *E-Waste Volume I, Inventory Assessment Manual UNEP*).

Exploratory Survey of Hyderabad		
Table VI: Assembling of Television Per Year		
S.No	Assemblers	Televisions Assembled
1	Gopinath electronics	384
2	A.B. Electronics	360
3	Master Electronics	360
4	Modern Electronics	300
5	Ganesh Electronics	420
6	M.K. Electronics	456
7	General Electronics	384
8	Metro Electronics	396
9	Sameer Electronics	420
10	Balaji Electronics	300
11	Sony Electronics & Service Centre	240
12	Praveen Electronics	540
	Total	4,560

Exploratory Survey of Hyderabad								
Table VII: Dealers of Televisions – Sale Figures Per Year Company Wise								
S.No.	Dealers	BPL	Samsung	Sony	Philips	LG	Others	Television
1	Esquire Watch & Electronics	60	168	96	0	0	0	324
2	Sameer Electronics	72	0	180	24	48	60	384
3	Prince Radio and Watch Co.	36	60	0	192	48	0	336
4	Sun Watch Electronics and Home Appliances	0	180	72	48	60	0	360
5	Shiva Sai Electronics	48	84	0	24	120	36	312
6	Bajaj Electronics	84	120	36	0	12	0	252
7	Sameer Electronics	0	144	108	48	0	0	300
8	Metro Electronics	24	156	180	0	36	24	420
9	General Electronics	60	48	60	0	264	0	432
10	M.K. Electronics	216	72	24	12	0	12	336
11	Ganesh Electronics	108	144	36	0	0	0	288
12	Master Electronics	0	0	216	84	36	0	336
13	Modern Electronics	36	72	84	0	0	0	192
14	A.B. Electronics	48	132	24	0	0	12	216
15	Bajaj Electronics	60	132	96	12	0	36	336
	Total	852	1,512	1,212	444	624	180	4,824

Exploratory Survey of Hyderabad				
Table VIII : Consumers / Users of Televisions in Bulk Quantities – E- Waste Generation Kg Per Year				
S.No.	Name of Company	Televisions Used	Discarded/Replaced / Year	E-Waste
1	Brindavan Residency	20	3	108.6
2	Hampshire Plaza	100	12	434.4
3	Metro Residency	30	6	217.2
4	Vasant Bahar	3	0	0
5	Hotel Dwarka Palace	25	4	144.8
6	Cosy Home	27	4	144.8
7	Anitha Avenue Apartment	22	2	72.4
8	Shree Krishna Travels	20	2	72.4
9	Shree Venkateshwara Hotel	42	7	253.4
10	Elite Court Apartment	25	3	108.6
11	Lumbini Apartment	30	7	253.4
12	Swarna Plaza	18	1	36.2
	Total	362	51	1,846.2

4.1.9 E- Waste Generation Due to Repairs of Television:

Around twenty three repairers were approached and thirteen responded. A total of 2,280 were repaired by thirteen surveyed repairers. While repairing approximately 92 Kg/year of e-waste is generated from the repaired / discarded parts like mother board, internal circuit, speakers, CRF etc. In some cases where there is no chance of repair, televisions are discarded as a whole, the quantity of which is 92 which accounts to e-waste generation of 3,330.4 Kg/year. E- waste generation due to the activity of repair is presented at **Table IX**. (Assuming an average weight of television is 36.2 Kg as per E-Waste Volume I , Inventory Assessment Manual UNEP) .The details of items / repair parts unit wise is as follows.



Television Repairer in Hyderabad

S.No.	Repairers	Parts Repaired
1	Sri. Padmawathi Electronics	Mother Board, Transformer, CRF Tubes, Electrical Cables
2	Reddy Electronics	Internal Circuit, Transformers
3	Sri. Lakshmi Electronics	Mother Board, CRF Tubes,
4	G. Srinivasa Electronics	Speakers, Electric Cables, Power Coils, Transformers
5	Vediocon	Speakers, Mother Boards
6	A.B. Electronics	Internal Circuit, Transformers
7	Ganesh Electronics	CRF Tubes, Mother Boards, Aluminium Parts
8	M.K. Electronics	Speakers, Alluminium Parts, Electrical Cables,
9	Ganesh Electronics	Mother Boards, Speakers, CRF Tubes
10	Ram Krishna	Speakers, Electric Cables, Power Coils, Transformers
11	Metro Electronics	Speakers, Mother Boards
12	Sameer Electronics	Internal Circuit, Transformers
13	Balaji Electronics	CRF Tubes, Mother Boards, Aluminium Parts

4.1.10 E -Waste Generation Due to Households Using Television:

A total of forty houses were surveyed to know the trend of usage of television and e-waste generation. It is observed that in forty houses they are using forty two televisions and mode of disposal is either discarded or donated, stored or sold / replaced. The waste

generated is 108.6 Kg per year. The details are presented at **Table X** . (Assuming an average weight of television is 36.2 Kg as per E-Waste Volume I , Inventory Assessment Manual UNEP)

Exploratory Survey of Hyderabad					
Table IX: Repairs of Televisions – E- Waste Generation Kg/Year					
S.No	Repairers	Repair/Yr	E-Waste	Discarded T V	E-Waste
1	Sri. Padmawathi Electronics	228	10	10	362
2	Reddy Electronics	276	12	15	543
3	Sri. Lakshmi Electronics	168	7	6	217.2
4	G. Srinivasa Electronics	216	9	10	362
5	Vediocon, Abids	120	4	2	72.4
6	A.B. Electronics	144	6	5	181
7	Ganesh Electronics	204	12	8	289.6
8	M.K. Electronics	228	10	10	362
9	Ganesh Electronics	216	8	8	289.6
10	Ram Krishna	144	7	5	181
11	Metro Electronics	168	5	6	217.2
12	Sameer Electronics	96	2	4	144.8
13	Balaji Electronics	72	1	3	108.6
	Total	2,280	92	92	3,330.4

Exploratory Survey of Hyderabad						
Table X : Households Using Television – E- Waste Generation						
Households Surveyed	Television used	Disposal Methodology				E-Waste Kg / Yr
		Discard / Yr	Donate / Yr	Store / Yr	Sell / Replace / Yr	
40	42	3	1	0	3	108.6

E-waste generated from usage of televisions from 25 sampled survey is 5,377.2 Kg per year (users / consumers in bulk quantities 1,846.2 Kg, repairers 3,422.4 Kg and house holds 108.6 Kg).

4.1.11 Assembling of Mobile Phones:

Table XI represents that a total of 20,096 mobile phones are assembled by six surveyed companies. They informed that no waste is generated while assembling the mobile phone. It is interesting to note that these six assemblers are dealers and also repairers. The repair work is done in a dedicated place where e-waste is generated. While performing the activity of assembling the mobile phones there was no e-waste generation.

Exploratory Survey of Hyderabad		
Table XI: Assembling of Mobile Phones Per Year		
S.No.	Assemblers	Mobile Phones Assembled
1.	Dreams Mobile	3780
2.	Choice Mobile	2420
3.	ARK Mobiles	3552
4.	R.K. Mobiles	4152
5.	New Choice Mobile	3696
6.	Mobile Shoppe	2496
	Total	20,096

4.1.12 Dealers of Mobile Phones:



Mobile Phone Dealer in Hyderabad

The dealers are responsible for the sale of mobile phones. Out of nineteen dealers approached only seven responded. To obtain information on sales of branded (Samsung, Sony Ericsson, Spice, Nokia and LG) and unbranded companies and also on e-waste generation, approached various dealers. It was observed that no e-waste is generated during this activity.

The detailed sales of mobile phones is presented at **Table XII**. It is observed from Table XII that 7,302 mobile phones were sold by seven sampled survey.

4.1.13 E -Waste Generation Due to Users/ Consumers of Mobile Phones in Bulk Quantity:

Out of 24 surveyed a total of eight firms have responded. These eight organizations uses 475 mobile phones and yearly discarded / repaired is 309. Total e-waste generated from these mobile phones is 25.5 Kg.(Assuming an average weight of mobile phone is 0.100 Kg as per E-Waste Volume I, Inventory Assessment Manual UNEP). **Table XIII** represents the waste generation from mobile phones usage in bulk quantities by hostels, hotels, traveling agents, universities and apartments in Hyderabad.

Exploratory Survey of Hyderabad								
Table XII: Dealers of Mobile Phones – Sale Figures Per Year								
S.No.	Dealers	Nokia	Sams ung	Sony Ericsson	Spice	LG	Other	Total
1	Dreams Mobile	445	208	154	66	56	98	1027
2	Choice Mobile	425	225	137	174	23	56	1040
3	ARK Mobiles	176	93	62	36	113	20	500
4	R.K. Mobiles	387	352	47	67	152	25	1030
5	New Choice	387	297	197	86	34	19	1020
6	Mobile Shoppe	398	276	191	70	67	33	1035
7	JD Electronics	665	418	143	192	182	50	1650
	Total	2883	1869	931	691	627	301	7302

Exploratory Survey of Hyderabad				
Table XIII : Consumers / Users of Mobile Phones in Bulk - E- Waste Generation Kg / Year				
S.No.	Name of Company	Mobile Phone Used	Discarded/ Repaired/ Yr	E-Waste
1	Shree Krishna Travels	4	2	0.2
2	ANGRAU	175	119	11.1
3	Cosy Home	14	8	0.8
4	Anitha Avenue Apartment	25	17	1.7
5	Shree Venkateshwara Hotel	150	77	5.8
6	Vasant Bahar	7	1	0.1
7	Swarna Plaza	30	18	1.8
8	SSS ,Hostal	70	67	4
	Total	475	309	25.5

4.1.14 E-Waste Generation Due to Repairs of Mobile Phones:

Nineteen repairers were approached but six responded. A total of 17,592 mobile phones were repaired per year by six surveyed repairers. While repairing 202.8 Kg/year of e-waste is generated. In some cases where there is no chance of repair, mobile phones were discarded as a whole, the quantity of mobile phones discarded is 76 per year which accounts to e-waste generation of 7.6 Kg per year. The details are presented at **Table XIV**. (Assuming an average weight of mobile phone is 0.100 Kg as per *E-Waste Volume I , Inventory Assessment Manual UNEP*) The items / part which are repaired are as follows.



Mobile Phone Repairer in Hyderabad

S.No.	Repairers	Parts Repaired
1	Dreams Mobile	Display, Key Pad , Speakers
2	Choice Mobile	Speakers, Batteries, board
3	ARK Mobiles	Chips, Panel Boards, Display
4	R.K. Mobiles	Speakers, Batteries,
5	New Choice Mobile	Display, Key Pad
6	Mobile Shoppe	Chips, Panel Boards, Display

Exploratory Survey of Hyderabad					
Table XIV: Repairs of Mobile Phones – E- Waste Generation Kg Per Year					
S.No	Repairers	Repair/Yr	E-Waste	Discarded / Yr	E-Waste
1	Dreams Mobile	2640	26.4	19	1.9
2	Choice Mobile	2736	32.4	7	0.7
3	ARK Mobiles ,	2520	27.6	13	1.3
4	R.K. Mobiles	2832	33.6	12	1.2
5	New Choice	3312	37.2	8	0.8
6	Mobile Shoppe	3552	45.6	17	1.7
	Total	17,592	202.8	76	7.6

4.1.15 E- Waste Generation Due to Households Using Mobile Phones:

A total of 39 houses were surveyed to know the trend of usage of mobile phones and e-waste generation. The ratio of usage of mobile phones is 1:3 approximately. Due to the advancement in features in mobile phones, a person who want to go for better features, either donate, store or discarded, replace by new one. The waste generated is 0.5 Kg / year . The details are presented at **Table XV**.

Exploratory Survey of Hyderabad						
Table XV : Household Using Mobile Phones - E- Waste Generation						
Households Surveyed	Mobile Phones Used	Disposal Methodology				E-Waste Kg / Yr
		Discard / Yr	Donate / Yr	Store / Yr	Sell / Replace / Yr	
39	101	5	2	1	3	0.5
<i>(Assuming an average weight of mobile phone is 0.100 Kg as per E-Waste Volume I, Inventory Assessment Manual UNEP).</i>						

E-waste generated from usage of mobile phones from sampled survey is 236.4 Kg per year (users / consumers in bulk quantities 25.5 Kg, repairers 210.4 Kg and house holds 0.5 Kg).

4.2 E-Waste generation in Bangalore:

To collect information on generation of E-waste due to computers, printers, mobile phones and televisions, a total of 213 units were approached out of which 148 have responded and 65 have not responded. The details of exploratory survey for three sub sectors computers and printers, mobile phones and television from

- i. Dealers,
- ii. Consumers / users of electronic items in bulk quantities,
- iii. Repairers / service organizations and
- iv. House holds are depicted at **Table XVI to XXVII** for Bangalore. There is no e-waste generation from dealers of computers, printers, television and mobile phone. Total e-waste generation due to computers and printers by 46 sampled survey is 37,562.2 Kg / year and 740 Kg / year respectively. E- waste due to television and mobile phones from

each 51 sampled surveyed is 9,479.6 Kg/year and 473.15 Kg/year respectively. Totaling to 48,254.55 Kg/year the details of waste generation from different categories of generators is as follows.

4.2.1 Dealers of Computers and Printers:

Fourteen dealers were approached but eight have responded. The dealers are responsible for the sale of computers and printers. To obtain information on sales of branded (Samsung, HCL, Lenova, Sony, IBM) and un branded companies and also on e-waste generation, approached various dealers. It was observed that no e-waste is generated during this activity (dealing / sales). On an average per year 2,505 computers and 791 printers are sold. The detail of sales of computers and printers per year dealer wise and company wise is presented at **Table XVI**.

Exploratory Survey of Bangalore								
Table XVI: Dealers of Computers and Printers- Sale Figures Per Year								
S.No	Dealers	Sams ung	HCL	Lenova	Son y	IBM	Total Computers	Printers
1	K.S Computers	60	36	120	36	15	267	60
2	Digitech,Pvt.Ltd	90	0	180	0	30	300	95
3	M.Sachchiyay.com	120	70	80	34	60	364	120
4	Digitech pvt ltd	96	0	150	65	0	311	70
5	Jaypee Agencies	60	70	100	60	0	290	150
6	Rajtronics	125	0	120	58	0	303	92
7	Digitech	60	30	120	70	60	340	120
8	Unique Computers Placement on map	120	50	120	0	40	330	84
	Total	731	256	990	323	205	2505	791

4.2.2 E-Waste Generation Due to Users / Consumers of Computers and Printers in Bulk Quantities:

Out of twenty four surveyed a total of nine have responded. These nine organizations are using 18,941 computers and 247 printers. They are discarding 1,153 computers and 73 printers yearly. Total e-waste generated from computer and printers is 34,128.8 Kg/year and 365 Kg/year respectively, totaling to 34,493.8 Kg/year. **Table XVII** represents the

waste generation from computers and printers from the firms whose usage is in bulk quantities like multi national companies and private organizations in Bangalore.

Exploratory Survey of Bangalore							
Table XVII : Consumers / Users of Computers and Printers in Bulk Quantities- E- Waste Generation Kg / Year							
S.No	Name of Company	Computers			Printers		
		Used	Discarded / Yr	E-Waste	Used	Discarded / Yr	E-Waste
1	Environmental management & Policy Research Institute	10	2	59.2	3	1	5
2	Wipro Technologies	12,613	750	22200	64	10	50
3	Satyam Computers Services Ltd	3000	200	5920	100	35	175
4	Tata Consultancy Services	3000	150	4440	60	20	100
5	ICICI Manipal Academy	300	50	1480	10	4	20
6	Amer (Boarding and Lodging)	4	0	0	3	1	5
7	Sanman Deluxe	2	0	0	2	1	5
8	Sudarshan Lodge	3	1	29.6	2	1	5
9	GTZ (HAWA Project)	9	0	0	3	0	0
	Total	18,941	1153	34128.8	247	73	365

(Assuming an average weight of personal computer is 29.6 Kg. and of printer is 5 Kg as per E-Waste Volume I, Inventory Assessment Manual UNEP & Report on Study on E Waste in Kolkata).

