Summary and Conclusion

CHAPTER-V

SUMMARY AND CONCLUSIONS

Waste is a continually growing problem at global and regional as well as at local levels. Solid wastes arise from human and animal activities that are normally discarded as useless or unwanted. In other words, solid wastes may be defined as the organic and inorganic waste materials produced by various activities of the society and which have lost their value to the first user. As a result of rapid increase in production and consumption, urban society generates solid material regularly which leads to considerable increase in the volume of waste from several sources such as houses, commercial complexes, institutions and industries in the most diverse categories.

Management of solid waste may be defined as that discipline associated with the control in generation, collection, storage, transfer and transport, processing, and disposal of solid wastes in a manner that is in accordance with the best principles of public health, economics, engineering, conservation, aesthetics, and other environmental considerations. In its scope, solid waste management includes all administrative, financial, legal, planning, and engineering functions involved in the whole spectrum of solutions to problems of solid wastes thrust upon the community by its inhabitants (Tchobanaglous. et al, 1997). Solid wastes have the potential to pollute all the vital components of living environment (i.e., air, land and water) at local and at global levels. The problem is compounded by trends in consumption and production patterns and by continuing urbanization of the world.

The problem is more acute in developing nations than in developed nations as the economic growth as well as urbanization is more rapid. This issue has now received the attention by international and national policy making bodies and citizens.

The government of India started encouraging proper management of solid waste as early as 1960’s by giving loans for setting composting plants for MSW. The government of India over the years has taken many initiatives and implemented new technologies and methods. With the rapid urbanization, the problem of the Municipal Solid Waste Management (MSWM) has compounded indicate the increase in the vol of

waste. New methods of storage, collection, transportation, processing and disposal are being implemented. It is necessary to evaluate the current process at this stage to understand if the methods being implemented are suitable for the Indian scenario and to identify the lacuna in the methods being adopted.

Recently several researchers have studied source separation awareness, interest, participation, economic incentives and cultural factors. It was found that economic, social, environmental, and legal factors affect Integrated SWM and thus there is no single solution or alternative to establish a source separation collection method. [White et.al, (1995), Wang et.al, (1997), Gallardo., (2000), Martin et.al(2006), Shaw et.al, (2006), Dahlen et.al. (2007)]. The success of a source separation program depends on public participation and remuneration. (Noehammer et al. 1997). As a follow up other influencing factors such as demographic, logistic and economic factors were studied to understand participation, quantitative analysis, and waste generation [Daskalopoulos et.al. (1998), Emery et al. (2003), Gonzalez-Torre and Adenso-Díaz, (2005)].

As a solution for the financial constraint, a number of previous studies used contingent valuation method, probit and tobit model for analyzing willingness to pay for solid waste management. [Yusuf,(2007), Lokina et.al, (2011), Khattak and Amin, (2013)]. In collection aspect, Sarker (2003) analysed the socio-economic and health hazards of rag pickers and found higher prevalence of respiratory symptoms, lung function decrement and a wide range of health problems among the solid waste collection workers. [Tiwari, (2008), Dhakal, (2010), Luitel, (2010), Pawar, (2011)]. Finally disposal aspect of solid waste management, gave importance to the composting, recycling and land filling [Garg et.al, (2006), Suthar,(2009), Ansari, (2011)].

The general steps involved in the solid waste management include generation, collection, sorting and segregation, transportation and disposal (Simon et.al, 2013). Sustainable solid waste management requires not only efficient collection, proper disposal but also waste reduction, reuse and recycle. Despite the numerous efforts and measures taken by the government it is still a major concern for the community with respect to the deteriorating conditions of the environment. The important aspect which

requires priority is to improve management and organizational capability to enhance the people's participation in appropriate manner. Now, it has become a critical issue in Coimbatore, which requires high level planning and management. The overall goal of waste management programmes must be welfare oriented to safe guard the public health, waste minimization, maximization of waste recovery and protection of environmental quality.

