Chapter Six

SUMMARY, CONCLUSION AND POLICY PRESCRIPTIONS

Although India has one of the most comprehensive MSW (management and handling) Rules 2000, it is just a directive on paper without any enforcement and implementation in Silchar. There are all kinds of excuses for its letdown. Silchar Municipality is currently facing MSW dilemma. Considering this, the study in this field has been undertaken highlighting the serious problems with urban waste collection and its disposal. The study also stresses need for proper government intervention and awareness program at all levels to improve the present scenario. In Silchar municipal area urban waste as serious as the other environmental problem. Streets are generally treated as the receptacles of waste. Consequently, unsanitary conditions affect overall health and environment. There is hardly any segregation of recyclable waste. Waste paper, plastic, metal, glass, rubber, rags and so on are thrown on the streets along with domestic, trade and institutional wastes. Transportation is not well coordinated with primary collection, resulting in multiple and manual handling of waste. This is injurious to the health of waste disposal workers. Waste collection from waste disposal sites (by collection vehicles) is irregular and hence leads to over accumulation. This is injurious to the health of all passersby. It creates a major threat to public health and gives rise to the insanitary condition in the town.

In view of the enormity of the problem, a feasible and credible solution is impossible without participation and co-operation of the stake holders. In this study the waste disposal habits of households is under the scanner along with the level of environmental awareness regarding the households’ immediate surroundings and the environment at large. The
willingness to pay (WTP) for a sustainable urban waste management system well reflects the household’s eagerness or urgency to overcome the disutility or the dissatisfaction on account of environmentally unethical and unsafe urban solid waste dumping practices in the city. This study attempts to capture the possible socio-economic roles of the stakeholders in controlling environmentally unethical, unsafe and unsustainable management of solid waste in Silchar Municipal area.

The present study has been carried out with a few specific objectives. First of all the demand for a safe and sustainable urban solid waste management in Silchar municipal area have been estimated and analyzed. Selected socio-economic factors are identified and their impact along with environmental awareness levels on the demand for improved urban solid waste management services in Silchar municipal area is assessed. A tariff system (policy) is also recommended to be imposed on households such that the proposed sustainable urban solid waste management system is economically viable. Finally the study suggested an environmentally desirable scheme for urban solid waste management in Silchar Municipal Area.

The focus of this study has been primarily on finding ways to provide safe and sanitary collection and disposal for solid waste so that the environment is no longer damaged or deteriorated by the unsafe and unhygienic solid waste management practices. In the backdrop of the present situation, the available alternatives, obstacles and challenges, that includes the institutional, financial and practical aspects, this study proposes a set of recommendations for a sustainable approach that can meet the basic and essential objective of minimizing risks to public health and the environment of Silchar town.

This study employs the Contingent Valuation Method (CVM) to determine the willingness to pay for improved waste collection and disposal system in Silchar. The CVM is a survey-based technique of monetary valuation used to elicit people’s preferences expressed in
terms of WTP. The CVM utilizes an appropriately designed questionnaire (or experiment) to elicit the valuations or bids of households about a decrease or increase in the amount of an environmental good, and how much they are willing to pay or to accept compensation in order to avoid an environmental damage. The assumption is that a market for environmental goods and services exist. It makes use of bidding games for approximating the willingness of households to pay for an environmental service. CVM has the advantages over the other methods of environmental valuation such as the travel-cost and hedonic pricing techniques. The method is able to quantify some types of benefits, such as non-use or passive use benefits, which lie outside the scope of travel-cost and hedonic pricing studies. CVM is able to measure passive use values and this has led to many applied environmental economists choosing it. For the present study Discrete Choice (DC) framework is adopted followed by an open ended question to estimate the households’ willingness to pay (WTP) along with its determinants for a sustainable urban waste management service in Silchar municipal area.

Descriptive statistical analysis revealed that the clearance of bins and drains are not regular in most of the wards. The problem of urban waste has manifested itself as a threat to the city. The performance of MSW disposal system has been observed to be miserably poor. There is neither the system of segregation nor the arrangement to facilitate easy transportation of solid waste. Very little has been done in waste disposal options. Land filling and incineration have not adopted till date. Open dumping is practiced by the municipality at present. The existing status of waste management and littered streets all over the city clearly speaks about the poor environmental health of the city.

