In this chapter various studies conducted on urban solid waste management in different parts of the world using the well-known Contingent Valuation Method (CVM), have been reviewed. By reviewing these works or researches it is possible to get a profound idea of precisely how others researchers have conducted their studies on the valuation of environmental hazards and benefits. In other words this review helps in developing both the theoretical and methodological issues related to the present study on urban waste management in Silchar municipal area. Furthermore it is instrumental in finding out the research gaps. Finally, this is vital from the point of view of fixing the objectives as well as the techniques adopted and applied in the present study.

The studies reviewed in this chapter are categorized into three groups. Contingent Valuation Method (CVM) and its applications in valuing in environmental benefits and costs are reviewed in section 2.1. Studies conducted on urban solid waste management in foreign countries covering almost all continents and regions are reviewed in section 2.2. Finally studies on urban solid waste management conducted in India in particular are reviewed in section 2.3. In conclusion the research gaps are identified and presented.

2.1 Contingent Valuation Method and its Applications

The Contingent Valuation Method (CVM) is a widely used nonmarket valuation method especially in the areas of environmental cost–benefit analysis and environmental impact assessment. Its application in environmental economics includes estimation of non-use values, nonmarket use values, or both, of environmental resources. In recent years, this
method is commonly used in developing countries to elicit the individuals’ preferences for the basic infrastructural projects such as water supply, waste management and sanitation. The CVM was originally proposed by Ciriacy-Wantrup (1947) who was of the opinion that the prevention of soil erosion generates some ‘extra market benefits’ that have the features of public goods, and therefore, one possible way of estimating these benefits is to elicit the individuals’ willingness to pay for these benefits through a survey method. However, Davis (1963) was the first to use the CVM empirically when he estimated the benefits of goose hunting through a survey among the goose-hunters in Maine, United States.

This method gained popularity after the two major non-use values, namely, option and existence values were recognized as important components of the total economic value of an environmental resource or benefit. This development in environmental economics literature took place during the 1960s. While the conventional revealed preference methods such as travel cost method are not capable of capturing these non-use values (Smith, 1993), the only method that is identified for estimating these values is the contingent valuation method (CVM). Hence, a considerable amount of studies on CVM—both theoretical and empirical in nature—have emerged in the economic valuation literature. It is true however that a large number of studies have criticized the conventional CVM that has led to its improvement over time. Since 1970s a large number of studies have been devoted to developing the literature on non-market valuation methods and its applications in various fields of environmental economic studies in developed countries, especially in valuing environmental goods and services besides environmental damages and costs (hazards).

Hanemann (1984) observed that a number of contingent valuation experiments have appeared involving discrete responses which are analyzed by logit or similar techniques. He addressed the issues of how the logit models should be formulated in order to be consistent with the hypothesis of utility maximization and how measures of surplus should
be derived from the fitted models using compensating variation and equivalent variation. Cameron and James (1986) examined the usefulness of close-ended contingent valuation surveys for the assessment of demands in hypothetical markets. Their work has focused upon valuing (non-market) environmental resources. They found that the interviewing strategy would seem appropriate for more general market research applications. They have developed a new maximum likelihood estimation technique for use with the survey data which solves the problem of truncation bias and readily accommodates explanatory variables. According to them the estimated models are easy to interpret as they employ the ordinary least squares regression results.

Mitchell and Carson (1989) observed that contingent valuation is a direct survey based approach to estimating consumer preferences. They found that when the good or service in question can be traded, a hypothetical market is described by means of an appropriately designed questionnaire. This contingent market defines the good itself, the institutional context in which it would be provided, and the way it would be financed. Respondents are then asked to express their maximum willingness to pay (WTP) for a hypothetical change in the level of provision of the good. In theory, contingent valuation is well rooted in welfare economics, namely in the neo-classical concept of economic value based on individual utility maximization. This assumes that stated WTP amount are related to respondent’s underlying preferences in a consistent mode.

The problem of reliability of CVM gained importance over time. For instance Loomis (1989) evaluated the reliability of the contingent valuation method by resurveying the same general households and visitors nine months after their original survey. He used a paired T-test and found that there was no statistical difference between an individual’s first and second reported willingness to pay. He also performed Chow tests comparing the original and resurvey willingness-to-pay functions which showed no statistical difference at the 1
per cent level. It was observed that reported willingness to pay is reasonably stable over the time period surveyed. Hanemann, Loomis and Kanninen (1991) analyzed that the statistical efficiency of conventional dichotomous choice contingent valuation surveys can be improved by asking each respondent a second dichotomous choice question which depends on the response to the first question—if the first response is "yes," the second bid is some amount greater than the first bid. While, if the first response is "no," the second bid is some amount smaller. They found that this "double-bounded" approach is shown to be asymptotically more efficient than the conventional, “single bounded” approach. Cameron and Quiggin (1992) found that dichotomous choice contingent valuation questions have gained status over the last several years due to their self-styled advantages for avoiding many of the biases known to be inherent in other value elicitation formats. However, they supposed that this type of valuation question is highly inefficient in that a vastly larger number of observations are required to identify the distribution of values with any degree of accuracy. They observed that an alternative questioning strategy introduces a second value threshold which elicits a second discrete response. The size of the second offer depends on the answer to the first question. In analyzing data from this type of questionnaire, they said, it is imperative to acknowledge the endogeneity of the second offered amount. They demonstrated the distortions in the final value estimates which can be introduced when this endogeneity is ignored or when inappropriate restriction are placed upon the stochastic structure of the model.

Kanninen (1993) established that the double-bounded dichotomous choice model is becoming popular in the contingent valuation literature. This technique considers the responses to two bids, the second one being determined according to the response to the first, and he found, it has been shown to be statistically more efficient than the standard, single-bounded model.
From the above studies, it has been established that CVM have been decently placed in environmental valuation of goods and services when open to trade. Economic Valuation is about “measuring the preferences” of people for an environmental good or against an environmental bad. The economic value of something is measured by a summation of many individuals’ willingness to pay (WTP) for it. The WTP reflects individuals’ preferences for the good in question. Valuation is in money terms because of the way in which preference revelation is sought, i.e., by asking people how much they are willing to pay. Many of environmental goods and services are provided freely. Therefore, they have zero prices because no market place exists in which their true values can be revealed through acts of buying and selling. Projects and programs appraisal cannot be sufficient or adequate without valuation. National priorities for environmental policies are better informed if economic values are known with a degree of certainty (Pearce, 1993).

Economic valuation of environmental goods and services has found vast application in determining compensatory payments for environmental damage (Willis and Corkindale, 1995). Valuation techniques are also applied to the more immediate human environment, such as water supply, waste management and sanitation. 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 (Pearce and Turner, 1990). It makes use of bidding games for approximating the willingness of households to pay for an environmental good or service. Venkatachalam (1997) have gone through several studies regarding CVM and came to observation that CVM is a simple, flexible nonmarket valuation method that is
widely used in cost–benefit analysis and environmental impact assessment. However, to his view the method is subject to severe criticism. The criticism revolves mainly around two aspects, namely, the validity and the reliability of the results, and the effects of various biases and errors. He reviewed the recent developments on measures to address the validity and reliability issues arising out of different kinds of biases/errors and other related empirical and methodological issues concerning contingent valuation method. In this regard, Brisson and Pearce (1995) in their study concerning externalities from waste management options observed that hedonic property price study or contingent valuation study both can be used, with acting as validity check on the other.

The measurement of passive use values has become an important issue in environmental economics. Adamowicz, et al. (1998) examined an extension or variant of contingent valuation, the choice experiment, which employs a series of questions with more than two alternatives that are designed to elicit responses that allow the estimation of preferences over attributes of an environmental state. They combined the information from choice experiments and contingent valuation to test for differences in preferences and error variances arising from the two methods. The results showed that choice experiments have considerable merit in measuring passive use values. Groothuis, Haitven and Whitehead (1998) examined an application of the contingent valuation (CV) method to measure the compensation required for the sitting of a hazardous waste disposal facility. Using the data, the authors tested for the internal consistency of the responses and calculate the willingness to accept (WTA) for sitting a hazardous waste disposal facility. The authors concluded that CV can be used to estimate reasonable measures of WTA and is a potentially useful tool for assessing the compensation required to site a hazardous waste disposal facility. Loomis, et al. (2000), examined with five ecosystem services that were described to respondents using a building block approach developed by an interdisciplinary team. These ecosystem
services were dilution of wastewater, natural purification of water, erosion control, habitat
for fish and wildlife, and recreation. Households were asked a dichotomous choice
willingness to pay question regarding purchasing the increase in ecosystem services
through a higher water bill. Their study results from nearly 100 in-person interviews
indicated that households would pay an average of $21 per month or $252 annually for the
additional ecosystem services. Hanley, Mourato and Wright (2001) examined some
popular choice modeling approaches to environmental valuation, which can be considered
as alternatives to more familiar valuation techniques based on stated preferences such as
the contingent valuation method. They found a number of choice modeling methods that
are consistent with consumer theory and focused on an attribute based theory of value that
permits a superior representation of many environmental management contexts to solve
some of the major biases associated with standard contingent valuation.

Alpizar, Carlsson and Martinsson (2001) provided the latest research developments in the
method of choice experiments applied to valuation of non-market goods. According to
them, choice experiments, along with well-known contingent valuation method, are very
important tools for valuing non-market goods and the results are used in both cost-benefit
analyses and litigations related to damage assessments. Their attempt facilitated the reader
with both the means to carry out a choice experiment and to conduct a detailed critical
analysis of its performance in order to give informed advice about the results. Whittington
(2004) attended some of the problems involved in the ethical review and oversight of
contingent valuation research in developing countries. To him, a central area of concern is
that contingent valuation (CV) surveys have the potential to confuse or mislead
respondents. This can cause an individual respondent who is confused or misled to take
actions that could harm himself or members of his household. The spread of
misinformation and confusion among the study population could also influence the policy
process itself in unintended and unfortunate ways. According to him, there are three main ways in which CV surveys can mislead or confuse an individual respondent and spread confusion in the study population: (1) inaccurate provision of background information in the CV scenario, (2) the description of the hypothetical market, and (3) the use of the referendum elicitation procedure and other split-sample experiments commonly used by CV researchers.

