

5. CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The research was discussed with PMC [Pune Municipal Corporation] Joint commissioner Mr. Suresh Jagtap, PMC Environment Officer Mr. Gowde, Ms. Archana Leading Coordinator for Swatch Bharat NGO and Maharashtra Pollution Control Board Assistant Regional Officer Mr. Salunke; the important inputs from them were included in the study and design of Conclusion and Recommendation .

This chapter covers the essence of the study. It covers - the gap in the Green IT awareness in cross-section of industries, Green IT implementation variation, e-waste disposal practices in companies in Pune and recycler challenges

5.1.1 E-waste Management in Pune

The conclusions from the study are as below:

- i. The survey demonstrates that eight percent of the companies have Green IT practices implemented, thirty seven percent plan to have it implemented in 1 year and forty two percent of organizations have not planned for green practices implementation yet. The data reflects the lack of awareness of Green IT initiatives and its benefits.
- ii. India is the world's fourth largest energy consumer. Its energy requirements continue to increase, but national energy shortages and an inadequate energy infrastructure could perpetuate national energy poverty.
 - a. Hence it is extremely important that Energy saving practices are propagated via education and government regulations resulting in the Green IT practices strengthening among the corporate.
 - b. 9% of the companies include the Green IT implementation of the department and energy saving targets to give benefits to the employees.
 - c. The decision on Green IT policy was in hands of senior management -CIO, COO and board of directors for 88% of the organizations.
 - d. Maximum use of Green IT practices in office environment 57.3 % and data center

56.3%.

iii. In Fig 5.1, 74% of the E-waste produced from the Organization is disposed via unorganized methods comprising Dismantler, scrap dealers, kept in warehouse and thrown; the constituents-ingredients of E-waste are not scientifically treated which increases risk to the environment, as hazardous materials are exposed to environmental streams. The environmental and health impacts are immense which may be immediate or long term impacting current and future generation. Further details can be read from "E-waste and Health Hazards" [28]

The distribution of Disposal

Disposal							
	Dismantler	Recycler	NGO	Scrap dealer	Warehouse	Thrown	Total
Numbers	30	13	2	33	10	13	101
%	29.7	12.87	2.02	33.33	9.21	12.87	100
95% CI	21.41-39.15	7.35-20.5	0.33-6.38	24.07-42.26	5.14-16.94	7.35-20.5	

Table 5.1 Disposal Methods

iv. Only 10.9% of the organizations are keeping the e-waste disposal records for last three years. In rest of the 89.1% the tracking mechanism of e-waste generated and disposed yearly does not exist. With lack of inventory management mechanism, e-waste generated from the city and country cannot be calculated. Also the disposal mechanism [pt iii] by the customers is not visible to the government. This creates huge gap for the cumulative data of e-waste available from the organization, city and country to assess and formulate the strategies for the country to address the e-waste issue.

Records of E-waste	Frequency	Percent	95%CI
Yes	11	10.9	5.86-18.14
No	90	89.1	81.86-94.14
Total	101	100.0	

Table 5.2 : Confidence Interval for the Organizations keeping E-waste

v. In Maharashtra Four recyclers registered with MPCB (Appendix A).

overall capacity of recycling in the three units is 10440 MTA the fourth recycler is non-operative, out of which utilized capacity 2026 MTA, which is 19.4% (95% CI 18.66-20.77). That means the remaining 80.6% capacity is unutilized in these recycling plants. 8-9% of the total E-waste generated in the state is only reaching the recyclers the 95% CI 4.9- 13.89. The remaining 91.% is being disposed by hazardous recycling techniques.

Recycler	Total Capacity in MT/A	Actual capacity of operation	Capacity of operation monthly(95% CI)	Expected e-waste reaching them (95%CI)
Recycler 1	7200	1440	20%(19.09-20.94)	8%(3.78-14.62)
Recycler 2	240	36	15%(10.9-19.94)	9%(4.47-15.87)
Recycler 3	3000	450	15%(13.76-16.31)	8%(3.78-14.62)
Total	10440	2026	19.4%(18.66-20.77)	8.33%(4.9-13.89)

Table 5.3 : Recycler Statistics

5.1.2 Unorganized PC Manufacturing

Assembled PC and Laptops manufacturer were interviewed on e-waste management practices followed by them, they were also enquired about the challenges they face.

