Municipal Solid Waste Management in Kalimpong Town: An Economic Analysis

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"Dissertation Submitted to Sikkim University in Partial Fulfilment of the

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Date: 27th of Feb 2015

DECLARATION

I, Priyanka Khati, hereby declare that the subject matter of this dissertation entitled **"Municipal Solid Waste Management in Kalimpong Town: An Economic Analysis"** submitted to Sikkim University in partial fulfilment of the requirements for the degree of Master of Philosophy in Economics is my original work. This dissertation has not been submitted for any other degree of the University or any other University/ Institute.

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CERTIFICATE

This is to certify that the dissertation entitled **"Municipal Solid Waste Management in Kalimpong Town: An Economic Analysis"** submitted to Sikkim University in partial fulfilment of the requirements for the degree of Master of Philosophy in Economics embodies the result of *bonafide* research work carried out by Ms. Priyanka Khati under my guidance and supervision. No part of the dissertation has been submitted for any other degree, diploma, associated-ship, fellowship.

All the assistance and help received during the course of the investigation have been duly acknowledged by her.

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ABBREVIATIONS

CMAP: Chicago Metropolitan Agency for Planning.

CPCB: Central Pollution Control Board.

CV: Contingent Valuation.

CVM: Contingent Valuation Method.

GDP: Gross Domestic Product.

GDP/c: Gross Domestic Product per capita.

GHG: Green House Gases.

MSW: Municipal Solid Waste.

MSWM: Municipal Solid Waste Management.

MT: Metric Tonnes.

NOAA: National Oceanic and Atmospheric Administration.

NSWAI: National Solid Waste Association of India.

OECD: Organization for Economic Co-operation and Development.

SWM: Solid Waste Management.

UN: United Nations.

UNECA: United Nations Economic Commission for Africa.

UNESCO: The United Nations Educational, Scientific and Cultural Organization.

UNEP: United Nations Environmental Protection.

UNIDO: United Nations Industrial Development Organization.

USEPA: United Nations Environment Protection Agency.

WTP: Willingness-To-Pay.

CHAPTER I
INTRODUCTION

1.1 Background

Rapid growth in developing countries and increase in population in recent times has led to acceleration in the pace of urbanization (Ahmad, Khan, & Naeem Ur Rehman, 2009). Increasing quality of life and high rates of urbanization has had an unintended and negative impact on the urban environment, one of which is generation of wastes far beyond the handling capacities of urban government and agencies (Adedipe, Sridhar, Baker, Verma, Faruqui, & Wagner, 2005), leading to insufficient or improper waste management. Moreover the problem of waste management is more aggravated in developing countries where the conditions, issues and problems of waste management are different to that of the developed countries. Even though the volume of waste generated by the developed countries are much larger in comparison to the developing countries, most of the developed countries have developed or are in the process of developing adequate facilities, infrastructures, competent government institutions and bureaucracies to manage their wastes. Developing countries on the other hand are still in the transition towards better waste management and therefore have insufficient and improper waste management system (Chopra, Prasad, & Rajput, 2009).

Solid wastes maybe sub-divided into five categories based on the source of their generation as follows:

i) Household waste or Municipal waste which consists of waste generated as a consequence of household activities.

ii) Biomedical waste or Hospital waste which includes pathological, anatomical and infectious wastes, which are produced from health care facilities and medical labs.

iii) Hazardous waste or Industrial waste, include those from industrial processes, mining extraction; from pesticide based agricultural practices etc.

iv) Agricultural waste which is composed of organic wastes (animal excreta in the form of slurries and farmyard manures, spent mushroom compost, soiled water and silage effluent) and waste such as plastic, scrap machinery, fencing, pesticides, waste oils and veterinary medicines.

v) Radioactive waste which mainly arises from nuclear power plants, nuclear testing labs, industrial establishment etc. (Chopra, Prasad, & Rajput, 2009)

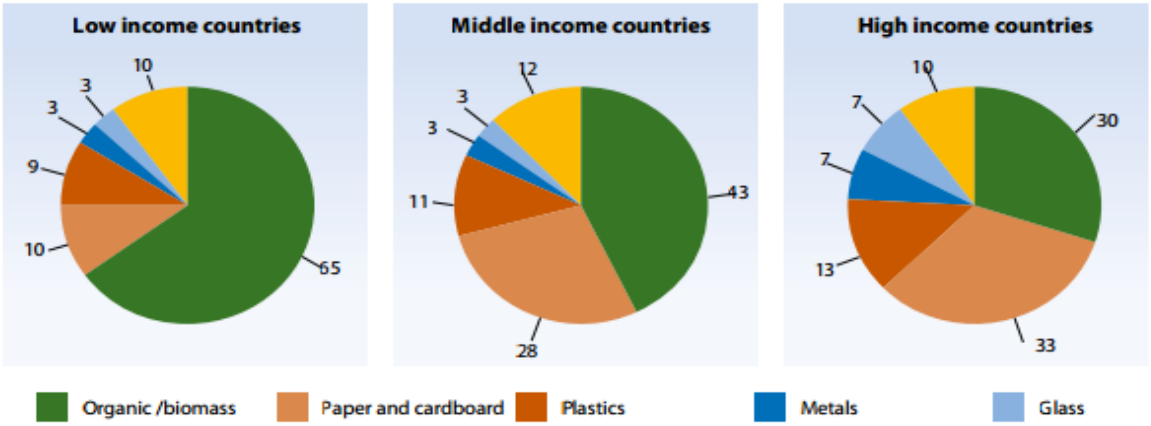
This study shall particularly deal with MSW of Kalimpong town and the issues surrounding its management, since off lately the town has been facing the brunt of the growing volumes of MSW. Not only in the small town of Kalimpong but the growing volumes of MSW has been an area of concern on a global scale. The World Bank too has expressed alarm over the growing piles of municipal garbage across cities of the world and the problems related to its disposal (Moyna, 2012). In definition as per the Indian Municipal Solid Waste Management and Handling Rule 2000 (NSWAI), MSW is defined as waste which includes commercial and residential wastes generated in municipal or notified areas in either solid or semi-solid form, excluding industrial hazardous wastes but including treated bio-medical wastes. According to (USEPA ,2013), MSW consists of everyday items we use and then throw away, such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances which comes from our home.

Though the term MSW is universal, it has different concern depending upon the location and living standard of the people (Sahu, 2007). In case of developing countries like India biodegradable waste takes up the higher share of the total MSW generated. As per the NSWAI 51 per cent of the total MSW generated in India consists of bio degradable waste, whereas in developed countries like the United States of America the non bio degradable take up the larger share (65 per cent) according to (USEPA, 2013).

Figure 1.1 below shows the composition of MSW according to the National Income of a country. From the figure it can be seen that, more a country moves towards higher National Income or in other words more economic growth, lesser is the percentage of

organic waste and higher the share of inorganic waste in the MSW composition. The figures relating to the type of waste composition by income level of different countries is given in Annexure A.

Fig. 1.1: Composition of MSW (in percentage) by National Income



Source: *http://www.unep.org/greeneconomy/Portals/88/documents/ger/8.0_Waste.pdf.*

The volume of MSW generated in a region is largely determined by factors such as population in any given area, rate of urbanization and GDP/c. Population is undoubtedly the most important factor as people are the major creators of waste, especially MSW. According to a report published by the UN, between now and 2025, the world population will increase by 20 per cent to reach 8 billion inhabitants (from 6.5 billion) out of which 97 per cent of the growth will happen in Asia and Africa which includes some of the poorest countries who are not equipped to deal with the problems of population explosion one of which is increase in waste generation (Mavropoulos, 2011). Projected increase in population in low medium income countries is 4011 million, with 2080 million increases taking place in urban population and the MSW generation increasing from the present level of 0.78 per capita (kg/capita/day) to 1.26 per capita (kg/capita/day) (UNEP, 2011).

Urbanization is another significant factor leading to increase in the waste pile ups; growing volumes of MSW which is an important by product of an urban lifestyle has been reported to be growing even faster than the rate of urbanization. A decade ago it was estimated that there were 2.9 billion urban residents worldwide who generated about 0.64 kg of solid waste per person per day i.e., 0.68 billion tonnes per year (Bhada-Tata &

Hoornweg, 2012). This figure has at present increased to about 3 billion residents generating 1.2 per kg of MSW per person per day i.e., 1.3 billion tonnes a year (UNEP, 2011). In a little over a decade, the global MSW generation is projected to further increase by 70 per cent from the current 1.3 billion tonnes per year to 2.2 billion tonnes in 2025 (UNEP,2011).

Besides overpopulation and urbanization, a remarkable increase in GDP/c especially in developing countries has been an important factor leading to generation of large volumes of waste. A correlation between the amount of municipal waste and the GDP of the country has been found to exist. Higher the GDP of a country, higher is the quantity of waste produced (Chopra, Prasad, & Rajput, 2009). Using the macroeconomic data from 30 OECD countries it has been estimated that a 1 per cent increase in National Income leads to a 0.69 per cent increase in MSW amount (Mavropoulos, 2011). In 2025, world production will have doubled in relation to the present times and by 2050 the world production may again have doubled compared to 2025. The global average GDP/c around 2025 will be more or less one and a half times the current one (Chabukdhara, Kaushal, & Varghese, 2012) meaning that waste generation will also increase more than the current times.

There are various negative impacts that are caused due to improper waste management. It leads to various environmental and health problems and also adversely affects the economy of a nation. Each year an estimated 11.2 billion tonnes of MSW are collected worldwide of which the organic fraction of the municipal waste contributes to about 5 per cent of the total GHG's emissions, known to be responsible for climate change (UNEP, 2011). The non biodegradable substances present in the MSW like polythene bags, block drain pipes as well as contaminate the water supply (Jhingan & Sharma, 2011). Unsanitary landfills also contaminate ground and surface resources when the leachate percolates to the water table or is washed as runoff during rains (Annepu, 2012).

Carbon dioxide, methane and nitrous oxide are the major GHG's, which emit from landfill areas and contribute significantly to global warming. Moreover, the global

warming potential of methane is 21 times higher than that of carbon dioxide and it has highest generation (60 per cent) than other gases. Compared to the west, the composition of MSW in developing countries has higher (40 per cent- 60 per cent) organic waste. This would have potential to emit higher GHG's from per ton of MSW compared to developed world (Ramanathan & Rawat, 2011). It also adversely affects the ecology, as when land is claimed for landfills, it is no longer hospitable to many plants and wildlife. Often, the fertility of the landfills cannot be completely reclaimed, even after the landfill is capped (CMAP, 2008).

Uncollected waste can be a factor in the spread of diseases such as typhoid, cholera, hepatitis A, heptospirosis, malaria, dengue and chickengunya (Anapolsky, Zhu, Asnani, Chris, & Shyamala, 2007). The United States Public Health Services has identified twenty one such human diseases that are linked to improper SWM (Pradhan, 2008).

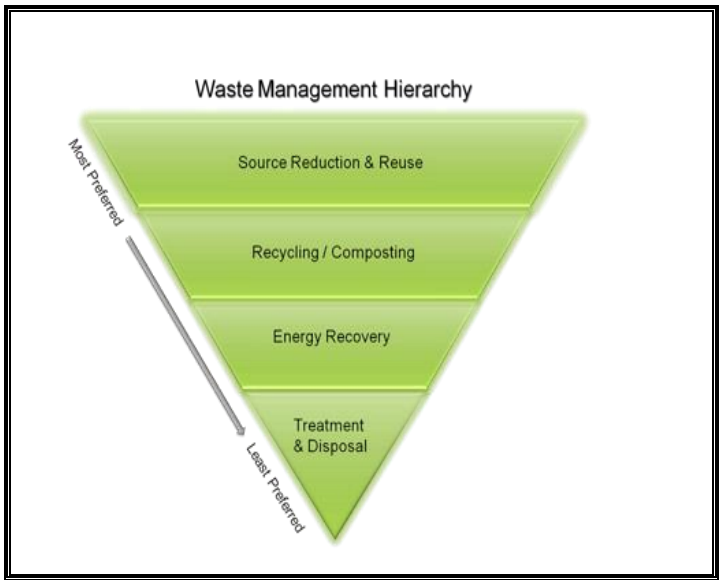
Management of solid waste also poses economic problems as it requires users to make choices and to resolve conflicts of interests (Jhingan & Sharma, 2011). Further it can lead to depreciation of the value of property nearer to dumping sites or incinerators, as no one wants to live near a landfill (Hosetti & Kumar., 1998). As regions urbanize, it becomes more difficult to find land that is suitable for dumping and amenable to the surrounding population (CMAP, 2008). It means that pollution is a problem of scarcity in terms of waste disposal capacity. The main problem of choice is how to utilize the scarce resources in relation to society's needs. This problem is solved through the market forces which can act as a helpful tool in determining the value of these scarce resources in the most rational manner (Jhingan & Sharma, 2011). All these above stated factors make proper, efficient and immediate management of MSW a major issue both in the developing and developed nations as it is essential not only for the economy of a nation, but for its ecology and environment as well as well-being of its population.

1.2 Solid Waste Management: Methods and Benefits

(OECD, 2011) defines SWM as the supervised handling of waste material from generation at the source through the recovery processes to disposal. Waste management and processing involves one or more of the following processes, i.e., reduction, reuse, recovery or disposal of waste with practices and technologies differing according to different economic and social circumstances (Adedipe, Sridhar, Baker, Verma, Faruqui, & Wagner, 2005). Since no single waste management approach is suitable for managing all waste streams in all circumstances a hierarchy is developed and followed all over the world ranking the most environmentally sound strategies for MSWM as shown in Fig 1.2. The hierarchy places emphasis on reducing, reusing, and recycling the majority of wastes. The hierarchy represents an inverted pyramid which shows the waste management activity ranging from most preferred to least preferred.