He further mentioned the difficulties of cross-cultural communication and cooperation add to the ethical complexity of conducting CV surveys in developing countries. From his view three cross-cultural problems deserve special attention by both institutional review boards and contingent valuation researchers: (i) promises of anonymity and the right of respondents not to participate, (ii) power asymmetries between international and local members of the contingent valuation research team, and (iii) compensation of respondent.

Louviere (2004) reviewed random utility theory (RUT) based stated preference elicitation methods, discussed types of elicitation procedures and data consistent with RUT and how one can use RUT as a basis for establishing a level playing field on which to compare and test alternative elicitation procedures with one another and with behavior in real markets. RUT provides a sound, behavioral-theoretic basis for many forms of preference elicitation procedures, and also provides the theory by which various forms of data can be combined and preference elicitation procedures compared and tested. Although closely identified with the preference elicitation model associated with the design and execution of discrete choice experiments, RUT also provides a theoretical basis for a variety of other forms of non-experimentally based preference elicitation, such as direct observations of choices in real or hypothetical markets, ranking of multi attribute choice options, and so forth. RUT provides a framework within which to formulate and test a wide variety of statistical preference models, the most familiar being families of probabilistic discrete choice models.
He found that the vast majority of stated preference research has been conducted in health economics. Lancsar and Savage (2004) found that discrete choice experiments (DCEs) are being used increasingly in health economics to elicit preferences for products and programs. The results of such experiments have been used to calculate measures of welfare or more specifically, respondents’ ‘willingness to pay’ (WTP) for products and programs and their ‘marginal willingness to pay’ (MWTP) for the attributes that make up such products and programs. They showed that the methods currently used to derive measures of welfare from DCEs in the health economics literature are not consistent with random utility theory (RUT) or with microeconomic welfare theory more generally. The inconsistency with welfare theory is an important limitation on the use of such WTP estimates in cost–benefit analyses. They described an alternative method of deriving measures of welfare (compensating variation) from DCEs that is consistent with RUT and is derived using welfare theory.

Jin, Wang and Ran (2006) studied reports results from a double-bounded dichotomous choice contingent valuation method (DC-CVM) and choice experiment (CE) study that aimed to examine Macao residents' preferences for alternative solid waste management policy changes in Macao. They conducted an empirical comparison of the welfare measures derived from the double-bounded DC-CVM and CE and found that there is no significant difference between the values derived from the two methods. The results suggested that both double-bounded DC-CVM and CE can be successfully implemented for environmental valuation in Macao. Choudhury and Tiwari (2006) observed that in a developing country such as India the contingent valuation method (CVM) cannot always provide a correct valuation of recreational use benefits of an environmental resource given the huge size of the parallel economy involving different categories of middle to upper income group families which have the capacity to move as tourists. The ‘participant
observation method’ (POM) and ‘unstructured interview schedule’ (UIS) are necessary tools to be used in such cases, in addition to a ‘structured interview schedule’ which is used for primary data collection in the travel cost method (TCM) and the CVM under normal circumstances. They developed a general model depicting the relation of the ratio of consumer surplus estimated in TCM and CVM with ‘corruption perception index’ in the case of tourists from various countries with different world rankings in so far as their parallel economy and level of corruption are concerned. Choudhury, Singh and Tiwari (2007) also assessed that developing countries have high proportion of black money and related corruption in the society in comparison to the developed ones. According to them this aspect has to be kept in mind while conducting CVM questionnaire survey (in-person) at the site whose economic valuation is being done. POM and UIS are the two means, which must be used in addition to structured interview schedule during CVM studies in developing countries to arrive at a reasonable non-market economic valuation figure of an environmental amenity. They observed that researchers generally ignore this fact during survey for primary data collection among respondents who are quite well off, educated and belong to countries of huge parallel economy. However they have utilized these two means during primary data collection for a CVM study and reached the conclusion that CVM has to be used with caution even among educated masses in the developing countries.

Fonta, et al. (2008) observed that for most public projects, especially environmental projects that are partly funded by multilateral donor agencies, cost–benefit analysis has become a routine procedure for the approval of project funds. These agencies are very keen to know whether the target community or country possesses the aggregate willingness to pay for the project. The two most commonly applied techniques for such analysis are stated preference and behavioral techniques. They employed the contingent valuation method (CVM), the most widely applicable of the stated preference methods, to establish
empirical grounds for pricing the services of a new solid waste management (SWM) improvement facility in Enugu State, Nigeria, initiated by the UK Department for International Development, the State's Environmental Protection Agency, and State and Local Government Program. They found that CVM can be fruitfully used to support the design and implementation of new SWM facilities and that analysis of the valuation function can give qualitative information that is difficult to identify using baseline surveys or most conventional economic valuation techniques.

CVM has over the years found increasing applications in valuations of forestry and forest management programmes. A very interesting study have been carried out by Lindhjem and Navrud (2009) where they found that the aggregate welfare measure for a change in the provision of a public good derived from a contingent valuation (CV) survey would be higher if the same elicited mean willingness to pay (WTP) is added up over individuals rather than households. They tested for differences between individual and household WTP in a novel, web-administered, split-sample CV survey asking WTP for preserving biodiversity in old-growth forests in Norway. They found in a test between samples that the WTP respondents’ state on behalf of their households was not significantly different from their individual WTP. However, within the same sample, household WTP was significantly higher than individual WTP; in particular if respondents are asked to state individual before household WTP. Their results suggested that using individual WTP as the response unit may overestimate aggregate WTP. Thus, the choice of response format needs to be explicitly and carefully addressed in CV questionnaire design and further research in order to avoid the risk of unprofitable projects passing the benefit-cost test.

Mogas, Reira and Brey (2009) analyzed that when many good variants are to be valued, like in several forest management programs which differ in the attribute levels, the Contingent Valuation Method may not be a practical option, given the cost and time
involved to value each variant separately. They suggested three alternative procedures in such situations. One (i) is to apply an attribute based valuation method like a Choice Experiment (CE); another (ii) is to conduct a CVM and a CE exercise and estimate a joint model; a third one (iii) is to use the CVM estimates to value a base scenario, and then use the CE results to adjust the CVM estimates for any new different scenario. Boyle and Ozdenair (2009) found in their study that the application of attribute-based choice questions is well established in the marketing literature, but there are unique aspects of the design that warrant investigation to assess their validity for economic welfare estimation. They investigated three design issues: (1) the placement of the monetary stimulus (policy cost to respondents) in the sequence of attributes, (2) the number of policy alternatives respondents are asked to consider in choice questions (two versus three), and (3) the inclusion, versus exclusion, of a status quo alternative in choice questions.

Mitani and Flores (2009) examined the issues of hypothetical bias, demand revelation, and gender differences in a threshold public goods experiment with heterogeneous induced-values. First, they found no evidence of hypothetical bias in their threshold provision public goods experiments, despite the fact this is an open-ended type mechanism. Their results supported recent experimental findings that use induced-values to investigate hypothetical bias. Second, they investigated the demand revealing performance of real and hypothetical payments and find no evidence that real payment performs better than hypothetical payment in their experiments. Third, they examined whether payments, real and hypothetical, are positively related to induced-values. Their results suggested there is statistical evidence that payments are positively related to true values. Finally, they examined the effect of gender on real and hypothetical payments in their experiment. The results showed that gender matters for contributions through both real and hypothetical payments, after controlling for true values as well as socio-economic variables. The results
also indicated that females are more likely to truthfully reveal their value than males through hypothetical payments, but gender is not significant for truthfully revealing their value through real payments. Watanabe and Asano (2009) developed a new estimation model for consistent estimation of mean WTP (willingness to pay) in dichotomous choice CV (contingent valuation). Consistent estimation of mean WTP in parametric models requires the correct specification of the probability distribution of WTP. However, it is not possible to foresee the probability distribution, and thus in practical applications there is always a danger of specification error, making it impossible to guarantee that mean WTP will be consistently estimated. They applied linear projection to develop an estimation model that enables consistent estimation of mean WTP without specification of the probability distribution. This linear projection model enables them to estimate mean WTP only by calculating a weighted mean of the indicator function defined as 1 (or 0) when a respondent says “yes” (or “no”) for a certain improvement in environmental quality. Moreover, when bids follow the uniform distribution, calculation is possible by multiplying “maximum bid” and “the rate of answering yes”. Blomquist, et al. (2009) examined that correction for hypothetical bias using follow up certainty questions often takes one of two forms: (1) two options, “definitely sure” and “probably sure”, or (2) a 10-point scale with 10 very certain. While both have been successful in eliminating hypothetical bias from estimates of WTP by calibrating based on the certainty of yes responses, little is known about the relationship between the two. They compared the two using data from three field experiments in a private good, dichotomous choice format. They compared four types of yes responses that differ in the criterion used to determine if there is sufficient certainty for a hypothetical yes response to be considered a true yes response. They made several comparisons, but focus on determining which values on the 10-point scale give the same estimates of WTP as “definitely sure” hypothetical yeses and
real yeses (actual purchases). Values that produce equivalence are near 10 on the certainty scale.

Mazzanti and Zoboli (2009) found in their study that waste generation and waste disposal are becoming increasingly prominent in the environmental arena, from a policy perspective and in the context of delinking analysis. In general, waste generation is still increasing proportionally with income, and economic and environmental costs associated to landfill are also increasing. They provided a comprehensive analysis of waste generation; incineration and landfill dynamics based on panel data. They concluded that although absolute delinking is far from being achieved for waste generation, there are some first positive signs of an increasing relative delinking for waste generation and robust landfill diversion. Their evidence suggests that if while landfill diversion is currently associated to a delinking, waste prevention must be the next objective of waste regulation efforts. Aiken, et al. (2009) observed that the passage of environmental legislation was accompanied by concerns about its potential detrimental effect on productivity. They assumed inputs can be assigned to either abatement activities or good output production. This allowed them to specify regulated and unregulated production frontiers to determine the association between pollution abatement and productivity growth. They employed “assigned input” model to determine the association between productivity and abatement activities for manufacturing industries in Germany, Japan, the Netherlands and the United States. Czajkowski and Hanley (2009) observed that insufficient sensitivity to scope (variations in the scale of the environmental good on offer) remains a major criticism of stated preference methods, and many studies fail a scope test of some sort. Across a range of existing explanations for insensitivity to scope (commodity miss-specification, embedding, warm glows), there seems to exist no clear conclusion on how to deal with the problem. They provided an alternative explanation for insufficient sensitivity to scope, based on re-
definition of the determinants of value for environmental goods within an attributes-based choice model. In the proposed framework respondents ‘Willingness To Pay need depend not only on physical characteristics of a good, but may also depend on the ‘label’ under which the environmental good is ‘sold’ in the hypothetical market. To investigate the problem, they conducted a Choice Experiment study of biodiversity. They found that controlling for the effects of a label—for that case, national park designation—leads to significant increase in the scope sensitivity of welfare measures.