A general scanning of the literature available from different sources indicate that very few studies have been conducted on all issues covering solid waste like generation, collection, transportation and disposal. It is against this background the current study is taken to focus on all aspects of solid waste management. The objectives of the study are as follows.

1. To examine the solid waste management practice by the selected households
2. To analyze the profile and working conditions and health status of sanitary workers
3. To understand the working of recycling unit in Coimbatore and to identify the major health issues of those working in this unit.
4. To suggest suitable measures to reduce the solid waste problem.

Hypothesis

1. Income is the major determinant of willingness to pay for solid waste management by the households.
2. Education is the basic factor to improve the condition of sanitary workers.
3. Unemployment is the predominant reason for selecting job in the recycling unit.

Methodology

Multi stage random sampling design was adopted for selecting the sample. The study is confined to Coimbatore city and the entire process of solid waste management was analyzed. Solid waste management includes management of generation, storage, collection, transportation, processing and disposal of solid waste. Coimbatore city has four major transfer stations situated in Peelamedu, Undiputhur, Ukkadam , and Sathy Road. Sathy Road is the highest waste collecting transfer station. Hence the households residing near Sathy Road were selected as sample.

First phase of the study deals with those who generate the waste. Households, institutions, industries, markets, hospitals etc are the major waste generators. Among them households were selected for the current study. Some of the areas which generate highest amount of waste under Sathy transfer stations are Gandhi Park, Sathy Road and Avinashi Road. A total of 279 households who come under these transfer station, were randomly selected. The households were chosen as follows- 97 were from Gandhi Park, 94 were from Avinashi Road and 88 were from Sathy Road.

The second phase of the study includes those who collect the waste. In Coimbatore city NGOs, contract workers and government sanitary workers are engaged in the solid waste collection. In collection phase only the government sanitary workers were included in the study. An important objective of the study was to understand the socio economic status, health problems and insurance facility of these workers. Four units were randomly selected for the study. A total of 242 sanitary workers were randomly selected from P.N.Puthur (38), Gandhi Park (54), Poo Market (83) and Bharathi Park (67). These sanitary workers were also doing transportation of the waste.

Vellalore is the only plant in Coimbatore which recycle the solid waste and produce vermin compost from the waste. Out of 80 workers, 50 recycling unit workers were considered for the study. The working of this plant was also taken up in the current study. The pre-tested interview schedule was administered to the selected respondents to collect the needed information.

Techniques of Analysis

Besides averages, percentages and graphs, techniques like Chi-square test, Multiple regression, ANOVA, Garatte rating scale, and Factor analysis were used.

Major Findings of the Study is presented under Three Main Heads

I. To examine the solid waste management practice by the selected households

II. To analyze the profile and working conditions and health status of sanitary workers

III. To understand the working of recycling unit in Coimbatore and to identify the major health issues of those working in this unit.

The major findings of the practice of solid waste management is summarized below,

I. The Practice of Solid Waste Management by the Households

- Among the respondent surveyed majority of the respondents have male family heads (82 percent) and belonged to the age group of 25 to 50 years.
- The respondents were mostly from the Hindu religion, and also belonged to the backward community and were living in a nuclear family structure.
- The education status of the respondents reveals that majority of the respondents were graduates (61 percent) and were employed in various private firms (56 percent).
- The survey revealed that the monthly income of the respondents (80 percent) was in the range of Rs 10,000-15,000.
- Around 63 percent respondents felt that Coimbatore city is highly polluted and solid waste problem is the second largest environmental issue.
- From factor analysis, the problems like bad smell, contamination of water, sewage problem, increasing disease and loss of soil fertility will increase its intensity due to solid waste**.**
- Solid waste generation is considered to be a first step in the solid waste management process. Nearly 86 percent of the selected households generated

2kg to 3kg waste per day. The Coimbatore Corporation has undertaken the system of providing two bins, green for biodegradable waste and white for non biodegradable waste to every household. Nearly 77 percent of households were using two bins for waste separation in the study area.