4.2.3 E- Waste Generation Due to Repairs of Computers and Printers:

Approached sixteen repairers and nine have responded. As regards to computers, 1,085 were repaired and 89 discarded as a whole. A total of 344 printers were repaired and 48 were discarded. E-waste generation form computer repair and discard is 790 Kg/year and 2,634.4 Kg/year respectively totaling to 3424.4 Kg. Generation of e-waste from printer repair and discard is 135 Kg/year and 240 Kg/year respectively, totaling to 375 Kg. The total e-waste generated from nine repairers of computers and printers is 3799.4 Kg/year. The details are presented at **Table XVIII**. The items/part which are repaired by individual repairers are as follows.

Parts Repaired / Replaced by Repairers		
S.No.	Repairers	Parts Repaired
1	Rajtronics	Mother boards, Hard disk, Laptops, HOD, Monitor, Printers, SMPs, CD roms
2	Sight N Sound Services	Mother Board, Monitor, computer parts
3	Allied Systems & Services	CPU, Monitor, Key Board, CRF Tubes, Alluminium Chips etc.
4	Gayathri Electronics	Printers, Scanners, Mother Board, CPU etc.
5	Digitech,Pvt.Ltd	CPU,Monitor,Key Board, CRF Tubes,Alluminium Chips etc.
6	A.R. Electronics	All computer parts and peripherals like mother board, key board, CPU etc.
7	A.R Electronics	Mother Board, Monitor, computer parts
8	H.R.S. Computers Sales & Services	Hard ware equipments, Mother Board, CPU etc.
9	B.S. T Repairers	Entire system, mother board, LAN cards, hard disk etc.

Exploratory Survey of Bangalore									
Table XVIII : Repairs of Computers and Printers – E –Waste Generation Kg/ Year									
S. No	Repairers	Computers / year				Printers / year			
		Repair	E-Waste	Discarded	E-Waste	Repair	E-Waste	Discarded	E-Waste
1	Rajtronics	180	150	10	296	80	30	0	0
2	Sight N Sound	150	110	12	355.2	60	25	0	0
3	Allied Systems & Services	100	90	11	325.6	40	15	8	40
4	Gayathri Electronics	130	70	12	355.2	0	0	5	25
5	Digitech,Pvt.Ltd	150	100	13	384.8	50	18	5	25
6	A.R. Electronics, BTM Layout	90	50	8	236.8	20	10	9	45
7	A.R Electronics	75	40	2	59.2	24	12	6	30
8	H.R.S. Computers Sales & Services	100	90	11	325.6	40	15	10	50
9	B.S. T Repaires	110	90	10	296	30	10	5	25
	Total	1085	790	89	2634.4	344	135	48	240

(Assuming an average weight of personal computer is 29.6 Kg. and of printer is 5 Kg as per E-Waste Volume I , Inventory Assessment Manual UNEP & Report on Study on E Waste in Kolkata).

4.2.4 E-Waste Generation Due to Households Using Computers and Printers:

A total of 20 houses were surveyed to know the trend of usage of computers and printers and e- waste generation. The computers used are 21 and printers 6 among the twenty surveyed samples. A total of 10 houses have informed that they have discarded small parts of computers which amount to 9 Kg of e-waste generation. In most of the houses the computers and printers are in good condition, how ever if any trouble arises , they get it repaired either from service centers or a person from service centers visits and rectify it. The details are presented at **Table XIX**.

Exploratory Survey of Bangalore								
Table XIX: Households Using Computers and Printers – E- Waste Generation Kg Per Year								
S.No.	Sub Sector	Households Surveyed	Items used	Disposal Methodology				Quantity of E-Waste
				Discard Items / Parts/ Yr	Donate / Yr	Store / Yr	Sell / Replace / Yr	
1	Personal Computer	20	21	10	0	0	0	9
2	Printer		6	0	0	0	0	0
	Total	20	27	10	0	0	0	9

4.2.5 Dealers of Television:



Television Dealer

The dealers are responsible for the sale of television, a total of fifteen were approached and eight have responded. The dealers for unbranded and branded companies (Samsung, Sony, BPL, Philips and LG) were approached to get information on sales and generation of e-waste. It was observed that no e-waste is generated during this activity. The detail of sales of television is presented at **Table XX**. It is observed from Table XX that 3,323 televisions were sold by 8 sampled survey.

Exploratory Survey of Bangalore							
Table XX: Dealers of Televisions – Sale Figures Per Year							
S.No.	Dealers	Samsung	Sony	Philips	LG	BPL	Total
1	Rajtronics	180	70	65	100	50	465

2	Radionics,	120	72	95	84	20	391
3	Sony Exclusive, G.K. vale & Co	0	300	0	0	0	300
4	Unilet Appliances Pvt ltd.	150	60	90	100	60	460
5	Unilet Appliances	70	95	100	90	70	425
6	Unilet Appliances Private Limited, Sanjaynagar	96	70	85	100	75	426
7	Unilet Appliances Private Limited, Sahakanagar Bellary Road	120	85	95	60	70	430
8	Unilet Appliances Private Limited, Cox Town	100	96	75	70	85	426
	Total	836	848	605	604	430	3,323

4.2.6 E-Waste Generation Due to Users of Television in Bulk Quantity:

Usually hotels are the main bulk consumers of television. A total of sixteen hotels were approached out of which only ten have responded. These ten hotels uses a total of 455 televisions per year and discarded and Repaired 191 in a year. Total e-waste generated from these televisions is 4,742.2 Kg/year. **Table XXI** represents the e-waste generation from television usage in bulk quantities by ten respondents.

Exploratory Survey of Bangalore				
Table XXI: Consumers / Users of Televisions in Bulk – E -Waste Generation Kg Per Year				
S.No.	Name of Company	Used	Discarded & Repaired/ Yr	E-Waste
1	Pushpamala hotel	20	9	325.8
2	Hotel Sharada	30	8	289.6
3	Janatha Lodge	70	25	543
4	Mayura Hotel	85	45	905
5	Espee Residency	44	10	362
6	Sudharshan Lodge	24	5	181
7	Sanman deluxe Lodge	37	10	362
8	Amar Hotel	80	50	724
9	Hotel Pooja Paradise, Deluxe Lodge	35	10	362
10	Hotel gokul	30	19	687.8
	Total	455	191	4,742.2
<i>(Assuming an average weight of Television 36.2 Kg as per E-Waste Volume I , Inventory Assessment Manual UNEP).</i>				

4.2.7 E- Waste Generation Due to Repairs of Television:

Thirteen repairers were approached and nine have responded. A total of 1,850 televisions were repaired. While repairing 1,582 Kg/year of e-waste is generated. In some cases where there is no chance of repair, televisions were discarded as a whole, the quantity of televisions discarded are 87 which accounts to e-waste generation of 3,149.4 Kg/year. Total Waste generated from and discarded is 4731.4 kg/years **Table XXII** represents waste generation from repairs of televisions. Various parts which are repaired are as follows.



Television Repairer in Bangalore

Repair of Television		
S.No.	Repairers	Parts Repaired
1	Gayathri Electronics	Speakers, Mother Boards
2	A.R. Electronics	Internal Circuit, Transformers
3	B.S. T Repairs	Speakers, Mother Boards
4	A.R Electronics	CRF Tubes, Mother Boards, Aluminium Parts
5	Sight N Sound	Speakers, Electric Cables, Power Coils, Transformers
6	Rajtronics	Speakers, Alluminium Parts, Electrical Cables,
7	Sunwheel Electronics	Speakers, Electric Cables, Power Coils, Transformers
8	Moon Electronic	Mother Board, Transformer, CR Tubes
9	Standard Electronics	CRF Tubes, Mother Boards, Aluminium Parts

Exploratory Survey of Bangalore					
Table XXII: Repairs of Televisions – E -Waste Generation Kg Per Year					
S. No	Name of Company	Repair/Yr	Waste Quantity	Discarded / Yr	Waste Quantity
1	Gayathri Electronics	240	200 Kg/A 207	10	362
2	A.R. Electronics	130	95	5	181
3	B.S. T Repairs	260	220	13	470.6
4	A.R Electronics	180	170	7	253.4
5	Sight N Sound	280	240	14	506.8
6	Rajtronics	160	150	10	362
7	Sunwheel Electronics	140	100	5	181
8	Moon Electronic	290	250	14	506.8
9	Standard Electronics	170	150	9	325.8
		1,850	1,582	87	3,149.4

(Assuming an average weight of Television 36.2 Kg as per E-Waste Volume I , Inventory Assessment Manual UNEP).

4.2.8 E -Waste Generation Due to Households Using Television:

A total of 24 houses were surveyed to know the trend of usage of television and e-waste generation. The usage of television is 25. In some occasions the house holds have discarded parts of television which amounts to 6 kg/year of e-waste generation. In most of the houses the computers and printers are in good condition, how ever if any trouble arises, they get it repaired either from service centers or a person from service centers visits and rectify the items. The details of waste generation due to house hold usage is presented at **Table XXIII**

Exploratory Survey of Bangalore						
Table XXIII: Households Using Television – E- Waste Generation						
Households Surveyed	Items used	Disposal Methodology				E-Waste Kg / Yr
		Discard Parts / Yr	Donate / Yr	Store / Yr	Sell / Replace / Yr	
24	25	11	0	0	0	6

4.2.9 Dealers of Mobile Phones:

A total of twenty dealers were approached but nine have responded. The dealers are responsible for the sale of mobile phones. The dealers for unbranded and branded companies (Samsung, Sony Ericsson, Spice, Nokia and LG) were approached to get



Mobile Phone Dealer in Bangalore

information on sales and generation of e-waste. It was observed that no e-waste is generated during this activity. The detail of sales of mobile phones is presented at **Table XXIV**. It is observed from Table XXIV that 8,610 mobile phones were sold by nine sampled survey .

Exploratory Survey of Bangalore								
Table XXIV: Dealers of Mobile Phones –Sale Figures Per Year								
S.No	Dealers	Nokia	Sams ung	Sony Ericsson	Spice	LG	Other	Total
1	The Mobile Stores	500	280	194	100	95	50	1219
2	Ridihi Sidhi	475	250	175	130	75	35	1140

3	B.T.M Shoppee	300	100	85	110	100	30	725
4	Shree Nidhi Tele Communication	400	320	90	100	80	45	1035
5	Pragathi Communication	387	297	197	86	34	50	1051
6	Limra Telelinks, Copper Corner	375	276	145	100	90	40	1026
7	Hot Spot Mobiles,Shop	420	350	100	75	150	30	1125
8	Almur Stores	250	150	90	85	75	95	745
9	Almur Stores	150	100	74	90	50	80	544
	Total	3,257	2,123	1,150	876	749	455	8610

4.2.10 E-Waste Generation Due to Users of Mobile Phones in Bulk Quantities:

Out of 16 units surveyed a total of 10 units have responded. These ten organizations are using 18,939, discard and repaired are 1,289 per year. Total e-waste generated from these mobile phones is 103.9 Kg/year. **Table XXV** represents the waste generation from consumers/ users of mobile phones in bulk quantities.

Exploratory Survey of Bangalore				
Table XXV : Consumers / Users of Mobile Phones in Bulk Quantities – E- Waste Generation Kg Per Year				
S.No.	Name of Company	Used	Discard & Repaired	E-Waste
1	Environmental management & Policy Research Institute	13	5	0.5
2	Wipro Technologies VG4	10000	550	50
3	Satayam Computers Services Ltd	5000	350	20
4	Tata Consultancy Services No. 42	3470	150	10
5	ICICI Manipal Hostel	380	200	20

6	Amer (Boarding and Lodging)	23	10	1
7	Sanman Deluxe Lodge	20	8	0.8
8	Sudarshan Lodge	10	7	0.7
9	GTZ (HAWA Project)	13	5	0.5
10	Janatha Lodge	10	4	0.4
	Total	18,939	1289	103.9
<i>(Assuming an average weight of Mobile Phone 0.100 Kg as per E-Waste Volume I , Inventory Assessment Manual UNEP).</i>				

4.2.11 E- Waste Generation Due to Repairs of Mobile Phones:

11 repairers were approached and 8 have responded. A total of 7,255 mobile phones were repaired by nine surveyed repairers in a year. While repairing 357.7 Kg of e-waste was generated. In few cases the mobiles were discarded as a whole as it could not be repaired. The quantity of mobile phones discarded is 103 per year which accounts to e-waste generation of 10.3 Kg. Total e-waste generating



Mobile Phone Repairer in Bangalore

from repairer and discarded is 368kg/year The details are presented at

Table XXVI. The parts which frequently repaired are as follows.

S.No.	Repairers	Parts Repaired
1	The Mobile Stores	Display, Key Pad , Speakers
2	Ridihi Sidhi	Speakers, Batteries, board
3	B.T.M Shoppee	Chips, Panel Boards, Display
4	Shree Nidhi Tele Communication	Display, Key Pad
5	Pragathi Communication,	Chips, Panel Boards, Display
6	Limra Telelinks,Copper Corner	Display, Key Pad , Speakers
7	Almur Stores,	Speakers, Batteries, board
8	Trans Globe	Chips, Panel Boards, Display

Exploratory Survey of Bangalore					
Table XXVI: Repairs of Mobiles – E- Waste Generation Kg Per Year					
S.No	Repairers	Repair / Yr	E-Waste	Discarded / Yr	E-Waste
1	The Mobile Stores	980	49.2	20	2
2	Ridihi Sidhi	775	37.5	10	1
3	B.T.M Shoppee	950	45	15	1.5
4	Shree Nidhi Tele Communication	990	40	10	1
5	Pragathi Communication	820	55	10	1
6	Limra Telelinks, Copper Corner	910	45	15	1.5
7	Almur Stores,	850	38	8	0.8
8	Trans Globe	980	48	15	1.5
	Total	7255	357.7	103	10.3

(Assuming an average weight of Mobile Phone 0.100 Kg as per E-Waste Volume I, Inventory Assessment Manual UNEP).

4.2.12 E Waste Generation Due to Households Using Mobile Phones:

A total of 24 houses were surveyed to know the trend of usage of mobile phones and e-waste generation. The usage of mobile phones is 74 among the 24 houses surveyed. The component of discarded items / parts of mobile phones is equal to 1.25 kg/year of e-waste generated. In most of the cases if any trouble arises, they get it repaired from service centers. The details are presented at **Table XXVII**.

Exploratory Survey of Bangalore						
Table XXVII: Households Using Mobile Phones - E Waste Generation						
Households Surveyed	Items used	Disposal Methodology				E-Waste Kg / Yr
		Discard Parts / Items/ Yr	Donate / Yr	Store / Yr	Sell / Replace / Yr	
24	74	23	0	0	0	1.25

5. Field Study Analysis and Mapping of E-Waste Movement

From the exploratory survey five units from each sector (computer and printer, television and mobile phones) have been selected for detailed study to do mapping of e-waste movement. Generation of e-waste, components and composition of e-waste, valuable substances, average weight and recycling efficiency has also been studied and presented.

On the basis of exploratory survey, field visits, structured and unstructured interviews and discussions with the stake holders, mapping of e-waste and various steps involved in management of e-waste has been identified.