The most preferred method of waste management is source reduction, which means reducing waste at source of generation. Source reduction can, save natural resources, conserve energy, reduce pollution, reduce the toxicity of our waste, and save money for consumers and businesses alike. The second most preferred method is recycling/ composting, which is a series of activities that includes the collection of used, reused, or unused items that would otherwise be discarded, and making it fit for reuse. The third most preferred method is energy recovery from waste, which is the conversion of non-recyclable waste materials into useable heat, electricity, or fuel through a variety of processes, including combustion, gasification, pyrolization, anaerobic digestion, and landfill gas recovery. This process is often called waste-to-energy. Lastly landfills (treatment and disposal) are the most common form of waste disposal and are an important component of an integrated waste management system. Methane gas, a byproduct of decomposing waste, can be collected and used as fuel to generate electricity from sanitary landfills (USEPA, 2013)

Fig. 1.2 Waste Management Hierarchy



Source: (USEPA, Non-Hazardous Waste Management Hierarchy, 2013)

The benefits of SWM can be sub-divided into three categories- environmental, economical, and land use related. Proper waste management can help control the problems of environmental hazards. Recycling allows post-consumption materials to replace virgin resources in manufacturing, thus reducing the need for more trees or oil needed to produce paper products and plastics. Composting allows organic materials to naturally degrade and be reused as fertilizer. This is a natural substitute for using chemical fertilizers, which either runoff during heavy rains or seep into the groundwater, contaminating water supplies. Compost also serves to maintain steady temperatures in the soil and thus helps in better crop production. It also leads to reduction in leachate amounts as well as odors and other sources of nuisance (CMAP, 2008).

Recycling and composting provides a more environmentally friendly alternative to dumping of yard leading to reduction in landfill space consumed. Scarcity of lands for landfills is one of the major problems for many municipalities and waste disposing authorities around the world as with the ever growing population in the world; demand for lands is steadily increasing (CMAP, 2008).

Economic benefits ranges from consuming the recycled materials which may lead to reduction of production costs, depending on the reuse of the materials as well as creation of a sustainable supply of raw materials (CMAP, 2008). It leads to increase in capital formation as reuse and recycling leads to revenue generation since, value is generated form products otherwise considered to have no value. Employment generation is another benefit that can be generated form waste management. Also when waste management becomes a market activity and is seen as a profit generating option, it will start attracting various investors who can take the pressure of waste management form the local governments and invest the needed capital for waste management activities. Countries also can charge a hosting fee from the landfill and use it to fund the SWM department and to enhance alternative waste disposal such as recycling and composting as well as promoting public awareness of the importance of the 3R's- Reduce, Reuse, Recycle (CMAP, 2008).

However in most of the developing countries such practices of waste management are mostly non prevalent and open dumping or burning of waste are the most common practices followed. Moreover, collection rates are lower than 70 per cent, with more than 50 per cent of the collected waste disposed through uncontrolled land filling and about 15 per cent processed through unsafe and informal recycling (UNEP, 2011). Very limited funds are provided to the SWM sector by the government in the developing nations, which is truer for small towns and rural areas, where the local taxation system is inadequately developed, and therefore the financial basis for public services, including SWM, is very weak (He, Kamata, Kim, & Wang, 2011). Lack of financial resources and infrastructure to deal with waste creates a vicious cycle of waste mismanagement. Lack of resources leads to low quality of service provision which leads to fewer people willing-to-pay for said services which in turn erodes the resource base (Pradhan, 2008).

The cost of waste management is another factor that makes it hard for poor and developing nations to undertake any waste management programs. The annual cost of global SWM is projected to rise from $205 billion to $375 billion (Moyna, 2012). The cost of MSW disposal in low middle income countries like India is expected to increase

from $20.1billion to $84.1 billion by 2025 (UNEP, 2011). Estimates of SWM cost in 2010 and 2025 according to the income level of the countries are given in Annexure B. According to a report by the World Bank urban authorities in Asia spend an estimated 50-70 per cent of their revenues on waste management. The effect of neglecting management of waste is said to cost and average 5 per cent of the worlds GDP (Borongan & Okumura, 2010).

Financing waste management programs bears burden to the municipalities or the urban local bodies, as it still at large is a non market activity and there is an estimated global shortfall of US$ 40 billion in financing for the MSW sector (World Bank, 2014). Lack of proper waste management leads to loss of value, the world market for municipal waste from collection to recycling is worth an estimated US$ 410 billion a year, but however only a quarter of the total municipal waste produced worldwide each year are recovered and recycled (UNEP, 2011). Proper waste management can act as a source of revenue for the people, local governments and the country as a whole. Thus it is imperative that countries start treating waste as a resource and tapping in on its value.

1.3 Solid Waste Management in Indian Context

India is the second largest populated nation in the world, with a population of over 1.21 billion according to the Census of India (2011) i.e., nearly 17.5 per cent of the world population and has around 2.4 per cent of world land area (Kumar, u.d). Moreover the growth of urban population in India is at a much faster rate than the growth of rural population. According to the provisional figures of Census of India (2011), 377 million people lived in the urban areas of the country i.e., 31.2 per cent of the country's total population (The share of people living in urban and rural areas is given in Annexure C). The level of urbanization increased from 27.81 per cent in 2001 to 31.16 per cent in 2011 according to the provisional figures of Census of India (2011). Very high rate of urbanization coupled with improper planning and poor financial condition has led to generation of large volumes of MSW making its management in Indian cities a herculean task (Chabukdhara, Kaushal, & Varghese, 2012). Furthermore the country does not have

enough resources or adequate systems in place to treat its growing volumes of solid wastes and is facing a major problem with its increasing urban population and keeping up with services and resources for providing proper SWM (Anapolsky, Zhu, Asnani, Chris, & Shyamala, 2007).

Besides increase in population, a remarkable increase in GDP leads to further increase in waste problems (Mavropoulos, 2011). Over the decades, the socioeconomic conditions in India have been fast changing. For example per capita income of India has changed from US$ 17.22 to US$ 1165.00 and GDP from US$ 9382.67 million to US$ 1876.8 billion during 1971–2014 (Trading Economics, u.d). Studies have indicated that for every Rs 1000 increase in income the solid waste generation increases by one kilogram per month. (Chabukdhara, Kaushal, & Varghese, 2012).

According to the status report on MSW by (CPCB, 2012), India generates about 127.49 million tonnes of MSW a day (the state wise figures of MSW generation is given in Annexure D), making it the sixth largest MSW generating country in the world (Ramanathan S. , 2014). This figure is projected to increase by more than 260 million tonnes annually by 2047 i.e. almost a 50 per cent increase from its present level (Pandey & singhal, 2001). However the country is reported to have provisions to treat only 12.5 per cent of the generated waste (Ramanathan S. , 2014). India is also set for a dramatic expansion of its domestic consumption that will make the country one of the largest consumer markets in the world. It is estimated that consumption will grow from Rs 17 trillion of present level to Rs 70 trillion by 2025, i.e. a fourfold increase in 10 years (Narayanswamy & Zainulbhai, 2007)Waste is an inevitable byproduct of consumption and production activities and its efficient management has become one of the major problems facing most developing countries of the world including India (Kansal & Yedla., 2003).

SWM in India, traditionally has been a neglected area of urban development and often accounted for severe environmental and health problems in the past (Bajaj, 2011).The outbreak of plague in Surat during 1994 demonstrated the health cost from improper

management of MSW. The outbreak of the plague can be attributed to the uncontrolled fermentation of wastes which created favorable conditions for breeding and growth of rodents and insects that acted as a vector of disease (Pradhan, 2008). In 1996 Ms. Almitra H. Patel filed a writ petition in the Supreme Court alleging that the practice of waste disposal followed by the local bodies in India was faulty and had a negative impact on resident's health. The Supreme Court in response formed a committee in 1998 to look into all aspect of SWM in class I cities of India. Based on the committee report the Municipal Solid Waste Management and Handling (MSWMH) Rules were drafted in 1999 and finally came into effect from 29th September 2000 (Sarkhel, 2012).

According to this rule of the Government of India, municipal bodies were asked to introduce doorstep collection of the segregated waste and replace open dumps by sanitary landfills. Particular emphasis was laid on the adaptation of alternate disposal practices, like composting, that would divert waste from being dumped in the landfills (Sarkhel, 2012). However, even after a decade, since the rule was first initiated, no city in India complies with these rules, open dumping, burning and landfill fires, and exposure of waste to humans and animal are a common sight (Chandran, 2013).

Moreover most of the towns/ cities are not having proper action plan for implementation of the MSWMH Rules**.** Indian cities are still struggling to achieve the collection of all MSW generated. Metros and other big cities in India collect between 70- 90 per cent of MSW, while the collection rate in smaller towns is less than 50 per cent (Annepu, 2012) with the remaining uncollected percentage being lost in the environment. House-to-house collection and segregation of waste is not fully covered in any of the cities (CPCB, 2012).

Factors that largely contribute to problems of inefficient SWM in developing countries like India are: (a) poor management by local authority who are responsible for the handling; (b) non availability of adequate facilities for waste management; (c) poor infrastructure (d). ineffective approach by concerned authorities to carry out waste management, (e) low skill of workers, (f) financial constraints (g) non-systematic process of garbage collection (h) lack of community participation and public concern and (i) lack

of law enforcement towards waste management (Ayotamuno & Gobo, 2004). Amongst all these factors financial constraints and lack of public concern and participation are the two key major challenges. A closer look on the factors will reveal that a proper financial base is important for improving of a, b, c, d, e and g.

In India the municipal bodies or the urban local bodies in various cities and towns are deemed responsible for proper management and handling of waste. However majority of the municipalities do not follow the proper handling rules. Most of the municipalities in India have no sanitary landfill facility and follow open dumping for disposal of MSW (Bajaj & Kumar, 2013). Over 90 per cent of municipality in India still dumps untreated solid waste in the open (Moyna, 2012). Generally, solid waste is disposed off in low-lying areas without taking any precautions or operational controls. These landfill sites are an environmental hazard and cause health problems (Bajaj & Kumar, 2013) particularly for the poorer residents in both urban and rural areas reducing the quality of life (He, Kamata, Kim, & Wang, 2011).

Also the high cost of proper SWM tends to be a problem to the Indian Municipalities, because disposing off the waste safely needs installation of new technology. The cost of waste collection in India tends to be a very large part of the overall solid waste budget. Urban local bodies in India spend about $10 – $30 (INR 600 – 1,800) per ton on SWM. About 60-70 per cent of this amount is spent on collection, 20-30 per cent on transportation, leaving little or no financial resources allotted for scientific disposal of waste (Annepu, 2012). Unskilled labours are used to sweep streets and collect garbage. Though labour rates are cheap and manpower abundant its low productivity leads to high costs. It is estimated that India spends four times on sweeping as on refuse collection (Bajaj, 2011). Investing in the modern technologies and equipments for SWM by a relatively poor country can result to greater financial problems (Atienza, 2011). Consequently rise in population and urbanization is not met by equal increase in infrastructural facilities due to lack of funds which lead to increase in filth and garbage, thus creating a vicious circle of pollution (Zebrock, 2003).

Moreover in many municipalities the landfill sites have been exhausted and there are not enough resources to acquire new land (Singh, 2010). Also there is ever increasing demand for new landfill sites which are scarce in supply. The need for the landfill sites if continued at the present rate of disposing waste using landfills will lead to a landfill requirement of almost 1400 sq. km. which is equivalent to the joint area of Hyderabad, Mumbai and Chennai (Annepu, 2012).

MSWM has been a non market activity at large in most of the regions of India as most of the solid waste services are provided by the municipal authorities (Sarkhel, 2012). The municipalities fund this service from their tax base, rather than provide it on a fee-for service basis, resulting in the common perception of SWM as a free service. This has inadvertently promoted overuse of the system leading to excess waste generation (Munroe, 1999). There is not much participation and responsibility from the public, who are the actual generators of waste. Public involvement is crucial not only in policy formulation but also in being actively involved in waste management and disposal (Singh, 2010). Many economists have pointed out that urban (public) goods, in this case SWM should be financed through user charges to the extent possible to overcome the financial constraints. It was further highlighted by (Appasamy & Nelliyat, 2007) in a report titled "Financing Solid Waste Management Issues and Options" that the people would be willing-to-pay for those services if the people are made to do so. Citizens, businesses and industries are producers of waste, and the impacts of this waste directly affect their health, environment and quality of life thus active public participation is crucial for proper waste management which in turn will lead to betterment of public health and quality of life (Anapolsky, Zhu, Asnani, Chris, & Shyamala, 2007).

Collection of refuse poses another problem as household waste is thrown indiscriminately in the open. Absence of segregation at the source makes it very hard to recycle the collected waste and gain value from it. At present mixed waste composting is done in India which generates only 6 to 7 per cent of compost form the total materials with the remaining percent again land filled (Annepu, 2012). Indian loses a total of 9.6 Million Tonnes of compost generation due to lack of source segregation or approximately Rs

48,000 million[1] and 6.7 Million Tonnes per year of recyclable material which could have been used as secondary raw materials and earn revenue (Annepu, 2012). This is caused due to lack of awareness in the part of the public regarding proper waste disposal and management practices. Thus a comprehensive approach is required for undertaking a sustainable SWM policy or program which undertakes all these factors that is leading to the failure of SWM at the current system.