- Around 87 percent of respondents depend upon door to door collectors and nearly five percent of respondents dumped their waste in community bins. Workers come to collect the waste on alternate days (72.4 percent). Masonry bins, cement concrete bins, metal containers, and open site were used as community bins in the Coimbatore municipality. Around 45 percent stated in the affirmative with regard to using the community bins and the rest did not give a positive answer regarding collection of waste in the community bins.
- Open hand cart, trucks, tractors, and dumper place with bin lifting system were commonly used for transportation of the waste in the study area. Around 52 percent of respondents reported that tractor was used for waste transportation.
- The households were not directly engaged in the solid waste disposal. The respondents were enquired about the 3R's (reduce, reuse, recycle) as a method of waste disposal. Majority of the respondents (nearly 74 percent) supported recycling as method of waste disposal.
- From factor analysis, it was observed that limited number of recycling unit, manpower inadequacy, poor civic sense of people and lack of financial resources are the major problems encountered in the solid waste management.
- As a solution for lack of financial resources in solid waste management, the respondents were enquired about the willingness to pay for solid waste management. The data revealed that most of the respondents (59 percent) were willing to pay below Rs 25 per month.
- Regressing age, sex, education, occupation, type of family, and household size and income of the respondents on willingness to pay, the results revealed that income is the only factor significantly related to willingness to pay.

- The results of ANOVA revealed that willingness to pay differs significantly among the respondents between areas.
- The results of chi-square test revealed that environmental conditions, method of charging for solid waste management, organization preferred for solid waste disposal had no significant influence on willingness to pay. Only two factors namely current way of handling solid waste and satisfaction towards solid waste management had significant influence on willingness to pay.
- The respondent suggested various measures to combat the problems in solid waste management. Majority of the respondents (99 percent) wanted complete abolition of littering. In terms of collection of waste, most of the respondents (90.7 percent) suggested that door to door collection of waste is required to manage the waste problem. Around 98 percent of the respondents recommended street sweeping twice a day is essential to make the city clean. In transportation of waste, around 79 percent wanted to have only closed vehicle. An amount should be charged on the basis of quantity of waste generated. Municipality, NGO, private sector, residential organization, self help group, co-operative sector, and a separate authority were the organizations preferred for solid waste management by the households.

II. An Assessment of Profile and Working Conditions and Health Status of Sanitary Workers

An assessment of socio economic condition of sanitary workers is summarized below,

- Around 44 percent of sanitary workers belonged to the age group of 40-50 years.
- Among the sanitary workers surveyed majority(81.8 percent) were males
- All the respondents belonged to the Hindu community and came under scheduled caste. Around 79 percent of respondents lived nuclear family structure.
- Educational status of the sanitary workers was found to be very low with 73.6 percent being illiterate.

- Around 53 percent of respondents had income in the range of Rs 10,000-15,000 per month.
- Poor economic conditions, working hours, community reasons and unemployment were the basic reasons for selecting this job.
- Lack of vehicles, poor safety measures, shortage of equipment, lack of health facilities and unpleasant working condition are the major problems faced by the sanitary workers. This is mainly due to lack of knowledge about the schemes provided by the government to improve the condition of the sanitary workers.
- Around 79 percent of sanitary workers were doing collection of waste and street sweeping and others are engaged in transportation of waste.
- While considering health problems, it was found that majority of the respondents had respiratory diseases (77.3 percent), eye disorders (72.6 percent), allergic problem (82.6 percent) and other health issues (65.1 percent). And only 20 percent of workers had injuries while doing the waste collection process and 21 percent of respondents had communicable diseases.
- Most of the respondents (96.3 percent) have insurance facility, which includes Life Insurance Cooperation, society insurance and ESIC.
- From the factor analysis it was observed that, legal support, improving working condition, more vehicles, housing facility and better pay are the major suggestions emerged from the study to improve the condition of sanitary workers.

