CHAPTER VIII

SUMMARY AND CONCLUSIONS
8.0. Summary

Recently the term environment is more associated with the problem of environmental pollution and the horizon of environmental Problems widened due to the rapid urbanization and unsustainable consumption patterns. The urban centres are considered as the symbol of human civilization and nucleus of incubating growth and innovation. The cities exhibit certain common features like congestion, shortage of basic requirements, industrial growth and steady influx of population with varying social and environmental backgrounds. The serious environmental problems faced by the cities threaten the sustainability of future growth and development. Among the environmental crises challenging the urban environmental scenario, solid waste pollution is one of the most important factors.

In the early part of the 20th century most of the urban solid waste was consisted of biodegradable components. With the introduction of disposable packing after 1950's the composition of solid waste has been changed into non biodegradable components. During the last few decades, the quantity of municipal solid waste has increased tremendously and facilities for disposal were quite inadequate. Moreover, the methods used to dispose the solid waste also resulted in
some kind of damage to environment. When wastes are put to open
dumps, it destroys the beauty of the surrounding areas and become an
abode for disease carrying vectors. Burning of solid wastes emits smoke
that causes air pollution and dumping of wastes into water leads to
various forms of water pollution.

As solid waste directly give rise to pollution it is inevitable to
manage solid waste in a proper manner. The solid waste management
system consists of two parallel methods of operation - The formal
system and informal system. Generally, the formal system is controlled
by the local authority concerned and manages mainly organic and
biodegradable wastes. The informal system deals with recyclable
materials by focussing mainly on non biodegradable products. This
system provides employment to a wide range of people represented by
waste pickers, itinerant buyers, petty traders, entrepreneurs and workers
involved in manufacturing new products from recycled materials. This
study attempts to trace out the economic aspect of waste management
options.

The area selected for this study is Calicut corporation. Like other
urban centres, the Calicut corporation, which is the second largest
corporation of Kerala State also faces the problem of solid waste
pollution. The studies conducted on the problem of solid waste pollution
in Calicut corporation concentrate upon sociological and technological
aspects of the problem. In this context it is worth to explore the economic aspect of solid waste management by comparing formal system with informal system of solid waste management in Calicut corporation area. The present study is the first attempt in such a manner.

The scope of the study is to analyse the economic and social implication of solid waste management system in Calicut corporation by incorporating the cost estimation of formal and informal system of waste management. The study also tries to analyse the socio economic condition of waste collectors and the total employment potentiality of the existing solid waste management system. Results of the analysis and their implications are summed up in the ensuing parts.

8.1 Solid waste pollution in Calicut corporation

As a fast developing city the Calicut corporation faces the ever fulminating problem of solid waste pollution. In 1994 Kerala urban development project estimated the per capita solid waste generation in Calicut corporation as 203 grams per day. But the recent trend of consumption pattern and higher standard of living has changed this rate to nearly 380 grams per day and the total waste generation per day ranges between 220 metric tons to 240 metric tons. Such a large quantity of waste requires proper system of collection, transportation and disposal.
Out of the total volume of solid waste generated the corporation authority collects an average of 110 to 115 metric tons per day. About 60 to 65 metric tons of recyclable parts of solid wastes are managed by informal sector for recycling and nearly 7 to 9 metric tons are reused by waste generators themselves. The remaining part is dispersed or dumped as unattended waste.

8.2 Formal solid waste management in Calicut corporation

The formal solid waste management system consists of collection and transportation of city waste to the trenching ground and its conversion into bio fertiliser. Collection and transportation is undertaken by corporation authority and processing of it into manure is controlled by a private company.

The management of formal system is totally under the control of the health department and the corporation health officer regulates the functions by dividing the total area into 16 sanitary circles. 53 administrative staff and 644 workers are engaged in the formal system of waste management. Total cost of collection and transportation of formal system include the capital expenditure and revenue expenditure incurred for this purpose. The total capital cost comes to Rs. 2,40,27,200. The revenue expenditure includes Rs. 4,00,134 as monthly salary to administrative staff, Rs. 26,05,916.20 as monthly remuneration to workers. Rs. 1,79,924 as fuel and repair charges, Rs. 35,953.80 as
maintenance expenses and Rs. 70,000.60 as miscellaneous expenses. By incurring a total cost of Rs. 34,92,158.60 the corporation collects and transports a monthly average of 3,450 metric tons of waste. The per ton cost of collection and transportation in the formal system is calculated as Rs. 1,012.22.

The collected organic solid waste is converted into useful organic manure through controlled aerobic composting and mechanical sieving by a private company. The company gives direct employment to 22 workers by investing a capital amount of Rs. 537 lakhs. According to the project reports of the corporation the fixed cost incurred per year comes to Rs. 95.5 lakhs and the variable cost come to Rs. 550 per ton. The daily production of bio fertilizer is 20 metric tons and per ton cost of processing is calculated as Rs. 1,890.30.