1.4 Mountain Ecosystem and the Problem of Waste Management

The present study is based in Kalimpong town which is located in a mountainous region thus the need arises to briefly describe the mountain ecosystem and the problems that such ecosystem faces with special reference to SWM.

There are many types of ecosystem: forest ecosystem, grassland ecosystem, costal ecosystem, freshwater ecosystem etc. From amongst these, mountain ecosystems constitute the most vulnerable biogeographical domain. Mountain environments consists of some 27 per cent of the worlds land surface, and provide direct livelihood support to around 22 per cent approximately 1.4 billion people of the world's population who live in mountain regions. Lowland people also depend on mountain environments for a wide range of goods and services, including water, energy, timber, biodiversity maintenance, and opportunities for recreation and spiritual renewal (Blyth, Groombridge, Lysenko, Miles, & Newton, 2002).

There are numerous pressures that threaten the mountain ecosystems like demographic pressures, changes in economic services, consumption patterns, trade policies of the countries and income level. Natural disturbances such as soil erosion, seismic hazards, climate change, degradation caused due to human activities which ranges from land cover change caused due to urbanization and agriculture intensification, infrastructure development like building of roads, dams, over exploitation of natural resources resulting

[1] Taking the value of 5000 per tonne or 5 per kg.

in environmental degradation, generation of solid waste and unscientific disposal of solid waste due to demographic pressure as well as rapid urbanization (UNEP, 2003).

From amongst the various threats facing a mountain ecosystem, solid waste emerges as the one that poses the greatest threat. The threat posed by solid waste is not only to the immediate surrounding areas and environment, but it can also have cascading negative effects on lower regions, threatening both human and environmental health (Pradhan, 2008).

Mountainous regions in developing countries face additional challenges in SWM in terms of their fragile environment and difficult terrain. The problems associated with solid waste in the mountainous regions have serious cascading effects on the lower valley. Often lack of proper SWM is the number one threat to the fragile ecology of the mountainous environment (Pradhan, 2008).

The huge influx of tourists has also led to serious damages of the ecosystem of the mountainous region, natural beauty and scenery. Tourism poses problems for the mountains. There are too many people at a time/ place that it is hard to sustain the activity wholesomely, resulting in some injury to the fragile environment. Tourism, especially mass tourism results in adverse impacts like construction of lodges to meet the demand of the tourists, deforestation, increased waste residuals, air and soil pollution etc. damaging the ecology and environment of the surrounding areas (Bhuimali & Das, 2011). Also large part of many mountainous regions economy depends upon tourism, therefore uncollected refuse and insanitary tips in full public view are eyesores and may lead to reduction in the number of visitors resulting in economic loss (Hosetti & Kumar., 1998).

1.5 Rationale and Scope of the Study

The understanding that MSWM is becoming a very serious problem in the town of Kalimpong has motivated this study. The rationale behind selection of the area is to emphasize on the major MSWM issues in small towns of a developing nation and also to investigate the issues related to MSWM in small towns. The town of Kalimpong is emerging as one of the popular hill towns in the eastern part of India which is undergoing rapid urbanization and population growth which in turn has led to the emergence of MSWM as a major problem.

Kalimpong being a small town, various services which are provided in the big cities are often left behind. As a result of this, budget allocated by the government to provide environmental amenities is always inadequate thus leading to lack of financial resources in the waste management front. It was also found that public participation regarding the issue of waste management in the study area was very negligible as they were wholly dependent on the municipality to take care of waste management. Thus the need arises to make a comprehensive economic evaluation regarding the importance of public participation for improved SWM services in the study area. The purpose of this study is to examine the current scenario of MSWM, present cost incurred in its collection and disposal by the municipality, household WTP for improved waste management services and to see whether it will be helpful in overcoming financial constraints (if any) being faced by the Kalimpong Municipality.

Most studies undertaken regarding MSWM are focused on the supply side, but the prime concern of this study is to generate the demand side information from households who are the major generators and victims of improper handling of solid waste. This information can be used to increase consumer welfare by providing services that are most in demand and also improve cost recovery by tapping into consumers WTP. From the analysis of households responses about their experience in handling solid waste, their perception and their WTP for improved SWM, various conclusions which might have policy implications will be drawn (Amiga, 2002). Various studies and research have been

and are being undertaken all over the world, but limited research activity been made on economic analysis of MSWM has been found in the Indian context and nonexistent in case of Kalimpong till date. Little is known about the waste problems, management issues and WTP of the people for MSWM in Kalimpong town. The main purpose of the study is to fill in this research gap. The information derived from the study shall act as important input for the design of an improved waste management services for Kalimpong Municipality. The findings from this study can serve as a tool for the Kalimpong Municipality and the government to formulate better policies and also in understanding the problems of MSWM in the town of Kalimpong and other similar hilly regions.

1.6 Research Questions

- What is the current level of public participation for MSWM in the study area?
- What is the volume of garbage generated by households per day in the town of Kalimpong?
- How much are the household's willing-to-pay for an improved MSWM services and what are the factors affecting the household's decisions?
- How much revenue can be generated from the amount the households are willing-to-pay and from other probable waste management activities.

1.7 Objectives

- To study the current level of public participation and awareness for MSWM in the town of Kalimpong.
- To examine the WTP for improved SWM services and identifying the factors that determines it.
- To examine the operational cost incurred by the Kalimpong Municipality for SWM.
- To understand the economic gains from revenue earned thorough households WTP and other probable SWM practices.

1.8 Limitations of the Study

The scope of this study is limited to obtaining demand side information about MSWM from households in Kalimpong. The CVM which this study is going to use, even if it is the best for it measures of total economic values of environmental goods has its own limitations. The hypothetical nature of the questions used in CVM surveys may pose problems since respondents may have little incentive to provide their true WTP (Amiga, 2002). Also this study could only take a limited number of households due to shortage of time and lack of financial resource. The study is also subjected to some researcher bias as being born and brought up in Kalimpong; I was familiar with the situation prevailing in the study area regarding SWM and also with the mindset and habits of the respondents.

CHAPTER II
LITERATURE REVIEW

2.1 Environment and Economic Linkages

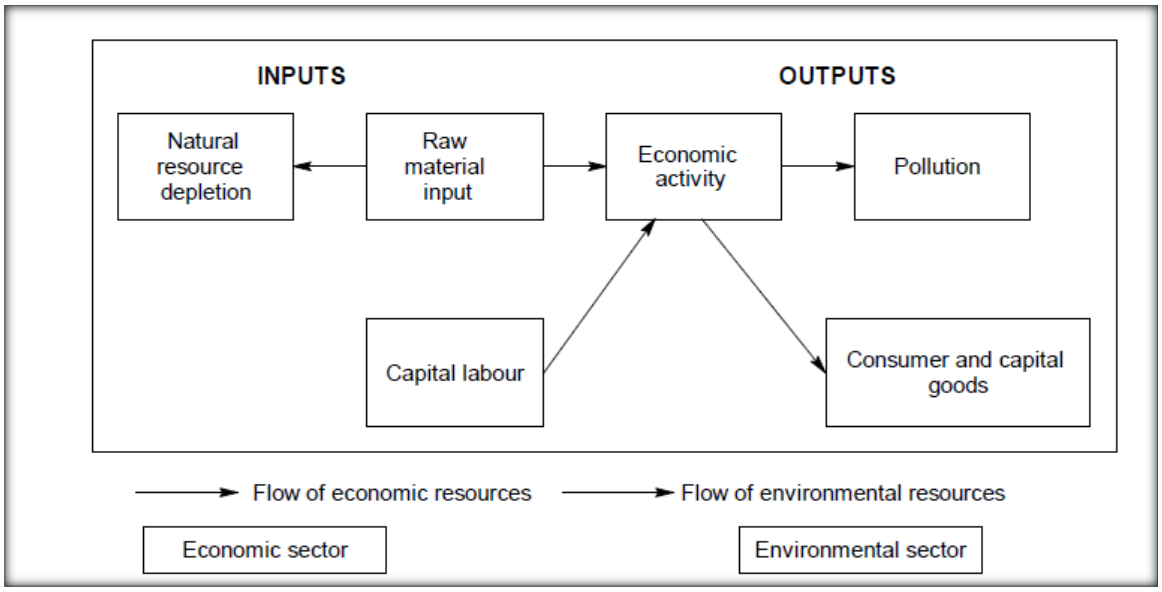
Since this study is related to the economic evaluation of an environmental good like waste management thus the need arises to make a brief review of the relationship between the economy and environment

Each year the Indian Economic Survey undertakes a major issue affecting the country for discussion. In the (Economic Survey, 1998-99) the issue chosen was "Promoting sustainable development: Challenge for environmental policy". The survey highlighted that activities such as extraction, processing, manufacture, transport, consumption and disposal change the stock of natural resources and add stress to the environmental systems and introduce wastes to environmental media. Economic activities affect the stock of natural resources available for the future and have inter-temporal welfare effects. The survey pointed out, the fact that productivity of an economic system depends in part on the supply and quality of natural and environmental resources, therefore creating a relationship between environment and the economy.

(Chabukdhara, Kaushal, & Varghese, 2012) in their study proclaims that in recent years, the world economy has achieved considerable economic and social development. This development process has further thrived through adoption of market oriented policies and the active participation of the private sector. It was further pointed out that such economic and social progress has resulted in the widespread degradation and depletion of the natural environment. The essence of the environmental problem as pointed out in the study is the economy, which results from the producer behavior and consumer desires. In short they assert to the fact that all economic activities either affect or are affected by natural and environmental resources.

Fig. 2.1 represents a flow chart representing the environment and economic interaction as shown by (Panth, 2005) in the book "Economic Measures of Environmental Damage Costs"

Fig. 2.1: Environment Economy Interaction



Source: Panth (2005)

(Joseph, 2009) in his book "Environmental Studies" points out that natural environment is an important component of the economic system, thus making its proper management and utilization a crucial aspect in development of an economy. Without the natural environment the economic system will not be able to function. Hence in recent years economists have started treating the natural environment in the same way as they treat labor and capital as an asset and a resource which is needed for development of an economy.

2.2 Solid Waste Management: A Theoretical Framework

SWM can be termed as an environmental good. (Vikhlyaev, 2003) distinguishes environmental goods in two ways: through environmental services, or as an "environmental service". The first category comprises of goods that play an integral role to the delivery of environmental services, such as wastewater treatment or waste

management. The second category consists of goods that are environmentally preferable to other, like in trade parlance, products. (Eurostat, 2009) defines environmental products as goods and services that are produced for the purpose of averting pollution and any other degradation of the environment and preserving and maintaining the stock of natural resources and hence safeguarding against depletion. Environmental goods and services are further broken down into environmental protection and resource management categories. Environmental protection products are produced for combating and preventing air and water pollution, managing waste, reducing noise, etc. Resource management products are produced for example for the management of water, forests, energy resources and minerals.

(Mishra, 2003) categorizes environmental goods and services as public goods. Likewise (Eugine, 2008) in the book “Environmental Economics” defines the whole of the environmental quality as a consumption public good. (Samuelson, 1954), an American economist is credited for the development of the theory of public goods. In his paper “*The Pure Theory of Public Expenditure* “published in “The Review of Economics and Statistics” (1954), defines a public good, or as he called it in the paper "collective consumption good", as goods, which all enjoy in common in the sense that each individual's consumption of such a good leads to no subtractions from any other individual's consumption of that good. (Holcombe, 1997), (Eugine, 2008), define public goods as goods having one or both of the two characteristics: no excludability and non rivalrous consumption.

(UNIDO, 2008), in their publication “Public goods for economic development” explains these two features of the public good which make them so different from private goods. They are non-excludable in their supply which means that consumption by one agent does not diminish the goods benefit for others. Non exclusion implies that it is not possible (or easy) to limit the supply of public goods only to those who are willing to contribute to the costs of supplying them for the society. (Cowen, 2008), in his study states that it is due to this feature of a public good, the non payers of the services cannot be prohibited from enjoying the benefits of the goods or services. On the other hand

(Eugine, 2008) defines the non rivalrous feature of the public good as a good whose consumption of the resources cannot be restricted to only the payers of the service, like in the case of private goods thus giving rise to zero marginal cost of use so the exclusion is inefficient since potential consumers with a positive marginal benefit are denied access to the good.

(Mothi, 2012), in his study "Urban Solid Waste Management: A Micro Analysis" declared that the two above mentioned features of a public good makes it prone to depletion as its uses is pushed beyond the limit of sustainable yield and over exploited resulting in deterioration of the quality of resources leading to scarcity thus making environmental quality an economic good as has been stated by (Eugine, 2008) in the book "Environmental Economics". Such process by which a common property resource is depleted because no individual has an incentive to conserve was first outlined by biologist (Hardin, 1968) in his article "Tragedy of Commons" in Science.

(Ostron, 2008) in his work asserted that "tragedy of the commons" arises when it is difficult and costly to exclude potential users from common –pool resources that yield finite flows of benefits, as a result of which those resources will be exhausted by rational, utility-maximizing individuals rather than conserved for the benefit of all. In this case indiscriminate consumption of resources have led to generation of waste far beyond the handling capacities.

(Ghosh, 2013), while studying about sustainable power supply for the state of Maharashtra briefly mentions that overuse of public good resources leads to the free-riders' problem as consumers take advantage of public goods without contributing sufficiently. If too many consumers decide to "free-ride", private costs exceed private benefits and the incentive to provide the good or service through the market disappears. The market thus fails to provide a good or service for which there is a need. The free rider problem depends on a conception of the human being as homo economicus: purely rational and also purely selfish—extremely individualistic, considering only those benefits and costs that directly affect him or her. Public goods give such a person an

incentive to be a free rider. The free rider would not voluntarily exert any extra effort, unless there is some inherent pleasure or material reward for doing so (for example, money paid by the government, as with an all-volunteer army or mercenaries).