Econometric analysis section presents the empirical results of the CVM exercise. The major findings are presented as follows:
The mean willingness to pay of the household for improved solid waste management was estimated to know the economic value of the proposed improvement. A binary logit regression model is used for this purpose. Following Hanemann (1989), the calculated mean willingness to pay is Rs. 160.64. The result shows that the mean willingness to pay is both positive and satisfactorily high. This is indicative of the voluntary commitment in monetary terms for an improved environmental quality by means of better SWM practice in the town. If all the houses are ready to pay the amount than total revenue of Rs. 31,56,897 can be accumulated.

Multivariate logit regression was used to determine the factors that influence the probability of households’ willingness to pay for improvement in their solid waste management. Expectedly the coefficient of price is found to be negative and statistically highly significant in other words as the offer price of the improved waste collection and disposal increases the estimated probability of households’ willingness to pay for the hypothetical service decreases. Households paying a given price for improved waste collection and disposal increases as household monthly average expenditure increases. The likelihood of households paying a given price for improved waste collection and disposal increases as household size increases but the z value is low which implies household size is statistically insignificant for determining the probability of WTP. The likelihood of household paying a given price for improved waste collection and disposal decreases as the household’s average education level increases. However the z value is low implying that educational attainment at household level is statistically insignificant in explaining the probability of WTP. A larger sample covering more houses per ward is likely to give different result. Likelihood of households paying a given price for improved waste collection and disposal increases as respondents’ awareness level increases. This is an expected result as because environmental awareness is most likely to influence the
probability of WTP in a direct and positive way. The likelihood of households paying a
given price for improved waste management decreases with the number of working woman
in the household. This result is somewhat unexpected as because working woman find
lesser time to manage the home and the surroundings of the house that may include
gardens and backyards. It is quite possible that households with working woman are more
informed about the corruption and malpractices of the town administrators that also
includes the municipal authorities. Thus these household may be more frustrated with the
present state of affairs with regard to collection and spending of public money on SWM
practices in town. Likelihood of households paying a given price for improved waste
collection and disposal decreases when the household has informal waste disposal
arrangement (IWDA). However the coefficient of IWDA is statistically insignificant
although the marginal effect is economically significant. Reason behind this observation is
rather straightforward. Some households have already subscribed to some type of IWDA, it
is expected that such households would rather be unwilling to pay any additional sum for
any improvement in current state of SWM practices. Satisfaction from municipal solid
waste management services (SSWM) has a ne
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negative influence on the probability of WTP
for the hypothetical SWM scheme at a given bid value or level. Moreover the coefficient
is found to be statistically significant. In other words the more satisfied households have
lower chances of paying the proposed bid price.

OLS regression is used to estimate the average level of maximum WTP (open ended
CVM) for the proposed SWM scheme and also to determine the partial effects of socio
economic variables on the open ended maximum WTP. The coefficient of Monthly per
capita household expenditure (MPHE) has the expected positive sign and is statistically
significant. This implies that with increased monthly expenditure, the household’s
maximum WTP amount will increase. The coefficient of Household size (HSZ) is
significant and is positive. This suggests that the bigger the family size more would be the volume of waste generated daily and higher would be the difficulties encountered in terms of waste disposal in the urban set up, and hence that would result in a higher WTP. The coefficient of Average Education (AE) has an expected positive sign and it is the most significant variable. This means that the higher the number of years of formal education, the more the WTP amount. The coefficient of Environmental Awareness (EA) is significant and has the expected positive sign. The variable awareness positively affects maximum WTP amount for improved waste management. This suggests that the more aware the person the more he/she willing to pay for improved waste management. The coefficient of the Number of working women (NWW) variable is also significant and has the expected positive sign. This suggests that the presence of working women in the family does affect the WTP amount for improved waste management. The coefficient of Informal waste disposal arrangement (IWDA), a dummy variable, is statistically insignificant. According to the estimated results this variable does not significantly explain the maximum WTP. The coefficient of IWDA is negative and thus the presence of IWDA negatively influences maximum WTP. Finally the coefficient of Satisfaction from Solid Waste Management (SSWM) is negative and significant. Thus SSWM negatively influences maximum WTP.

In the probit model the coefficient of MPHE is small in absolute value but at the same time it is statistically highly significant. The household size is found to influence the probability of payment positively although the coefficient is statistically insignificant. Average number of years of formal education in the household is found to have a negative impact on the probability of payment for the hypothetical scheme. Environmental awareness also has a negative impact on Pr (WTP) but the coefficient is found to be statistically insignificant for the present sample. NWW is found to influences the probability of
payment of the monthly per household average cost (Rs. 135/-) negatively. Informal waste disposal arrangement (IWDA) dummy coefficient is found to be positive. The positive sign of the IWDA coefficient signifies that subscription to some waste disposal arrangement positively influences the probability of payment of the average cost per month. The coefficient of SSWM negative and is statistically significant. The estimated coefficients of the logit model are very similar in nature when compared with those of the probit model estimates. MPHE, HSZ and IWDA positively influence the probability of WTP. Education, awareness, number of working women and satisfaction on municipal waste management services, is found to have negative influences on the probability of payment of the average cost of the hypothetical project.