8.3 Informal solid waste management system

The informal system deals with nearly 60 to 65 metric tons of non biodegradable materials mainly paper, plastic, metal and glass. This informal system of waste management becomes popular through waste collectors consisting of ragpickers and itinerant buyers. The importance of this sector is that this sector provides employment and income to a large number of people represented by the waste collectors to the entrepreneurs and workers, involved in recycling activity.
8.4 **Socio-economic condition of waste collectors**

This study surveyed 160 waste collectors as sample respondents, they are classified into four categories as, itinerant buyers (75) ragpickers (62) itinerant buyers cum ragpickers (20) and waste sack collectors (3). Most of the waste collectors are forced to select this occupation because of inaccessibility of other means of gainful employment. Out of the total respondents 84.37 percent accepted this occupation before 19 years of age and continues this activity till they become physically incapable. Due to the practice of entering the occupation at an early age they lack formal educational opportunities and 57.50 percent have their education upto primary level and 31.25 percent are illiterates.

Concerning the nature of dwelling most of the ragpickers spend their nights in verandas of some shops, near railway station or under the railway over bridge and in the streets where there were light traffic. The itinerant buyers who earned more income stayed in rented houses. Waste collectors are subjected to a number of health hazards like skin diseases. tuberculosis, anemia, scabies, lice, oozing ears, sore eyes, leprosy, distended stomach, worms and respiratory infections. It is observed that approximately 76.87 percent of the respondents are suffering from one or more diseases related with their working
conditions. Moreover they are subjected to abuse, unwanted suspicion, harassment and physical assault from the police, municipal workers and natives. The study reveals that 75.63 percent of the respondents worked as full time waste collectors and 41.25 percent of waste collectors work for 7 to 9 hours and 21.25 percent have to work for more than 9 hours to fetch their livelihood.

8.5 Economics of waste collection

The waste collectors earn their livelihood through the sale of collected waste materials to scrap dealers. It is very difficult to estimate the total quantity of recyclable waste collected and sold by waste collectors. However, on an average each collector collects roughly 15 to 25 kgs of waste per day. Out of the sale 43.75 percent of respondents earn Rs. 51.75 per day and income of 19.38 percent respondents varies from rupees 76 to 100 per day.

The detailed analysis shows that the male itinerant buyers earn the highest income and female ragpickers the lowest income when compared to other categories. The study also reveals that the males in each category earn better than the females of the same category. The Gini coefficient of income reveals that there is higher income inequality among children itinerant buyers and lowest among male buyers cum
ragpickers. The Wilks Lambda test indicates that all the categories of waste collectors have differences in the pattern of income distribution.

Analysis of expenditure of waste collectors shows that male itinerant buyers spend more than other categories. The Gini coefficient shows that the highest inequality in expenditure is shown by children ragpickers and lowest inequality by male and female buyers cum ragpickers.

A separate analysis of food expenditure of waste collectors is attempted as it constitutes the major chunk of their total expenditure. The highest inequality in food expenditure is shown by male ragpickers and lowest by female buyers cum ragpickers. The stepwise multiple regression analysis indicates that the income of waste collectors is highly correlated to total expenditure and category of waste collectors and no other variables are contributive to income of waste collectors. So the category in which the waste collectors belong determines the income of waste collectors apart from any other variables.

8.6 Processing stage of recycling

Processing stage sorts and cleans the collected materials for reprocessing and it is considered as the second stage in the recycling sector. Processing is undertaken by two categories of people. Retail dealers at the first stage and wholesale dealers at the second stage. There are 55 retail dealers in the study area, they are classified into low
level, middle level, high level general dealers, waste paper dealers and old bottle dealers. The total quantity of waste processed by retailers is estimated as 1,902.995 metric tons per month. The monthly average income of different classes of retail dealers are Rs.13,231.85, Rs.19,555.67, and Rs.27,240.52 for low level, middle level and high level general dealers respectively. The study further estimates that waste paper dealers get Rs.12,494.78 and old bottle dealers get Rs.10,289.25 as their monthly average income.

The retail dealers incur several types of expenses such as monthly rent for shops, license fee, electricity charges, medical expenses, transportation charges, packing charges, wages and miscellaneous expenses. The sum total of these expenses is considered as the total retail cost of processing. The total average monthly expenses of low level, middle level and high level retail dealers are calculated as Rs.9,469.78, Rs.12,633.53 and Rs.16,712.32 respectively. The waste paper dealer incurs Rs.6,755.21 and old bottle dealer spends Rs.5,301.87 as their average monthly expenses.

By deducting the average monthly expenses from the average monthly income of each category of retail dealers the average net income of retail dealers are calculated. Low level dealer gets Rs.3,762.07, middle level dealer Rs.6,922.14, high level dealer
Rs.10,528.20, waste paper dealer Rs.5,739.57 and old bottle dealer received Rs.4,987.38 as their average monthly net income.

8.7 Second stage of processing

There are 38 wholesale dealers who process the solid waste in the second stage of processing, they are classified into general wholesale dealers, plastic waste dealers, waste paper dealers, P.V.C. dealers, tin and iron scrap dealers, old bottle dealers and aluminium scrap dealer. The total monthly quantity of recyclable waste processed by wholesalers is estimated as 1,719.033 metric tons.