5.1.2.1 Penetration into Class B and Class C cities

India's majority of the population stays in rural areas. Low cost startups, huge demand and good earnings give immense motivation to the assemblers to start business from home. They have good understanding of the local market and are able to reach out to customers conveniently. Low or negligible advertisement and marketing cost. FDI's and big brands usually have high cost of advertisement, also the cost of computers are much higher than what local assembler quotes. From the study 45% Assembling firms in Pune confirmed that during festive season and weekends, they had huge sales when people from rural areas came and took bulk orders for running businesses in small towns and villages.

5.1.2.2 Restriction of Hazardous Substances Directive (RoHS) Regulation are not applied on the products in unorganized sector

There no distinctive quality certification for the products manufactured /assembled in this sector. There are no formalized records to monitor Sales from unorganized channel. The data is not available, which severely impacts the body of knowledge. This would eventually create hindrance on predicting the turnover and earnings from the sector at city/state or national level. This also causes hindrance in predicting e-waste from assembled electronic products.

5.1.2.3 ERP regulation [E-waste regulation on extended producer responsibility] are not clearly defined

The ERP regulations are not clearly defined on the assembled computers, hence no formal responsibility exists to the Assembled PC's manufacturers/dealers for the Recycling of the Computers E-Waste once it is discarded by the users .

This creates very big problem, as e-waste is untracked. There is need to create awareness on e-waste problem and create formal process for e-waste disposal for the suppliers and the consumers.

5.2 Recommendation

5.2.1 Business Model 1-Proactive E-waste Management for Smart City

New Business Model is proposed for E-waste management in City , State and country by creating handshake between the end-user/s and Recycler giving visibility to the government on E-waste generation and its consumption. **The software is created as part of the research to support the model. It is B2B, B2C and B2 G Business model (Chapter 4).**

- a. Users will Register into the Software system per their profile as - Recycler , End User- IT Companies, Government .
- b. The IT Companies / Individual users can enter the E-waste items to be sold with their preferred price also status as - Working / Non-Working .

- c. The other IT companies can buy the pre-owned Working items at lower cost. They can bid for same.
- d. The End-user holds rights to sell the equipment at his preferred quote and customer.
- e. The Non-working equipment available in the system can be bought by the registered recycler's.
- f. Government will be able to see the transactions. It'll be able to calculate the e-waste generated from city /state and its end state.