(Mothi, 2012), revealed that environmental problems are considered as problems of non-optimal pricing and misallocation of resources as many environmental goods either have complete absence of markets or they are incomplete which results in the inefficient distribution of resources leading to unregulated use of the environment and its wide spread degradation. Environmental resources have no price, because there is no market where they are bought and sold, undervaluing the economic costs of production and consumption by ignoring environmental costs. Also (Panth, 2005) in the study "Economic Measures of Environmental Damage Costs" mentions that the traditional price theory does not include environmental costs in its analysis of firms and consumers. Only the private internal costs of economic units are considered and not their "external costs "and so the private costs are lower than social costs. This leads to a sub-optimum level of production and consumption i.e., market failure. In short it can be said that environmental degradation is the result of the failure of the market system to put the deserving value on the environment, even though the environment serves economic functions and provides economic and other benefits. Firms and consumers only include the cost/ price of commodities that they purchase in the markets.

(Jhingan & Sharma, 2011) in their book "Environmental Economics: Theory, Management and Policy" gives an example of market failure in case of public goods. Suppose waste management is supplied by the municipal corporation. Let us assume there are 2 individuals A and B who use it. Both uses the services, but they differ in how much they are willing-to-pay for those services.

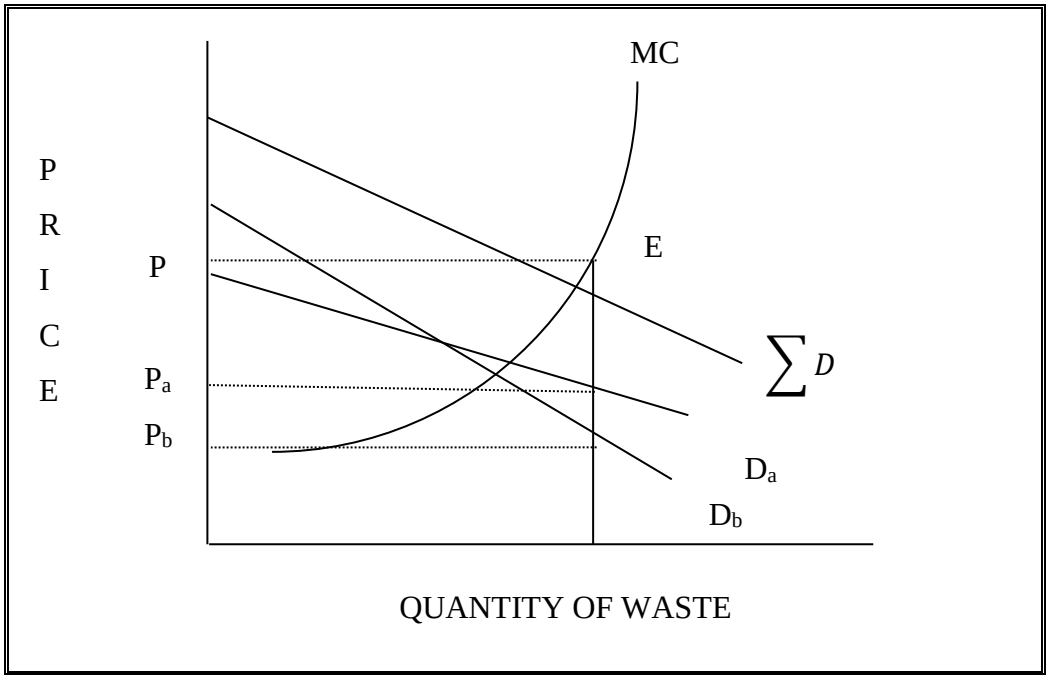
This is shown in Fig. 2.2 below, where D_A and D_B are the demand curves of two individuals A and B respectively OP_A and OP_B the corresponding prices to the SWM services being offered at let's say OW quantity. The curve $\sum D$ is the vertical summation of D_A and D_B curves.

The Lindhal Eqilibrium[2] for a public good exists where the sum of the individual prices equal MC, i.e,

$$OP = OP_A + OP_B = MC_W$$

But each consumer is being charged a different price. This is a case of price discrimination because price OP_A is greater than OP_B for the same services resulting in market failure.

Fig. 2.2: Market failure due to price discrimination in public goods



Source: Jhingan and Sharma, (2011)

(Panth, 2005) in the book "Economic Measures of Environmental Damage Costs in Dimensions of Environmental and Ecological Economics" makes reference about the theory of Neo-Classical welfare economics and describes how perfectly competitive

[2] Lindhal Equilibrium is a method for finding the efficient level of provision for public good (Sander, 2006)

market allocate economic resources in optimum manner to ensure maximum social welfare of all market participants- Pareto optimality.

(Joseph, 2009) in his book “Environmental Studies” defines Pareto Optimality as a point where optimal distribution of resources is reached and therefore it is impossible to redistribute resources in the economy in such a way that it benefits one individual without harming another. Pollution and environmental degradation are a case of market failure that results in the non-optimal distribution of resources. The optimum situation requires the existence of complete markets for all goods. The market ability of an economic good or services not only depend on demand and supply, but on ownership or a well defined property right.

(Kavi & Kumar, 2006) points out that market failure leads to externality effect like environmental problems such as pollution created by human production and consumption. Market failures in environmental goods and services occur because the market prices underestimate the social values of the goods and services by not including the costs created by the externalities. That necessitates a collective action for their upkeep, which incurs considerable public cost.

(Kolstad, 2000) in his book “Environmental Economics” defines externality as a consequence when the consumption or production choices of one person or firm enter the utility or production function of another person or firm without their permission.

(Amiga, 2002) categorizes externality into two parts- positive or negative. Positive externality occurs when one economic agent benefits from the action of another economic agent whereas negative externality decreases the utility or production of another economic agent – like disposing solid waste on street or into a river. (Amiga, 2002) proclaimed that all gaseous, liquid and solid wastes, are the inescapable and unfortunate consequences of human activities and improper management of such wastes can cause tremendous externality effect to the consumers, firms and the nation at large. It

was argued that, because environmental assets are free or under-priced, they tend to be overused and abused, resulting in environmental damage.

(Hastings, Tolley, & Rudzitis, 1978) revealed that economists have for long treated waste generation as having a zero price, but in reality there is some demand for, and cost for getting rid of wastes. Demand for residential solid waste collection and disposal is based on the consumer utility that a household derives from the services. The utility derived from the waste collection and disposal is based on the desire to get wastes out of the way and to provide a clean orderly healthy and safe environment. The interest applies not only to waste generated in ones household, but to those generated at the residences of others, in the streets, public areas.

According to (Joseph, 2009) in the book "Environmental Studies" the above problem can be overcome by putting a price on the environment so that it can be incorporated into the economic system and taken seriously by those who make decisions.

(Crooper & Oates, 1992) in their article "Environmental Economics" described pollution as a public bad that results from "waste discharges" associated with the production and consumption of various goods and services.

They further present a theoretical framework for waste generation and externality using utility function of a consumer, which is given as:

$U = U(X, Q)$ …… . . . . (i)

Where X = a vector of private goods

Q = level of pollution

In the above given utility function we see that utility of a consumer is a function of private goods that they consume and also the level of pollution. This means that even though the consumers may not want it but due to the externality effect caused due to pollution it enters into the consumer's utility.

In this equation $U_X > 0$ (the derivative of U with respect to X is assumed to be positive) which means that a unit increase in X will increase the utility of the consumer, while $U_Q < 0$ (the derivative of U with respect to Q) is assumed to be negative which implies the

level of pollution is inversely related to the utility of the individual or in other words level of pollution has a negative externality effect on the consumers utility thereby reducing it. The level of pollution (Q) measures, for instance the level of air pollution, bad odor (caused as externality of waste mismanagement) or unpleasant aesthetic view.

Considering further in this analysis, the production of X and Q are given by:

$$X = X(L, E, Q) \quad \text{(ii)}$$

$$Q = Q(E) \quad \text{(iii)}$$

Where L represents a vector of conventional inputs used in the production of X like labor and capital, E stands for the quantity of waste discharges and Q indicates the level of pollution. In this production function $X_L > 0$(the derivative of X with respect to L) is positive while $X_E < 0$ (the derivative of X with respect to E,) and $X_Q < 0$ (the derivative of X with respect to Q) are negative. Thus output increase with increase in conventional inputs like labour and decreases with quantity of waste discharged. Waste emissions (E) are treated as an input determining the level of X. This is because the attempts of emission reduction (abetment activities) by a firm will require the reduction in the level of other inputs employed in the production of X. This means a reduction in E will decrease X. Q also affects the production of X; this is the case when firms (households) are the victims of pollution. For instance, the production of X can decrease as a result of absenteeism of workers due to illness, which comes as a result of unclean environment, or the discharge of untreated waste from a chemical industry can reduce the fishery business somewhere else.

Equation (3) shows emission (E) determining the level of pollution, and, in this model, $Q_E > 0$ (the derivative of Q with respect to E,) is positive. For instance, increased disposal of solid waste in an open space would pollute the environment more (unpleasant odour, insect breeding, etc.), keeping other factors constant.

But victims can defend themselves from pollution by taking various measures like paying for proper management of solid waste. This can be represented as:

$$F = F(L, Q) \quad \text{(iv)}$$

F indicates the level of pollution to which the individual actually is exposed to which can be reduced by the individuals by employing a vector of inputs (L) to lessen, in some sense, their exposure to pollution ,and Q indicates level of the pollution itself (Q).
Substituting Eq. 4 into Eq. 1, we have the utility function of the victim as:

$$U= U [X, f (L, Q)] \quad \text{(v)}$$

From Eq.5 it can be seen that the individual will maximize his/ her utility given the unit prices of X and L subject to constraints eq. (2) and (3) along with a further constraint on resource availability. This maximization process will satisfy the first-order conditions for Pareto-efficiency which means the individual will allocate his/her limited income between X and L so that the marginal rupee spent yields the same marginal utility whether it is spent on X or L.

(Amiga, 2002) has also cited the above given theoretical framework, where he states that the given equations help in understanding that elicitation of households WTP for an improved SWM (their willingness to contribute for defensive activities, L) by supporting it with basic environmental economic theories based on utility.

2.3 Importance of Public Participation in Managing Solid Waste

(Garg, 2006) in his study expressed that man, in small numbers, can be tolerated as a parasite in the biosphere but it's when the population and their activities occupy a significant portion of the biosphere, the problem of waste assimilation, and even continued life, become paramount. Further he makes reference to the work of (Davis, 1965) who proposed that the environmental impacts of waste often are magnified by virtue of increased human densities resulting from urbanization, the net effect of which is not only increased domestic waste, but decreased areas of the natural environment available for waste discharge. The study points out the importance of public participation in waste management as it can help increase trust in government, and in legitimacy, credibility and acceptability of risk management decisions. This increase is driven both by citizens who demand a greater role in shaping the decisions that affect their well being

and by agencies that recognize the benefits of involving citizens in their decision making process.

(Kurukulasuriya & Robinson, 2006) in their report, recommended that environmental issues are best handled with the participation of all concerned citizens. Community participation can involve factors ranging from involving the citizens to make financial contributions for instance paying fee for waste disposal to making them do physical activities for SWM. Likewise (Awang, Mohammed, Sani, Shukor, & Syazwina, 2013) too points out the fact that SWM is one of the activities where community participation is the key to success. Solid waste is a by-product of human activities which tends to increase with rapid urbanization, improved living standards and changing consumption patterns. Therefore it is only reasonable that they play an integral part in its management. The study states that community participation is important as it helps in effectively targeting resources and efficiently allocating them as communities are willing to share ideas and opinions thus allowing two ways communication leading to new thinking and innovative idea from community. Also the community's involvement in planning and decision will give them a sense of responsibility and ownership thus helping to overcome the problem of non ownership of resources.

(Ebreo, Hershey, & Vinning, 1999) in the article "Reducing Solid Waste: Linking Recycling to Environmentally Responsible Consumerism" lays down the benefits of household participation and involvement on SWM. The study points out that public participation helps the government to provide more efficient and effective, SWM services. Furthermore the article states that intensive public participation and involvement would only be made possible if the households were aware of the underlying concerns on proper SWM. The rationale behind the view of regarding public participation for waste management services was based on the fact that everyone generates waste and can be affected directly and indirectly if not well managed.

Similarly a study conducted by (Squires, 2006) revealed that as developing countries achieve greater socio-economic well-being, the more waste per capita is realized and more critical is the need for effective and efficient SWM systems. Performance of such

systems depends on the meaningful participation of individuals, communities and institutions, producers, NGOs and governments.

A study conducted by (Kumar & Nandini, 2013) about the relationship between communities attitude, perception and WTP towards SWM in Bangalore city found that community participation had a direct and positive bearing on efficient SWM.

(Gebreegziabher, Hagos, & Mekonnen, 2012) stated that households are the primary producers of solid waste and suffer the effects of uncollected solid waste more directly. Therefore households should be able to participate in municipal discussions on improving SWM and structuring effective public-private partnerships to deliver such services. The service provider (whether city or private vendor) needs to better understand households demands and motivation. Therefore making it essential in understanding how much the citizens are willing-to-pay for efficient and cost-effective delivery of solid waste services to residential areas.

The problem of budget constraint for SWM in most of the developing countries can overcome to a certain level through means of public participation as specified by (Atienza, 2011) on the importance of the governments to devise schemes that uses households contribution to cover the shortage in funding the services due to inadequate amount of budget available for MSWM services in developing countries. It was further stressed that for effective functioning of any SWM policies by the government, public participation was crucial.