The general wholesale dealers process a monthly average of 53.211 metric tons of waste and earn Rs.38,338.00 as average monthly income. Waste paper dealers process 98.012 metric tons of paper waste and earn Rs.42,068.00, plastic waste dealers process 61.382 metric tons and earn Rs.23,006.00, tin and iron scrap dealers process 27.480 metric tons and get Rs.30,064.00, old bottle dealers process 30.607 metric tons of bottle and cullet and earn Rs.23,850.00, aluminium scrap dealers process 40.570 metric tons and earn Rs.36,816.00 and P.V.C. waste dealers process an average of 24.819 metric tons and earn Rs.32,265.00 as their average monthly income.

Comparing the items of expenses, the major portion is incurred for paying wages to labourers and towards transportation charges. The highest mean expenditure is met by wholesale dealers and lowest by
other category of retail dealers. The Gini coefficient of expenditure reveals that there is higher inequality in expenditure is shown by low level retailers and lowest inequality in expenditure by high level retail dealers.

8.8 Stage of reprocessing:

The reprocessing is undertaken by specialised industries using solid waste as raw materials for their Production process. Within the study area only four items of recyclable materials are reprocessed – Plastic waste materials, P.V.C. materials, Aluminium scrap and Iron scrap. All the remaining processed recyclable materials are transported to Tamilnadu, Karnataka or to other states.

Plastic waste materials are reprocessed by the pellet industries and there are 11 pellet making firms in the study area. By taking a firm as representative the per ton cost of plastic reprocessing is calculated as Rs.3,421.43. The reprocessing of P.V.C. is similar to plastic reprocessing and it is reprocessed by polymer industry to make footwears. The per ton cost of P.V.C reprocessing is estimated as Rs.5,157.58. The per ton cost of aluminium reprocessing is calculated as Rs.4,333.30. The cast iron reprocessing requires so many other ingredients and due to the difficulty of estimating the market value of all those ingredients it is not easy to calculate the per tons cost of iron scrap reprocessing. So the study delimit the analysis of cast iron reprocessing
to total monthly expense of cast iron plant and its employment potentiality.

8.9 Cost of Recycling

The cost of recycling is categorized into collection cost, processing cost and reprocessing cost. The sum total of the expenses incurred by waste collectors as consumption expenditure, entertainment expenditure, transportation expense and miscellaneous expenses are considered as total cost of collection. The total cost incurred for collecting 1,875 metric tons of waste per month is calculated as Rs.29,19,070.35 and per ton cost of collection is estimated as Rs.1,556.84.

The retail dealers process 1,902.995 tons of materials per month as first stage of processing by incurring Rs.6,69,885.40 as total cost and per ton cost of first stage of processing is estimated as Rs.350.02. Wholesale dealers' process 1,719.033 tons of waste materials at the second stage of processing. The total cost of processing by wholesalers are calculated as Rs.8,31,706.00 per month and per ton cost of wholesale processing is calculated as Rs.483,82.

8.10 Recycling performance

Recycling performance is analysed with the help of collection rate, diversion rate and potential diversion rate. The collection rate of
recycling is the ratio of material collected for recycling to total weight of waste generated and it is estimated as 26.04 per cent. The diversion rate is expressed as the ratio of the weight of materials collected and processed in recycling to total weight of waste generated. The diversion rate of first stage of processing is 26.43 percent and 23.88 percent for the second stage of processing. The potential diversion rate measures the performance of recycling of certain items of waste stream. It is estimated that the highest potential diversion rate is shown by newspaper and lowest by cement sacks. The lowest performance indicators reveal that there is further scope for recycling within the study area and it can be attained by making awareness among the inhabitants about recycling.

8.11 Sectoral overview of employment in Informal Sector of waste management

Informal solid waste management sector provides direct employment opportunities to thousands of unemployed workforce in collection, processing and reprocessing activities. There are about 2,501 waste collectors in the study area comprising 1,172 itinerant buyers 969 ragpickers 313 ragpickers cum buyers and 47 waste sack pickers. The total workforce engaged in the first stage of processing comes to 86 male labourers, 27 female labourers and 67 imputed Labour by the retailers. The second stage of processing generated 261 direct employment opportunities including 131 male workers, 110 female
workers, 17 clerical staff and 3 watchmen and the reprocessing activity gives direct employment to 1,054 persons. Out of the total employment potentiality major share is contributed by waste collection activity and second by the reprocessing sector.

In upshot solid waste management activities in Calicut corporation employ a large number of workers in both systems of waste management. The informal waste management provides inormous opportunities for the economy of Calicut. So its is urgently needed to acknowledge the value of the informal system and its workers, learn from them and integrate them into the total scheme of solid waste management. If the recyclable waste materials are collected by the corporation, they can be properly manage either by using hi-tech or lo-tech methods of recycling. Hence it is high time for the corporation to think of a project in which all sorts of waste are processed. Moreover the city dwellers are to be motivated to tackle the problem as they are all part of the solution.