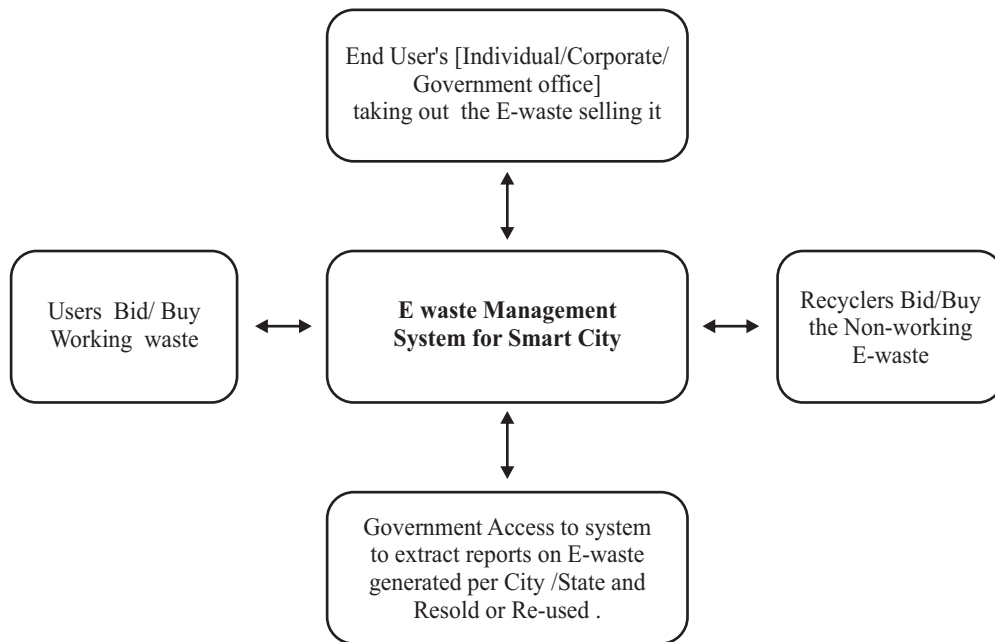


Fig 5.1 Smart City Business Model

Benefits of the Model

- I. Yearly disposal from the IT Company can be tracked through the system.
- ii. It provides “Open Market “concept where supplier and customers are available in one place, allow fast circulation of items.
- iii. E-waste can be resold through the system, which allows extending the EOL of the equipment.
- iv. Recyclers can reach the IT Companies to buy the E-waste system .
- v. It provides ONE STOP shop for E-waste disposal.

5.2.2 Business Model 2-E-waste Management with CSR for Socio-economic Upliftment

New business model is proposed for e-waste management as CSR initiative for socio-economic upliftment. It is self powered and extremely sustainable model (in fig. 5.2). The companies earning revenue more than five hundred crores yearly are required to spend two percent revenue under CSR Bill [25][26]. In India main concerns are Literacy, poverty and energy. The business model addresses all the 3 concerns to great extent (in fig. 5.2).

It provides B2B , B2C and B2G model . The model suggests following steps :

- a. Government authorized CSR consultants to authorize and regulate CSR earnings and investments.
- b. The companies taking out yearly E-waste will contact CSR consultant [New position- job opportunity] for disposal. They would provide certificates for working non-working HW. The Non -working hardware would be given to the government authorized recyclers for complete disposal .However the working hardware will be used to setup public cloud at district and state level.
- c. The CSR consultants can engage the universities and IT department of companies to get technical and financial help to set first time public cloud.
- d. Government should facilitate computer literacy programs associated with universities. CSR consultants to affiliate with universities and governments to launch free education program and create centers for learning's with NGO's for educating people [men/women] from 15-40 years. This will create immense literacy, empowerment and employability for the people living in slums , under privileged, orphans and families below poverty line.
- e. The employees from the companies can share their knowledge in the training centers as part of corporate social responsibility, which would enhance the personal gratification and engagement.
- f. The model will give benefits at state and national level. Also it will enhance employee retention within companies.