In Hyderabad, Multinational companies, Government offices and bulk users of computers and printers were storing the e-waste in their premises till recent time. After the mid of 2009 one formal authorized recycler by name Earth Sense has established its recycling facility. The A.P. Pollution Control Board has given consent for authorization and establishment to Earth Sense. The various organizations / e-waste generators have slowly started approaching the authorized recycler after September 2009. Not much awareness has been generated on the recycling of e-waste by the authorized recycler, it is still in budding stage. Most of the units have sourcing and procurement of e-waste by informal recyclers by sale / purchase, auctions and company exchange offers. They do stockpiling and aggregation of e-wastes in godowns, shops, houses and backyard of houses and warehouses. These are then segregated and dismantled by the scrap collector himself or by dismantlers. These are then sold / purchased, repaired and reused. The dismantled components are segregated into components as PCBs, metals, batteries, glass, plastics, cables, etc. The components which cannot be reused or repaired are sold further for recycling and component recovery.

In Bangalore the waste is being picked up by informal as well as formal recycler by name E-Parisaraa. The formal sector/ recycler undertakes recycling and recovery of metals from the e-waste component. A portion of e-waste is being exported to Belgium for precious metals recovery.

Consumers are being offered exchange offer from various companies / assemblers of computer, printer, mobile phone and television. They adopt the policy of exchanging with new one. In some cases they store in their own houses/ office premises. Some people donate to their relatives. In few cases parts are frequently repaired / replaced by repairers. In some cases these are (whole unit/part of it) sold to the scrap dealers from where unauthorized recyclers lift the scrap and recycle in an unscientific way.

5.1 Mapping of E-Waste Movement and Management in Hyderabad:

From the exploratory survey and field visits five units from each sub sector have been studied extensively for mapping the movement of e-waste. The Mapping of E -Waste from Computers and Printers, Televisions and Mobile Phones are presented at **Table XXVIII, XXIX and XXX** respectively. The details are as follows.

5.1.1 Mapping of Movement And Management of E-Waste from Computers and Printers:

To study in detail the movement and management of e-waste and mapping, three bulk users and two repairers have been selected. The data is presented at **Table XXVIII**. The details are as follows.

i. CMC-The company used 1200 computers & 50 printers , they do not prefer repair of computers, discard on an average 120 computers which is equal to 3552 Kg of e-waste. They are storing in their own premises or other wise hand over to scrap dealers.

ii. Wipro- The company uses 3,900 computers 31 printers, they do not prefer to get the computers repaired, on an average they discard 100 computers which is equal to 2960 Kg/year of e-waste which they store in their own premises. But recently since July 2009 an authorized recycler by name Earth Sense Recycler Pvt. Ltd. has been established. The authorized recycler is not familiar among the e –waste generators. This project has constituted a committee and the members are accidentally from Wipro and Earth Sense, during the meeting after introducing each other by EPTRI, awareness has been generated and Wipro started giving to Earth Sense Recycler an authorized formal sector for recycling where they do dismantling manually, segregating, shredding, pulverizing and

density separation. For recovery of precious metals, they are sending to E-Parisaraa (a formal recycler in Bangalore), in turn they send to Belgium.

iii. A.P. Secretariat- This is Government organization, uses 3000 computers & 1200 printers. On an average they discard 250 computers & 200 printers which is equal to 7400 Kg & 1000 Kg. per year respectively. They store this e-waste in their own premises and Andhra Pradesh Technology Services (APTS) is responsible for managing the waste. They lift the waste and store in a temporary store house. They are planning to give it to authorized recycler for managing the waste. The status is that they have called for tenders to lift and recycle it.

iv. Shweta Computers and Peripherals – This is a repairing company. They repair 336 computers and 96 printers per year. On an average during repairing they generate 25 Kg. of computer waste and 8 Kg. of printers waste per year. They discard 25 computers & 43 printers which is equal to 740 Kg and 215 Kg of e-waste per year. From the activity of repair and discard the company is generating 988 Kg of e-waste which is being handed over to scrap dealers. They either sell as second hand equipment or dismantle manually and segregate into plastic waste, glass waste and metal waste. The plastic waste is sold to plastic factory where it is crushed and grinded into plastic granules. These plastic granules are used for making a new plastic items. The metallic waste is sold to molding industry where it is molded / pulverized to reuse in other form.

v. Global Technologies Pvt. Ltd. – The Company is repairing 450 computers and 30 printers per year. During repair they generate 28 Kg. of computer waste and 30 Kg. of printers waste per year. They discard 38 computers and 7 printers which is equal to 1124.8 Kg and 35 Kg. per year. They hand over 1217.8 Kg of e-waste to scrap dealers. They either sell as second hand equipment or dismantle manually and segregate into plastic waste, glass waste and metal waste. The plastic waste is sold to plastic factory where it is crushed and grinded into plastic granules. These plastic granules are used for making a new plastic items. The metallic waste is sold to molding industry where it is molded / pulverized to reuse in other form.

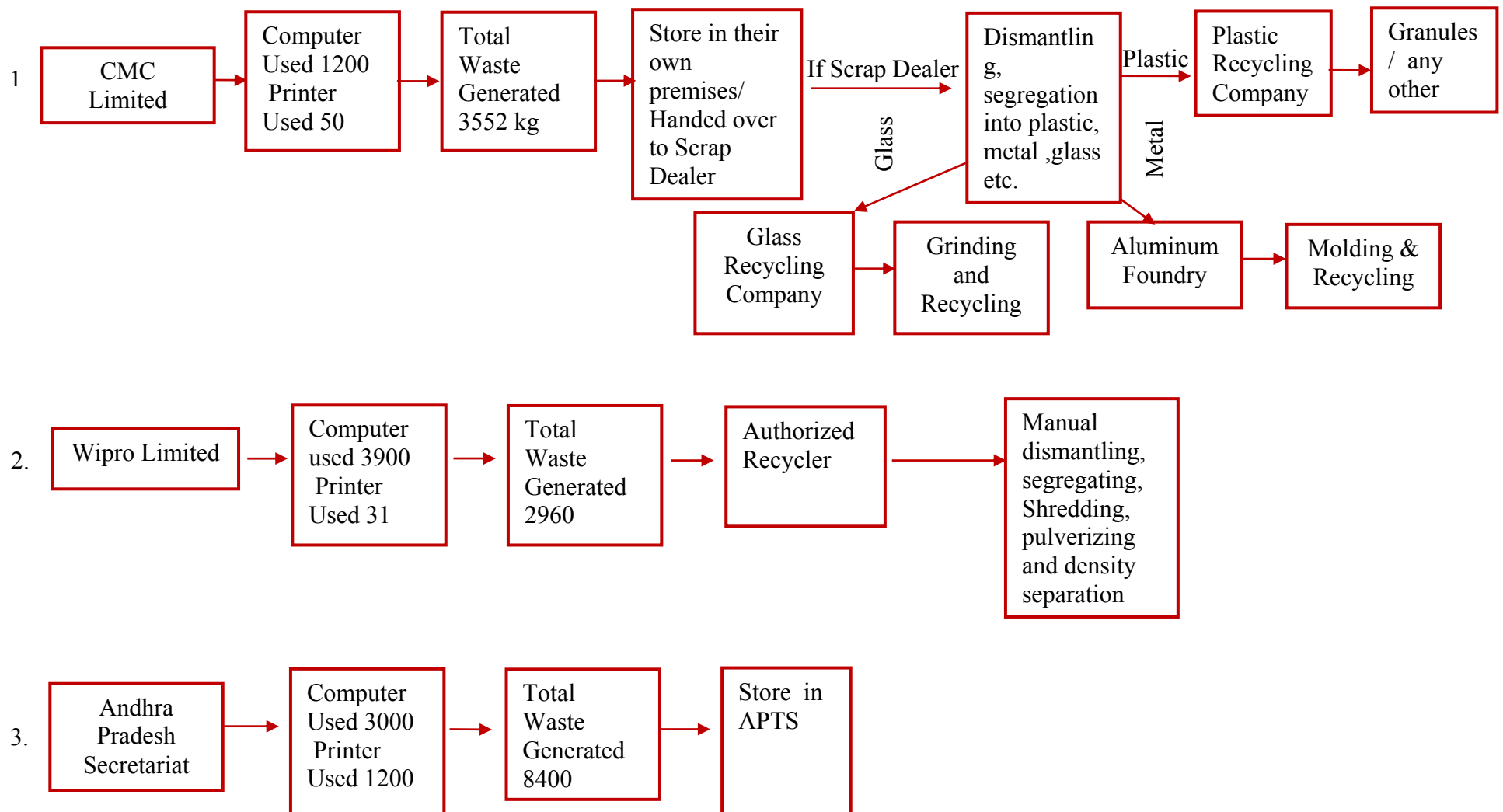
Table XXVIII

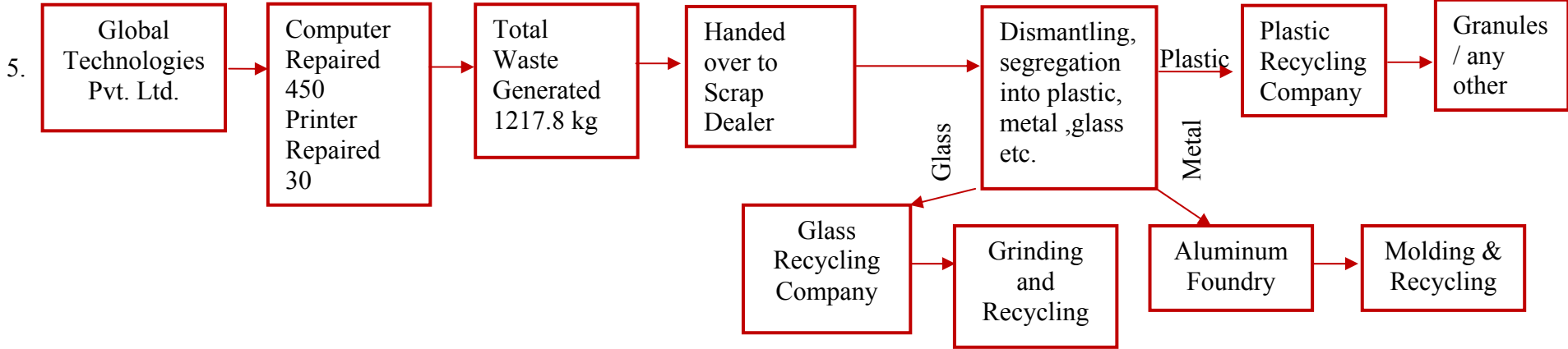
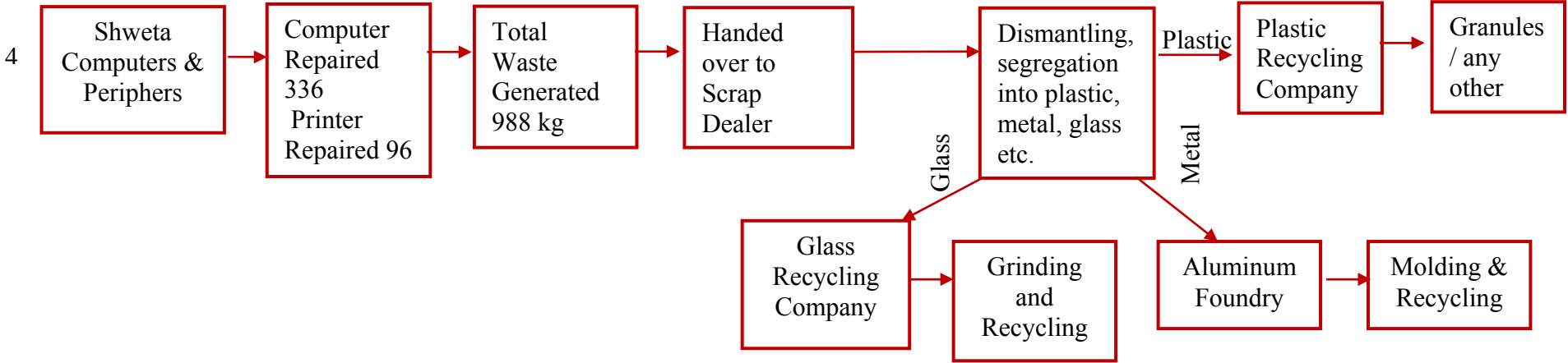
Mapping of E-Waste Movement & Management (Hyderabad)

Table XXVIII : Computers and Printers E-Waste

S. No.	Name of Company	Computer						Printer						Component of E-Waste	Mode of Disposal	Recycling
		Used	Repaired	Waste Kg / Yr	Discard / Yr	Waste Kg / Yr	Total Waste Kg / Yr	Used	Repaired	Waste Kg / Yr	Discard / Yr	Waste Kg / Yr	Total Waste Kg / Yr			
1	CMC Limited	1200	0	0	120	3552	3552	50	0	0	0	0	Nil	Discarded Personal Computer	Store / Hand over to scrap dealer	No
2	Wipro Limited	3900	0	0	100	2960	2960	31	0	0	0	0	Nil	Discarded Personal Computer	Hand over to authorized Recycler	No
3	Andhra Pradesh Secretariat	3000	0	0	250	7400	7400	1200	0	0	200	1000	1000	Discarded Personal Computer & Printer	Store in APTS	No
4	Shweta Computers & Peripherals	0	336	25	25	740	765	0	96	8	43	215	223	Entire part of computer and Printers	Hand over to scrap dealer	No
5	Global Technologies Pvt. Ltd.	0	450	28	38	1124.8	1217.8	0	30	30	7	35	65	Mother boards, Hard disk, HOD, Monitor, Printers, SMPs, CD roms etc.	Hand over to scrap dealer	No
	Total	8100	786	53	533	15776.8	15894.8	1281	126	38	250	1250	1288			

Computer and Printer E-Waste- Mapping of E-Waste Movement and Management - Hyderabad





5.1.2 Mapping of Movement And Management of E-Waste from Televisions:

To study in detail the movement and management of e-waste and mapping, three bulk users and two repairers have been selected. The data is presented at **Table XXIX**. The details are as follows.

i. Hampshire plaza - The hotel uses 100 televisions and discard 11 televisions which is equal to 398.2 Kg of e-waste. They exchange or replace discarded items with dealers.

ii. Shree venkateshwara Hotel - The hotel uses 42 televisions and discard 6 televisions which is equal to 217.2 Kg of e-waste. They exchange or replace discarded items with dealers.

iii. Cozy Homes- They are using 27 televisions and discard 4 televisions which is equal to 144.8 Kg of e-waste. They exchange or replace these items with dealers.

iv. Sri. Padmavathi Electronics – This unit repaired 228 televisions on an average, during repairing they generate 10 Kg of television waste. The various components of waste are mother boards, CRF tubes, electrical cables, transformers etc. They discard 10 televisions which is equal to 362 Kg of e-waste. They hand over this e-waste to scrap dealers. They either sell as second hand equipment or dismantle manually and segregate into plastic waste, glass waste and metal waste. The plastic waste is sold to plastic factory where it is crushed and grinded into plastic granules. These plastic granules are used for making a new plastic items. The metallic waste is sold to molding industry where it is molded / pulverized to reuse in other form.

v. Sri Lakshmi Electronics - They repaired 168 televisions, components of waste are mother boards, speakers, condenser. On an average during repairing they generate 7 Kg. of television waste. They discard 6 television which is equal to 217.2 Kg of e-waste . They hand over this e-waste to scrap dealers. They either sell as second hand equipment or dismantle manually and segregate into plastic waste, glass waste and metal waste. The plastic waste is sold to plastic factory where it is crushed and grinded into plastic