(UNECA, 2008) in their publication "Africa Review Report on Waste Management: An Executive Summary" asserted that lack of awareness and appreciation of best practices for environmentally sound management of wastes is a major constraint for proper SWM, therefore a paradigm shift among communities and society at large is needed where public participation and awareness should be the major focus of the governments.

2.4 Economic Valuation of Environmental Goods and its Importance

(Hales, 2013) in his book "Fundamentals of Environmental Economics" describes the theory of economic valuation to be based on the measurement of human preferences for or against changes in the state of environments. Such valuation techniques are used in order to correct economic decisions that treat environmental goods as free. Hales points out that it is not the environment that is actually being valued but it's the individual's preference for the environment that is being measured instead. The basic idea behind environmental valuation is the identification of the relevant changes in consumers demand and producers supply arising from change in the provisions of an environmental resource.

(Hales, 2013) further states that the total economic value can be divided into two categories: use value and non-use value. Use value is defined as the value derived from the actual use of a good or service, which can be extracted, consumed or directly enjoyed. It is therefore also known as extractive or consumptive use value.
Non-use value can further be sub-divided into existence and bequest value. According to (Hales, 2013) existence value is the worth people attach to environmental service not because they want to use it but simply for its existence, (Karman, 1997) defines Bequest value as use or non-use value that one expects his/her descendents to get from the environmental amenity or service.

(Banerjee, 2001) mentions, the main problem with an environmental good is the absence of proper market for it. Therefore direct information regarding the price-quantity relationship is not available and neither is the demand of the consumers for the environmental goods known. Thus an economic valuation system helps in estimating an implicit demand curve of the consumer for the environmental services.

(Moffat, Motlaleng, & Thukuza, 2011)in their study of households WTP for improved water quality of Chobe ward of Maun, China expressed that the concept of economic valuation is about "measuring the preferences" of people for an environmental good against an environmental bad. According to the study economic value of something is

measured by a summation of many individuals` WTP for it. The WTP reflects individuals` preferences for the good in question. Similarly environmental goods are also valued using the WTP technique. Valuation is done in money terms as in any other normal good, because of the way in which preference revelation is sought i.e., by asking people how much they are willing-to-pay in order to acquire those services in such a way as to maximize their utility. (Altaf & Deshazo, 1996) also mentions that in case of SWM, the economic valuation is based on the assumption that management improvements of solid waste is a normal good i.e., goods for which demand increases when income increases, and falls when income decreases but price remains constant, i.e. with a positive income elasticity of demand.

A study by (Moffat, Motlaleng, & Thukuza, 2011) points out that since environmental goods and services are provided freely they have zero prices, thus valuation of such goods plays an important role for proper pricing.

(UNEP, 2005) provided a comprehensive report on the problems and possible solution to Kenya's and particularly Nairobi's waste problem by using economic instruments. The study pointed out that economic valuation can lead to development of pollution control technology and provide the government with a source of revenue to support waste management programmes. One such economic instrument for economic valuation suggested in the report was charging user fees to the users of such environmental services. The report asserts that environmental fee is charged to help clarify price signals and encourage efficient use of environmental and natural resources. Most of these fees first address the issue of recovering the cost of providing goods and services from the beneficiaries. Thus an economic analysis is important as it helps to quantify the various economic, social and environmental components of municipal waste and also helps in planning and implementation of proper policies to overcome the problem.

(Amiga, 2002) in his study if households WTP for improved SWM in Addis Ababa, stated that environmental valuation techniques help to estimate the value people attach to environmental amenity or services, i.e., how much better or worse off individuals are or

would be as a result of a change in environmental quality. Since there are no existing markets for environmental goods, people's valuation for these kind of goods will have to be derived from "hidden" or implicit markets by looking at the consumption of related private goods (Hedonic Pricing Methods, Travel Cost Methods, etc,) or by constructing artificial markets where people are asked to reveal their preferences (CVM).

(Mishra, 2003) asserts that valuation of environment goods and services may help the resource managers to deal with the effects of market failures, by measuring their social and opportunity costs. The costs to society can then be imposed, in various ways, on those who are responsible, or can be used to evaluate and regulate environmental impact.

2.5 Environmental Valuation Techniques

(Kolstad, 2000) in his book "Environmental Economics" writes that since there are no existing markets for environmental goods, valuation or the measure of demand for such goods is not straightforward. In his book he identifies two basic approaches to measuring the demand or value of an environmental good: revealed preference and stated preference. In revealed preference, a real choice (a choice that involves a commitment of resources) in some market are observed and information on the trade-off between money and the environmental good are inferred. The second approach which is the stated preference, basically deals with directly asking people to assign a value to the worth of the environmental goods and services.

Further there are two methods of environmental valuation based on revealed preference: Hedonic and Travel Cost Method. (Hales, 2013) in his book "Fundamentals of Environmental Economics" defines Hedonic Method as an approach based on the consumer theory, which measures the welfare affects in environmental goods or services by estimating the influence of environmental attributes on the value (or price) of properties. Thus Hedonic Method relies on the proposition that an individual's utility for a good or services is based on the attributes which it possess. For example, with housing

we may observe that the price of a house varies not only with the size of the house but also with the air pollution level surrounding the house.

Travel cost Method: This method is a technique which, attempts to deduce values from observed or revealed behavior of the individual. Travel Cost method in which a recreationist is viewed as choosing one or more sites, site qualities, and site visit rates based in part on relative travel costs from home to each site. (Das S. , 2013) states that in principle Travel Cost Methods assume that consumers often combine market goods with environmental goods in their consumption basket. There are three major dimensions to travel cost analysis of the demand for an environmental good. First dimension concerns how demand depends on quality of the good, second is associated with the number and duration of trips during a period of time such as a year. The third concerns the treatment of substitute such as when a visitor to a national park faces the choice of several parks.

(Kolstad, 2000) refers to the CVM to be based on the stated preference method. Stated preferences of valuation is based on finding an individual's WTP for a good by posing a set of questions regarding preferences directly to the individual. In CVM the individuals are asked to imagine some situation that is outside the experience of the individual and speculate on how he or she would react in such a situation.

Likewise (Deb & Roy, 2013) defines CVM as a survey-based technique of monetary valuation used to elicit peoples preferences expressed in terms of WTP. 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. All this is done making the assumption that there is a market for and hence a demand for environmental goods.

(Deb & Roy, 2013) identifies several ways by which the CVM can be carried on such as the use of (1) direct questionnaires, (2) face-to-face interviews, (3) mail surveys, and (4) telephone.

(Kolstad, 2000) states that although assembling a questionnaire and administering it is an easy task; there is indeed a fairly well accepted protocol that is generally accepted and followed by the practitioners of the CVM.

(Carson, 2000) describes seven major components that make up a good CV Surveys. These are described as follows:

a) An introductory section that helps set the general context for the decision that the respondents will have to make. This is done by setting up a hypothetical market scenario. This step helps to put the respondents in the right frame of mind and also make them understand better and answer more efficiently the questions following up.
b) A detailed description of the good to be offered to the respondents. The goods in question are goods that actually do not have a market, thus it is important to make a detailed explanation of the good and its value for the respondents
c) The institution setting in which the goods will be provided.
d) The manner in which the good will be paid or in other words the payment vehicle to be used. (Genzago & Guillermo, 2013) specifies the different payment vehicles as pay-as-you-throw system, ticket collection system, community tax, property tax, business permits and other modes as provided by the household.
e) A method by which the survey elicits the respondent's preferences with respect to the good. (Kolstad, 2000) categorizes four primary ways of eliciting value: direct question, bidding games, and payment card and referendum choice.
    I. Direct Question: In this method after the goods have been described the residents are simply asked to state the amount they are willing-to-pay for the good. The problem with this method is that the respondents may not have any idea regarding the amount and might end up overstating or understating their WTP
    II. The Bidding Game Approach: It starts with a WTP amount that the interviewer suggest to the respondents, and seeks for a yes –no response for the given amount. If the respondents reply yes, the amount is gradually

increased until a no is received. Similarly if the reply is no then the amount is gradually decreased until an amount is reached where a yes response is received. The problem with bidding game is what is known as a starting point bias which means that if the good is unfamiliar, the cues given by the interviewer may influence the response.

III. Payment Card: This method consists of showing the respondents with a set of cards with different values written on it spanning the range of the responses. Different payment cards can be shown to different income group people. One problem with such a method is that they cannot be used for telephone or mail surveys

IV. Referendum or discrete choice: Under this method essentially a WTP figure is offered to the respondent who is asked if he or she is willing-to-pay for the amount with a yes or a no. Different respondents are offered different WTP figures chosen to span the acceptable range of WTP. This approach is recommended by the United States NOAA (National Oceanic and Atmospheric Administration) as it minimizes the possible bias.

f) Debriefing questions about why the respondents answered certain question the way they did.

g) A set of questions regarding respondent characteristics including their attitudes, demographic and socio-economic status.

2.6 Uses of Contingent Valuation Method

(Carson & Hanemann, 2005) argues that contingent valuation (CV) is an inherently more flexible tool than revealed preference techniques such as hedonic pricing and the household production function approach as it is the only approach that can generally be used to include what is usually referred to as the existence or passive use component of the economic value of an environmental good. CV surveys involve the elicitation of monetary measure of welfare which is the maximum WTP to obtain a desired good not currently possessed.

(Carson, 2012) in his book "Contingent Valuation: A Comprehensive Bibliography and History" points out three distinct advantages of CVM. First, CVM can obtain useful information where data on past consumer behavior had not been collected. Second, it permits the creation and presentation of scenarios that provide new goods or changes in existing goods that were substantially outside the range of current consumer experience. Third, it allows measurement of the desired Hicksian consumer surplus[3] measure rather than its Marshallian approximation[4].

(Deb & Roy, 2013) further points out that CVM is one of the ways to assign money values to non –use values of environment which mean values that do not involve market purchases.

(Kavi & Kumar, 2006) specified that SWM services are determined through the waste generated, which is the externality created by production and consumption. Deciding on how much households will value the SWM service is difficult as it must be centered on identifying the means to ensure that externalities are incorporated in the cost of the service therefore, CVM helps in efficiently estimating the total economic value of an environmental service like SWM.

Similarly (Genzago & Guillermo, 2013) pointed out that the challenge for environmental goods and services are to overcome the barrier concerning their social cost value because these types of commodities cannot be measured using market valuation methods. In order to monetize the cost of the non-marketed good, non-market valuation methods are being used of which CVM is a popular valuation method.

(Bernstein, 2004) defines CV as a type of economic analysis that helps to ascertain whether the populations who will be the beneficiaries or recipients of a public service value that service enough to justify its cost. In case of solid waste services, the goal of

[3] Hicksian Consumer Surplus: It is the difference between the marginal valuation of a unit and the price which is actually paid for it (Sundaramponnusamy, 2014)

[4] Marshallian Consumer: It is the difference between the maximum amount you are willing to pay and the actual amount you pay(http://www.geocities.ws/lheam00/NotaKuliah02EEP2023Tambahan, u.d)

economic analysis is to identify whether the households served would collectively be willing-to-pay enough of their own money to finance the costs of the service.

(He, Kamata, Kim, & Wang, 2011) in their study identified the two advantages of using CVM for environment related public service valuations, first was the flexibility as it allows the respondents to state their values and preferences for the specified qualities and quantities of improvement. Secondly CVM method helps to calculate both the use as well as the non use values. (Amiga, 2002) argues that other valuation methods like Hedonic Pricing and Travel Cost Method underestimates the benefits people get form improved SWM since they measure use values only. Similarly (Freeman, 1993) mentions that since non-use values could be larger in some cases, and, in these cases, using methods, which do not capture non-use values, will underestimate the total value. The other reason for using CVM is its ease of data collection and requirement compared to other valuation methods. For instance, hedonic pricing method requires detailed micro data about the prices of houses and house characteristics. On top of that Hedonic Pricing method and the Travel Cost Method are not relevant for measuring WTP for improved SWM.

A study conducted by (Gebreegziabher, Hagos, & Mekonnen, 2012) found that CVM was better than other valuation technique as it was more flexible and better adapted to valuation tasks such as improvement of waste.

2.7 Households Demand for Improved Environmental Quality: (Willingness-to-Pay)

The following are the literatures reviewed from various studies which analyzed the WTP for SWM and the results they observed from the study.

(Altaf & Deshazo, 1996) conducted a study of households WTP in Gujranwala (Pakistan). The study integrated the demand-side information and it aims at showing the importance of survey information obtained from such studies act as useful inputs in providing valuable information during the planning process for improvement of SWM services. A two stage stratified sampling procedure was used generating a sample of 1000

households and the CVM method was employed to elicit households maximum monthly WTP. 71 per cent of households in the city were found willing-to-pay for an improved SWM services. Further it was found that households attached higher priority for SWM services in comparison to water and sewer services. The provided labor and capital were found to be inefficient in handling the waste management problem.

(Niringiye & Omortor, 2010) conducted a study in the City of Kampala, Uganda showed that the mean WTP of households for SWM was influenced by the level of education, marital status, quantity of waste generated, household size, and household expenditure significantly. Similar findings have been made on studies by (Altaf & Deshazo, 1996), (He, Kamata, Kim, & Wang, 2011), (Ojok, OkotOkumu, Koech, & Tole, 2012), (Deb & Roy, 2013) who found that factors like age, household size, gender, marital status education and household expenditure influenced WTP of households for improved waste collection and disposal system.