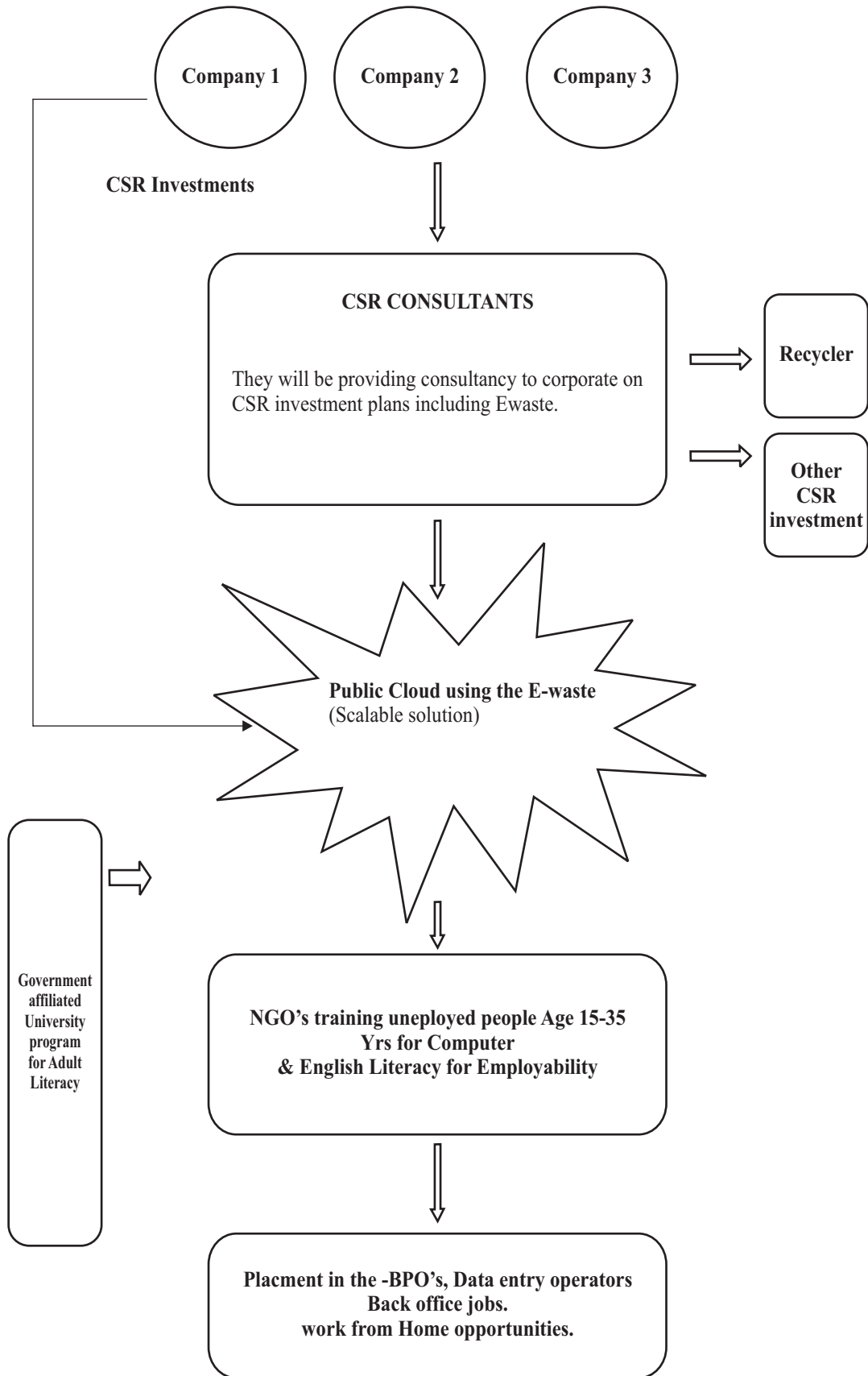


Fig 5.2: Business Model 2 : CSR oriented e-waste management

Benefit of the Model:

- i. Centralized model for CSR investments to allow visibility and transparency to government for regulating and directing investments/expenses to needed venues.
- ii. The model assists in utilizing the discarded hardware for betterment of society which otherwise would be restricted in use or put in landfills. In order to extend the life of these assets by an additional two (2) to three (3) years, re-using electronic equipment is nine times greater for the environment than recycling it.
- iii. Immense opportunity for NGO. It provides playground to come with several literacy and employment initiatives to utilize the wealth being made available from CSR funds for collective betterment of society.

5.2.3 Business Model 3 - E-waste management for IOT enabled devices and wearables.

- a. As in fig. 5.3 after the devices will be sold to the customer /consumer the tracking mechanism is enabled and device registered with customer details.
- b. The health check report of the devices is regularly published to the manufacturer-customer care and the customer by the device via SMS.
- c. The device faults are reported, and the manufacturer's customer care ties the Technical support.
- d. On reaching EOL of the device, the Alerts are send to the customer care, recycler and customer.
- e. Customer care initiates the recycler and customer interaction, where-in the device is sold by customer if in non-working conditions.
- f. Manufacturer also sends personalized offers on the buy-back of working equipment crossed EOL, with the new model , in exchange offer's with discount.
- g. Recycler recycles the non-working device in his premises via incineration process. [pt. e]