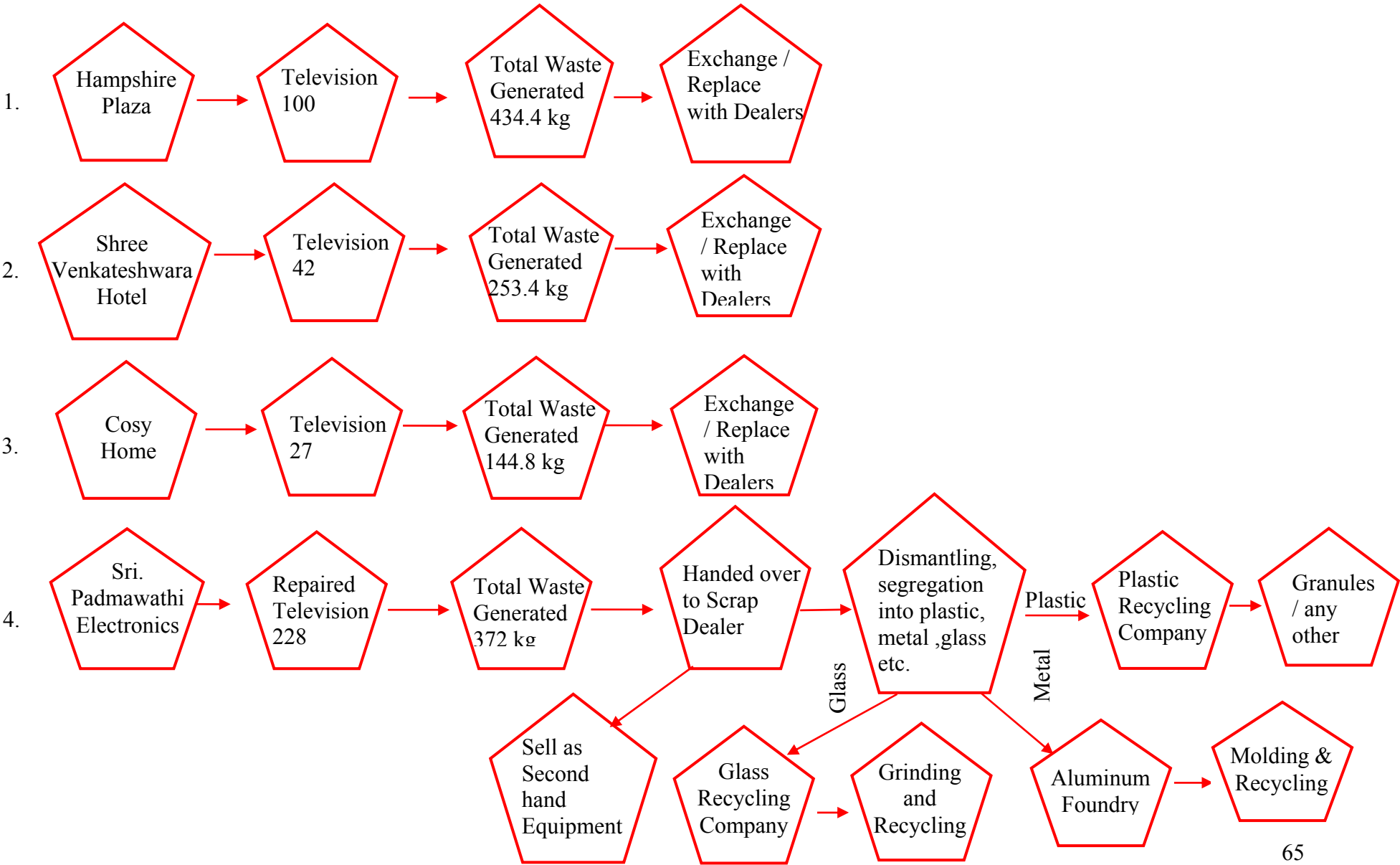
granules. These plastic granules are used for making a new plastic items. The metallic waste is sold to molding industry where it is molded / pulverized to reuse in other form.

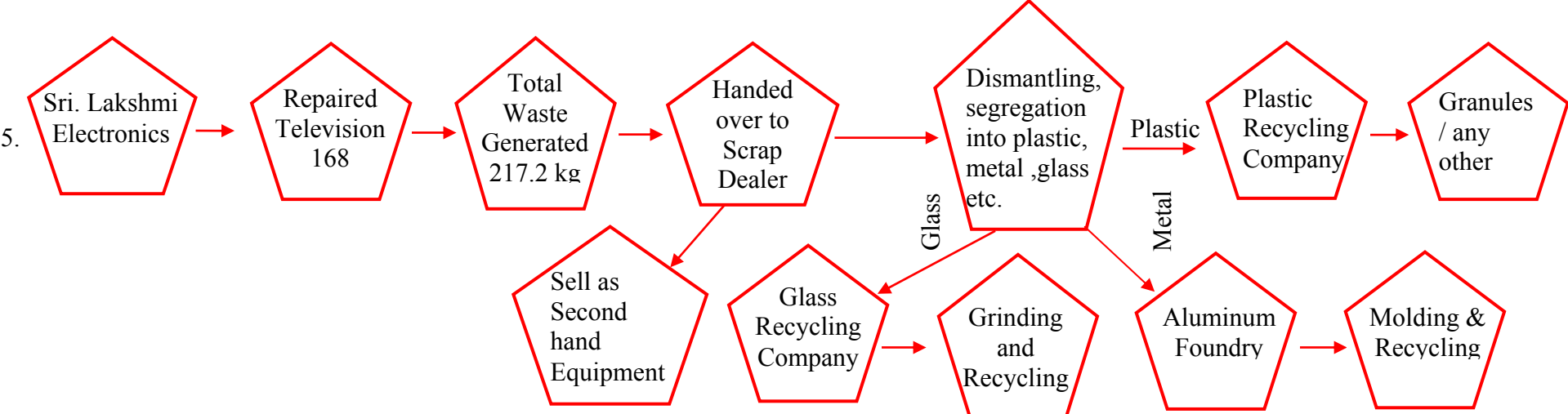
Mapping of E-Waste Management & Movement (Hyderabad)

Table : XXIX : Television E-Waste

S. No.	Name of Company	Used	Repaired	E-Waste Kg / Yr	Discarded / Yr	E-Waste Kg / Yr	Total E-Waste Kg / Yr	Components of E-Waste	Mode of Disposal	Recycling
1	Hampshire Plaza	100	10	36.2	11	398.2	434.4	Mother Board, Transformer, CRF Tubes, Electrical Cables etc & whole television	Discard television by exchange/replace	Nil
2	Shree Venkateshwara Hotel	42	20	36.2	6	217.2	253.4	Mother Board, Transformer, CRF Tubes, Electrical Cables etc. & whole television	Exchange/replace	Nil
3	Cosy Home	27	0	0	4	144.8	144.8	Whole television	Exchange/replace	Nil
4	Sri. Padmawathi Electronics	0	228	10	10	362	372	Mother Board, Transformer, CRF Tubes, Electrical Cables	Hand over to scrap dealer	Nil
5	Sri. Lakshmi Electronics	0	168	7	6	217.2	224.2	Mother Board, CRF Tubes,	Hand over to scrap dealer	Nil
	Total	169	426	89.4	37	1339.4	1428.8			

Television E-Waste- Mapping of E-Waste Movement and Management - Hyderabad





5.1.3 Mapping of Movement And Management of E-Waste from Mobile Phones:

To study in detail the movement and management of e-waste and mapping, three bulk users and two repairers have been selected. The data is presented at **Table XXX**. The details are as follows.

i. Shree Venkateshwara Hotel- The hotel is using 150 mobile phones and around 20 have under gone repair during which 0.1 kg of waste has been generated. On an average they discard 57 mobile phones per year which is equal to 5.7 Kg of e-waste. They exchange or replace this discarded mobile with dealers.

ii. ANGRAU- They are using 175 mobile phones out of which 10 have been repaired. During repairing 0.2kg of waste has been generated. On an average they discard 109 mobile phones which is equal to 10.9 Kg of e-waste. They exchange or replace this discarded mobile with dealers.

iii. SSS Hostel- The hostel is using 70 mobile phones. Around 30 mobile phones are repaired. During repairing 0.3kg of waste generated. On an average they discard 37 mobile phones which is equal to 3.7 Kg of e-waste. They exchange or replace this discarded mobile with company dealers.

iv. New Choice- This unit is engaged in repair of mobile phones, have repaired 3312 mobile phones. During repair 37.2 kg of waste has been generated. Most frequently repair parts are key pads, display etc. On an average they discard 8 mobile phones which is equal to 0.8 Kg of e-waste. The mode of disposal is municipal dumping or are sold as second hand equipments.

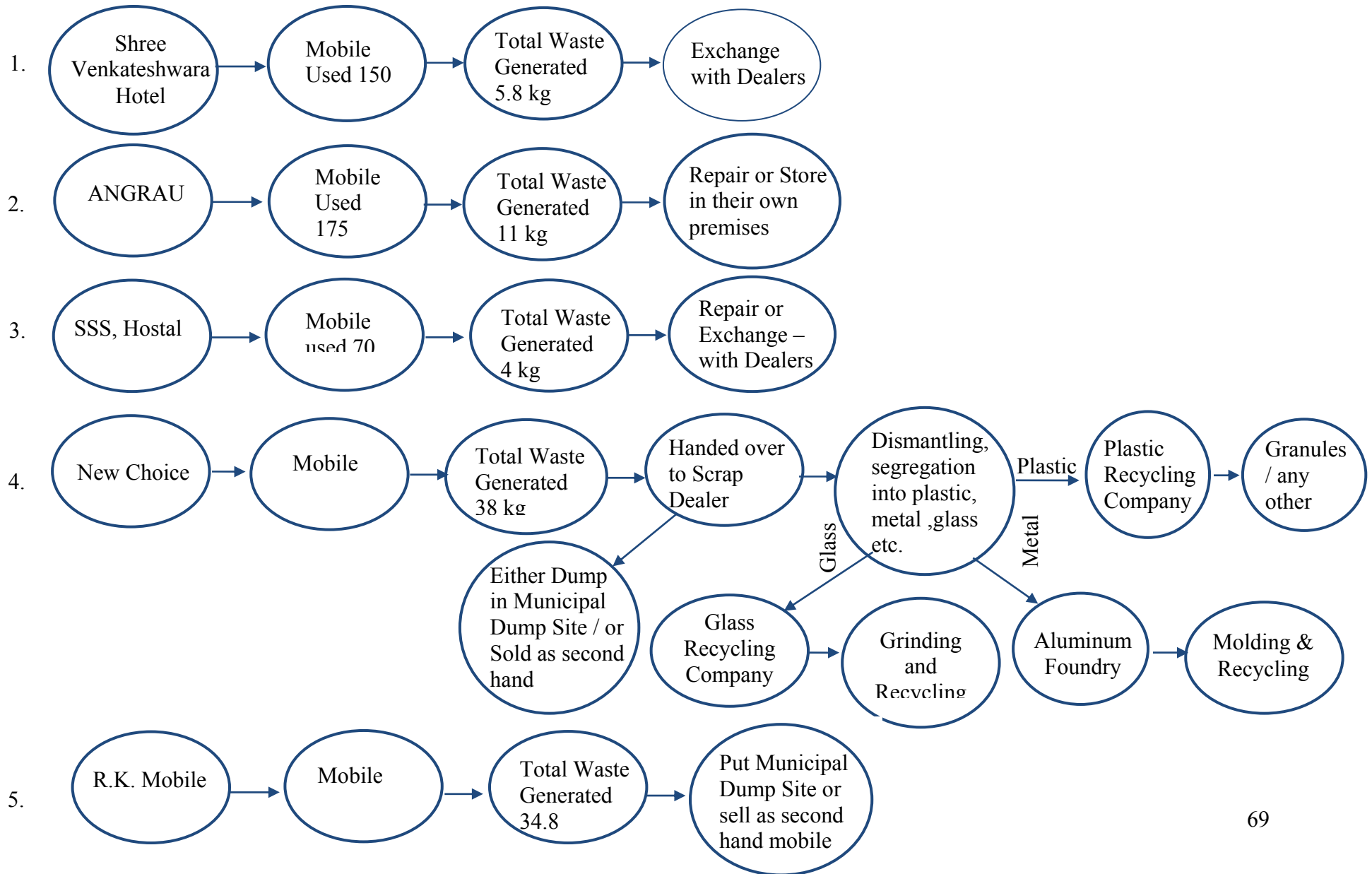
v. R.K Mobile- This is a repairing company and around 2832 mobile phones have been repaired. During repair 33.6 kg of waste has been generated. Components of e-waste are batteries, speakers, display etc. On an average they discard 12 mobile phones which is equal to 1.2 Kg of e-waste . They are dumping this waste into municipal dumping site or are sold as second hand equipments.

Mapping of E-Waste Management & Movement (Hyderabad)

Table : XXX : Mobile Phone – E-Waste

S. No.	Name of Company	Used	Repaired	waste (Kg / Yr)	Discarded	waste (Kg / Yr)	Total Waste (Kg / Y r)	Component of E-Waste	Mode of Disposal	Recycling
1	Shree Venkatesh wara Hotel	150	20	0.1	57	5.7	5.8	Display, Key Pad	replace from company	Nil
2	ANGRAU	175	10	0.2	109	10.9	11	Chips, Panel Boards, Display	Repair or store .	Nil
3	SSS ,Hostal	70	30	0.3	37	3.7	4	Chips, Panel Boards, Display	Repair or Exchange	Nil
4	New Choice	0	3312	37.2	8	0.8	38	Display, Key Pad	Give to scrap dealer or put into Dump	No
5	R.K. Mpbile	0	2832	33.6	12	1.2	34.8	Speakers, Batteries,	Put in to dump or sell as second hand mobile phones	No
	Total	395	6204	71.4	223	22.3	93.6	-	-	-

Mobile Phone E-Waste- Mapping of E-Waste Movement and Management - Hyderabad



5.2 Mapping of E-Waste Movement and Management in Bangalore:

From the exploratory survey and field visits conducted at Bangalore, the following units have been studied extensively for mapping the movement of e-waste. **Table XXXI, XXXII** and **XXXIII** depicts the e-waste movement from computers and printers, televisions and mobile phones respectively. The details are as follows.

5.2.1 Mapping of Movement And Management of E-Waste from Computers and Printers:

To study in detail the movement and management of e-waste and mapping, three bulk users and two repairers have been selected. The data is presented at **Table XXXI**. The details are as follows.

- i. Wipro** - The company uses 12,613 computers and 64 printers, do not prefer to get the computer repair, on an average they discard 750 computers and 10 printers which is equal to 22,200 Kg and 50 kg of e-waste from computers and printers respectively. They are storing in their own premises.

- ii. Satyam** - The company uses 3000 computers and 100 printers, do not prefer to get the computer repair, on an average they discard 200 computers and 35 printers which is equal to 5920 Kg and 175 kg of e-waste they store in their own premises.

- iii. TCS** - The company uses 3000 computers and 60 printers, do not prefer to get the computer repair, on an average they discard 150 computers and 20 printers which is equal to 4,440 Kg and 100 kg of e-waste and they store in their own premises.

- iv. Digitech pvt. Ltd** – This is a repairing center. They repaired 150 computers and 50 printers which is equal to e-waste of 118 Kg .They discard 13 computers and 5 printers which is equal to 409.8 and 25 kg of e-waste. These are sold to scrap dealer and remaining minute waste is dumped into municipal bins. The scrap dealers either sell as second hand equipment or dismantle manually and segregate into plastic waste, glass

waste and metal waste. The plastic waste is sold to plastic factory where it is crushed and grinded into plastic granules. These plastic granules are used for making a new plastic items. The metallic waste is sold to molding industry where it is molded / pulverized to reuse in other form.

