CHAPTER-VI

SUMMARY, FINDINGS AND POLICY CONCLUSIONS

In several rapidly growing cities in developing countries solid waste is a major source of concern due to lack of appropriate planning, inadequate governance, resource constraint and ineffective solid waste management. According to UNEP (2004), the generation of solid waste has become an increasing environmental and public health problem everywhere in the world, particularly in developing countries. In Tirunelveli city, solid management service is mainly provided by the municipality and it has been measured and evaluated always based on the role and performance of the service provider (supplier of the service) and demand side i.e. WTP of the residents is ignored. The participation of the service receivers or clients especially households solid waste management service is mainly provided by the municipality and it has been measured and evaluated always based on the role and performance of the service who are the primary producers and generators of significant proportion of uncontrolled solid waste and perhaps the main victim of the effect of solid waste, should allow to determine their providers and participate in making of sound policy decisions including designing of effective joint solutions of solid waste management. Among others, this would help the providers to understand household’s willingness to participate and pay.

This study was initiated by a major environmental hazard of the people of Tirunelveli City are facing. Inadequate supply of solid waste management has always been a main environmental problem in the city. The major cause of this problem is inadequate finance for this service. Hence, the main objective of this study is to see the possibility of cost recovery by looking at the demand side of solid waste management in Tirunelveli city through service charges. For that the Contingent Valuation Method
(CVM) is used to estimate the value of households in Tirunelveli City give for an attempt to improve solid waste management. Five hundred and ten randomly selected households in different zones as categorized by the Corporation and they were interviewed.

The elicitation technique used was closed ended with an open ended follow-up. Information gathered from the survey was also analysed using descriptive statistics and econometrics models like Logit and Tobit. From the interviewed households, 262 (51.4\%) reported to practice other mode of dumping by throwing the refuse into an open space, street or near by water resources (river). This is increasing the cost of street sweeping in all main roads of the city and also the Tamirabarani River is carrying various wastes into the city side with its own implications on the healthy of the people who use the river water for various activities including drinking without any treatment. Illegal dumping is more common in all income categories of the respondents in all zones. This may be due to low responses towards willingness to pay to improve municipal solid waste management.

The survey results show that nearly 75 percent of the households are getting solid waste collection service including those getting private collection services but the Corporation did not fulfill the respondent’s expectation with regard to municipal solid waste management, but this is based on daily generation and collection and not on the number of households getting collection services. To reduce the health and other environmental risks from inadequate solid waste management, it is high time the Corporation tries to provide solid waste collection service at household level, especially in Palayamkottai and Melapalayam zones where these problems are most severe. Given this service coverage it is surprising that the households in Tirunelveli city is
overwhelmingly (65.50 %) affected little due to solid waste and 7 percent of respondents have stated the service was worst towards solid waste management by the Corporation. Based on the nature of the data, a Tobit Model is used to identify factors explaining the amount a household is willing to pay. Tobit mode was selected due to the censoring of willingness to pay amount at zero. The Probit model is also used to identify factors responsible for being willing or not willing to pay for the proposed improvement.

The Tobit Model shows that the willingness to pay amount is affected by various factors. Income of household, time spent in the area, quantity of waste generated, responsibility of solid waste management, education dummies, being the owner of the house in which one is living and the number of children in the household have positive and significant effects on willingness to pay. Respondent’s age has a negative and significant effect on willingness to pay amount. The starting price does not significantly affect the willingness to pay suggesting there is no starting point bias. The rest of the explanatory variables (sex of the respondent, marital status, respondent status in the household, case of disease in the household) were also found to be insignificant to explain willingness to pay. In the Probit Model the starting price, sex of the respondent, status of the respondent in the household, responsibility of solid waste management, case of disease in the household are found to be insignificant. The identification of the variables and their relative importance in explaining the willingness to pay amount might help to tap the maximum willingness to pay of households for solid waste services in Tirunelveli city, if and when service charges are implemented.
The Tirunelveli city’s annual solid waste collection is 39401000 kilograms (As per 2010). Solid waste collection coverage is very low this implies solid waste is thrown everywhere in the city such as open space, green areas, rivers, canal ditches etc due to this waste is spread to all residential houses in the form of dust by the high wind in the city and causes disease. River stretches and other water bodies are found to be filled by waste and causes flood overtop on the streets. In addition, none of the modern solid waste management is implemented and still there are no recycling activities by the municipality in an organized manner. Solid waste is not separated or sorted at source and after collection simply it is dumped together. But, more importantly, cost recovery a serious problem of solid waste management in the city. The revenue generated covers only 9.5 percent and the rest 90.5 percent has to be covered from other sources. Since the waste management has no enough source of revenue it can’t be sustainable even with the present condition. This study aims to analyze households’ willingness to pay to improve solid waste management service in Tiruveli City by using the data obtained from the sample of 510 household heads.