6.1 Suggestions

The collection technique and procedure used by waste management authorities in Silchar are often found to be inappropriate and inconvenient. The current approach to waste management is only confined to the basic function of collection, handling and dumping.

A number of suggestions are made here, aimed at the development of a sustainable system for urban waste management in Silchar.

- Currently at the level of waste generation and collection there is no source segregation of compostable waste from the other non-biodegradable and recyclables waste. About 93 per cent of the total household waste generated in Silchar municipal area is covered by biodegradable waste but only 47 per cent of the households separate it before dumping. Therefore, source segregation of the waste under various heads- biodegradable, recyclable and hazardous should be implemented properly. Proper isolation would lead to better options and opportunities for scientific disposal of waste. Bio-degradable waste can be used as compost in the agricultural production process. It has important economic benefit.
To improve awareness among the residents about the importance of source-segregation, a proper informational campaign through print and electronic media must be initiated. Educational campaign in schools and colleges etc is simultaneously required. So that non-biodegradable waste can be recycled and biodegradable waste can be land filled systematically.

➢ To make urban waste management in Silchar municipal area more economically sustainable, it is required to introduce a user fee for waste collection and management. However, the fee must be charged in accordance with the income groups so that the poor section is not deprived of the facilities as most of the people are willing to pay if the waste collection facility is improved.

➢ There is an immediate requirement to introduce a door-to-door collection system in Silchar and improvise the primary and secondary collection system with or without the participation of the private contractors. Door to door collection of MSW should be organized through methods like the collection on regular pre-informed timing and scheduling. To minimize costs, an improved waste storage and collection system is required. Each household should use standard waste bins that are placed outside for ease of collection. In areas where this practice is not suitable centrally located waste collection points should be established that are shared by a number of households. The number of containers should be increased in every ward and should be maintained properly. Moreover the containers must appropriately design with features like metallic containers and have large enough capacity to accommodate extra waste generation in the area.

➢ There is an urgent need to appoint urban waste management expert to look for optimal solution for an integrated urban waste management plan of the city. In the year 2012, SMB invited tender for the consultant of Detailed Project Report (DPR) for solid waste management. Public awareness and attitudes towards waste management can affect all
stages in the urban waste management process. This has an impact on household waste storage, waste segregation, recycling, frequency of collection, littering and willingness to pay for waste management services. Moreover, public participation in the form of community organization and NGO’s and common people should be encouraged while preparing an integrated plan.

- Quantity and characteristics of waste are the major factors, which decide magnitude of waste management problem. It is necessary to perform the exercise regularly to assess the quantity of waste. On the basis of quantity of waste, infrastructure requirement can be estimated. It is also necessary to conduct categorization studies frequently in order to assess the changes in waste characteristics due to ever changing scenario. This will also serve as a basis for selection of disposal or treatment option. Formation of database on the waste quantity from various sources separately is also recommended in Silchar with regular update to keep a track on the achievements and obstacles.

- Appropriate vehicle is needed as per condition for the proper disposal of waste. Vehicles specially designed for carrying waste should be used wherever possible to avoid material being scattered and littered during transportation. Small vehicles should be provided for narrow lane which may be a rickshaw van. Regular maintenance of vehicle is required. Training needs to be provided particularly for drivers operating waste tipping equipments. More vehicles are needed to cope with increasing waste generation. Proper garage should be provided to save the vehicles from wear and tear.

- Stakeholders in an integrated urban waste management include participation of residents, government authorities and the informal waste-recycling sector. Stake holder’s participation is strongly recommended for better implementation of various programs and policies and improvement in waste management in an effective manner. 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 conditions of rag pickers and other marginalized groups. The official policy of encouraging the public to separate municipal waste and market it directly to the informal network appears to be better option.

- There is no clear policy of composting in Silchar municipality. Sorting is required and this is where cooperation from households is needed to separate biodegradable waste at source. Composting of biodegradable wastes and increased wastes recycling and recovery are identified as areas for further development.

- Littering of urban waste should be prohibited in cities, towns and urban area notified by the state government. Enforcement of waste management legislation is required as are proper policies and planning framework for waste management. The government must control unauthorized use of land and this should be achieved by enforcing relevant clauses in development guidelines.