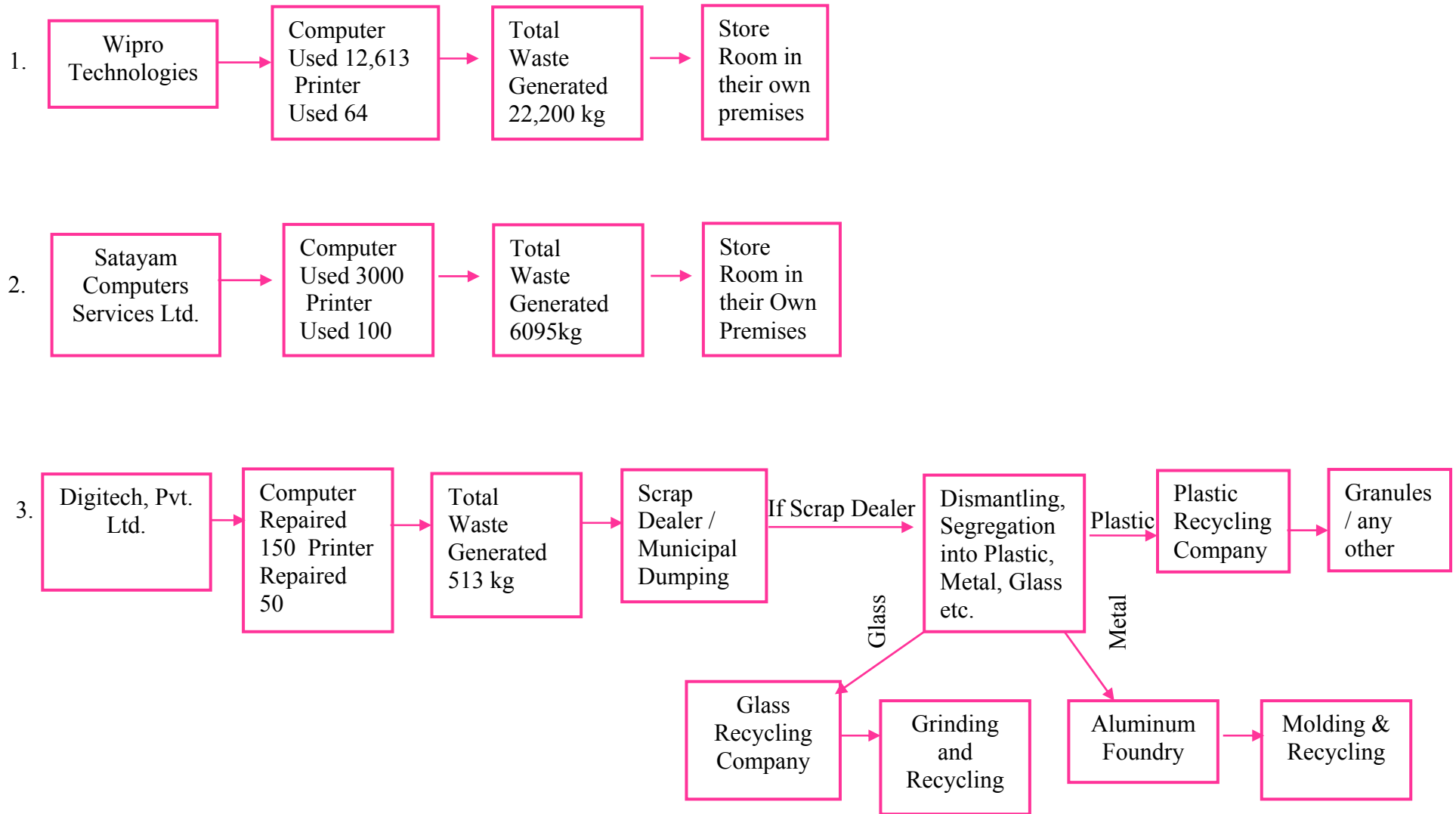
v. Allied Systems & Services – The job of this company is they under take repair works. Around 100 computer and 40 printers have been repaired which is equal to e-waste of 90 Kg of computer waste and 15 kg of printer waste. They discarded 11 computers and 8 printers which is equal to 325.6 Kg and 40 kg of e-waste. The discarded items are sold to scrap dealers and e-waste generated while minor repair is dumped into municipal dumping site.

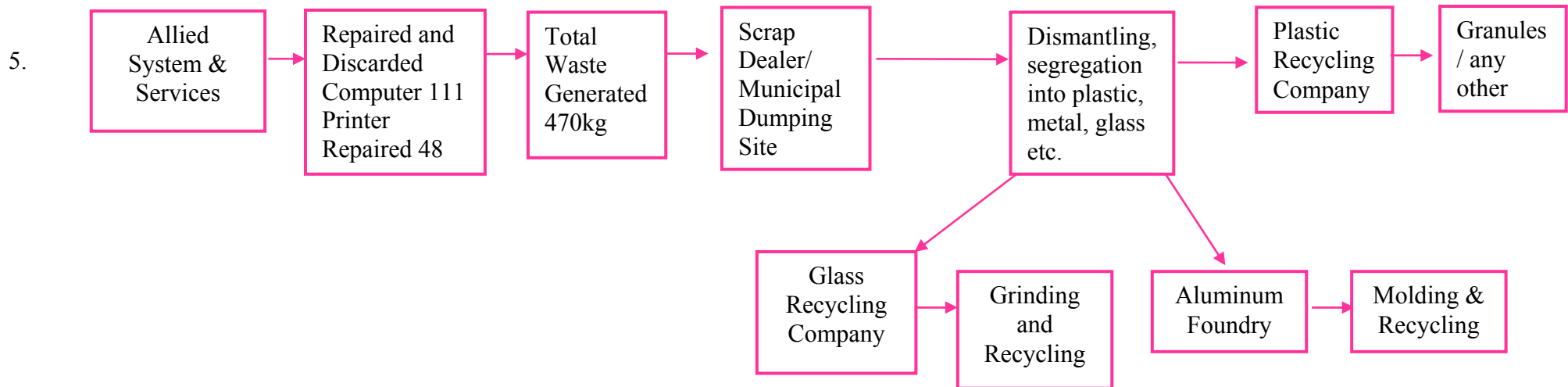
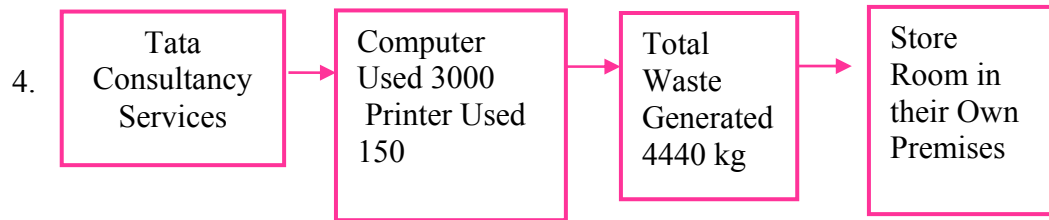
Mapping of E-Waste Management & Movement - Bangalore

Table XXXI : Computers and Printers - E Waste

S.No.	Name of Company	Used	Repaired	Waste (Kg/Yr)	Discarded / Yr	Waste (Kg / Yr)	Total waste (Kg/Y)	Printers Used	Repaired	Waste (Kg/Yr)	Discarded	Waste (Kg / Yr)	Total waste (Kg/Yr)	Component of E-Waste	Mode of Disposal	Recycling
1	Wipro Technologies	12,613	0	0	750	22200	22200	64	0	0	10	50	50	Discarded Computer /Printer	Sotrage Room	Authorized Recycler
2	Satayam Computers Sevices Ltd	3000	0	0	200	5920	5920	100	0	0	35	175	175	Discarded Computer /Printer	Sotrage Room	Authorized Recycler
3	Tata Consultancy Services	3000	0	0	150	4440	4440	60	0	0	20	100	100	Discarded Computer /Printer	Sotrage Room	Authorized Recycler
4	Digitech,Pvt.Ltd	0	150	100	13	384.8	484.8	0	50	18	5	25	43	CPU,Monitor,Key Board, CRF Tubes,Aluminium Chips etc.	Scrap Delear/ Municipal Dumping Site	No
5	Allied Systems & Services	0	100	90	11	325.6	415.6	0	40	15	8	40	55	CPU,Monitor,Key Board, CRF Tubes,Aluminium Chips etc.	Scrap Delear/ Municipal Dumping Site	No
	Total	18,613	250	190	1,124	33,270.4	33,460.4	224	90	33	78	390	423			

Computers and Printers E-Waste- Mapping of E-Waste Movement and Management - Bangalore





5.2.2 Mapping of Movement And Management of E-Waste from Televisions:

To study in detail the movement and management of e-waste and mapping, three bulk users and two repairers have been selected. The data is presented at **Table XXXII**. The details are as follows.

i. Janatha Lodge – They are using 70 televisions and got 10 televisions repaired which is equal 36.2Kg of waste generation. On an average they discard 14 televisions which is equal to 506.8 Kg of e-waste. If any manufacturing defect is detected or any television needs to be discarded, they get it exchanged with dealers.

ii. Mayura Hotel – A total of 85 televisions are in use, 20 got repaired which is equal 72.4Kg of e-waste, on an average they discard 23 televisions that means 832.6 Kg of e-waste. Unused televisions are exchanged with dealers.

iii. Amar Hotel – Around 80 televisions are being used, 30 had to be repaired which is equal 108.6 Kg of e- waste, on an average they discard 17 televisions which is equal to 615.4 Kg of e-waste. They follow exchange offer with dealers.

iv. Gayatri Electronics - They are doing the work of repairing of televisions, repaired 240 televisions, components of repaired parts being mother boards, CRF tubes, condensers etc. The waste generated is 207 Kg, on an average they discard 10 television which is equal to 362 Kg of e-waste. The discarded items are sold to scrap dealers and the e-waste generated during repair is put into municipal dust bin. After purchasing the e-waste the scrap dealers either sell as second hand equipment or dismantle manually and segregate into plastic waste, glass waste and metal waste. The plastic waste is sold to plastic factory where it is crushed and grinded into plastic granules. These plastic granules are used for making a new plastic items. The metallic waste is sold to molding industry where it is molded / pulverized to reuse in other form.

v. Moon Electronics – Their job is to repair televisions. They repaired 290 televisions, components of repaired parts are mother boards, speakers, condenser etc. amounting to

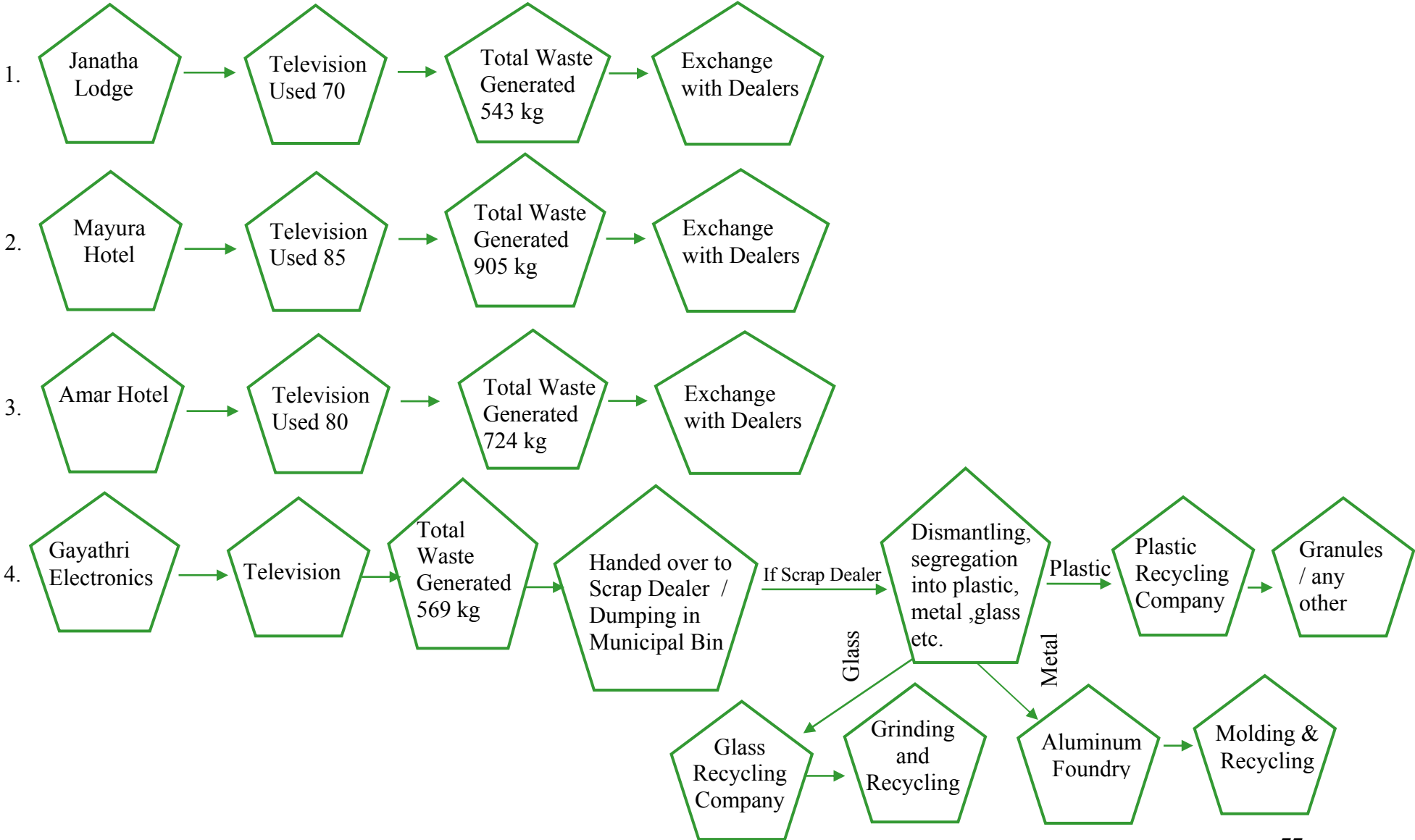
250 Kg of e-waste, on an average they discard 14 television which is equal to 506.8 Kg of e-waste. The discarded items are being sold to scrap dealers and smaller amount of e-waste finds its way into municipal dump site. The scrap dealers either sell as second hand equipment or dismantle manually and segregate into plastic waste, glass waste and metal waste. The plastic waste is sold to plastic factory where it is crushed and grinded into plastic granules. These plastic granules are used for making a new plastic items. The metallic waste is sold to molding industry where it is molded / pulverized to reuse in other form.