Stackleberg and Hammit (2009), reported the results of several contingent valuation (CV) surveys to elicit willingness-to-pay values from the general public for risk reductions associated with decreases in exposure to a chemical, PCBs, in the environment. They developed Quality Adjusted Life Years (QALYs) from the survey using both standard gamble and time-tradeoff elicitation methods to explore the relationship between QALYs and willingness-to-pay (WTP), and to develop QALY weights for subtle developmental effects. The results of the CV surveys are designed for incorporation into a case study of an integrated risk model to monetize the benefits of predicted risk reductions. Respondents showed a nearly proportional, positive relationship between decreasing the risk of a 6-point reduction in IQ (a standard measure of “intelligence”) and WTP, but showed a negative relationship between risk reduction and WTP for reading comprehension as an outcome. Respondents who answered questions about ecological endpoints first were willing to pay a small additional amount when asked about human health effects, but those respondents who answered questions about human health endpoints first were not willing to pay any additional amount when subsequently asked about ecological effects.

Awad and Hollander (2010) attempted to apply the Contingent Valuation Method (CVM) in Ramallah Governorate, including urban, rural, and refugee camps. The CVM was utilized to obtain estimates of Willingness to Pay (WTP) for improved domestic water
supply services for current and future generations. Analysis of bid function underlying the WTP responses was undertaken, with a range of explanatory variables being investigated. In their CV survey, they adopted a dichotomous choice with follow-up debriefing questions, as well as open-ended follow-up question to model individual’s WTP. Also, tobit econometric model and Ordinary Least Squares (OLS) were used. A sample of 525 household heads was undertaken, and the survey was used for in-person interviews. Their results showed that the mean annual WTP of Total Economic Value (TEV) of improved domestic water supply services was about NIS 627 per annum, which seemed to them to be insignificant amount based on key socioeconomic explanatory variables suggested by economic theory and previous CV studies. Accordingly, the mean WTP is unlikely to be a realistic value that can gauge the TEV.

Above studies conveyed two principal important messages. The first message is of a methodological nature and refers to the review of the main reasons that steer economists to develop interest in the field of the economic valuation of the environmental benefits. Policy guidance constitutes an important motivation since most of the monetary value assessments of these benefits are crucial when performing a cost-benefit analysis of any environmental protection project (Nunes and Blaeiji, 2005). Furthermore, since most of environmental benefits are not market priced, identification and description of the wide range of economic valuation tools that the economist has access to be necessary when deciding to run an economic valuation exercise.

The second message is of an empirical nature and refers to presentation of case studies. In each valuation study, not only explanation of how different economic valuation methodologies, including travel cost, contingent valuation and stated choice method, can be applied to the economic valuation of environmental benefits but also stresses on the link between the valuation estimates and policy guidance are needed. In other words, an
economic valuation exercise needs a follow-up. In particular, the valuation results always need to be contrasted with the monetary costs regarding the (specific program of) environmental protection. From a cost benefit perspective, the protection is recommended if and only if the benefit from such a protection program far exceeds the costs.

2.2 Applications of CVM on Urban Waste Management outside India

Globally, urban development and growth has triggered a host of problems since the rapid growth of urbanization of the early 1970s. The diverse environmental problems associated with urban growth in developing countries are partly due to "excessive scale" (calculated as population times the per capita use of resources), which strains the natural resource base in and around cities (Foy and Daly, 1989). The strain on the natural regenerative capacity of the land can be lessened up to a certain extent by importing resources from outside. But the ever-increasing amounts of waste that urban areas generate far exceed the assimilative capacity of nature - and, in many cases, the disposal facility of urban waste management authorities. Other urban systems and services, such as water supply, sanitation, public transportation, and roads, are increasingly hassled as well due to growing urban conglomerations in terms of housing, construction and the industrial boom (which obviously requires land) as well as population expansion. Population in the big cities is ever increasing mainly on account of in-migration from rural, semi-urban as well as smaller urban regions. Housing, sanitation, roads and transportation, fuel and power (i.e., energy) and finally the waste disposal and management (which is perhaps most vital from the point of view of environmental sustainability) remains an inaccommodious challenge for urban authorities in both developed and developing nations.

The incapability of many local and municipal governments in developing countries to provide sufficient infrastructure and waste management services has led to the degradation of the physical living conditions and natural environment in and around cities. Less than 60
per cent of the urban population in developing countries has access to adequate sanitation, and only one-third are connected to sewer systems (World Bank 1991). Moreover, the collection and disposal of household garbage (solid waste) is a constant problem for local authorities. Uncollected solid wastes end up in neighborhood dumps where disease carrying rates and insects proliferate or in the drains where they ultimately cause flooding and traffic obstruction. Solid wastes placed in open dumps often lead to groundwater pollution.

There is an extensive literature on the willingness to pay for solid waste management in urban areas of both developed and developing countries. Some studies have shown that the willingness to pay for solid waste management is associated with income, education, quantity of waste generated, household size, and age. Previous studies have shown that low-income consumers are willing to pay for services they want. However, little is known about the determinants of willingness to pay for solid waste management in North Eastern India. This is particularly true for the town of Silchar in southern Assam. The main purpose of this study is to fill the gap in this regard by employing the Contingent Valuation Method (CVM).

Studies on the willingness to pay for environmentally sustainable and efficient urban waste management using non-market valuation techniques are of relatively recent origin. However the importance of the existence of an environmentally safe urban waste management system has been recognised by many researchers during the last couple of decades.

Rushbrook (1990) observed that upgrading landfill disposal operations to acceptable standards is an essential step to improve the quality of a solid waste management service in any municipality. Good solid waste landfill provides a foundation from which a
municipality can develop an expanded range of waste management options. To him, these may include mechanized waste treatment, incineration, and resource recovery. He emphasized on international funding agencies to promote and encourage projects on siting and upgrading of municipal waste landfill operations. Such projects would support and supplement the existing international programs which promote resource recovery.

Dent and Krol (1990) observed that municipal solid waste (MSW) conversion — the recovery of energy (and materials) from MSW has encompassed a wide range of technology options — mass combustion, production and combustion of refuse derived fuels, abstraction and utilization of landfill gas, anaerobic digestion, and thermal processing. The emphasis has been on research and development which concentrates on technical and environmental aspects of energy recovery. Chang, Mount and Schuler (1993) examined the multivariate statistical analysis designed to isolate the effect of size from other variables that influence the underlying cost structure of municipal solid waste incinerators. The regression models for both construction and operating costs investigated several inherent factors, including design capacity, material and/or energy recovery, air pollution control, ownership, as well as actual and expected operating hours for different technologies. They evaluated several econometric model structures systematically to find the most appropriate functional form for both construction costs and operating costs. Their results showed that it is important to model individual technologies separately to avoid exaggerating the importance of scale economy by overall observations.

Harvey (1993) observed that plastic items in some portions of municipal solid waste (MSW), particularly from households and restaurants, have long been viewed as a disposal problem and a symbol of a "throwaway society". According to him, the amount of plastics, and the contribution of the items discarded, must be viewed holistically in setting a solid waste management policy. Jorgensen and Jakobsen (1994) on the basis of nine case studies
of Municipal Solid Waste Management Systems in the Mediterranean region attempted to draw some general conclusions on the socio-economic constraints for improved solid waste management. Policy formation, planning approach, institutional capacity, cost-effectiveness and financing models were assessed. They pointed at three general findings: firstly, there is a great need for improving the planning and management capacity at the municipal level; secondly, there is an immense potential for facilitating a more cost-effective municipal solid waste planning and management through improved counseling and technical "back-stopping" from a national or regional body; thirdly, the national legislative framework for municipal solid waste management should specify policy objectives and measures which are operational and introduced in a realistic time schedule.

Altal and Deshazo (1996) observed that solid waste management in most cities of the developing world is unsatisfactory despite consuming a relatively high proportion of municipal budgets. Most attempts at improving performance have focused on supply-side issues such as collection and disposal capacity but have not yielded significant results. They suggested a different approach based on integrating demand-side information into the planning process. Their analysis called into question conventional presumptions that households accord low priority to solid waste management compared to other urban services and are unwilling to pay for it. They indicated that simple and inexpensive household surveys can provide valuable inputs into the planning process. Sawell, Hetherington and Chandler (1996) analyzed that the management of municipal solid waste in most countries has become a complicated task, due mainly to the combined pressures of dwindling landfill space and the public’s desire to conserve resources. They observed that despite the apparent availability of landfill space in Canada, the waste management situation for major municipalities in Canada does not differ from that in other industrialized nations. They described the differences in waste regulations between regions.
and provided an overview of waste related statistics, including the chemical and physical composition of the waste. Chough, et al. (1999) examined that in current landfills breakdown of municipal solid waste (MSW) occurs slowly and the landfill leaves a legacy of care, management, monitoring and potential catastrophic failure over several generations. Social concern over these long term issues, with their legislative and economic implementation, increasingly favors practices which promote short stabilization times and minimize environmental impact. They described experiments carried out on mixed and unsorted municipal solid waste (MSW) in which 75 per cent of the rapidly biodegradable fraction was degraded in about 2 months with an average yield of 0.18 m$^3$ CH$_4$/kg volatile solids. The experiments served to demonstrate that with proper leachate management very rapid decomposition of waste can be accomplished by taking the waste through a series of controlled degradation stages.

Klundert and Anschutz (1999) presented the concept of Integrated Sustainable Waste Management (ISWM), in the context of the selection of technologies and the design of systems for waste management. To them ISWM differs from the conventional approach towards waste management by seeking stakeholder participation, covering waste prevention and resource recovery, including interactions with other systems and promoting an integration of different habitat scales (city, neighborhood, household).