- There should be no dumping on roadside and drains. Roadside refuse should be removed immediately so as to keep the area clean. Reduction of plastic in civic life is essential as synthetic plastics are not biodegradable and burning of plastic generates hazardous gases that cause cancer. Therefore there should be controlling of indiscriminate littering of plastic bags. Increase in awareness among the people about the ill effects of mismanagement of waste can also result in better compliance and co-operation for implementing various programs and is therefore recommended.

- Most of the MSW in Silchar is dumped in an uncontrolled manner. Such inadequate disposal practices lead to problems that will damage health and results in economic, environmental and biological losses. Composting and vermin composting are successful and quite popular now in India instead of incineration. So, keeping this point in mind the SMB can follow the method of composting and vermin composting. It is also advisable to
move from open dumping to sanitary land filling in a phased manner. An open dump or an uncontrolled waste disposal area should be rehabilitated. A properly sited engineered land filling should be constructed. All wastes dumped along road, underneath bridges, culverts and in drainage canals in Silchar needs to be cleared at utmost urgency. Land filling should be restricted to non-biodegradable and other waste that is not suitable either for recycling or for biological processing.

6.2 Policy prescriptions

✓ The role of environmental awareness is crucial for the present study. It has been observed and understood from the field survey that many of the respondents are aware of the hazardous fallouts of environmentally unsustainable dumping of household daily solid waste. Awareness is primarily determined by education and exposure to mass media. Although the urban residents covered under the present study are more or less aware about the pros and cons of unethical waste dumping practices, there still remains ample scope for awareness build up.

✓ In the open ended CVM problem it has been seen that awareness positively influences the open ended monetary WTP. This implies that the voluntary WTP amount may be raised by raising the awareness levels. In other words people have to be informed about the hazardous fallouts of environmentally unsustainable solid waste dumping. The same study if conducted after some sort of an awareness campaigning may yield better results with respect to economic viability if the project. Expected or average WTP may be severely influenced by awareness building.

✓ People have supported all types of campaigning programs and hence these may be pursued by the municipal authorities. Mass media may also be used. NGOs may be invited to take some initiates in this regard.
✓ Since around two-thirds of the sample respondents are found to be voluntarily willing to contribute towards the monthly average running cost of the scheme the project may certainly be considered as economically viable.

✓ People have to be immediately educated about the benefits of waste segregation at source according to types. As part of their extracurricular activities, school and college students can also take up awareness programs on safe and sustainable SWM.

✓ A significant proportion of individuals believe that corruption is the main reason why the municipal authorities are unable to deliver properly. They think that even with the present volume of revenue collection from the house owners it is quite possible to collect, transport and dump waste in an environmentally safe way. What the authorities lack is commitment or the will. Here the civil society, NGOs and various political organisations can play a pivotal role. Corruption can be eliminated to a large extent through collective pressure.

✓ The concept of community work is rather weak and hazy among schools, colleges and other academic institutions in the region. This may be introduced as part of curriculum if necessary and students may be trained to motivate people regarding the benefits of good waste disposal practices.

✓ Waste has to segregate at source. Bio-degradable and bio-non-degradable wastes have to be separately kept in different containers and have to be treated differently.

✓ The municipal authorities have to search for separate land fill in the outskirts of the town area if and when necessary to dump the rising volume of daily household solid waste.

✓ Business establishment are not covered under the present study. But they are equally (if not more) responsible for the poor solid waste disposal practices in town. Shops must dispose-off their daily solid waste in some municipality demarcated spot from where daily collections by the authorities have to be done. This may perhaps be done twice a day.
✓ Penalty has to be charged to any offenders who are seen or found to dispose-off daily waste in some municipality non-demarcated spot. Law amendments may be required for smooth and efficient implementation of ethical solid waste disposal scheme.

✓ A complaint cum enquiry cell has to be created by the municipal board with the sole objective of addressing day to day complaints and grievances of residents regarding mishandling of household solid waste or regarding improper or inefficient functioning of the waste management staff. A toll free phone number may also serve the same purpose.

✓ It was found during the course of the survey that the Municipality does not serve all the wards equally well. This is highly objectionable and is perhaps an instance of gross negligence and violation of rules by the authorities themselves. All wards have to be served adequately and the true reasons behind subscription of some type of IWDA, have to be thoroughly investigated.