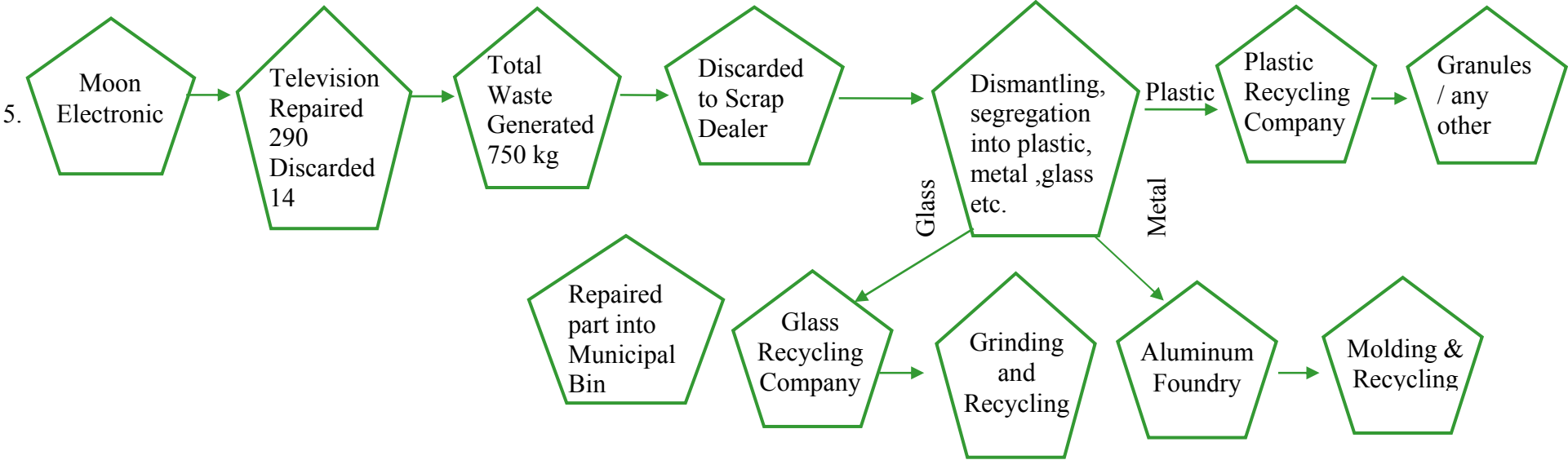
Mapping of E-Waste Management & Movement –Bangalore

Table XXXII- Televisions - E Waste

S. No	Name of Company	Used	Repaired	Waste (Kg/year)	Discarded / Yr	Waste (Kg / Yr)	Total Waste (Kg/Yr)	Components of E-Waste	Mode of Disposal	Recycling
1	Janatha Lodge	70	10	36.2	14	506.8	543	Discarded Television	Exchange to Manufacture Dealer	No
2	Mayura Hotel	85	20	72.4	23	832.6	905	Discarded Television	Scrap Dealer/Seco nd Hand Equipments	No
3	Amar Hotel	80	30	108.6	17	615.4	724	Discarded Television	Exchange to Manufacture Dealer	No
4	Gayathri Electronics	0	240	207	10	362	569	Mother Board, Transformer,C RTubes	Give to scrap dealer	No
5	Moon Electronic	0	290	250	14	506.8	756.8	Spekars,Mothe r Boards	Repaired & discarded parts give to scrap yard person	No
	Total	235	590	674.2	78	2823.6	3497.8			

Mapping of E-Waste Movement and Management - Bangalore
Table: XXXII: Television





5.2.3 Mapping of Movement And Management of E-Waste from Mobile Phones:

To study in detail the movement and management of e-waste and mapping, three bulk users and two repairers have been selected. The data is presented at **Table XXXIII**. The details are as follows.

i. Wipro – There are 10000 employees and all are using mobile phones (1000 mobile phones in use), around 50 mobile phones have been repaired which is equal to 5 kg of e-waste, on an average they discard 450 mobile phones which is equal to 45 Kg of e-waste. In some cases individual employee sell their instrument to second hand dealers and the damaged instruments are sold to scarp dealers.

ii. Satyam - Around 5000 employees works for the company and all have mobile phones (5000 mobile phones), 100 have been repaired which is equal to 10 kg of e-waste, they have discard 100 mobile phones which is equal to 10 Kg of e-waste. It was observed that employees are selling their instrument to second hand dealers and damaged peaces are sold to scarp dealers.

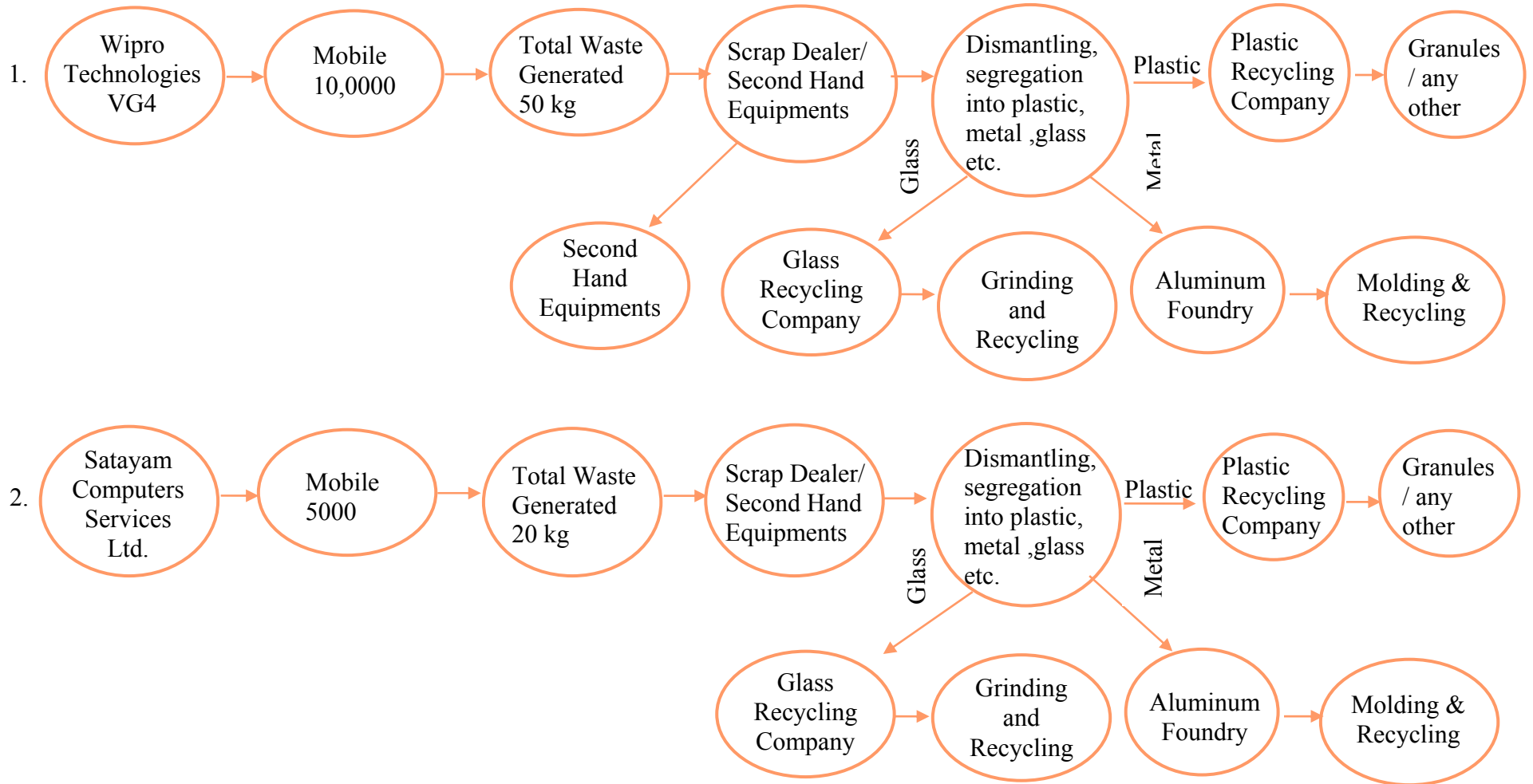
iii. Sanam Deluxe Lodge- A total of 20 mobile phones are used by 20 employees, one mobile phone got repaired which is equal to 0.1 kg of e-waste. They have discarded 7 mobile phones which is equal to 0.7 Kg of e-waste. The instrument which is not fit for use is being sold to scrap dealers.

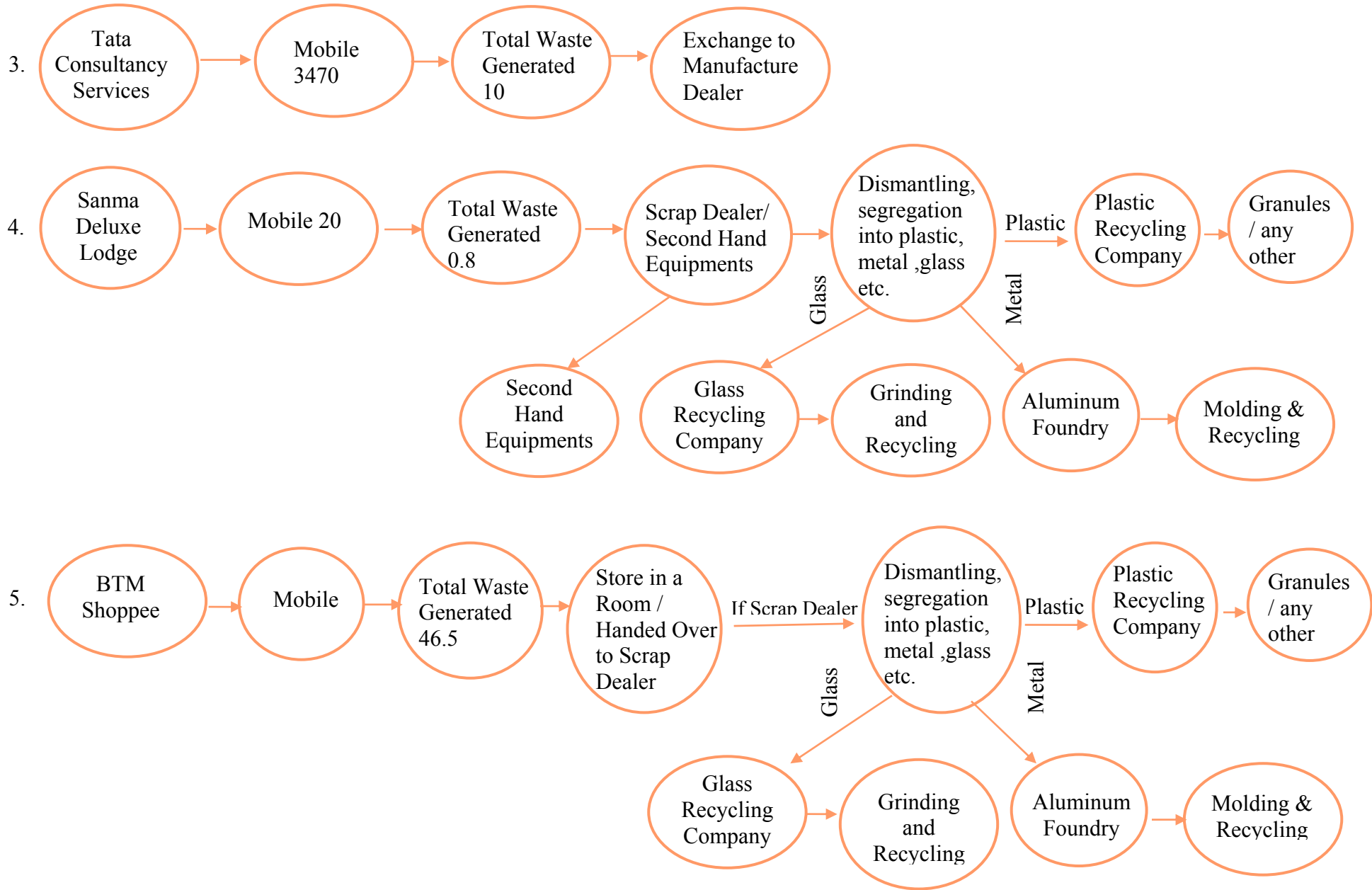
iv. B.T.M Shoppee - They repair mobile phones, repaired 950 mobile phones , components are panel boards, chips, display etc. which is equal to e-waste of 45 Kg. Around 15 mobile phones have been discarded which is equal to 1.5 Kg of e-waste, which they stored in storage room. When the number of mobile phones are sufficient in number they sell to scrap dealer and the repaired small parts are thrown in municipal dump site.

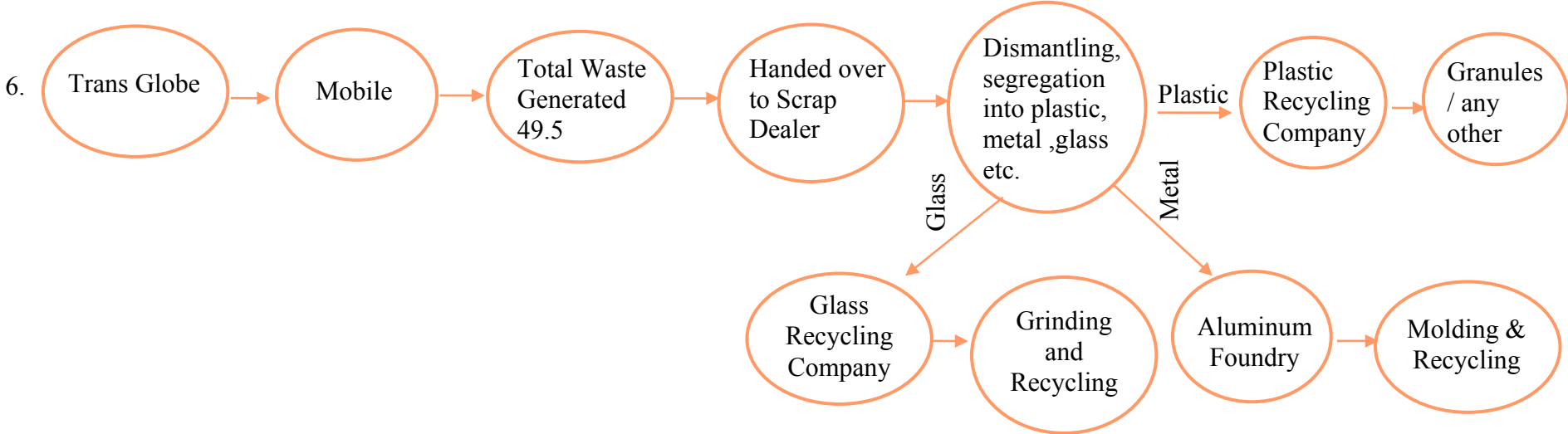
v. Trans Globe - They repaired 980 mobile phones components being panel boards, chips, display etc. which is equal to e-waste of 48 Kg. They have discarded 15 mobile phones which is equal to 1.5 Kg of e-waste. The discarded mobile phones are stored in storage room then after accumulating quite good number sell to scrap dealers and totally useless material is dumped in municipal dump site.

Mapping of E-Waste Management & Movement -Bangalore										
Table XXXIII : Mobile Phones - E Waste										
S.No.	Name of Company	Used	Repaired	Waste (kg/Yr)	Discarded / Yr	Waste (Kg / Yr)	Total Waste (Kg/Yr)	Components of E-Waste	Mode of Disposal	Recycling
1	Wipro Technologies VG4	10000	50	5	450	45	50	Discarded Mobile Phones	Scrap Dealer/Second Hand Equipments	Nil
2	Satayam Computers Sevices Ltd	5000	100	10	100	10	20	Discarded Mobile Phones	Scrap Dealer/Second Hand Equipments	Nil
3	Tata Consultancy Services No. 42	3470	50	5	50	5	10	Discarded Mobile Phones	Exchange to Manufacture Dealer	Nil
4	Sanman Deluxe Lodge	20	1	0.1	7	0.7	0.8	Discarded Mobile Phones	Scrap Dealer/Second Hand Equipments	Nil
5	B.T.M Shoppee	0	950	45	15	1.5	46.5	Chips, Panel Boards, Display	Put into dump or store in a room then handover to scrap dealer	Nil
6	Trans Globe	0	980	48	15	1.5	49.5	Chips, Panel Boards, Display	Give to scrap dealer or put into Dump	Nil
	Total	18490	2131	113.1	637	63.7	176.8			

Mobile Phones E-Waste- Mapping of E-Waste Movement and Management - Bangalore







5.3 Scrap Dealers:

The scrap dealers are unauthorized un authorized organizations. Most of them are dealing all types of scrap such as paper, plastic, metals, cloth, e-waste etc. The details scrap dealers are as follows.

5.3.1 Scrap Dealers of Hyderabad:

The details of identified Scrap dealers with their capacity of handling e-waste is as follows.

1. Shah Enterprises, 8-112,Gowtham nagar, Ferozguda Bowenpally, Hyderabad



**Scrap Dealer in
Hyderabad**

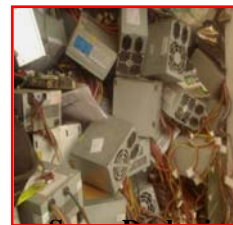
Shah Enterprise is working since 1995. They collect scrap from repairing centers by arranging a trolley/vehicle for collecting scrap. They buy the scrap @ Rs. 13/- per Kg and plastic @ Rs. 5/- per Kg . They are following manual dismantling of Aluminium Condensers, IC's etc.), segregate electronics spare parts and other scrap materials (Aluminium and Iron). Three men and two women are working. No pollution problem and they informed no health problem. They do not recycle the waste, sell this scrap @ Rs. 15/- per Kg to Iron or Alluminium foundry where it gets molded. Holding capacity of E-waste is 100T/ year.