(He, Kamata, Kim, & Wang, 2011) conducted an economic analysis of SWM in Eryuan located in Yunnan province of China. The study was conducted to mainly focus on the valuation of MSWM services in small towns. The mean WTP was found to be about 1 per cent of the household's income and the amount was found sufficient enough to cover the costs of a MSWM project which was intended to improve the solid waste collection and disposal system. Further analysis showed that lower income households had a stronger demand for the proposed improved SWM services and were willing-to-pay a higher percentage from their income than the households with higher income.

(Ojok, OkotOkumu, Koech, & Tole, 2012) made a study evaluating the WTP of the households for improved MSWM services in Kampala. 48.1 percent of the sampled households were willing-to-pay the amount ranging from USD 0.054 to 37.8 per month. Improving MSWM service from its very low current level would not be more costly to the Kampala Municipality than the current service since households in Kampala were willing-to-pay for the service. Also higher class sections of the society were willing-to-pay higher amounts.

(Deb & Roy, 2013) conducted a study in Silchar Municipal area under Cachar district in Assam and analyzed the WTP for improved waste management. The study has analyzed the problem of waste management from an economic point of view. Systematic sampling technique was used as well as the CVM method for elicitation of WTP. Multiple regression model was used in order to understand the effects of various socio-economic factors on the households decision of WTP. Factors such as household expenditure, awareness, education, number of working woman all had a significant effect on the households decisions of WTP. The sampled households regarded waste management as an environmental service for which they had a demand and were willing-to-pay for it. On an average 60 per cent of the total households who were questioned were found to be willing-to-pay for improved waste management. Segregation of waste was not present and the unsanitary condition was found to be affecting the overall health and environment of the area. The local municipality was found to be inefficient in doing their jobs as there was no initiative from the municipality to educate the local public on waste management and other waste related issues.

2.8 Economic Prospects of Waste Management

(Goldman & Ogishi, 2001) conducted a study, attempting to estimate the economic impacts of waste disposal and diversion system in California. The analysis estimated the direct and indirect economic impacts of solid waste disposal and diversion. It was estimated that indirect economic impacts of solid waste disposal and diversion were, over $9 billion in sales, $21 billion in total output impacts. Almost $8 billion in total income impacts, almost $11 billion in value-added impacts, and over 1,79,000 additional jobs impact. In addition, the results show that diverting solid waste has a significantly higher impact on the economy than disposing it. When material was diverted rather than disposed, total sales and value-added impacts more than doubled, output impacts and total income impacts nearly doubled, and the jobs impact nearly doubled.

(Econsult Corporation, 2007) in their report identified that aside from its overall regional and statewide economic impacts; MSWM also provides monetary boosts to local

municipal and county budgets and generates various tax revenues to state and federal governments. Along with the quantitative impacts, proper waste management also provides local communities with important qualitative benefits that are not included in the economic impacts. Such qualitative benefits include various funding and donations that provide local communities a number of benefits like maybe a community library, support for local economic development programs and initiatives, environmental education for local youth, land for the local school district etc.

(Econsult Corporation, 2007) in their report submitted to Pennsylvania Waste Industry Association, also identifies the benefits of proper waste management procedure that helps turn waste into energy. Sanitary landfills or modern landfills can also provide a significant source of green energy. While landfill gas was once considered only a byproduct of waste decomposition, it is now being turned into useful energy. The report refers to operating gas-to energy projects of approximately two dozen landfills in the State of Pennsylvania which in 2006 generated more than 100 megawatts electricity, which is enough to power more than 63,500 homes and many additional landfills which have future capacity for such projects.

(Kaushal, 2012) in his article points out the problems of waste management in India. In many big cities in India, garbage collection is a major problem; garbage is not collected, just thrown in streets, making the task of waste management even more complex. However he writes that waste management, is not as impossible a task as the mountains of garbage collected in many cities indicate. The composition of waste in India is such that the organic share is higher than the inorganic and therefore can be converted into compost to recover value. The article also points out initiatives being taken in other nations to manage waste, like SEMASS, a waste-to-energy facility in Massachusetts, in the US, which uses 1 million tonnes of MSW to generate 600 million kilowatt-hours of electricity every year and recycles 40,000 tonnes of metals.

As per the reviews above, it makes it apparent that waste management is regarded as an environmental good for which markets exists as households have a demand for it and are willing-to-pay for those services. CVM has been applied in the above reviewed studies

for valuation of a number of environmental and natural resources. However, applications of CVM to SWM in developing countries, particularly small towns are found to be limited. We do not know of any study of SWM for Kalimpong Town using an economic analysis. Also, our review of CVM in developing countries shows that simple and inexpensive household surveys can provide valuable inputs into cities planning processes and, in our case, can inform policymakers on how to improve SWM service delivery. The reviewed literature also shows that various waste management prospects which can act as a source of income as well as reduce waste generation. Such kinds of practices are not followed in developing nations and nonexistent till date in Kalimpong. The study recognizes these as the research gap.

CHAPTER III
METHODOLOGY

3.1 Introduction

This chapter underlines the various methodologies and statistical tools that were used for establishing the objectives for this study. The study was conducted using both primary and secondary data. Primary data's were obtained from interviews with the 170 sampled household representatives using an interview schedule and also through interviews with the current Chairman, Vice Chairman, Health official and various workers of the Kalimpong Municipality. Secondary information were collected from various published sources (newspapers, magazines) and unpublished works, electronic sources and Kalimpong Municipality to further present the background of the study conducted.

3.2 Data Collection Method

Out of the 23 wards under the Kalimpong Municipality 10 wards were selected. The selection was made on the basis of 5 wards that generated the most amounts of waste and 5 wards that generated the least amount of waste. The information regarding the total number of households and waste generation in each ward was obtained from the Kalimpong Municipality Annual Report, 2013. Only the data for the year 2013 was considered for making the selection due to lack of time series data available with the Kalimpong Municipality. After obtaining the list of number of households in each ward, 170 sample households were selected randomly. The information from the household was collected with the help of a structured questionnaire. The questionnaire was finalized after conducting a pilot survey. The Pilot survey was conducted on 20 households of ward no. 2 on May 2014. The questions were on demographic characteristics of the households, information on waste disposal practices (e.g. throwing in street, river, burning etc.), awareness regarding waste problems in Kalimpong and WTP for the better management of waste and causes for not paying. Family income, sources of income and

education level were also among the questions asked. The questions were filled by visiting the selected households from 1st of June to 3rd of October 2014.

The data's were collected on the following basis for fulfillment of the objectives.
The first objective: In order to understand the current level of public participation in Kalimpong Town, information was obtained through means of interview with the various municipality officials and structured questionnaire household survey.

For fulfillment of the second objective, the CVM was employed to determine the WTP for improved waste management services in Kalimpong. The CVM involves directly asking people through means of survey about how much they are WTP in absolute monetary terms. It is the most common method used in valuing nonmarket resources including environmental quality improvement programs. The CVM was recommended by the NOAA Panel in 1993 as dependable method for valuing nonmarket resources (Alhasaan & Mohammed, 2013).

A single-bounded dichotomous contingent valuation method was used in this study; such kind of method has been used by (Alhasaan & Mohammed, 2013), (Deb & Roy, 2013), (Genzago & Guillermo, 2013) in their studies. The double-bounded dichotomous choice format is useful to correct the strategic bias and improve statistical efficiency over single-bounded (Edriss & Gebremariam, 2012).

The third objective was fulfilled by evaluating the operational cost incurred by the municipality for waste management in the region. This information was collected through secondary data obtained from Kalimpong Municipality as well as from interview with the municipality officials and the labourers. This information was gathered in order to perceive whether Kalimpong Municipality was facing any revenue deficit in providing waste management services.

The fourth objective was to understand the economic prospects of WTP and probable SWM practices that could be undertaken in Kalimpong Town. This objective was fulfilled through collection of primary and secondary data and estimating the various

economic values that could be generated through amount the people were willing-to-pay and through other waste management activities which could be undertaken.

3.3 Data Collection Instruments

The following steps were followed for estimating the WTP of the people using the CVM
An introduction of the study: First the respondents were given a brief introduction about the ongoing problem of waste management in Kalimpong and the various health and environmental problems that can be caused by it. The respondents were made to understand the value of proper waste management in the town through various examples of how it would benefit the individual, their family and the society as a whole. Also the respondents were informed regarding the plans of the municipality to start waste management project in the near future.

An interview schedule was used throughout the data collection process consisting of relevant interview items keeping in mind the specific objectives of the study. The interview schedule were divided into four parts, which included the: (1) socio-demographic and economic characteristics of the household, (2) the solid waste disposal practices of the household and average daily amount of solid wastes generated by households, (3) the level of awareness of household on proper SWM, (4) the WTP of an household for an improved municipal solid management services.

The first part of the interview schedule asked several questions pertaining to the socio-demographic and economic characteristics of the household representative, which included age, gender, marital status, highest educational attainment, employment status, family type. This part of the questionnaire also looked into the household member's profile, which included the household size, the number of working household members, total monthly household income, and house hold ownership.

The second part of the interview schedule asked for the solid waste disposal practices and the waste disposal areas used by the households. In this part the weighing of the household waste at the time of the interview was also carried on.

The third part assessed the awareness of the household in proper SWM, particularly in MSWM. In this part of the interview schedule, participants were asked questions pertaining to the concern of waste management in the town of Kalimpong, knowledge on proper SWM, household perception on who they regarded were to be blamed for the current waste pile ups.

The fourth part looked into the WTP of the households for an improved MSWM services. This part primarily determined the number of households that were willing-to-pay for an improved service given the bid price assigned. The study participants had to answer either "yes" or "no". The households were also asked to give reasons behind the choices they made regarding their non WTP for an improved waste management services

The last part of the schedule was consisted of the household's view/suggestions/thoughts on SWM as an answer for the ongoing problems. The bid prices used in the final interview schedule were also determined through the values identified during the pilot survey.

3.4 Statistical Tools Used

Descriptive statistics was used in analyzing the data gathered for calculating the mean, percentage and standard deviation.

The formula for mean is given as:

$$\text{Mean} = \quad \bar{X} \ or \ \mu = \frac{\sum x_i}{N}$$

Standard Deviation provides an indication of how far the individual responses vary or deviate from the mean or in short it tells the researcher how much the responses are

spread out from its average value. Standard Deviation is depicted by the symbol σ (sigma).

The Standard Deviation formula can be written as:

$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(X_i - \mu)^2}$$

Growth rate was calculated using the formula: $\frac{End\ Value}{Start\ Value}^{\frac{1}{(Periods)}} - 1$

For computation of mean WTP, the Turnbull Willingness-to-Pay estimation model (Turnbull, 1976) was applied. Turnbull Mean Willingness-to-Pay is a nonparametric estimation model calculates the lower-bound mean willingness-to-pay values and confidence interval for every option and is used in studies by (Genzago & Guillermo, 2013). The advantage of the Turnbull estimator is that it makes no assumption about the shape of the underlying WTP distribution. Instead, the fraction of the empirical distribution falling into each price interval is used to calculate mean willingness-to- pay for the sample (Blomquist, Koford, Hardesty, & Trokse, 2011)

Turnbull Willingness-to-Pay equation can be written as:

$$T_{wtp} = \Sigma\ t_j\ f_{*j} + 1 \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{(i)}$$

Where:

T_{wtp}= Turnbull Mean Willingness-to-Pay

$F^*_j = N^*_j / T^*_j$ and is the ratio of those who are not willing-to-pay on an offered bid price, where

N^*_j = number of not willing-to-pay responses

T^*_j= number of samples offered a specific bid

t_j = bid price, and

f_{*j} = Turnbull estimate of N^*_j / T^*_j (Genzago & Guillermo, 2013)

Since the study uses dichotomous choice CVM, the data's are usually analyzed by fitting parametric distributions to the data to depict a representative individual's demand for non marketed goods (Ker, 2002) and the factors influencing the demand. Thus the logistic regression model as presented below.

3.5 Model Specification

The study will use the binary logit linear regression model for the analysis of the factors influencing the WTP for an improved MSWM services amongst the households. The household responses to the WTP questions were regressed against the household's WTP potential (independent variables). This model was adopted because of its ability to deal with a dichotomous dependent variable (Niringiye & Omortor, 2010).

The logit regression model specified below was used to obtain the WTP of the households for an improved SWM. The coefficient estimates obtained were then used to calculate the mean willingness -to- pay of the households.

The model is given as:

$$P_i = E\left(Y = \frac{1}{X_i}\right) = \frac{1}{1+ e^{-(\beta_0 + \beta_1 X_i)}} \quad \text{..... (i)}$$

Where *Pi* is a probability that *Yi* = 1

Xi is a set of independent variables

Y is dependent variable

ß0 is the intercept which is constant

ß1 is the coefficient of the price that the households are willing-to-pay for SWM

To identify the factors influencing WTP for improved waste disposal by households, the household responses to the WTP question was regressed against the households WTP potential and other socioeconomic characteristics of the household. The regression logit model is specified as:

The regression binary logit model can be written as

$$Y = \frac{1}{1 + \exp^{z}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (ii)$$

Where, Y is the response of household on their WTP, and
Z is the sum of the products of the coefficients and the dependent variables (plus the error term) which can be written as:

$$Z = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \ldots \beta_{12} x_{12} + U_i \quad \ldots\ldots\ldots\ldots\ldots \text{(iii)}$$ (Adepoju & Salimonu, 2002)

Where β's are the set of unknown parameters to be estimated, while x's represent the set of determinants/dependent variables for the WTP for an improved municipal solid waste collection service, and U_i is the well behaved error term (Genzago & Guillermo, 2013). The Model for this study can be written as:

$$Y_i = \beta_{0+} \beta_1 \text{ BID} + \beta_2 \text{ AGE} + \beta_3 \text{ GEN} + \beta_4 \text{EDU} + \beta_5 \text{FAM} + \beta_6 \text{MS} + \beta_7 \text{ HHIN} + \beta_8 \text{ HHO} + \beta_9 \text{ AW} + \beta_{10} \text{ WG} + U_i \ldots\ldots\ldots\ldots \text{(iv)}$$

Where:
Y is the endogenous variable in this case being the households WTP for improved waste management. (1 if the households are WTP and 0 otherwise)
β_0: The Intercept Term.
$\beta_1, \beta_2 \ldots\ldots\ldots \beta_n$: Coefficients of the explanatory variables.