CVM method was employed with single bounded elicitation format followed by open-ended follow-up questions, and we administered the door to door household survey questionnaire among the respondent’s. The study used both descriptive and econometric techniques to analyse eighteen explanatory variables were used in the regression models based on the degree of theoretical importance and their impact on WTP. Probit and Tobit models were used to identify the determinants of households’ WTP for improved solid waste management system and to analyze the mean WTP of the households.
Estimation results of the probit model, the variables that are significantly related to providing positive WTP values are only household education and income of the respondents. Age has negative sign but significant relation with the likelihood that the respondent will provide a positive WTP value. All of the signs of these three variable coefficients (coefficients of income, education and age) make intuitive sense and significant at 1%, 5% and 5% respectively. The rest of the variables have no significant impact on the likelihood that the respondent will provide a positive WTP value.

In the tobit model of regression results, on the other hand, four variables out of eighteen explanatory variables have statistically significant impact on the amount of WTP for improved solid waste management system. Amount of solid waste generated by the household per week, Educational level of respondents, income and age of the respondents and House ownership status of the heads have a positive relationship with the amount of WTP and significant even at 1 percent. Type of solid waste service demanded by the households and Income of respondents (income) have positive relationship and significant at 5% and sex of respondents (marriage) has positive and significant at 5 % significant level while perception of respondents for the current solid waste management has negative relation and significant at 5% with the amount of WTP for improved solid waste management system.

By using single bounded the mean WTP for improved solid waste management per month per household is found Rs.100 and using the open-ended (maximum WTP) is found Rs.150 to Rs.200 per month per household. The aggregation of the monthly WTP of the entire city households is estimated to be Rs.1, 28, 94,700. Using the dichotomous single bounded question the monthly WTP is estimated to be Rs.50 to Rs.100 and therefore the actual WTP of the households in Tirunelveli city may fall
between these two figures. Comparing with the revenue collected based on the service fee regulation and current expenditure for the existing solid waste management, this WTP is much bigger and SWM of the city can be improved by residents’ participation.

**Policy Implications**

- By the current sanitation fee and the existing system, the solid waste management can not be improved and can’t cover its cost even with the existing level and therefore participation of residents is important to improve and make sustainable for improved solid waste management of city.

- Assuming that what respondent’s say to day remained the same for the future, an important policy implications of greater WTP obtained in this study is that the current payment for sanitation in the city is much below WTP of the people.

- The strong positive relationship between income, education and age of the respondents reveals that efforts towards improving residents income, education will increase WTP for improved environmental quality in general and improved solid waste management in particular.

- If people know or are informed about the nature of improvement towards solid waste management, the envisaged welfare improvement elicits people’s WTP (Hartwick et al.1998). Therefore, WTP can be used to predict the level of welfare gained from improved SWM system.

- Comparing this mean WTP with what would be done to choose private service provider towards solid waste management in future with the
approval of urban local body to practically what would be charged for households for the service i.e. Rs. 100 this study can be used as a basis to determine initial fee to be charged to the various waste generating agents such as households for public decision making.

- By charging the mean WTP of this study to each household, efficient and better solid waste management service can be provided in the city.

- As far as possible faecal matter should not be allowed to mix with municipal refuse.