2. H and H Company, Plot No-112 Near Saibaba temple, Sobhna Colony, Balanagar, Hyderabad

H and H Company is working since 1995. They collect scrap from repairing centers, arrange a vehicle to collect scrap. They buy scrap @ Rs. 14/- per Kg and plastic @ Rs. 5/- per Kg. Manual dismantling and segregation of electronic spare parts was observed. Three men are working. No pollution problem, on an enquiry on health related issues they informed that there is no health problem among the workers. They do not recycle the waste, sell this scrap @ Rs. 15/- per kg to Iron or Alluminium foundry where it is molded. They deal with 105 T/year of e-waste.

3. Sana Electronics, Nampally, Hyderabad

Sana Electronics is working since 2001. They collect scrap from repairing centers by arranging vehicle to collect scrap. They buy scrap @ Rs. 13/- per kg and plastic @ Rs. 5/- per kg. They do manual dismantling of Aluminium parts and electronic spare parts (mother Boards, Condensers etc.), segregate electronics spare parts and other scrap materials (Aluminium and Iron). Three men and two women are working.



Scrap Dealer in Hyderabad

No pollution problem, no health problem. They are not into recycling of e-waste. They sell this scrap @ Rs. 15/- per Kg to Iron or Aluminium foundry where it is molded. Plastic material is sold to plastic factory. The deal with 45 T/year of e-waste.

4. Sai Mallikarjuna Traders, 7-2-26/B Railway gate Lane, Fathenagar, Hyderabad

Sai Malikarjuna Traders are working since 2005. They collect scrap from repairing centers. They buy the scrap @ Rs. 13/- per kg and plastic @ Rs. 5/- per kg. Dismantling is manual where in Aluminium parts and electronic spare parts are segregated, electronics spare parts and other scrap material is recovered. Two men and one woman are working. They do not recycle the waste hence no pollution. They sell this scrap @ Rs. 15/- per Kg to Iron or Aluminium foundry where it is recycled. Their capacity to handle e-waste is 36 T/ year.

5. Khairuddin Scrap Materials, Plot No- 50, near Railway Bridge, Balanagar

Kharuddin scrap dealer is new in this field working since 2008. He is collecting scrap from repairing centers by arranging vehicle. They buy scrap @ Rs. 14/- per kg and plastic @ Rs. 5/- per kg. Manual dismantling of Aluminium parts and electronic spare parts (mother Boards, Condensers etc.), segregate electronics spare parts and other scrap materials (Aluminium and Iron). Three men are working. No pollution problem, no health problem. They do not recycle the waste, sell this scrap @ Rs. 15/- per Kg to Iron

or Aluminium foundry where it is molded. Plastic material is sold to Plastic factory. They deal with e-waste of 30 T/year.

6. Fareed Computer Scrap Materials, Patel Nagar, Nampally, Hyderabad



Scrap Dealer in Hyderabad Fareed Computer Material is working since 1999. They are collecting scrap from repairing centers. They buy the scrap @ Rs. 13/- per kg. Manual dismantling of Aluminium parts and electronic spare parts (mother Boards, Condensers etc.), segregate electronics spare parts and other scrap materials (Aluminium and Iron). Three men are working. No pollution problem, no health problem. They do not recycle the waste, sell this scrap @ Rs. 15/- per Kg to Iron or Alluminium foundry where it is molded. Holding capacity of E-waste is 58 T/year.

7. Hyderabad Industries, Road No- 12, Near Shahi Exports, Nacharam IDA, Hyderabad

This scrap dealer is new in this field working since 2008. Collect scrap from repairing centers, arrange a trolley for collecting scrap. They buy scrap @ Rs. 14/- per kg and plastic @ Rs. 4/- per kg. Manual dismantling of Aluminium parts and electronic spare parts (mother Boards, Condensers etc.), segregate electronics spare parts and other scrap materials (Aluminium and Iron). Five men and one woman are working. No pollution problem, no health problem. They do not recycle the waste, sell this scrap @ Rs. 15/- per Kg to Iron or Alluminium foundry where it is molded. Plastic material are sold to Plastic factory. Holding capacity of e-waste is 50 T/year.

5.3.2 Scrap Dealers of Bangalore:

The Scrap dealers identified in Bangalore along with the e-waste handled is as follows.

- 1. Imran Pasha Enterprises, 104th cross, JJ Nagar, Near church, Gauripalya, Bangalore.**

Working since 2000. Collect scrap from repairing centers, once in a week arrange a trolley for collecting scrap. They buy scrap @ Rs. 15/- per kg and plastic @ Rs. 6/- per kg. Manual dismantling of Aluminium parts and electronic spare parts (mother Boards, Condensers etc.), segregate electronics spare parts and other scrap materials (Aluminium and Iron). Four men are working. No pollution problem, no health problem. They do not recycle the waste, sell this scrap @ Rs. 16/- per Kg to Iron or Alluminium foundry where it is molded. Plastic material are sold to Plastic factory. Holding capacity of E-waste is 36 T/Yrs.



Scrap Dealer in Bangalore

2. Ayubpasha Scrap Material, 104th cross, 4th main, JJ Nagar, Near church, Gauripalya, Bangalore.



Scrap Dealer in Bangalore

Working since 2000. Collect scrap from repairing centers, arrange a trolley for collecting scrap. They buy scrap @ Rs. 15/- per kg and plastic @ Rs.6/- per kg. Manual dismantling of Aluminium parts and electronic spare parts (mother Boards, Condensers etc.), segregate electronics spare parts and other scrap materials (Aluminium and Iron). Three men are working. No pollution problem, no health problem. They do not recycle the waste, sell this scrap @ Rs. 16/- per Kg to Iron or Alluminium foundry where it is molded. Plastic material are sold to Plastic factory. Holding capacity of E-waste is 24 T/Year.

3. Rajeshwari Metallurgical Limited, 79 Yashwanthpur, Bangalore-22.

Working since 1999. Collect scrap from repairing centers, arrange a trolley for collecting scrap. They buy scrap @ Rs. 15/- per kg and plastic @ Rs. 6/- per kg. Manual dismantling is practiced. Three men and two women are working. No pollution problem, no health problem. They do not recycle the waste, sell this scrap @ Rs. 16/- per Kg to Iron or Aluminum foundry where it is molded. Plastic material is sold to Plastic factory.

4. Asif pasha ScrapMaterial , 14th cross, Housr Road, Bommanalli, Bangalore.

Working since 2000. Collect scrap from repairing centers @ Rs. 14/- per kg and plastic @ Rs. 6/- per kg. Manual dismantling of Aluminum parts and electronic spare parts (mother Boards, Condensers etc.) are segregated. Two men are working. No pollution problem, no health problem. They do not recycle the waste, sell this scrap @ Rs. 16/- per Kg to recycling industry. Holding capacity of e-waste is 30 T/Year.

5.4 E-Waste Composition:

Electronic appliances are composed of hundreds of different materials that can be both toxic but also of high value. While bulk materials such as iron, aluminum, plastics and glass account for over 80 % weight, valuable and toxic materials are found in smaller quantities but are still of high importance. The material composition of different appliances is often similar, but the percentage of different components can vary a lot. The average weight and composition of personal computer, television and mobile phones are as follows.

Average % Weight and Composition of Personal Computer, Television and Mobile Phone							
Appliances	Average Weight	Fe	Non Fe Metal	Glass	Plastic	Electronic Components	Others Weight
Computer	29.6	53.3	8.4	15	23.3	17.3	0.7
Television	36.2	5.3	5.4	62	22.9	0.9	3.5
Mobile Phone	0.08 to 0.1	8	20	10.6	59.6		1.8

(source: Guidelines for Environmentally Sound Management of E-Waste by MoEF & CPCB, March 2008 & Volume- I : Inventory Assessment Manual by UNEP.)

5.5 Valuable Substances in E-Waste:

Gold, silver, copper, platinum etc. are valuable substances found in e-waste, turn recycling into a lucrative business opportunity. On the other hand, the recycling of hazardous substances, e.g. carcinogens such as lead and arsenic is critical and poses serious health risks and environment dangers if not properly handled. Electrical and electronic equipment contain various fractions of valuable materials. Most of the valuable substances are found in printed circuit boards, which occur in relevant quantities. Besides well known precious metals such as gold, silver, platinum and palladium also scarce

materials like indium and gallium start to play an important role, due to their application in new technologies (e.g flat screens, photovoltaic's).

5.6 Recycling Efficiency and Recoverable Weight of Elements:

Composition of a desktop **personal computer** weighing ~32 kg its recycling efficiency and recoverable quantity of elements are as follows.

Recycling Efficiency and Recoverable Quantity of Elements of Personal Computer						
Material name	Content (% of total weight)	Weight of material in computer (kg)	Use	Location	Recycling efficiency(%)	Recoverable weight of elements
Lead	6.2988	2.016	Metal joining	Funnel glass in CRTs, PWB	5%	0.08566368
Aluminum	14.1723	4.5344	Structural, Conductivity	Housing, CRT, PWB, connectors	80%	3.08389248
Germanium	0.0016	0.000512	Semiconductor	PWBs	0%	0
Gallium	0.0013	0.000416	Semiconductor	PWBs	0%	0
Iron	20.4712	6.5504	Structural, Magnetivity	Housing, CRTs, PWBs	80%	4.45453312
Tin	1.0078	0.3232	Metal joining	PWBs, CRTs	70%	0.19188512
Copper	6.9287	2.2176	Conductivity	CRTs, PWBs, connectors	90%	1.69614576
Barium	0.0315	0.01024		Panel glass in CRTs	0%	0
Nickel	0.8503	0.272	Structural, Magnetivity	Housing, CRT, PWB	0%	0
Zinc	2.2046	0.704	Battery, Phosphor emitter	PWB, CRT	60%	0.35979072
Tantalum	0.0157	0.00512	Capacitor	Capacitors/ PWB, power supply	0%	0
Indium	0.0016	0.000512	Transistor, rectifier	PWB	60%	0.00026112
Vanadium	0.0002	0.000064	Red Phosphor emitter	CRT	0%	0
Terbium	0	0	Green phosphor activator	CRT, PWB	0%	0
Beryllium	0.0157	0.00512	Thermal Conductivity	PWB, connectors	0%	0

Gold	0.0016	0.000512	Connectivity, Conductivity	Connectivity, conductivity/PWB, connectors	99%	0.000430848
Europium	0.0002	0.000064	Phosphor activator	PWB	0%	0
Tritium	0.0157	0.00512	Pigment, alloying agent	Housing	0%	0
Ruthenium	0.0016	0.000512	Resistive circuit	PWB	80%	0.00034816
Cobalt	0.0157	0.00512	Structural, Magnetivity	Housing, CRT, PWB	85%	0.00362984
Palladium	0.0003	0.000096	Connectivity, Conductivity	PWB, connectors	95%	0.00007752
Manganese	0.0315	0.01024	Structural, Magnetivity	Housing, CRT, PWB	0%	0
Silver	0.0189	0.00608	Conductivity	Conductivity/PWB, connectors	98%	0.005037984
Antimony	0.0094	0.003008	Diodes	Housing, PWB, CRT	0%	0
Bismuth	0.0063	0.002016	Wetting agent in thick film	PWB	0%	0
Chromium	0.0063	0.002016	Decorative, Hardener	Housing	0%	0
Cadmium	0.0094	0.003008	Battery, blue-green Phosphor emitter	Housing, PWB, CRT	0%	0
Selenium	0.0016	0.000512	Rectifiers	rectifiers/PWB	70%	0.00030464
Niobium	0.0002	0.000064	Welding	Housing	0%	0
Yttrium	0.0002	0.000064	Red Phosphor emitter	CRT	0%	0
Rhodium	0	Â	Thick film conductor	PWB	50%	0
Platinum	0	Â	Thick film conductor	PWB	0%	0
Mercury	0.0022	0.000704	Batteries, switches	Housing, PWB	0%	0
Arsenic	0.0013	0.000416	Doping agent in transistors	PWB	0%	0
Silica	24.8803	7.9616	Glass, solid state devices	CRT,PWB	0%	0

(Source: Study on Cyber Waste in Karnataka , Final Report , Sponsored by Department of Ecology & Environment Conducted by EMPRI , May 2005I and Volume- I : Inventory Assessment Manual by UNEP)

Recycling efficiency and recoverable quantity of elements of televisions are as follows.

Recoverable Quantity of Elements in a Television				
S.No	Elements	Percentage	ppm	Recoverable Weight of elements (kg)
1	Aluminum	1.2		0.4344
2	Copper	3.4		1.2308
3	Lead	0.2		0.0724
4	Zinc	0.3		0.1086
5	Nickel	0.0038		0.013756
6	Iron	12		4.344
7	Plastic	26		9.412
8	Glass	53		19.186
9	Silver		20	0.000724
10	Gold		10	0.000362

(Source: E-Waste Volume I, Inventory Assessment Manual- UNEP)

Recovery and recycle of mobile phones are in the early stages of development. The recoverable quantity of elements are as follows.

Recoverable Quantity of Elements in a Mobile Phones	
Metal	Wt (g)
Copper	16 (1 to 3 % can be recovered)
Silver	0.35 (3 to 10 % can be recovered)
Gold	0.034 (4 to 18% can be recovered)
Palladium	0.015 (small quantity)
Platinum	0.00034 (small quantity)

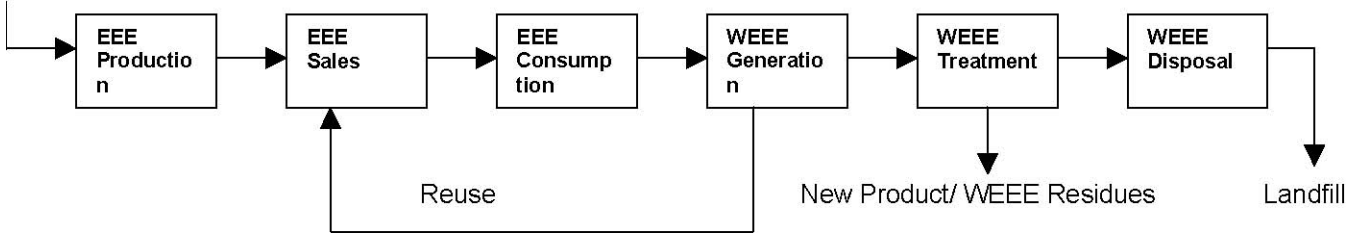
(Source: http://www.eoearth.org/article/Cell_phone_recycling)

5.7 Life Cycle of E-Waste:

Conceptual life cycle of electrical and electronic equipment (EEE) is shown in the following figure where in the life cycle of E-waste starts after electrical and electronic equipment's consumption period.

Conceptual Life Cycle of Electrical and Electronic Equipment

Raw Material Input



(Source: E-Waste Volume I, Inventory Assessment Manual- UNEP)

5.7.1 Average Life of Electronic Goods:

Average life cycle/ obsolescence rate is the time span after which the electrical and electronic item comes to its “end of life”. It can be defined in terms of ‘active life’, ‘passive life’ and “storage”.

Average life cycle/ Obsolescence rate = Active Life + Passive Life + Storage

The number of years, a machine can be effectively used is called its active life. After active life, it can be refurbished or reused for certain time period. This time period constitutes passive life. Storage includes storage time before disposal and storage at repair shops before dismantling.

In developed countries, average life cycle of electrical and electronic equipment is generally equivalent to “Active Life”, while in developing countries, it is a sum of active life, passive life and storage. Therefore, in developing countries, a second hand market exists for WEEE/ E-waste after its active life. All the three parameters vary in different geographical regions. Therefore, average life cycle/obsolescence rate varies in each geographical region and leads to different WEEE/ E-waste inventory.