BID: Amount that the household will be willing-to-pay for an improved municipal solid waste management services.

AGE: Age of the respondents

GEN: Gender of the respondents (1 for male, 0 for female)

EDU: Total Years of education received

FAM: Family Size

MS: Marital Status (1 if the respondent is married 0 otherwise)

HHIN: Total Family Income (in rupees terms)

HHO: Household Ownership (1 if the respondent has their own house, 0 otherwise).

AW: Level of awareness (1 if the respondent thinks Municipal Solid Waste Management is a problem in Kalimpong, 0 otherwise).

WG: Waste Generation (in terms of grams)

U_i: The well behaved Error Term.

Goodness of Fit measure:

In ordinary linear regression, the primary measure of model fit is determined by the value of R^2, which is the indicator of the percentage of variance in the dependent variable explained by the model. However, the R^2 measure is only appropriate to linear regression, with its continuous dependent variables. To get around this problem, a number of statisticians have developed so-called 'Pseudo R^2' measures that aim to mimic R^2 for logistic regression models (Gujarati, 2004). Pseudo R^2 (sometimes called McFadden's R^2) provides a measure of the explanatory power of the entire model. The statistic is restricted to the interval (0,1). If the value of the pseudo R^2 is zero, the logit model does not explain the distribution of WTP in the sample at all. The larger the pseudo R^2 is the greater the explanatory power of the model (Ahtiainen, 2007).

3.6 Prior Expectations

Whether households in the town of Kalimpong are willing-to-pay or not for an improved SWM and the amount the households are willing-to-pay is expected to be affected by various factors. The factors which are undertaken for this study is defined as follows:

BID: This variable refers to the bid price or amount that the households agree on paying for municipal SWM in the town of Kalimpong. This variable is expected to have a negative relationship with the depended variable i.e., WTP, as the most fundamental expectations of economic theory is that as the price of a good increases the consumption of the good shall fall (Ahtiainen, 2007).

HHIN (Household Income): This variable refers to the monthly money income of households in rupee terms. It includes the income of head of the family and all other members of the households from all sources. This variable is expected to have a positive and a direct relationship with the WTP as it is assumed that more a person earns, they have more disposable income and hence would be more WTP for SWM services. Economic theories predict a positive association between WTP and respondents income (Ahtiainen, 2007).

AGE (Age of Respondents): Age can play a crucial factor in influencing the WTP even though a prior expectation is not possible to know how a respondent's age may impact WTP. However, in general, it is hypothesized that as people grow older, they become more politically conservative, and their WTP will decrease. Consequently, the estimation coefficient of this variable is expected to be negative.

EDU (Education of Respondent): Education is expected to affect the WTP of the respondents significantly and the estimation coefficient of this variable is expected to be positive. This variable is considered because of the hypothesis that higher the level of education the more the respondent would be aware about the consequences of solid waste generation and its problems and in turn would be WTP more for its management

FAM: Though a prior expectation is not possible to know how a respondent's family size may impact WTP. Family Size is expected to have a direct relationship with the WTP of the respondents as more family members may mean more income generators which in turn may lead to WTP by the respondents.

GEN (Gender of Respondents): This is a dummy variable taking 1 if the respondent is male; 0 otherwise. A positive relationship between WTP and GEN might exist when the respondent is female as they are the ones who take care of domestic household chores such as travelling to other places to fetch water in times of need, hence they will be willing-to-pay.

WG (Waste Generation): This variable refers to the total waste generated by each household per day. Waste generation is expected to have a positive relationship with the respondents WTP as more a households generates waste, more it faces the problem of its disposal.

MS (Marital Status): This is a dummy variable, taking 1 if the respondent is married 0 otherwise. A positive relationship is expected between WTP and marital status as married respondents would be willing-to-pay more than the unmarried respondents as they are expected to be more concerned about their households and married respondents are likely to have larger family size and hence face higher risks than those not married.

LoA (Level of awareness): This is a dummy variable taking 1 if the respondent thinks Municipal Solid Waste Management is a problem in Kalimpong, 0 otherwise. The coefficient of these variables is expected to be positive as it is assumed that higher the awareness regarding the problem of waste management in Kalimpong Town, more the people will be WTP for it.

HHO (Household Ownership): This is a dummy variable taking 1 if the respondent has their own house, 0 otherwise. This variable is considered, under the hypothesis that

respondents who do not have household ownership and live in a rented or informal settlement may not be WTP for the waste management services as they may not consider it to be their responsibility.

3.7 Sampling Technique and Design

Multistage sampling technique was used for deciding the sample size. The Universe of the study was 23 wards under the Kalimpong Municipality. In stage two 10 wards were selected from the 23 wards. In stage three a total of 170 households were selected randomly from the 10 selected wards following the bid price sampling. In the 10 ward that was selected 17 households were interviewed in each ward and 34 households were interviewed in every bid price as shown in Table 3.1.

Table 3.1: Sampling Design

Ward No	Bid Price 1 (Rs 30.00)	Bid Price 2 (Rs 50.00)	Bid Price 3 (Rs 100.00)	Bid Price 4 (Rs 150.00)	Bid Price 4 (Rs 200.00)	Total Households
2	3	3	4	3	4	17
10	3	4	3	4	3	17
11	4	3	3	4	3	17
12	3	4		3	3	17
13	3	3	4	3	4	17
6	4	3	3	3	4	17
14	3	4	3	4	3	17
17	4	3	4	3	3	17
18	3	4	3	3	4	17
22	4	3	3	4	3	17
	34	34	34	34	34	170

Source: Kalimpong Municipality, 2013

CHAPTER IV
AN OVERVIEW OF THE STUDY AREA

4.1 Introduction of the Study Area

Kalimpong town is located at an elevation of 4,091 ft (1,350m) along the ridge of one of the foot hills of the Himalayan Range, in the Northern region of the state of West Bengal. The main town or bazaar is situated at 3,933 feet above sea level flanked on either side by higher grounds, on the south by the hill of Durpin, about 4,500 feet above mean sea level and on the north-east by Deolo Mountain 5,590 feet above mean sea level (Dash, 1947). The hill range is surrounded by Teesta River on the West and by River Relli on the South-Eastern side. It is home to the ethnic Nepalese, indigenous ethnic group and non-native migrants from other parts of India. The town also is a religious centre of Buddhism (Biswas, 2013). Fig.4.1 below, shows the location of Kalimpong Town on the Indian map.

Fig.4.1: Location Map of Kalimpong Town

Source:http://commons.wikimedia.org/wiki/File:Kalimponglocation.png (accessed on 24th of May 2014).

4.2 Historical Background of Kalimpong

Until the mid-19th century, the area around Kalimpong was ruled in succession by the Sikkimese and Bhutanese kingdoms. Under Sikkimese rule, the area was known as Dalingkot. In 1706, the king of Bhutan won over this territory from the Sikkimese monarch and renamed it Kalimpong. The area was sparsely populated by the indigenous Lepcha community and migrant Bhutia and Limbu tribes. Later in 1780, the Gorkhas invaded and conquered much of the territory in the southern foothills of Sikkim. After the Anglo-Bhutan War in 1864, the Treaty of Sinchula was signed, in which Bhutanese held territory east of the Teesta River was ceded to the British East India Company[5]. At that time, Kalimpong was a hamlet, with only two or three families known to reside there (Kalimpong Municipality Annual Report 2013).

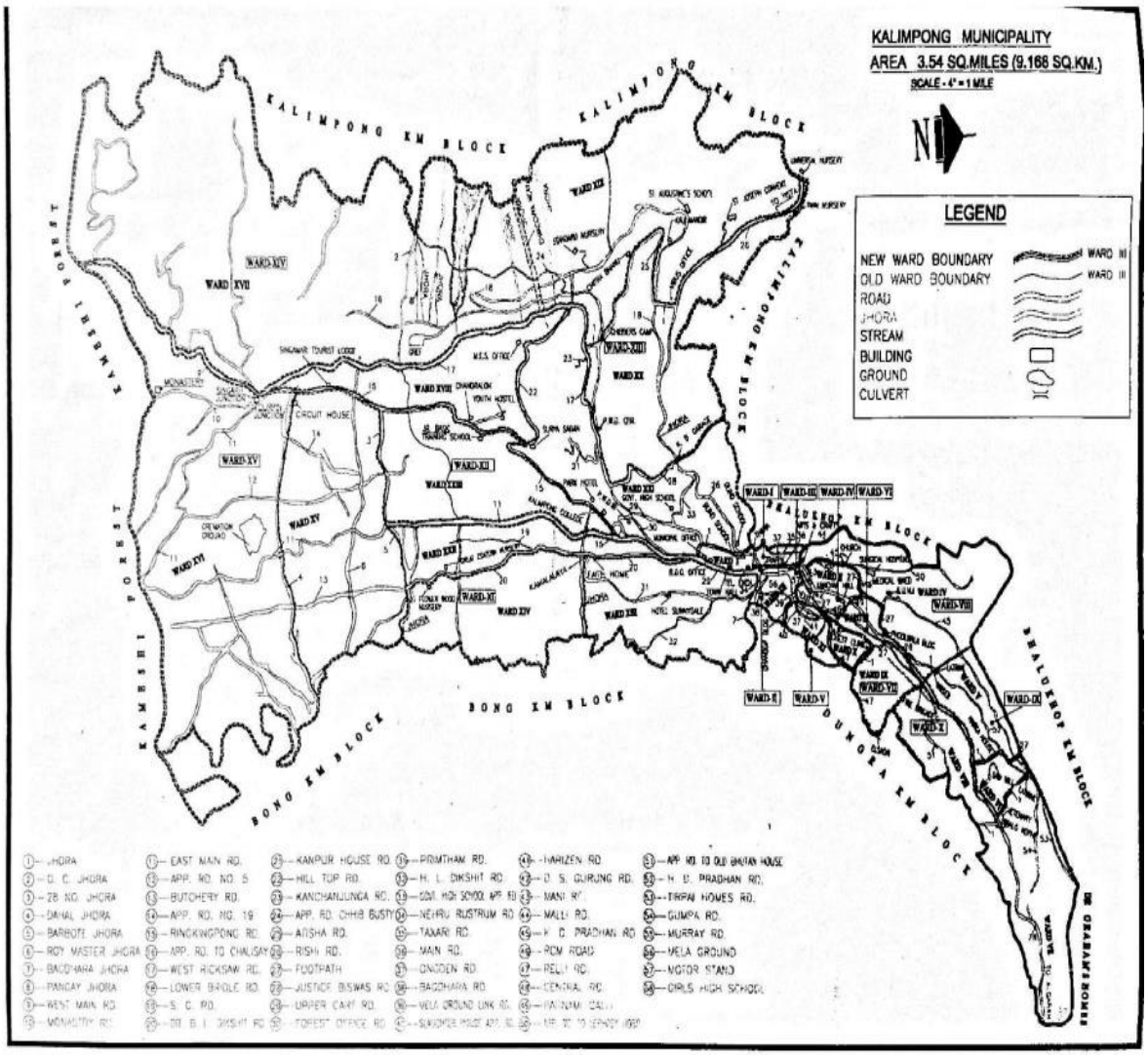
In 1866–1867 an Anglo-Bhutanese commission demarcated the common boundaries between the two countries, thereby giving shape to the Kalimpong subdivision and the Darjeeling district. Kalimpong was notified as a sub-division of the Darjeeling district in 1866. Missionary education and wool trade with Tibet were probably the most dominant factor in the early expansion of Kalimpong from a sleepy hamlet to a sizeable town (Kalimpong Municipality Annual Report, 2013)

4.3 Area under Kalimpong Town

Kalimpong town is the Sub divisional Headquarters of Kalimpong Subdivision of Darjeeling District and covers an area of 8.6 Sq. Km comprising of 23 municipal wards. The wards are further sub-divided into four zones namely zone A, B, C and D (Kalimpong Municipality Annual Report, 2013). Fig. 4.2 below, shows the map of Kalimpong town along with its 23 municipal wards.

[5] More information can be found on http://kalimponglive.com/history.html. Accessed on 6th September 201

Fig. 4.2: Map of Kalimpong town along with its 23 wards under the Kalimpong Municipality



Source: Kalimpong Municipality

4.4 Kalimpong Municipality – Composition, Powers and Functions

Kalimpong Municipality was established in 1945 which extended over the Development Area, the bazaar and the Mission Compound covering 3.35 sq. miles or 8.68 sq. km. The Municipality comprised of 10 municipal wards at that time which was raised to 15 during 1954 ((Majumadar, 2006). Later in the year 1999 due to de-limitation the number of wards was increased to 23 and remains so till date though the area under the municipal limits remained unchanged (Kalimpong Municipality Annual Report, 2013).

Under The West Bengal Municipal Act (1993), the authorities charged with municipal area administration are as follows:

a) The Municipality,
b) The Chairman-in-council,
c) The Chairman,
d) The Vice Chairman.