✓ **Households that are not served by the authorities often have been forced to subscribe to some type of IWDA. This is indicative of high possibility of success of the proposed SWM scheme if it is implemented.** Since IWDA's are already popular in wards that are either not attended or are infrequently attended by the municipality, and further since the average WTP is around Rs.160 per month, the present hypothetical scheme may be considered to be both feasible and economically viable. Most of these IWDA's cost the household a sum of Rs. 70 to Rs. 150 per month which are well beyond the annual municipal taxes paid by most households. This implies that a varying garbage disposal tax in between Rs. 70 to Rs. 160 per household per month may be levied depending on the volume of waste generated by the household on a daily basis.

✓ Bio-degradable waste may be treated to produce bio-gas. This may provide low cost energy to rural poor households. Rural poor depend on timber for their daily fuel requirements. Timber collection leads to deforestation at a rapid pace. Thus subsidised
fuel in the form of bio gas may provide a means of promoting sustainable development without hurting the economic interests and standards of living of the poor.

6.3 Conclusion

Rise in the urban population and overcrowding with the construction of the building have made it difficult to dispose garbage from every corner of the town which results in heaps of garbage left uncollected. These uncollected waste leads to environment degradation in the area. Thus the environmental quality in the town is not impressive due to the poor management policy of municipality. It can be concluded that there is population hazard in the area and the environmental quality is not up to the satisfactory level.

Most people still do not appreciate that environmental quality is not just the responsibility of the government and municipality and that the individuals also has an important role. The municipality is less concern regarding waste issue and waste is currently taken to a single poorly maintained land disposal site. At the household level people hardly separate their waste from common waste to organic waste. There is generally no system of segregation of organic, inorganic or recyclable wastes at household level.

Owing to degrading environmental quality and lack of initiatives by the municipality, the people are willing to pay for waste management services. Some of them are also ready to pay for the clearance of garbage on volume basis. Most of the people suggested that proper government intervention will help in better management of waste. It is found that most of household waste is covered by biodegradable wastes and other consists of plastic, paper, metals, burning residues and others. This is a positive sign for the municipality to make proper use of biodegradable wastes and increased wastes recycling and recovery are identified as areas for further development. But it is found that no such steps are taken by the municipality till date. Thus the waste management policy of the people and the municipality for cleaning up the living area is not up to the satisfactory level. Moreover it
can also be concluded that the people are not fully aware and conscious regarding waste management.

Dumping of garbage by the people on the roadside and drains, irregular clearance of this garbage by the municipality in time creates pollution hazard in the area. The poor environmental quality due to poor waste management services of the municipality has caused enormous hazard to the people. It can be concluded that since the environmental quality in the town is not impressive there is demand for qualitative environment by the people and thus are willing to share cost as well as willing to pay some amount of money.

6.4 Drawbacks and Possible extensions

The present research undertaking on productivity and efficiency of the tea industry in Assam is specifically focused on a set of well outlined objectives. This focused or streamlined approach to the study (or else what is otherwise known as vertical integration) is expected in a doctoral research programme. Policy implications of such specific studies may often be narrow in the sense that suggestions based on results and outcomes may be confined or applicable to that sector or industry alone and not to others. Admittedly any econometric study based on firm level empirical data is bound to suffer from certain limitations or drawbacks. These lacunae or gaps may either be theoretical (i.e. conceptual) or empirical (i.e. either statistical/econometric or data related). Identification of the limitations is crucial from the point of view of extensions of the study along with its future modifications.

First, the study considers a limited number of samples in relation to the population of Silchar Municipal Area. A larger sample would have provided statistically superior estimates of parameters. Considering the nature of the CVM exercise at least 10%
households should be selected for statistical validity especially for convergent validity test (Hanley, Shogren and White).

**Second,** Hospital waste- government and private, waste of business establishment like petty shops, departmental stores, etc. are not covered in the study. Since they are municipal tax payers and bigger polluters compared to the individual households, their payment for a safe and sustainable waste management has to be more compared to households and hence if their voluntary payment is considered, average payment per household will come down considerably from the proposed sum of Rs. 160.64. This is the most serious drawback of the present study.

**Third,** during survey weighing of daily waste as par waste category is not conducted. Optimum tariff should be definitely and positively related to volume of waste generation at the household level. If this is not implemented, then all houses are charged equally which is wrong on the grounds of environmental ethics.

**Fourth,** aspects like constant waster logging near the household, very poor drainage system etc. are not incorporated in the CVM exercise. Logically willingness to pay would be more for houses situated in disadvantageous location.

**Fifth,** detailed information regarding expenditure on waste management in Silchar Municipal Area could not be collected due to lack of accessibility of official data which would have provided a deeper picture of overall SWM at the municipality level.

If some or all of the above aspects are incorporated in future research works then it would obviously make the study more comprehensive with deeper policy implications on economic as well as environmental grounds.