From the above studies, it can be emphasized that waste management is not a purely technical issue, but that other aspects need to be taken into account. While selecting a technology or designing a system, the political factor should be the most important (Klundert and Anschutz, 2000). Needs for future research to further develop the concept of ISWM are indicated, including identifying criteria for sustainability and defining weighting procedures.
Arene and Mbata (2000) attempted to analyze the profitability of urban agriculture using metropolitan organic waste in Abuja, the Federal Capital Territory of Nigeria. The results showed that the enterprise is profitable, and that output price is the most important determinant of maximum variable profit. Other price factors, specifically planting materials, labor, and metropolitan waste (organic manure) were not significant. Further analysis showed that level of education, age of farmers, per capita farm income, and household size are important determinants of choice of urban agriculture for food security and improvement of environmental quality. To them, the chances of farmers willing to pay for urban agriculture will increase when their level of education and per capita income increase, while the chances of not willing to pay for such venture will increase when their ages and household size increase. The creation of more market outlets for urban produced foods is also recommended by them. Zurbrugg (2002) analyzed that public awareness and attitudes to waste can affect the population's willingness to cooperate and participate in adequate waste management practices. General environmental awareness and information on health risks due to deficient solid waste management are important factors which need to be continuously communicated to all sectors of the population. To him, participation of the population can be by carrying waste to a shared container, by segregating waste to assist recycling activities, or even if only by paying for waste management services. Mastro and Mistretta (2004) aimed to calculate the energetic and environmental effects of an integrated solid waste management system in Palermo, Italy in particular; the thermal treatment of Municipal Solid Waste (MSW) with energy recovery was assessed. Two different options of collection are taken into account: (1) unselected wastes; and (2) sorted collection, according to the current Italian regulation. Their results showed that the thermal treatment of selected MSW, associated with a co generative recovery of energy, represents a relevant sustainable strategy of waste valorization as an alternative to fossil fuels. Kuma
(2004) found that a rapid population growth and high rural-urban migration causes many environmental challenges for the Addis Ababa city. One of these is dry waste management. Inadequate dry waste management has resulted in the accumulation of waste on open lands, in drains and in the living area of many people, causing a nuisance and foul-smelling pools, environmental pollution through leaches from piles (water and soil pollution) and burning of waste (air pollution), clogging of drains, and the possible spread of diseases. Unattended piles of waste are a breeding place for insects and rats. To him, this situation is believed to result in poor environmental conditions and an ever-present risk of epidemics, which in turn present a formidable threat to health and productivity and identifies a need for improved waste management. He observed that the present system of waste removal in Addis Ababa relies entirely on the municipality which is expected to provide the full range of waste collection and disposal. This is proving to be an impossible task, and except for privileged areas, the services offered are found to be largely inadequate. Even in the privileged area it accumulates for weeks. This approach neglects the many activities that waste management comprise to tackle a range of problems associated with waste management in order to achieve socially and environmentally responsible waste management. To him, dry waste management may include legitimization of the informal system, community participation and possibly partial privatization. Such an integrated approach according to him seems to be the best option and could well hold the key to effective and sustainable waste management system in developing cities such as Addis Ababa. Nas, et al. (2004) discussed the poorly assessed topic of informal waste management systems, in which there appears to be a high level of heterogeneity throughout the world. They considered the ways scavengers function within the broader context of waste management; they showed a wide range of locally formed and adapted activities and social systems. They included Examples from different cultures: the United States,
Jamaica, Brazil, Egypt and Indonesia. The authors advocated comparative research and found a contextual, holistic approach to be the most appropriate. Using such an approach, they isolated the important factors that characterize these systems: technical, socio-cultural, socio-political and organizational aspects are elaborated. Experiments in intervention have been undertaken at various levels, from varying ideological and theoretical backgrounds. Academic analyses have ranged from neo-Marxist political economy models to neo-liberal development approaches. The authors concluded that informal waste management systems are unjustifiably considered problematic whereas they often reveal great development potential.

Buchholz (2005) observed that parties involved in solid waste collection scheme in Jakarta – Indonesia are the communities in neighbourhood units, groups of waste collectors operating waste as micro-enterprises, and local administrators. In planned settlements disposal is organised by neighbourhood unit, while in unplanned ones usually disposed off into a river, vacant land or burnt. Local government agency transports waste from the primary to secondary waste disposals, where groups of waste collectors recycle it. Currently the respective actors mentioned execute their own function without any cooperation among them, yet contribute to the process of waste management. They found that main problems are health and environmental consequences, lack of sanitation in semi urban, unplanned settlements and odorous emissions in the surroundings areas of waste disposals. Hurst, et al. (2005) investigated the ability of municipal waste compost as a daily cover material to reduce the odorous emissions associated with landfill surfaces. Trials were carried out using landfill gas, a certified sulphurous gas mix and ambient air as a control. Their results showed the ability of compost to reduce landfill odors under differing conditions. Mubaiwa (2006) observed that throughout Zimbabwe, urban waste collection rates dropped from at least 80 per cent (mid 1990s) to as low as 30 per cent in
some large cities and small towns. According to him, currently more than 2.5 million tons of household and industrial wastes are produced per annum in urban areas and this continues to raise due to unprecedented urban growth rates and absence of waste minimization strategies. He found that areas worst affected are low-income residential areas and informal settlements, with some not receiving service at all. The low waste collection levels have triggered widespread illegal open dumping and backyard incineration. This has created negative environmental impacts and increased the health risk of the residents. He also observed the application of ISWM system in some parts of Zimbabwe. Saphores, et al. (2006) examined that the electronic waste (E-waste) has become the main contributor of lead to landfills in the U.S.A. Households also stores large volumes of e-waste, yet little is known about their willingness to recycle e-waste. They started to fill these gaps based on a 2004 mail survey of California households. Using multivariate model, they found that education, convenience and environmental beliefs but not income or political affiliation are key factors explaining the willingness to drop-off e-waste at recycling centre. A comparison of ordered probit with a semi nonparametric extended ordered probit model of survey responses used by them showed that the latter better predicts less frequent answers. Their results suggested to target public education program about recycling at teenagers or younger adults and making recycling more convenient for older adults; moreover they suggested that e-waste drop off center should first be created in communities that already offer curbside collection program for conventional recyclable products. They found that during the last decade, systems analysis has become a more frequently used tool in municipal waste management. They investigated how one such analysis, carried out in a Swedish county, was perceived by local municipal officers and politicians as support in the decision-making process. They sent a questionnaire to municipal officers and politicians in local government committees.
and municipal councils. The respondents considered the most important aspects in evaluating scenarios to be possibilities for municipal co-operation to minimize cost and negative environmental influence; sound working conditions for refuse disposal personnel; low emissions of greenhouse gases; keeping household economy in mind; and using technologies that are known and reliable. Aspects of relatively low importance were the number of locally generated job opportunities, and minimizing work efforts for the households. The study showed differences between male and female respondents and between politicians and municipal officers, on how scenarios were valued and on which aspects of the systems analysis were of greatest importance for this valuation.

On the basis of the studies reviewed above some important aspects of urban areas are identified. Urban areas in almost all nations face the problem of open waste dumping which are prime breeding sites for houseflies, mosquitoes and other vectors of communicable diseases such as viral fever, diarrhea, cholera and malaria. Fumes from burning waste causes acute respiratory infections and the odors make the environment uninhabitable. The leachate from the dumpsite pollutes underground water, which is an important alternative water source for the residents. Loose papers and plastics blown by wind, result in an aesthetic interruption of the surrounding environment. To address the problems there are various waste management strategies adopted in an ISWM. Nowadays through technological interventions waste is being converted into marketable products. There are also micro-enterprises which provide low cost waste management services. Through community health and hygiene extension education and training waste handling can be improved and thus can contribute to improved health and hygienic standards. One of the key success factors is the effective working partnerships formed between communities, local authorities and private sector.
Begum, et al. (2007) observed that Malaysia is facing an increase in the generation of waste and of accompanying problems with the disposal of this waste. In the last two decades, extensive building and infrastructure development projects have led to an increase in the generation of construction waste material. They found that construction industry has a substantial impact on the environment, and its environmental effects are in direct relation to the quality and quantity of the waste it generates. Sufian and Bala (2007) present a system dynamics computer model to predict solid waste generation, collection capacity and electricity generation from solid waste and to assess the needs for waste management of the urban city of Dhaka, Bangladesh. Their simulated results showed that solid waste generation, collection capacity and electricity generation potential from solid waste increase with time. Population, unclear waste, untreated waste, composite index and public concern are projected to increase with time for Dhaka city. Simulated results also showed that increasing the budget for collection capacity alone does not improve environmental quality; rather an increased budget is required for both collection and treatment of solid wastes of Dhaka city. They emphasised that this model can be used as a computer laboratory for urban solid waste management (USWM) policy analysis. Yusuf, Salimonu and Ojo (2007) examined the economic value of improved household solid waste management in Ibadan North Local Government, Oyo state. They used a dichotomous choice contingent valuation technique to elicit households’ willingness to pay for an improvement in management of their solid waste. The data were analysed using logit regression technique. Their results revealed that the significant factors determining households’ willingness to pay for improved solid waste management (collection and disposal) are the posted price of the service, age, educational level, household size and household’s monthly expenditure. The willingness to pay elasticity coefficient are generally inelastic and low. According to them households should demand for improved
and efficient management of their refuse and pay for such service because of tremendous benefits that accrue to them from it, adopt an acceptable family planning programme to control their population as well as mobilize their family labour by establishing non-capital intensive small scale business in order to improve their income and hence their purchasing power and that they sort their solid waste for recyclable items which could be sold to make some income.