- Hospital waste needs to be efficiently handled.

- Burning of refuse should not be permitted

- Discharging of waste into drains and open areas should be prohibited by law

- Solid waste should be handled once and its contact with workers minimised as much as possible.

- Efforts should be made to remove solid waste from habitations regularly

- Regular medical check up of personnel handling solid waste should be carried out.

- Health records should be maintained for the areas served under municipal solid waste management programme.
• Service charges for solid waste management should be based on willingness and ability to pay than making it flat and compulsory across all income groups.

• This means service charges should be set at a level that does not encourage illegal dumping and maximise cost recovery. The proposed solid waste management fees by various researchers in the past have not looked into the willingness and ability to pay of households seriously.

• As a result most of them suggested a sanitation fee much lower than what the market reflects. Therefore, this study would recommend to the proposed sanitation fees need to be revised before they are put into practice.

• The Corporation needs to undertake educational campaign in the city on how to deal with solid waste including the avocation of the three R’s (Reduce, Reuse and Recycle).

• Households report lots of trouble in primary storage. Hence, the Corporation should try to introduce standardised waste storage receptacles which are affordable to poor households through cross subsidies.

• Environmental Policies and laws have helped a lot to bring a desired result in many parts and therefore, the Tirunelveli Corporation should be environmental laws prohibiting activities that harm the environment.
Waste minimisation is a process of reducing waste produce by individuals, communities and companies which reduces the impact of chemical wastes on the environment to the greatest extent.

- Household level of proper segregation of waste, recycling and reuse.
- Process and product substitution e.g. use paper bag instead of plastic bags.

Above all, the Corporation should implement informal policy of encouraging the public to separate MSW and market it directly to the informal network appears to be a better option. The involvement of people and SHGs could improve the efficiency of MSWM. Public awareness should be created among the masses to inculcate the health hazards of the wastes. Littering of MSW should be prohibited in the city areas notified by the Tirunelveli Corporation. Moreover, house-to-house collection of MSW should be organized through methods like collection on regular pre-informed timing and scheduling. The collection bins must be appropriately designed with features like metallic containers with lids, and to have a large enough capacity to accommodate more than the expected waste generation in the area, with a design for mechanical loading and un-loading, placement at appropriate locations, etc. Municipal authorities should maintain the storage facilities in such a manner that they do not create unhygienic and unsanitary conditions. Proper maintenance of the MSW transportation vehicles must be conducted, and the Dumper Placer should replace the old transportation vehicles in a phased manner.

Currently, at all level of waste generation and collection, there is no source segregation of compostable waste from the other non-biodegradable and recyclable
waste. Proper segregation would lead to better options and opportunities for scientific disposal of waste. Recyclables could be straightway transported to recycling units that in turn would pay a certain amount to the corporations, thereby to increase revenue for SWM collection. Organizing the informal sector and promoting micro-enterprises are an effective way of extending affordable services. Promotion and development of recycling is a means of upgrading living and working health conditions of rag pickers and other marginalized groups.

Most of the MSW in Indian cities are dumped open space or nearby roadside in an uncontrolled manner. Such inadequate disposal practices lead to problems that will impair human and animal health and result in economic, environmental and biological losses. An open dump or an uncontrolled waste disposal area should be rehabilitated. It is advisable to move from open dumping to sanitary land filling in a phased manner. The current regulations (MSWM rules, 2000) are very stringent. Norms have been developed to ensure a proper MSWM system. Unfortunately, there is a large gap between policy and implementation. The producer responsibility is to avoid having products on the market that cannot be handled effectively and environmentally sound when they become waste products. A new survey should be carried out on the generation and characterization of MSW in India. Since the MSW is heterogeneous in nature, a large number of samples have to be collected and analyzed to obtain statistically reliable results. Finally, the study concluded that the lack of resources such as financing, infrastructure, suitable planning and data, and leadership, are the main barriers in MSWM. Therefore, this study would recommend to the Corporation of Tirunelveli to adopt minimum user fee based on the results obtained from the city dwellers by the way of willingness to pay analysis towards MSW.