III. The Working Condition of the Recycling Unit Workers and Working of the Unit

The recycling dump yard in Coimbatore Municipal Corporation was started in 2009-2010 as a part of Jawaharlal Nehru National Urban Renewal Mission. The waste from various transfer stations are transferred and dumped in Vellalore.

- The segregation of waste is done manually.
- The safety measures and health insurance are compulsorily given to the workers to ensure protection from harmful effects of waste.
- Socio economic profile of the recycling unit workers is that majority (84 percent) of the workers were in the age group of 25-50 years and belongs to the Hindu community (80 percent) and from scheduled castes (80 percent). The educational status of the workers was very low with 84 percent being illiterate.
- Almost 84 percent of the workers work on contract basis and only 16 percent were permanent workers. Majority of the respondents (64 percent) had an income in the range of Rs 300-500 per day.
- Health problems of the workers revealed that out of total respondents, 84 percent of recycling unit workers had injuries when they collecting waste and 34 percent of workers had communicable disorders, 28 percent had respiratory disorders, 56 percent reported eye disorders, 88 percent reported allergic problem and 86 percent had other health problems like back pain, asthma etc.
- After segregation of waste land filling and waste to energy method is used as a disposal method in the plant.
- To find a solution to the problem of waste accumulating at the Vellalore dump yard, the Coimbatore Corporation has planned to establish a waste-to-energy plant. As a part of waste-to- energy, the plant has taken initiative to produce vermin compost from the waste.

Suggestions

Some of the suggestions which emerged from the study are mentioned below.

- Segregation of waste at source should be compulsory for all. Chain of segregation should not be broken from household to landfill sites.
- Vehicles used for transportation of municipal waste should be efficient, modern, fully covered and equipped with global positioning system. Adequate maintenance facilities should be made available.
- There should be decentralization of processing and disposal of garbage. Each and every colony should come forward to manage the waste at local level.
- Heavy fine should be imposed on persons for littering and for not following the rules. There is dire need to change the mind set of people. A behavioral and attitudinal change of the people is hence required.
- Awareness and participation for people should be enhanced regarding sustainable solid waste management with the involvement of eco club and NGO.
- Pay-as-you-dump method should be introduced as a cost recovery mechanism to offset waste collection costs
- Government must encourage composting, vermin-composting, incineration for processing and treatment methods for reducing solid waste problems. Composting/vermin composting in individual households/residential colonies/wards should be promoted.
- Government must take necessary steps to educate the sanitary workers and formulate special development plan for sanitary workers.
- Communities should be motivated to reduce, reuse and recycle solid waste as far as possible.
- Only the non-utilizable, non-reusable and non-recyclable solid waste should be permitted in the community bins.

- A judicious fee collection from the customers should be done to finance the processing units and service units.
- Residential colonies with the help of the ward councilor can take initiative in implementing the recycling and reuse of solid wastes.
- Can give incentive to residential colonies for managing SW through carefully organized scientific eco friendly techniques.
- The landfilling site should be selected through scientific scrutiny.
- The workers should be trained in the technique of handling the solid waste.
- The corporation should collect and keep a regular record of solid waste data.
- Specific regulations, backed with regulating powers are needed for enforcement of proper MSWM.
- Civic authorities should be given sufficient powers for prosecution of offenders.
- Even in the absence of economic motivation, environmental motives should foster waste reduction, reuse and recycling.

Scope for Further Research

Every research work creates new research issues. Few major topics identified for further research are:

- ❖ Vermin composting as solution to solid waste management.
- ❖ Management of municipal solid waste for urban sustainable development.
- ❖ Location of landfill sites using GIS
- ❖ Role of NGO’s in solid waste collection process.
- ❖ The economic analysis of electronic waste management.