Bhattacharyya, et al. (2007) examined that the importance of the use of potassium in agriculture is increasing in South Asia for making most productive use of the nutrient in terms of economic returns. Municipal waste compost may be an alternative source of nutrient supplements. Field experiments were conducted at the Experimental Farm of Calcutta University, West Bengal, India during the wet seasons of 1997, 1998 and 1999 on flooded lowland rice. Potassium fractions in municipal waste compost and cattle manure were determined by sequential extraction and also the potassium uptake by rice to compare the effectiveness of municipal waste compost with traditional manure. Potassium was significantly bound to the organic matter in municipal waste compost. Potassium uptake by rice grain and straw increased significantly with the combined application of organics and fertilizers and it was higher in grain than in straw. Water-soluble and non-exchangeable potassium contents of municipal waste compost and cattle manure were highly correlated with the uptake of potassium by straw and grain. Exchangeable and residual potassium were also significantly correlated with the uptake of potassium by straw and grain of rice. Much higher uptake of K in rice straw and rain resulted from applying the manures in conjunction with fertilizers than when applied alone. El-Hagger (2007) found in his study that the potential use of Municipal Solid Waste (MSW) plastic rejects resulting from composting rotating screens or from dumpsites in the production of a composite material for different applications in construction, sanitary, mechanical, costal zones, etc. is very
important for approaching a cradle-to-cradle concept for MSW in order to reach sustainable development. He observed that this is a new approach worldwide and has been implemented with full success at The American University in Cairo (AUC) as well as The Association for the Protection of the Environment (APE). Both AUC and APE are non-profit organizations and the cooperation among universities, research institutes, and NGOs (non-governmental organizations) represents a unique model for sustainability. The evaluation of using MSW rejects as a new material is based on both mechanical and service properties of the proposed material together with an environmental assessment associated with the production and use of this composite material. Cai, et al. (2008) elucidated that major theme of the research is to develop a participatory network for integrated solid waste management under uncertainty and complexity through a broad participation of stakeholders. The network can integrate relevant factors, processes, objectives and their interactions into a general modelling framework through comprehensive data collection, participatory modelling formulation and interactive policy analysis.

Todesse, Ruijs and Hagey (2008) analyzed that in many cities of developing countries, such as Mekelle (Ethiopia), waste management is poor and solid wastes are dumped along roadsides and into open areas, endangering health and attracting vermin. The effects of demographic factors, economic and social status, waste and environmental attributes on household solid waste disposal are investigated using data from household survey. Household level data are analyzed using multinomial logit estimation to determine the factors that affect household waste disposal decision making. Results showed that demographic features such as age, education and household size have an insignificant impact over the choice of alternative waste disposal means, whereas the supply of waste facilities significantly affects waste disposal choice. Dangi, et al. (2008) observed that
relatively few studies have been performed to characterize municipal solid waste (MSW) at household level. This is due in part to the difficulties involved with collecting the data and selecting an appropriate statistical sample size. Their study demonstrated a statistically sound and efficient approach for characterizing MSW at the household level. Moreover, a household approach also allowed for consideration of the socio-economic conditions, level of waste generation, geography, and demography. The study utilized two-stage cluster sampling within strata in Kathmandu Metropolitan City (KMC) to measure MSW for 2 weeks. In KMC, the average household solid waste generation was $161.2 \text{ g capita}^{-1} \text{day}^{-1}$ with an average generation rate between 137.7 and 184.6 g capita$^{-1}$ day$^{-1}$ for a 95 per cent confidence interval and 14.5 per cent relative margin of error. The results showed a positive relation between income and waste production rate. Organic waste was the biggest portion of MSW, and hazardous waste was the smallest of the total.

Rahji and Olortuntoba (2009) examined the determinants of willingness-to-pay for private solid waste disposal systems by urban households in Ibadan, Nigeria. They used a multistage random sampling technique to select 552 households for the study. Data obtained from survey were analysed using a logit model-based contingent valuation. Evidence from the logit model indicated that seven variables had significant influence on the households’ willingness-to-pay. Of these, income and asset owned were positive and significant at $P < 0.01$ but amount of willingness-to-pay and firm services were negative and significant at $P < 0.01$. Education and occupation were positive and significant at the $P < 0.05$ level while age was negative and significant at $P < 0.10$. The implication is that households have certain socio-economic characteristics, which influence their willingness-to-pay for solid waste disposal. The study recommended government intervention in a variety of forms such as encouraging public–private participation in solid waste disposal, an aggressive environmental clean-up campaign, decentralization of Waste Management...
Boards and privatization of some aspects of waste management to ameliorate solid waste problems and improve health. Afroz, Hanaki and Hasegawa (2009) employed the contingent valuation method to estimate the willingness to pay of the respondents to improve the waste collection system in Dhaka city, Bangladesh. Their objective was to estimate how WTP differs between respondents who received or did not receive door to door waste collection. The methodology consisted of asking people directly about their willingness to pay an additional waste collection service charge to cover the costs of a new waste management project. The mean value of WTP for areas that received waste collection service areas was higher than for residents of areas that did not but the difference was not statistically significant. The aggregate value of WTP of the respondents in Dhaka city was 7.6 million Taka (USD 0.1 million).

Olorunfemi (2009) assessed that landfills constitute a significant risk to human health and the environment. Even though the location of landfills in urban areas is beneficial in that they provide the most efficient and safe means of disposal of wastes generated, the perceived environmental costs, health-related hazards, social and economic impacts associated with landfills are often confined to the immediate zone of influence of landfills. He examined the willingness to pay for improved environmental quality among people living close to the two functional landfills (Olushosun and Abule Egba) in Lagos metropolis. He used a structured questionnaire in the collection of data for the study. The sample size consists of 930 heads of households in the two locations used for the study (488 in Olushosun and 442 in Abule-Egba). He found three important from the study. First, the presence of the landfills and its associated environmental impacts is an important factor contributing to respondents’ willingness to pay for any environmental improvement in their neighborhood. Secondly, the proportion of respondents willing to pay decreased consistently as distance increases away from the landfills in the two locations. Lastly,
respondents are generally not willing to pay high amount for environmental amelioration. Longe, et al. (2009) examined the structure of household waste management system, collection and disposal within the context of a wider research on integrated solid waste management in households. A sample of 30 households from eleven selected residential areas with a focus group of 60 respondents in Ojo Local Government Area, Lagos State, Nigeria was used. They divided the selected residential areas into high, middle and low socio-economic strata. Their research examined a range of environmental behaviors, attitude and perception of respondents on household solid waste management. The results established waste management behaviors among the respondents on solid waste management system, services, patronage of services and cost recovery methods. Public opinion and perception on solid waste management system is characterized with irregularity and inefficient collection system; with poor monitoring of the private waste service providers by the local authority. Willingness to pay for waste management services provided by the private service providers. The private sector participation operators are higher among the middle and high income socio-economic groups than in the low income group. However, according to them with the application of sustainable environmental education greater success ratio could be achieved. Level of patronage of solid waste management services is high across the three socio-economic groups but patronage is shared among the two operating service providers (formal and informal). The private sector participation has the highest patronage level with 64.6 per cent severity index while the informal sector (Cart pushers) have only 48.7 per cent severity index both percentages translate to the agreed and neutral perception opinion ranges respectively. They advocated for improved solid waste management system through proper monitoring of the services of the private sector participation operators by the Local Government Area for improved service efficiency. Dann, et al. (2009) analyzed the correlation of socio economic status,
awareness, knowledge, and perception with solid waste management practices in the coastal barangays of Talisay and Balibago, Calatagan, Batangas. They employed structured survey and key informant interviews. Statistical analysis revealed that total family monthly income and environmental awareness are negatively correlated with solid waste management practices.

Sanusi (2010) observed in his study that the problem of solid waste remains a single environmental problem common to the urban centers in Nigeria. He attempted to overcome this problem in Minna, Nigeria by introducing private-public partnership. It is discovered that the private firms also experience weak capacity. In addition, the firms operate mainly in high/middle income residential neighborhoods. Thus, even where they make impacts in managing solid waste, such impacts are restricted. He observed that although, people are ready to continue to patronize the waste firms, the capacity of the firms must be strengthened while their operation should cover all parts of the city.

Jensen, et al. (2010) investigated an enzymatic liquefaction of Municipal Solid Waste (MSW) organics, paper and cardboard. Liquefaction trials were conducted in different trial volumes. These results showed that paper particles were the main obstacles needing additional treatment in order to become fully liquefied. In a pilot scale test treating authentic MSW; more than 90 per cent of initial organic and paper dry matter (DM) was recovered. MSW enzymatic liquefaction promotes the separation of organics and paper from solids, which facilitate the use of these degradable fractions, with minimal loss, capable to enter a biogas plant through existing pipes. Anderson, et al. (2010) examined that the emission of greenhouse gases (GHGs) is a potential environmental disadvantage of home composting. Because of a lack of reliable GHG emission data, they set up a comprehensive experimental home composting system. The system consisted of six composting units, and a static flux chamber method was used to measure and quantify the
GHG emissions for one year composting of organic household waste (OHW). They found that GHG emissions (in kg CO$_2$-eq. Mg$^{-1}$ ww) from home composting of OHW to be in the same order of magnitude as for centralized composting plants. Ferreira and Teixeira (2010) found that the management of healthcare wastes is receiving greater attention because of the risks to both human health and the environment caused by inadequate waste management practices. They analyzed the healthcare waste management practices in hospitals of the Algarve region, Portugal, and in particular to assessed the risk perceptions of, and actual risk to, healthcare staff. The study included three of the six hospitals in the region, covering 41 per cent of the bed capacity. Data were collected via surveys, interviews, and on-site observations. Their results indicated that waste separation is the main deficiency in healthcare waste practice, with correct separation being positively related to the degree of daily contact with the waste. Furthermore, legislative definitions and classifications of healthcare wastes appear to have conditioned the management practices associated with, and the perceptions of risk concerning, healthcare wastes. Babington, et al. (2010) found that the uses of electronic and electrical devices have relatively increased with rapid increases in economic and technological development over some period of time in Malaysia. They suggested that there is needs for Malaysia to apply “3R” principles of reduce, reuse and recycle for efficient control and management of material circle of electronic and electrical equipments (EEE). They tended to highlight, the E-waste recycling practice within the material recovery facilities (MRF) studied in Selangor and Penang, the guidelines overseeing the E-waste recycling activities, stakeholders and future plans for E-waste management in Malaysia. They sent a total of 25 questionnaires to MRF through email, fax and personal delivery and a questionnaire with personal discussion held with the department of environment (DOE) Malaysia. Their result showed that E-waste recycling in Malaysia is still at infancy as there are no
sophisticated technologies to carry out complete recycling process in a MRF, lack of specific regulation on E-waste, poor E-waste collection from households at the same time help to understand various activities going on within the MRF studied.

Harren, Themelis and Barlaz (2010) compared the environmental impacts of composting yard wastes in windrows with using them in place of soil as alternative daily cover (ADC) in landfills. Their results showed that the ADC scenario is more beneficial for the environment than windrow composting. ADC use is also a less costly means of disposal of yard wastes. They observed that this finding applies only in cases where there are sanitary landfills in the area that are equipped with gas collection systems and can use yard wastes as alternative daily cover. Otherwise, they suggested the environmentally preferable method for disposal of source-separated yard wastes is composting rather than land filling.