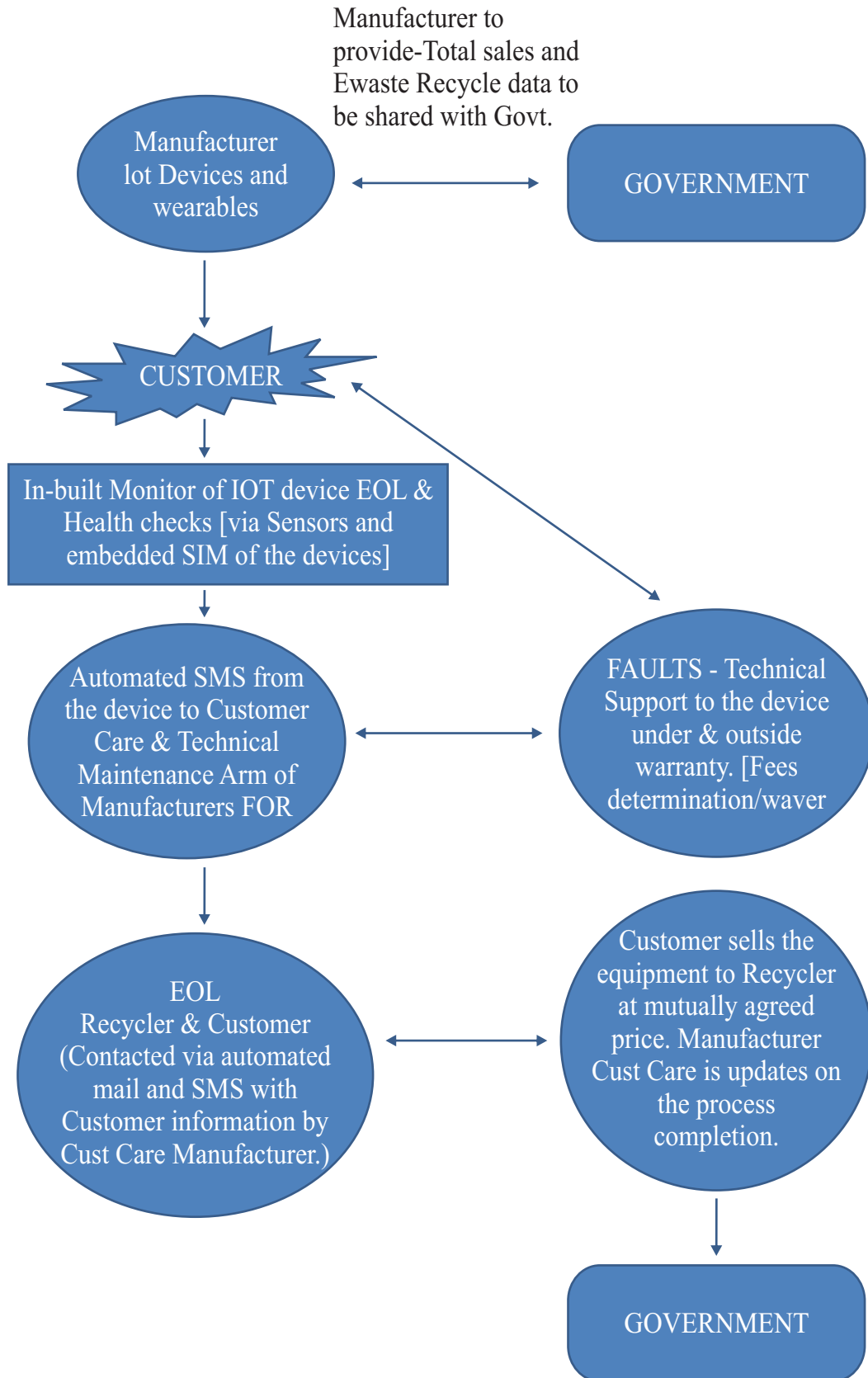


Fig 5.3 Business Model 3: IOT oriented e-waste management

- h. Manufacturer updates the information of the equipment in his device tracking system.
- i. Yearly reports are shown by the manufacturer to the government, on the total sales of the equipment, buy back of the equipment and recycled .
- j. If customer wants to re-sell the equipment , then he has to have the manufacturer's-customer care registration updated with new owners details, rest of the flow would flow same as earlier user.

Benefit of the Model

1. Accountability of the equipment maintenance and recycle remains with manufacturer.
2. Government has eye on electronics production and recycle quantity for all the manufacturers.
3. E-waste is disposed by Formal channel, reducing carbon footprint and impact to the environments.