6. Projection

Annual e-waste generation from Hyderabad and Bangalore (computer and printer, television and mobile phone) from all sectors is **3,263.994 MT** and **6743.87MT**. Around 95,120 Kg and 1,21,410 Kg of e-waste (computers, television and mobile phones) from house hold sector is generated in Hyderabad and Bangalore respectively in 2009 and the same is expected to touch 1,07,886 Kg and 1,30,383 Kg by 2013 respectively. Most of the e-waste collectors and recyclers, only do size reduction (shredding) and segregation. The formal sector Earth Sense in Hyderabad and E Parisaraa in Bangalore they too do size reduction by dismantling, shredding and segregation. After segregation Earth Sense send its waste to E Parisaraa and in turn it gets exported to Belgium along with its waste for precious metal recovery.

Annual e-waste generation for Hyderabad and Bangalore has been estimated. The details are presented at **Tables XXXIV to XXXXIII** for Hyderabad and Bangalore. Projection of e-waste for five years based on population projection and findings from house hold sector have been estimated from 2009 to 2013 and presented at **Table XXXXIV and XXXXV** for Hyderabad and Bangalore respectively.

6.1 Annual Waste Generation In Hyderabad :

To estimate the annual waste generation, guidance from the report on Study on E-Waste In Kolkata. The total amount of e-waste generation annually in Hyderabad is 3,264 MT. The break up is as follows. From computers 3111.25 MT, 86.46MT from printers, 61.0 MT from televisions and 5.284 MT from mobile phones. Details is presented at **Tables XXXIV to XXXVIII**.

Table XXXIV : Annual Waste Generation - Personal Computer (Hyderabad)

Personal Computers								
S.No.	Sector Studied	Wt of E-Waste (MT)	Period of Obsolescence / Yr	No. of Unit Observed	E-Waste MT / Yr / unit	No. of Actual unit Exits	Total Amount of E-Waste Generated MT / Yr	
1	Assembler	0	3	20	0	180	0	
2	Manufacturer / Dealer	0	3	19	0	3 / 280	0	
3	Consumers	IT Sector	14	3	5	0.93	2515	2338.95
		Government Organizations.	7.4	3	1	2.46	282	693.72
		Other Users	0.47	3	9	0.01	698	6.98
		Household	0.013	3	26	0.00016	7211997 =18 % of 1.4 Million Households = 25631.89	41.54
4	Repairer	6.5	3	8	0.27	110	29.7	
						Total	3111.25	

Table XXXV: Annual Waste Generation - Printers – Hyderabad

Printers								
S.No	Sector Studied	Wt of E-Waste (MT)	Period of Obsolescence / Yr	No. of Unit Observed	E-Waste MT / Yr / unit	No. of Actual unit Exits	Total Amount of E-Waste Generated MT / Yr	
1	Assembler	0	4	0	0	0	0	
2	Dealers	0	4	19	0	0 / 220	0	
3	Consumer	IT Sectors & Other Users	0.025	4	14	0.00044	3213	1.41
		Government Org.	1	4	1	0.25	282	70.5
		Household	0.005	4	26	0.000048	7211997 =18 % of 1.4 Million Households = 25631.89	12.46
4	Repairer & Care Centre	0.62	4	8	0.019	110	2.09	
						Total	86.46	

Table XXXVI: Annual Waste Generation - Televisions – Hyderabad

Televisions								
S.No.	Sector Studied	Wt of E-Waste (MT)	Period of Obsolescence / Yr	No. of Unit Observed	E-Waste MT / Yr / unit	No. of Actual unit Exits	Total Amount of E-Waste Generated MT / Yr	
1	Assembler	0	10	12	0	110	0	
2	Dealers	0	10	15	0	0 / 220	0	
3	Consumer	Hotels	0.83	10	3	0.027	92	2.484
		Private Hostels & other Users	2.01	10	9	0.011	260	2.86
		Household	0.1	10	39	0.0002	7211997 =18 % of 1.4 Million Households = 25631.89	51.92
4	Repairer	3.4	10	13	0.026	130	3.38	
						Total	61.0	

Table XXXVII: Annual Waste Generation - Mobile Phones- Hyderabad

Mobile Phones								
S.No.	Sector Studied	Wt of E-Waste (MT)	Period of Obsolescence / Yr	No. of Unit Observed	E-Waste MT / Yr / unit	No. of Actual unit Exits	Total Amount of E-Waste Generated MT / Yr	
1	Assembler	0	2	6	0	80	0	
2	Dealers	0	2	7	0	0 / 360	0	
3	Consumer	Hotels & other Users	0.014	2	7	0.001	838	0.838
		University	0.011	2	1	0.0055	12	0.066
		Household	0.0005	2	39	0.0000064	7211997 =18 % of 1.4 Million Households = 25631.89	1.66
4	Repairer	0.2104	2	6	0.017	160	2.72	
						Total	5.284	

XXXVIII: Total Annual E-Waste Generation in Hyderabad - (MT)		
S. No.	Three Sub Sectors	Quantity of E-waste
1	Personal Computers	3,111.25
2	Printers	86.46
3	Televisions	61.00
4	Mobile Phones	5.284
	Total Waste	3,263.994

6.2 Total Annual E-waste generation in Bangalore :

To estimate the annual waste generation, guidance from the report on Study on E-Waste In Kolkata. The total amount of e-waste generation annually in Bangalore is 6743.87 MT. The break up is as follows. From computers 6,558.9 MT, 53.71MT from printers, 76.91 MT from televisions and 54.35 MT from mobile phones. Details is presented at **Tables XXXIX to XXXXIII.**

Table XXXIX: Annual E - Waste Generation - Personal Computer –Bangalore								
S. No.	Sector Studied		Wt of E-Waste (MT)	Period of Obsolescence / Yr	No. of Unit Observed	E-Waste MT / Yr / unit	No. of Actual unit Exits	Total Amount of E-Waste Generated MT / Yr
1	Manufacturing		0	3	8	0	0	0
2	Consumers	(IT Sector)	34.12	3	8	1.42	4500	6390
3		Government Org.	0.059	3	1	0.019	175	3.325
		House holds	0.009	3	20	0.00015	16,780,626 / 5 = 18% 3.3 million = 604102.53	90.61
4	Repairer		3.4	3	9	0.1	600	75
							Total	6,558.9

S.No.	Sector Studied	Wt of E-Waste (MT)	Period of Obsolescence / Yr	No. of Unit Observed	E-Waste MT / Yr / unit	No. of Actual unit Exits	Total Amount of E-Waste Generated MT / Yr
1	Manufacture	0	4	8	0	0	0
2	Consumers (IT Sector)	0.365	4	8	0.011	4500	49.5
3	Government Organizations	0.005	4	1	0.0012	175	0.21
4	Repairer	0.36	4	9	0.01	400	4
						Total	53.71

S.No	Sector Studied		Wt of E-Waste (MT)	Period of Obsolescence / Yr	No. of Unit Observed	E-Waste MT / Yr / unit	No. of Actual unit Exits	Total Amount of E-Waste Generated MT / Yr
1	Manufacture		0	10	8	0	0	0
2	Consumers	(Hotels)	4.7	10	10	0.047	430	20.21
4		House holds (As per 2001 census)	0.006	10	24	0.000025	16,780,626 / 5 = 18% 3.3 million = 604102.53	15.10
3	Repairer		4.71	10	9	0.052	800	41.6
							Total	76.91

S.No	Sector Studied		Wt of E-Waste (MT)	Period of Obsolescence / Yr	No. of Unit Observed	E-Waste MT / Yr / unit	No. of Actual unit Exits	Total Amount of E-Waste Generated MT / Yr
1	Manufacture		0	2	9	0	0	0
2	Consumers	(IT & Hotels)	0.1033	2	10	0.005	4930	24.65
		House hold	0.00125	2	24	0.000026	16,780,626 / 5 = 18% 3.3 million = 604102.53	15.7
3	Repairer		0.36	2	8	0.02	700	14
							Total	54.35

S.No.	Three Sub Sectors	Quantity of E-waste
1	Personal Computers	6558.9
2	Printers	53.71
3	Televisions	76.91
4	Mobile Phones	54.35
	Total Waste	6743.87

6.3 Year Wise Projections of E-Waste in Hyderabad :

The year wise projection of e-waste due to computers, televisions and mobile phones is presented at **Table XXXXIV**.

Year	Population	Disposal of Assets			Waste Generation Kg			Total Waste Kg
		Computers	Televisions	Mobile Phones	Computers	Televisions	Mobile Phones	
2009	72,11,997	25,963	54,089	25,963	41,540	51,920	1,660	95,120
2010	74,42,780	26,794	55,820	26,794	42,869	53,581	1,713	98,163
2011	76,80,948	27,651	57,607	27,651	44,240	55,296	1,767	1,01,303
2012	79,26,738	28,536	59,450	28,536	45,655	57,065	1,823	1,04,543
2013	81,80,393	29,449	61,352	29,449	47,117	58,890	1,881	1,07,886

6.4 Year Wise Projections of E-Waste in Bangalore:

The year wise projection of e-waste due to computers, televisions and mobile phones is presented at **Table XXXXV**.

Year	Population	Disposal of Assets			Waste Generation Kg			Total Waste Kg
		Computers	Televisions	Mobile Phones	Computers	Televisions	Mobile Phones	
2009	16,780,626	60,410	1,25,854	60,410	90,610	15,100	15,700	1,21,410
2010	17,082,677	61,497	1,28,120	61,497	92,240	15,371	15,982	1,23,593
2011	17,390,166	62,604	1,30,426	62,604	93,900	15,647	16,269	1,25,816
2012	17,703,189	63,731	1,32,773	63,731	95,590	15,928	16,561	1,28,079
2013	18,021,846	64,878	1,35,163	64,878	97,310	16,214	16,859	1,30,383

7. Conclusion and Recommendation

Many of the institutions which are not aware of the E-waste management guidelines have admitted to their ignorance and have expressed the need for education and training regarding the guidelines. A need for educational and awareness program for technicians has also been expressed so that, they too can be clear about waste management issues. Many Institutions felt that this should be a part of their pre-service curriculum apart from what they learn in the institutions where they work. There should be a common pool of information on E-waste management for all to share. Some of them have asked that awareness be created among the general public too and for this, NGOs should be involved for imparting proper education and awareness regarding E-waste management besides conducting such programs in their institutions. Many institutions are involved in illegal trade of their waste. Improper disposal of the waste close to residences and other small establishments has indicated not only their non compliance to rules but also ignorance of environment problems associated with it. It is understood that, motivation towards that a management of e-waste is important for public health and the people own protection is essential. Development and publication of relevant education materials in local languages for the different categories involved in this activity of waste management tackling specific issues should be carried out regularly and should be updated periodically. The status of health of women should be studied who are working in recycling of waste in informal sector.

The primary and secondary data, interviews with various categories of people and estimation of e-waste suggests that the generation of e-waste in Hyderabad and Bangalore are going to increase due to high obsolescence rates, lack of policy for disposal for producers, consumers and manufacturers and lack of awareness. The manufacturers need to undertake green initiatives like Take-back and Extended Producer Responsibility (EPR) for taking responsibility of environment friendly disposal of their end of life products as they form the largest contributor of e-wastes. All individuals who generates e-waste should take the responsibility for proper collection and disposal of e-waste. The government and regulatory agencies have a major role to play by formulating guidelines,

benchmarks, creation of awareness and monitoring the implementation of norms. The consumers should adhere to the norms and policies of the government while disposal of their end of life products. The NGOs and civil society action group should enhance the capacities and build awareness of the producers and consumers on the hazards associated with improper disposal, extending the useful life of products and reuse.

The role of informal sectors in managing such complex e-waste is also been a subject of great appreciation by many. This has to be formalized. As per the current regulation on Hazardous waste management, all these operations would be termed illegal and would require to be regulated by the state authorities. There is an urgent need to bring all stakeholders and engage them in dialogue to find sustainable solutions on the issue of e-waste. One of the foremost requirements is to have sustainable legislation on electronic and electrical waste. The current policy states only about the recyclers. It has to impose stringent procedures to the generators also. There is a need of a proper technology to be adopted by the recyclers. It seems that the recyclers are collecting, dismantling and segregating the waste. Extended producer responsibility is perceived is to be the most appropriate frame work that attempts to amalgamate all the enlisted principles of environmental justice. Along with the sound legislations and the will to implement, there should be a new recycling infrastructure. An awareness programs should be conducted to focus on developing a knowledge base and a better understanding the current e-waste scenario in India. Another important challenge is the lack of awareness amongst the generators of e-waste, ranking from the individual consumers to large corporations. They are still auctioning their e-waste for disposal. They have to prefer only the authorized vendors. “Passing the buck” attitude is also seen among many of the establishments as they felt that only the Government should manage the waste and they have no role in it. All these people are not aware of the principles like “Polluter must pay” and “generators have responsibility”.

Recovery and recycling of e-waste is in the early stages of development. For e-waste recycling to grow, recycling must become economically viable. Efficient recovery infrastructure, product designs that simplify dismantling, and other changes are needed to

facilitate the growth of e- waste recycling. When these items (mobile phone, television, computer and printer become obsolete, however, the quantity and value of the metals contained in those items become significant.

A common guidance document needs to be developed for the control of illegal traffic and environmental sound management of e-wastes. Develop criteria on distinguishing waste from non-waste, hazardous e-wastes from non-hazardous e-waste. National and regional policies to be evolved for managing the e-waste in environmental sound manner. To make available the information on e-waste definition, characteristics, generation, collection, transportation, import and export a net work to be established through the Basel Convention Regional Centers.

Annex I

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17. Report Assessment of Electronic waste in Mumbai- Pune Area by IRG Systems South Asia Pvt.Ltd New Delhi for Maharashtra Pollution control Board.
18. Report of the Project on the import/Export Management of E-waste and Used EEE. By Basal convention coordinating center for Asia and the Pacific.
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➤ **Information from Meeting & Discussion :**

1. Discussion on E-Waste Management with Mr. Md. .Amjad Ansari, Assistant Manager, Earth Sense Recycle Private Limited.
2. Discussion on E-Waste Management with Mr. Robert, Chief Executive, Earth Sense Recycle Private Limited.
3. Discussion on E-Waste Management & Inventorisation with Lt Col Ganta Chandrashekhar Rao ,Joint Director (Infrastructure),in Information Technology & Communications Department ,A.P. Secretariat, Hyderabad (India).
4. Meeting with Mr. D. Sudhakar Executive Engineer from GHMC.
5. Meeting & Discussions with, Fareed Malik, Fareed Computer Scrap Materials.
6. Meeting & Discussions with, Mohd. Hussain, H & H Company Trading of All Kinds of Scrap & General Supplier.
7. Meeting & Discussions with, Md.Abdul Hussain, SHAH Enterprises Trading of All Kinds of Scrap & General Suppliers.
8. Meetings and discussions with Mr. Imran Pasha of scrap dealer Trading all kind of scrap in Bangalore.
9. Meetings and discussions with Mr. Ayub Pasha of scrap dealer for Trading all kind of scrap & General Supplier in Bangalore.

10. Meetings and discussions with Mr. Asif Pasha of Scrap dealer for Trading all kind of scrap in Bangalore.
11. Meeting & Discussions with, Baqir Shameem, Arfasa Enterprises, Trading of All Kinds of Scrap & General Supplier.
12. Electronic Equipments Exhibition, 27th December2008, khairtabad from Jetking Institute (Institute of Hardware & Networking), Hyderabad.
13. Discussions with authorized and unauthorized television Repairers in Hyderabad and Bangalore for gathering actual units.
14. Discussions with authorized and unauthorized computer Repairers in Hyderabad and Bangalore for gathering actual units.
15. Discussions with authorized and unauthorized mobile phones Repairers in Hyderabad and Bangalore for gathering actual units.
16. Discussion with computer assemblers, dealers and repairers.