Anderson, Christensen and Scheutz (2010) performed four user surveys at recycle centers (RCs) in the Municipalities of Aarhus and Copenhagen, Denmark, to get general information on compost use and to examine the substitution of peat, fertilizer and manure by compost in hobby gardening. Six case studies were performed as home visits in addition to the Aarhus surveys. From the user surveys and the case studies they found that the total substitution of peat, fertilizer and manure was not 100 per cent, as is often assumed when assigning environmental credits to compost. It was more likely around 50 per cent and thus there is great potential for improvement. It was indicated that compost was used for a lot of purposes in hobby gardening. Apart from substitution of peat, fertilizer and manure, compost was used to improve soil quality and as a filling material (as a substitute for soil).

Afroz and Masud (2010) employed contingent valuation method to estimate the willingness to pay (WTP) of the households to improve the waste collection system in Kuala Lumpur, Malaysia. They evaluated how household WTP changes when recycling and waste separation at source is made mandatory. The methodology consisted of asking
people directly about their WTP for an additional waste collection service charge to cover the costs of a new waste management project. The new waste management project consisted of two versions: version A (recycling and waste separation is mandatory) and version B (recycling and waste separation is not mandatory). The households declined their WTP for version A when they were asked to separate the waste at source although all the facilities would be given to them for waste separation. The result indicated that the households were not conscious about the benefits of recycling and waste separation. According to them concerted efforts should be taken to raise environmental consciousness of the households through education and more publicity regarding waste separation, reducing and recycling. Cofie, et al. (2010) observed that municipal authorities in developing countries are facing immense challenges in managing both solid and liquid waste in a sustainable way. Recycling is not yet high on their agenda although they appreciate the potential of composting for waste volume reduction. This offers an entry point to introduce organic waste recycling as a component of sustainable integrated sanitation which has the potential of a win-win situation by reducing waste flows, ensuring environmental health, supporting food production and creating livelihoods. However, they observed that due to several constraints recycling attempts have often a short life time. They analyzed related reasons by drawing from a larger study in Ghana and a survey of compost stations in different parts of Africa and concluded with a framework for the analysis and the planning of recycling interventions in the context of sustainable sanitation, looking in particular at community-based options for solid waste and human excreta.

Niringiye and Omortor (2010) have studied the willingness to pay for improved solid waste management in Kampala city. They employed a multi stage sampling technique to select one hundred eighty two households from the study area and used a dichotomous choice contingent valuation technique to elicit households’ willingness to pay for
improvement in management of their solid waste. They used a logistic equation model to establish the determinants of willingness to pay for solid waste management. The logistic regression estimates, revealed that the age of the household head is negatively associated with the willingness to pay for solid waste management. Other variables were not significantly associated with the willingness to pay for improved solid waste management. The results suggested there is little chance of success if solid waste collection service charges are introduced.

Sunthornchai, et al. (2010) aimed to investigate the effects of waste management training program on knowledge and awareness of waste management of 54 administrators in the sub district administration organizations in Nongkhai Province with different ages, positions and educational levels which were selected purposively. The research instruments included a waste management training program for 3 days, a questionnaire each on knowledge of waste management and awareness on waste management. The collected data were analyzed by the uses of percentage, mean, standard deviation, paired t-test and F-test (one way ANCOVA). Their major findings revealed that the administrators in the sub district administration organization showed gains in knowledge and awareness of waste management from before training (p<0.05). The sub district administrators with different ages and educational levels did not indicate this knowledge and awareness differently. However, the secretary to the sub district administrator and the deputy of the sub district administrators indicated more knowledge than the head of the sub district administrators (p<0.05). The sub district administrators with different positions did not show awareness differently (p>0.05). Aguilar, et al. (2010) stated that a comprehensive study of the generation and characterization of municipal solid waste is essential to the long term efficient and economical planning for solid waste management. Their aim was to quantify and analyze the solid waste generated in the city of Ensenada, Mexico, and to use
the data in a project that will generate energy through methane gas production. They found that Ensenada’s per capita waste generation is approximately 0.87 ± 0.07 kg per person per day within a 98 per cent confidence interval. Ensenada’s solid waste composition consists of food scraps at 34.28 per cent, paper and cardboard 22.49 per cent, plastic 12.53 per cent, disposable diapers 7.14 per cent, and textiles 6.58 per cent. Of the total waste generated, 86.36 per cent has potential for reuse, whereas 13.65 per cent has no further identifiable use and must be land filled. According to them of the usable percentage, 48.34 per cent can be recycled and 51.66 per cent can be used to generate energy, obtaining financial and environmental benefits. Young, et al. (2011) studied the impact of food waste content on the municipal solid waste (MSW). Using reconstituted fresh MSW specimens with different food waste content (0 per cent, 40 per cent, 58 per cent, and 80 per cent), 48 small-scale (100-mm-diameter) direct shear tests and 12 large-scale (430 mm × 430 mm) direct shear tests were performed by them. A stress-controlled large-scale direct shear test device allowing approximately 170-mm sample horizontal displacement was designed and used. At both testing scales, the mobilized internal friction angle of MSW decreased considerably as food waste content increased. Chen, et al. (2011) analyzed that with the increasing attention on developing a low-carbon economy, it is necessary to seek appropriate ways on reducing greenhouse gas (GHG) emissions through innovative municipal solid waste management (MSWM), such as urban symbiosis. However, they observed quantitative assessments on the environmental benefits of urban symbiosis, especially in developing countries, are limited because only a limited number of planned synergistic activities have been successful and it is difficult to acquire detailed inventory data from private companies. They applied a two-step simulation system and used it to assess the potential environmental benefits, including the reduction of GHG emissions and saving of fossil fuels, by employing various Japanese plastics recycling/energy-recovery
technologies in Shenyang, China. The results showed that among various recycling/energy-recovery technologies, the mechanical waste plastics recycling technology, which produces concrete formwork boards, has the greatest potential in terms of reducing GHG emissions (1.66 kg CO$_2$e/kg plastics), whereas the technology for the production of refuse plastic fuel (RPF) has the greatest potential on saving fossil fuel consumption. According to them additional benefits can be gained by applying combined technologies that cascade the utilization of waste plastics. Moreover, the development of clean energy in conjunction with the promotion of new waste plastics recycling programs could contribute to additional reductions in GHG emissions and fossil fuel consumption. Couth and Trois (2011) in their paper summarizes research into waste management activities and carbon emissions from territories in sub-Saharan Africa with the main objective of quantifying emission reductions (ERs) that can be gained through viable improvements to waste management in Africa. It demonstrated that data on waste and carbon emissions is poor and generally inadequate for prediction models. They showed that the amount of waste produced and its composition are linked to national Gross Domestic Product (GDP). Waste production per person is around half that in developed countries with a mean around 230 kg/hd/yr. Sub-Saharan territories produce waste with a biogenic carbon content of around 56 per cent($+/-25$ per cent), which is approximately 40 per cent greater than developed countries. This waste is disposed in uncontrolled dumps that produce large amounts of methane gas. They stated that greenhouse gas (GHG) emissions from waste will rise with increasing urbanization and can only be controlled through funding mechanisms from developed countries. Ohakwe, et al. (2011) investigated the general attitude and concerns of residents of three cities in Southeastern Nigeria towards the waste management practices, the sitting of a SWM facility and the residents’ likely attitude towards such facility. They designed a questionnaire and administered in three cities: Aba, Umuahia, and Owerri in southeastern
Nigeria. The questions assessed residents’ general attitude and concerns of the impact of present waste management practices, and the sitting of a new solid waste management (SWM) facility. Using factor analysis by principal component method, they extracted four components namely; “pollution and health effects (F1)”, “nuisance (F2)”, “damage to the nature (F3)” and “general attitude towards construction of waste management facilities (F4)”. They examined that F1, F2, and F3 were found to be statistically significant when modeled with concern variable. Comparison of concerns using the means of the factors indicated that the cities were more concerned over the “pollution and health effect” of waste management (mean of concern, 2.70 on a 3.0 scale), followed by “nuisance” (2.20) and then “damage to nature” (2.11). Rating of concerns was different in the three cities reflecting perceptions, attitude, and possible behavior towards waste management. Overall, they found that concerns in Umuahia and Owerri (capital cities) were approximately 11 per cent and 16 per cent higher than in Aba, a commercial and fast industrializing city respectively.

Above case studies and literature reviews address some questions: how can waste flow data from collection systems be interpreted and compared? And which factors are decisive in the urban waste management systems? Above reviews contributed to the understanding of how various strategies affect the quantity of waste and sorting activities. It is discussed how the results from various waste sorting systems can be interpreted and made comparable. A set of waste flow indicators together with generic system descriptions can facilitate comparisons of different collections systems (Dahlen and Lagerkvist, 2010). CVM studies discussed also signify the influence of various socio-economic factors on WTP. To conclude the evaluation of waste management depends on the system boundaries and will always be site-specific to some degree. Various factors are relevant in this regard for example environmental objectives, technical function, operating costs; types of
recyclable materials collected separately, property-close collection or drop-off systems, economic incentives, information strategies, residential structure, social codes, etc.

2.3 Studies Conducted on Waste Management in India

A few numbers of studies have been carried out recently on the willingness to pay for sustainable and efficient urban waste management using CVM in India despite the fact that India is faced with the problem of increasing waste which led to the degradation of the living and natural environment in and around cities.