5.2.4 Scientific - Process Oriented Recommendations

- a. **Establish Index for Measuring the Toxicity in Indian City (Air, Water, Soil) :**
Mechanism of e-waste causing environmental pollution and the health problems to human beings is a complex problem. One has to Study in details about the process of e-waste recycling, transportation of toxic components to environment and then to organism. It is recommended that countries establish the e-waste evaluation and management centers of excellence, building on existing organizations working in the area of recycling and waste management. Sampling the toxicity levels of air, soil and water and the corresponding human biological sampling to correlate the impact and reaching to the threshold levels beyond which may cause severe impact to organisms. calculate regular Toxicity levels of the city and publish in news paper, TV for creating awareness on impending health concerns and preventive actions .
- b. Since e-waste growth and disposal across nations, directly concerns environmental impact, **global treatment as cohesive & collaborative efforts** between nations is

essential. International network for e-waste management between developed, under-developed and developing countries is required to share the best practices of e-waste management for bringing right focus and knowledge & technology sharing . It would also address issues of illegal export of second hand -e-waste equipment's between the countries, which is currently leading to piling of e-waste in African and South east Asia developing and under developed countries.

c. EPR (Extended Producer responsibility)

With producer take-back programs (also called extended producer responsibility), manufacturers are responsible for taking back discarded electronics and for recycling them. Recycling process includes collecting e-waste either in the manufacturer's own take-back program or in partnership with certified collection and recycling organizations. Manufacturers are accountable for recycling their old products; take-backs also encourage companies to design products that use fewer toxic substances. Take-back programs are popular in Japan, South Korea, Taiwan and the European union.

In India we need to bring monitoring and control from government for waste electrical and electronic equipment (WEEE) and restriction of hazardous substances (RoHS) directives, which require electronics manufacturers to manage their own e-waste and reduce their use of toxic chemicals.

d. Advanced Recycling Fees

This program shifts the recycling burden from the manufacturer to the consumer. When user buys , a new flat screen TV, you pay a nonrefundable recycling fee of anywhere from about \$4 to \$12. The variation can be that ROHS practices and quality control is mandatory under corporate law for Electronic and Electrical manufacturers.

e. Financial assistance for Recycler's

Central government is providing e-waste recycling facilities up to 25% of the total projected cost as central subsidy, subject to matching grant by the State/UT government concerned and limited to a maximum of Rs. 12.5 crores. In case of NE states, up to 50% of the total project cost would be provided as central subsidy, subject to 25% contribution by the state government concerned. In case of NE states, the central subsidy would be limited to Rs. 25 crores. State Level further subsidy of the

70% of eligible fixed capital investment with ceiling of Rs. 6 crore can be helpful to accelerate the Recycling unit setup within Pune Region and Maharashtra , Pune has been identified as one of the best 200 cities of the World to live in, by "Business Standard Mar 5-2015 edition " . It is anticipated to attract Foreign Direct Investment in booming area of IT and Electronics Industry . Therefore it is necessary to support the current and future need to manage the e-waste generated from the region .

f. Waste Minimization by Co processing

The concept on "Utilization of Hazardous waste" as a supplementary resources or for energy recovery, or processing in line with hazardous waste (movement, handling & trans-boundary movement) Rules,2008. Central Pollution Control Board (CPCB) has been empowered to accord approval for utilization of different categories and type of hazardous waste. Subsequently CPCB has developed guidelines in February-2010 for co processing of hazardous waste in cement kilns. Other substances with high calorific value viz.; tires and plastic wastes, which are otherwise treated as "waste" not in the purview of "hazardous waste" can also be co-processed in the cement industry, thermal power plant, iron and steel industry, through co-processing. At present Gujarat pollution control board has permitted a few cement plants to co-process different compatible hazardous wastes. During the year 2009-2010 approx. 13000 MT of waste has been co-processed in the cement Industries, which is a good initiative to start with even in Pune region.

5.3 Further Study

Online market is developing fast with e-commerce, already some portion of business has moved to online. The assembler PC dealers and manufacturers can look at it as next best opportunity for business.