Roy (1988) stated that social crisis arising out of energy and material shortage and ecological imbalance is going to hit the developed and the developing nations of the world in a big way. He observed that of late, the attention of the city planners and the scientists has rightly been focussed on the huge tonnages of solid waste generated by the urban folk, which otherwise poses a serious threat to the habitat due to its improper and unscientific disposal. On the other hand, hygienic solid waste management techniques are often cost-intensive. To him, technological innovations with resource or energy winning are economically balanced propositions for urban solid waste management. Srinivas (1998) explained that waste management is not an isolated phenomenon that can be easily solved with innovative technology. It is an urban related problem depending on urban resource consumption pattern, jobs and income levels, and other socio-economic and cultural issues. All these issues have to be brought together on a common program in order to ensure a long term solution to urban waste. Chakrabarti (1998) stated that disposal of wastes is a very crucial problem to the modern urban societies in third world countries claiming the major share in the total expenditure allotted for all urban services. She observed that the existing system of disposal through land filling and reusing a part is inadequate and leaves behind a large volume of garbage accumulating over time. She attempted formulate a suitable policy model for solving the problem of disposal of this remaining part through
productive use. Bhowmick and Kumar (1998) focused that SWM is difficult process because it involves many disciplines. These include technologies associated with the control of generation, storage, collection, transportation, processing, marketing, incineration and disposal of waste. All of these processes have to be carried out within existing legal and social guidelines that protect the public health and environment and are aesthetically and economically acceptable. Barman (2000) elucidated that segregation is a very important activity that one must do before throwing out garbage. Most household garbage contains many things that can be used but often render totally useless by dumping them along with other waste. To him, beginning can be made by segregating garbage into useful and totally useless material. Apart from what retained for selling to the rag collector, there are items in the garbage, which are generally classified as ‘road waste’. These are scraps of paper, plastics, metal, glass and rags which are retrieved by the rag pickers. To him, by doing this they are not only helping society, but also saving raw material and energy, in the way getting self-employments. However, they are unknowingly exposing themselves and others to dirt and disease by scattering waste while looking for useful material in the garbage. To avoid this, according to him, segregation can be made even road waste from our garbage and hand it over to the rag picker, thus enabling them to earn their livelihood in safer and healthier manner while contributing to saving our environment by recycling. Organic wastes from kitchens, gardens and dining tables are compostable and so these can be used for making organic fertilizers. For effective segregation, separate containers can be kept in the houses for DRY, WET, and TOXIC wastes. Joarder (2000) focused on the issues in institutional arrangements for solid waste management. He touched particularly on the impact of municipalities’ financial health and autonomy and the limitations and potential of alternative actors, particularly the economically exploited waste collectors and vendors of the non formal sector. Direct and indirect financial
Instruments of cost recovery and generation control are advocated, taking into account their operational hurdles in capacity building of local bodies. The author suggested that the non-formal sector be organized and that the private sector participate more widely in collection and recycling. A project done by Mathew (2000) under Kerala Research Program on SWM in Kottayam Town (Kerala) observed that the method of disposal in the town is primitive and unhealthy. All the waste is mixed together at the time of collection and these are never segregated. The study was done in two phases. The first consisted of a detailed study for assessing the quality and quantity of solid waste generated and the second phase was an action research for the disposal of the solid waste by way of processing, recycling or reuse at local level without the need for transportation and massive disposal. The phases contain awareness campaigns regarding the local level processing of waste, experiments on the recycling of plastics and establish local level solid waste processing units on an experimental basis for vermin-composting. Kansal (2000) emphasized on economic development, urbanization and improving living standards in cities have led to an increase in the quality and complexity of generated waste. Management of municipal solid waste resulting out of rapid urbanization has become a serious concern for urban local bodies. Kansal’s study on the Indian cities revealed that, Mumbai is the highest solid waste generating city.

Singhal and Pandey (2001) stated that increase in MSW generation can be ascribed to changing life style and food habits. They observed that the average collection efficiency for MSW in Indian cities is about 72.5 per cent. The municipalities in India therefore face the challenge of reinforcing their available infrastructure for efficient MSWM and ensuring the scientific disposal of solid waste. They emphasized that in order to achieve a satisfactory and efficient SWM system, targeting waste reduction at source, technological intervention and effort towards institutional and regulatory reforms needs consideration.
Gupta (2001) analyzed that there is no Indian policy document, which examines waste as part of a cycle of production-consumption-recovery or perceives the issue of waste through a prism of overall sustainability. In fact, interventions have been fragmented and are often contradictory. The new Municipal Solid Waste Management Rules 2000, which came into effect from January 2004, fails even to manage waste in a cyclic process. Waste management still is a linear system of collection and disposal, creating health and environmental hazards. Urban India is likely to face a massive waste disposal problem in the coming years. He observed that till now, the problem of waste has been seen as one of cleaning and disposing as rubbish and a closer look at the current and future scenario reveals that waste needs to be treated holistically, recognizing its natural resource roots as well as health impacts. To him, waste can be wealth; which has tremendous potential not only for generating livelihoods for the urban poor but can also enrich the earth through composting and recycling rather than spreading pollution as has been the case. Observing the fact, he stated that increasing urban migration and a high density of population will make waste management a difficult issue to handle in the near future, if a new paradigm for approaching it is not created. Upadhyah, et al. (2005) recognized that the population growth has put tremendous pressure on the quality of environment of urban life. They highlighted the present scenario of waste management and the options available to convert these wastes into useful products. The residents generate various kinds of wastes of biodegradable and non-biodegradable categories. The impact created by these wastes on the environment is enormous, if proper disposal and management options are not applied. The waste could become a resource and the society can benefit from these wastes with proper collection and disposal technologies. Majority of wastes can be recycled and the recycling technologies available today worldwide have a promising employment and energy generating options. The sanitary landfills, biogas generating technologies, vermin-
composting, incineration, municipal solid waste combustion technologies offer good incentives for the local bodies and the governments to derive benefits by utilizing the wastes.

Kumar (2005) observed that due to rapid urbanization and uncontrolled growth rate of population, municipal solid waste management (MSWM) has become acute in India. MSWM, though an essential service, is given low priority. Lack of financial resources, institutional weaknesses, improper choice of technology and public apathy towards MSW has made this service far from satisfaction. The current practices of the uncontrolled dumping of waste on the outskirts of town/cities have created a serious environmental and public health problem. He evaluated the present situation of MSWM in India based on published information and National Environmental Engineering Institute’s (NEERI) expertise towards MSWM. The expertise of NEERI towards MSWM has provided extensive services to various municipal bodies in improving their MSWM system such as community based organization to promote sustainable integrated waste management in mega cities. Mahanta and Das (2005) tried to find out whether the city dwellers are satisfied with the cleanliness of the city and garbage disposal system, how the household are disposing their household solid and liquid waste, what is the main cause of water logging in the city and which factors are playing predominant role in determining their satisfaction with disposal of both liquid and solid waste in Dibrugarh town, Assam. Both primary and secondary data were collected for the study. The results revealed that the Dibrugarh Municipal Board is somewhat responsible for the inefficient management of waste in the city. Though, the authorities claimed that it is only because of lack of adequate fund. Mishra and Pandey (2005) observed that currently in India even though hazardous waste emanations and effluents are regulated, solid waste often are disposed off indiscriminately posing health and environmental risk. In view of this, management of
these wastes including their disposal in environmental friendly and economically viable way is very important. According to them out of the various categories of waste, solid waste contributes a major share towards environmental degradation. They outlined the nature of waste, waste generating industries, waste characterization, health and environmental implication of waste management practices, steps towards planning design development models for effective hazardous waste management.

Sarkhel (2006) found that the city of Kolkata generates more than 4000 tons of solid waste per day. As a group, households are the single largest producers of municipal waste and account for more than 50 per cent of the total waste in the city. As open dumping is no longer viable, the Kolkata municipal corporation is trying alternative models of disposal such as composting. However in the absence of incentives, households do not separate organic waste from regular waste. This in turn increases the processing cost of compost producing units in Kolkata. Using a simple static general equilibrium model, he considered the optimal policies that would induce source separation of post-consumption waste at the households’ level. He observed that a deposit refund system coupled with a subsidy on organic manure would be the optimal outcome. However from the point of the local bodies, a user fee coupled with a subsidy on compost output is the first best outcome though its efficiency can be questioned given the possibility of illegal dumping. Zia and Devadas (2007) observed that Indian cities are often characterized by poorly rendered services including waste management—the most ignored of all basic services, on account of various reasons. The situation worsens with increasing population pressure in urban centers. They found that Kanpur is one such metropolitan city of North India, having an inefficient, outdated and unscientific waste management system. They assessed the existing state of municipal solid waste management (MSWM) in Kanpur city with the aim of identifying the main obstacles to its efficiency and the prospects for improvisation of the
solid waste management system in the city and found that primary and secondary collection, transportation and open dumping are the only activities practiced that too in a non-technical manner.

Ahmed, Vaisya and Gupta (2007) emphasized that increasing population levels, rapid economic growth and rise in community standard accelerates the generated rate of MSW in India. They determined the qualitative and quantitative characteristics of MSW along with basic information and created a Geographical Information System (GIS) maps for Allahabad city. The samples have been randomly collected from various locations to determine the features of MSW. They carried out a questionnaire survey to collect data from inhabitants including MSW quantity, collection frequency, satisfaction level etc. The GIS has been used to analyze the existing maps and data, to digitize the existing sanitary ward boundaries and about wards and disposal sites. The generated Arc GIS maps gave efficient information concerning parameters of the MSWM problems such as the generation rate of the MSW in different static and dynamic wards, collection point locations, MSW transport means and their routes and the number of disposal sites and their attributes.

Das and Ghosh (2007) conducted a study on the issues associated with the Municipal Conservancy Service to dispose of solid waste in a small town of Birbhum district, West Bengal. The findings portrayed that the high density population areas where the poor, illiterate, immobilized people largely reside generate considerable amount of solid waste. They suggested that an integrated management structure should be identified taking into account the migration and distribution of population, especially belong to backward communities incorporating technologically sound disposing operations, educating and mass awakening in respect of evils of accumulate waste, which in future will be expected to solidify the economic foundation and ecological balance in urban environment. Das,
Birol and Bhattacharya (2008) employed the choice experiment method to estimate residents’ willingness to pay (WTP) for improvements in the solid waste management (SWM) services provided in Chandernagore and South Dum Dum municipalities of Greater Kolkata in West Bengal, India. 101 randomly selected residents took part in a choice experiment survey. They analysed Data with conditional logit, random parameter logit and random parameter logit with interactions models. The best fitting random parameter logit with interactions model revealed that there is significant conditional and unconditional heterogeneity in residents’ preferences for improvements in SWM services. Their results revealed that on average residents of these municipalities are WTP significant amounts, in terms of higher monthly municipality taxes, to increase the frequency of waste collection, and to ensure that the waste is collected by covered trucks. Sundaravadivel and Vigneswaran (2009) analysed that liberalised economic policies of developing countries in the recent decades have accelerated the pace of economic growth and urbanisation. They evaluated the waste management issues of India through a review of current policies and practices. To overcome the issues, they suggested multi-disciplinary strategies encompassing technological, economic and financial aspects of waste management. Their findings confirmed the need for the adoption of low-cost technologies to match the communities’ ‘willingness to pay’ so as to achieve economic efficiency and financial sustainability through full cost recovery. Narayana (2009) observed that unlike that of western countries, the solid waste of Asian cities is often comprised of 70–80 per cent organic matter, dirt and dust. Composting is considered to be the best option to deal with the waste generated. Composting helps reduce the waste transported to and disposed of in landfills. He found that several developing countries established large-scale composting plants that eventually failed for various reasons. The main flaw that led to the unsuccessful establishment of the plants was the lack of application of simple scientific methods to
select the material to be composted. Landfills have also been widely unsuccessful in countries like India because the landfill sites have a very limited time frame of usage. He observed that the population of the developing countries is another factor that detrimentally impacts the function of landfill sites. As the population keeps increasing, the garbage quantity also increases, which, in turn, exhausts the landfill sites. Landfills are also becoming ever more expensive because of the rising costs of construction and operation. Incineration, which can greatly reduce the amount of incoming municipal solid waste, is the second most common method for disposal in developed countries. However, to him incinerator ash may contain hazardous materials including heavy metals and organic compounds such as dioxins, etc. Recycling plays a large role in solid waste management, especially in cities in developing countries. He compared the three methods, keeping in mind the costs that would be incurred by the respective governments, and identified the most economical and best option possible to combat the waste disposal problem. Kumar, et al. (2009) observed that solid waste management is one of the most challenging issues in urban cities, which are facing a serious pollution problem due to the generation of huge quantities of solid waste. They presented an assessment of the existing situation of municipal solid waste management (MSWM) in major cities in India. The quantity and composition of MSW vary from place to place, and bear a rather consistent correlation with the average standard of living. Extensive field investigations were carried out for quantification, analysis of physical composition, and characterization of MSW in each of the identified cities. The MSW management status (per the MSW Rules, 2000) has also been assessed, and an action plan for better management has been formulated. Studies carried out in 59 selected cities in India have revealed that there are many shortcomings in the existing practices used in managing the MSW. They found that these shortcomings pertain mainly to inadequate manpower, financial resources, implements, and machinery.
required for effectively carrying out various activities for MSWM. To overcome the deficiencies in the existing MSWM systems, an indicative action plan has been presented incorporating strategies and guidelines which can be a base of municipal agencies to prepare specific action plans for their respective cities. Nishanth, et al. (2010) stated that there is an increase in commercial, residential and infrastructure development due to the population growth and this has negative impact on the environment. Urban solid waste management is considered as one of the most serious environmental problems confronting municipal authorities in developing countries. One of these impacts is due to location of dumping site in unsuitable areas. Das and Gogoi (2010) observed that cost sharing of waste management is affected by family income positively in Tinsukia municipality of Assam. They found that if the family income increases then the probability that the people are in favor of cost sharing is 13 per cent. The study further revealed that the amount of monthly waste generated per household has also influence on peoples WTP for waste management. The authors found that if the amount of garbage generated increase by 1 kg per month then the chances that the people are in favor of cost sharing is 21 per cent. Das (2011) highlighted the problem of solid waste management in the city of Guwahati. The institutional responsibility of solid waste disposal system is assigned to the Guwahati Municipal Corporation. But the service provided by the corporation is neither efficient nor sufficient. This has created enormous problem in the city. The author attempted to examine people’s willingness pay to solve the problem. She conducted a study in the city of Guwahati at household level to collect primary information about the problem of solid waste. Respondents have been asked about their demographic characteristics, level of education and income level. The iterative bidding game was used in the survey. The author found that on an average people are willing to pay Rs. 60.22. She recommended that door
to door solid waste collection service may be implemented in the city as people have shown willingness to pay.

Some studies on waste management in Silchar have also been reviewed. Relatively few studies have been found on this aspect. Goswami (1998) observed that with rapid increase of urban population growth, the generation of domestic wastes has increased. It is a common sight to find both domestic and commercial solid waste dumped in wayside, municipal drains, streets corners. The domestic and commercial solid waste dumped in the road side or in any public place for days together cause public health problem by serving as the breeding ground for carriers of diseases such as files, mosquitoes, rats etc. which spread germs of diseases like typhoid, cholera, etc. He observed that there are many wards in Silchar town where there are no dustbins. Because of lack of garbage management people generally throw their garbage into the drains, roadside etc. For example three dustbins of a Siv colony in ward number 28 were filled up by soil because this garbage is collected after long time. The area becomes polluted and that’s why people now a day’s throw their waste in a nearby canal. Poor garbage management is also responsible to a great extent for the pollution problem in the town. Goswami (2000) also founds that the river Barak near Silchar town receives more than 8000 kilo liters of urban waste water and sewage daily in addition to other household and commercial garbage. In a project by Indo-Canadian Institution (2005) a study was conducted in Silchar. A total of 300 households, selected randomly from the 28 municipal wards and 3 slums of Silchar municipal area, were interviewed for their awareness and perceptions about solid waste management in Silchar. In major findings, it is found that the major category of wastes is food wastes followed by rags, plastics, newspapers, fruits and garden wastes, glass, metal scraps, pesticides cans bottles and other assorted materials. Largest parts of the household are not covered by any door-to-door waste collection system and the rest self-dispose their waste.
In the case of 90.7 per cent of the respondents, the community bin was more than 500 meter from their houses, and 71.7 per cent experienced problems like foul odor, stray animals, mosquitoes and flies in the bins, 80 per cent of the respondents were found to be aware of the Bhagidari system of community participation in waste management and felt that was very successful strategy. However, only 31.7 per cent of the respondents had attended any Bhagidari workshop on waste management. The study found biodegradable wastes from the bulk of the residential solid waste of the city of Silchar. There is, therefore, bright prospect for compost generation from these wastes that could provide entrepreneurial and employment opportunities. It is also evident from the study that there is no proper system for segregation, collection, transportation and disposal of solid wastes in Silchar and that there is a tremendous scope for improvements on all these aspects. The study also pointed out to the need for wider community participation at all levels to improve the present situation. Bhattacharya and Gupta (2011) made a study on the waste pickers and waste traders of Silchar, Assam. Their results revealed that children constituted 63 per cent of the population, women 21 per cent and the remaining 16 per cent were men. There were itinerant buyers also who contributed largely in waste collection. The waste collection was highest in the pre monsoon and lowest in the monsoon. The waste collected by waste pickers and itinerant buyers was around 15.7 per cent of the total waste thus saving approximately 15.7 per cent of the expenses of municipal authorities. It was recorded that trader to whole-seller price was approximately 50 per cent higher than the waste pickers to traders while whole-seller to recycling unit price was more than 100 per cent higher than the waste pickers to traders. They also discussed earning, health condition, social status and finally contribution in MSWM by the waste pickers.

In the above studies a comprehensive review of the characteristics, generation, collection and transportation, disposal and treatment technologies of MSW practiced in India are
discussed. The reviews pertaining to MSWM for Indian cities has been carried out to evaluate the current status and to identify the major problem areas. It can be concluded that the lack of resources such as financing, infrastructure, suitable planning and leadership are the main obstacles in MSWM. The increase of service demands combined with the lack of resources for municipalities are putting a huge strain on the existing MSWM system.

2.4 Research Gaps

The review of literature done in the previous section sheds profound light on the current nature of empirical studies on urban waste management in India and abroad. Undoubtedly numerous studies have been conducted globally. Evidently, only a handful of studies have been carried out in India on the willingness to pay for a safe and environmentally sustainable urban waste management employing the CVM technique. This is in contrast with the vast amount of literature that has accumulated over the years in foreign countries. In north eastern states of India very few studies have been conducted on the WTP for safe and sustainable waste management system. Only a couple of studies are reported in literature - one conducted in Guwahati city (Das, 2011) and another study conducted in Tinsukia Municipality (Das and Gogoi, 2010).

In 2006 a project was carried out in Silchar by Indo-Canadian SHARP project where the best strategies for maximizing community participation, cost effective approaches, efficient pilot project and capital investment issues relating to solid waste management were analyzed. The project employed technical issues. Application of CVM to understand and enumerate the willingness of residents to adopt a safe and sustainable waste management system in Silchar town has not been done before. Thus a very large research gap exists in this area on the topic in question and consequently it is a sufficient justification for undertaking the present research problem.
Waste management in Silchar municipal area depends completely on Silchar Municipal Board and at present municipality finds it hard to tackle the situation competently. In such case, awareness of households along with their active participation is very much needed. It is important that local stakeholders identify the problem, collect and analyze information, make recommendations and implement change on their own. In planning and implementing new or improved solid waste management system, the degree to which the public is involved in strategic decision making is a critical determinant of the proper functioning of the system as well as sustainability. Therefore, in this study, willingness to pay for sustainable waste management scheme is estimated by using single bounded dichotomous choice contingent valuation method. Such an approach to this problem has never been under taken in any city or town of the northeastern part of India and hence this study is the result of a pioneering effort.

The present study is an improvement over other studies conducted in the northeastern cities on various accounts. A thorough assessment of socio-economic and demographic characteristics of the population is the key to formulate recommendations for the improvement of SWM in the city. The study examines the effects of selected socio-economic factors on the WTP for a safe and sustainable waste management system in Silchar town. It further estimates the impact of environmental awareness levels on the WTP for the proposed waste management scheme. In order to be able to implement a sustainable SWM, it is very important to know to what extent these variables affect WTP for the proposed waste management scheme.

The level of environmental awareness can have an effect on the types of product purchased as well as whether unused objects are discarded, recycled or sold. This factor may also affect the means by which households recycle waste products and the extent to which they pay their solid waste related tariff or charges. Households’ participation and commitment
depend on their willingness to involve themselves in the proper operation, functioning and maintenance of waste collection and disposal system. This may be promoted by specific or targeted awareness building programs dealing with general public health and environmental issues as well as focused information campaigns on specific SWM issues. Households’ attitude towards waste disposal practices is a key determining factor behind peoples’ active participation (or cooperation) in a safe and sustainable SWM system in Silchar. Attitude can influence commitment, the converse being also true. Interestingly these are directly linked to awareness and consciousness both of which in turn are determined to a large extent by education, information and knowledge. Thus ultimately without peoples’ willingness and commitment any proposed or hypothetical (also an ideal) SWM scheme can never come to being. It is hoped that the present study will be a significant step in revealing peoples’ preference (or choice), willingness and commitment for a cleaner, healthier and environmentally safer Silchar.