The municipality refers to the Board of Councillors which is composed of elected municipal councillors from respective wards and non-elected members who are nominated by the State Government. The Board of Councillors is charged with the authority for municipal governance of the town. Decisions are made by a majority voting system; it should be noted that the non-elected members do not hold voting rights. The Chairman is elected by the Board of Councillors from amongst its members. Usually the leader of the party with majority on the Board of Councillors is elected as Chairman (Pradhan, 2008).

The Chairman is the executive as well as the administrative head of the municipality, and presides over meetings of the Board of Councillors, as well as Chairman-in-Council. In her/his absence the role is taken over by the Vice-chairman. The West Bengal Municipal Act (1993) provides for the Chairman-in-Council system of governance, which consists of the Chairman, the Vice-chairman and other members depending on the size and classification of the municipality. The Chairman nominates the members for the Chairman-in-Council, and distributes responsibilities to those members. In Kalimpong

Municipality there 23 municipal councillors at present, each elected from their respective wards. A Chairman, Vice-Chairman and a Health Official are the main administrative bodies of Kalimpong Municipality. The municipality of Kalimpong are in charge of the infrastructure of the town such as drinking water, waste management and roads (Kalimpong Municipality Annual Report, 2013).

4.5 Climate and Rainfall

The town receives South Western monsoon from around mid June to end September with July being the wettest month. Total rainfall varies from 2200 millimeters to 4000 millimeters. Winter months starting from early October to early March remains normally dry. The atmosphere is highly humid with relative humidity varying from 90 to 95 per cent during the monsoon months. Average minimum winter temperature ranges from 10^0 C to 15^0 C. The summer season which normally extends from mid March to mid June has temperature ranging between 18^0 C to an occasional maximum of 32^0 C (Kalimpong Municipality Annual Report, 2013).

4.6 Economy

Although agriculture is an important part of the economy of Kalimpong, its impact is not considered in this study as we are only considering the area that falls under the 23 wards of Kalimpong Municipality which is the main town with little agrarian land. Agriculture is more prevalent in other parts of the Kalimpong sub-division. Tourism is the most significant contributor to the town's economy as Kalimpong is a popular hill station of West Bengal. Summer and spring seasons are most popular with tourists, keeping many of towns residents employed directly or indirectly in the hospitality industry. Also, in recent years there has been a remarkable rise in the number of hotels, restaurants and travel and tour agencies. Almost a total of 43 hotels and restaurants are registered under the Kalimpong Municipality at present (Kalimpong Municipality Annual Report, 2013).

Floriculture is another major economic activity. The climatic conditions of Kalimpong are ideally suited for development of floriculture. At present there are at least 50 nurseries operating within the municipal boundaries and its hinterland (Horticulture Department Kalimpong 2013). A number of bigger nurseries also export bulbs/tubers and plants to Japan, United States and European countries. The major export floricultural products are various bulbs, tubers, and flower. Gladioli flowers are also cultivated at a large scale for cut-flower production which is sold in major cities throughout India.

Education sector is another significant contributor to the town's economy. The schools in Kalimpong, besides imparting education to the locals, attracts a significant number of students from the plains, the neighboring state of Sikkim and countries such as Bhutan, Bangladesh, Nepal and Thailand (Kalimpong Municipality Annual Report, 2013). Education, therefore, has become not only a necessary social service but also a strong economic activity of the town with a reasonable high employment potential. Small contributions to the economy also come from the sale of traditional arts and crafts of Sikkim and Tibet. Kalimpong exports a wide range of traditional handicrafts, wood-carvings, embroidered items, bags and purses with tapestry work, copper ware, scrolls, Tibetan jewelry and artifacts. Government efforts related to sericulture and fisheries also help in providing a steady source of employment to many of its residents. Kalimpong is also well renowned for its cheese, noodles and lollipops which are produced in small cottage industries (Kalimpong Municipality Annual Report, 2013).

4.7 Infrastructure

4.7.1 Communication:

The main route to Kalimpong town is through Siliguri - Gangtok highway (NH 31a). From Teesta Bazaar one has to branch off the highway and climb up the hill range for about 16 km. to reach the town. The transport system for Kalimpong is based entirely on roads. Kalimpong does not have any railway or air links. The nearest railway stations are Siliguri Junction and New Jalpaiguri Railway Station. Siliguri Railway Station is about

80 km. away to the South. The nearest airport is Bagdogra, which is 80 km. away from Kalimpong. Presently there is one bus stand situated in the heart of the town and another under construction (Kalimpong Municipality Annual Report, 2013). The total length of various types of roadways within the main town is given below:

Table 4.1: Length of various types of road within Kalimpong Municipal area

Motor able Bituminous Roads	26.56km
Non- Motor able Bituminous Roads	1.00km
Kutcha Road	5.60 km
Concrete Stepped Path	19km

Source: Kalimpong Municipality, 2013

4.7.2 Market Facility:

There are 16 numbers of small and big markets in Kalimpong town. The municipality owns a small fish market and a vegetable market known as "Hat Bazaar" which is located in the heart of the town in Ward No. 3. (Kalimpong Municipality Annual Report, 2013). At present there are open stalls in cemented platforms with CGI (Corrugated Iron) sheet roof cover supported on concrete pillars. The "Haat Bazaar" is open on Saturdays and Wednesdays and provides a central marketing platform for people from surrounding rural villages who come to sell their fresh agricultural and farm produce.

4.7.3 Health Facility:

Kalimpong has one Government General Hospital. There are four private nursing homes and a few dispensaries and pathological laboratories. The Kalimpong Sub-divisional Hospital is well equipped with specialist doctors and surgeons which attract a lot of patients from the entire subdivision, both the rural and urban areas who come for treatment of their ailments.

4.7.4 Educational Facility:

Kalimpong has been developed as a centre for imparting excellent education from the primary right up to the higher secondary level. There are some old and new reputed educational institutions like Dr. Graham's Homes School, St. Joseph's Convent, St Augustine's School, Scottish Universities Mission Institution (SUMI), Kumudini Homes, Saptashri Gyanpeeth, Kalimpong Girls High School, St. Philomena's Girls High School, Pranami Balika Vidya Mandir, Government High School, Jubilee High School etc. located in the town. There are about 35 schools in Kalimpong out of which 13 are higher secondary schools. Besides schools, there are two vocational institutions, one basic training college, one art college, one Government college, Cluny Women's College and one business management college. There are two public libraries present in the town.

4.7.5 Drainage and Sanitation:

The hilly topography of the town is such that it helps in rapid drainage of the area. There are several minor jhoras[6] which joins different streams on the downhill drainage course. The drainage outfall is thus natural jhoras. The Kalimpong town also has open surface pukka drains having a total length of 55km (Kalimpong Municipality Annual Report, 2013). Kalimpong town or the bazaar sewerage system was completed in 1930 with surface drainage entering the sewer piping system through gulley pits (Dash, 1947). During 1947 there were 5000 feet of sewers in the main town serving 8 public latrines and a number of houses (Kalimpong Municipality Annual Report, 2013). The sanitation of the town has not been upgraded with the passing of time. The town still has the old sewerage network made during the British era and covers only up to 12 wards thus leading to open defecation (Kalimpong Municipality Annual Report, 2013). Most of the infrastructure has not been upgraded with time leading to various problems as the current system is not able to cope with the increasing population.

[6] Natural lanes

4.7.6 Water Supply:

In Kalimpong, the sources of water supply are the perennial springs and temporary rain-fed streams (Dash, 1947).There are two sources of the perennial springs, one at the source of Relli and the other is situated at Thugchu. Water from these sources is first stored in the Deolo reservoir which has a capacity of 40 lakh gallons (Kalimpong Municipality Annual Report, 2013). The reservoir was constructed during the British period and now badly requires being de-silted. From the Deolo reservoir water is first supplied to different small reservoirs or tanks loacted at different areas of the town. There are 20 main zone reservoirs or tanks (Kalimpong Municipality Annual Report, 2013). The existing capacities of all the reservoirs are not adequate to cater to the present demand due to increase in population in Kalimpong Town. The Deolo Reservoir has a pressure filter, constructed during pre- Independence days. This is suffering from drainage problems due to the backwash of the present filter. The municipality is also constructing an additional water storage tank to meet the requirement of potable water, and planning on increasing the water supply from the Neora Khola water supply project for this purpose (Biswas, 2013) but this project has come under various speculations due to its potential environmental side effects and has yet to be undertaken.

4.8 Overview of Kalimpong Town's Municipality Solid Waste Management

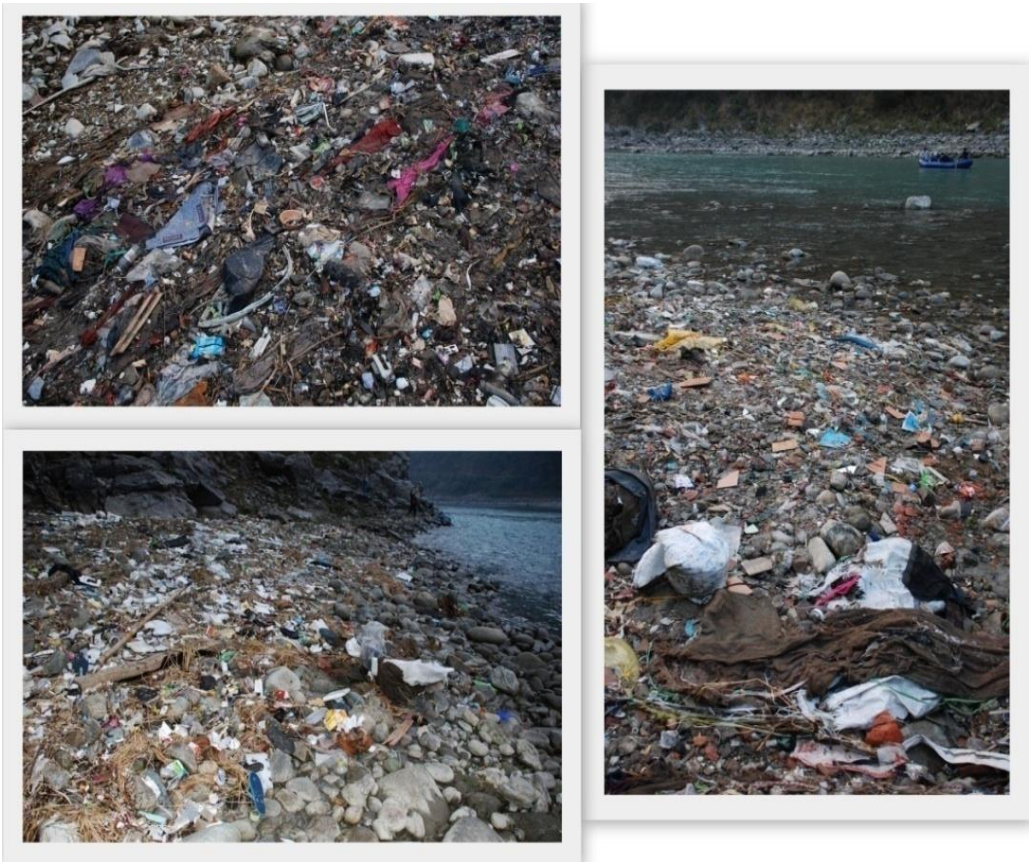
MSWM has been one of the major problems in the town of Kalimpong for the past few years resulting in piles of unsightly and decaying waste being littered all over the town from streets, market centers, to residential areas. Waste management remains a massive task for the Kalimpong Municipality as it has not been able to deal with waste problem at the current level of its generation. Therefore MSWM is one of the crucial civic services required at present in this town. In the wake of fast growing environment consciousness and increasing public health problems, the concern of inefficient MSWM is being realized. Furthermore if these wastes are not stored, collected, hauled and disposed off safely and timely, the same causes aesthetic problems and severe impact upon the public health, plus air and soil pollution, and natural water contamination.

Kalimpong town has not had a proper waste management system till date. The system of open dumping without further treatment of waste has been the practice followed by the municipality till date. The disposal site was located at a distance of 0.5 km from the main town in a place known as Bhalukhop. The system of collecting waste and dumping it on open landfills was being followed until the forced closure of the old dump yard at Bhalukhop on June 5, 2008. People living in and around Bhalukhop stopped the civic body from using the dump yard after landslides had started taking place rather too frequently in the area. The Bhalukhop protests sent the civic body looking for an alternative suitable dumping ground (Ravidas, 2010).

Kalimpong Municipality got permission from the army to use a plot of land in Durpin, 2km from Kalimpong town. But there too, the residents of two adjacent villages of Chalisay and Chibo Busty protested and the municipality had to stop dumping at the site in December, 2008 even though the army had granted permission for use of the site till 31st January, 2009.The municipality since then had been storing the waste at a vacant garage space under the municipality building due to lack of dumping area (Ravidas, 2010).

With no solution for the problem the municipality had to take the desperate measure of loading the waste into trucks and dumping it in the Teesta River causing great environmental problems to the people living in and around the banks of the river. Kalimpong Municipality has since then been struggling to find a suitable place to dump the trash generated in the town. Thus the absence of a proper dumping site has led to accumulation of huge piles of waste all over the town, with small vacant area along the roadsides serving as the dumpsites.

Fig. 4.3 Wastes being dumped in River Teesta



Source: Chinlop Fudong Lepcha

At present waste is disposed of in an uncontrolled procedure by open dumping at places wherever low lands are available, turning the whole town into a dumping yard with waste piles being found in every open space. Garbage collection by the municipality came to a standstill due to lack of proper dumping areas. House-to-house collection of waste though prevalent some years back has become almost non-existent at present. The method of garbage collection and disposal that was being followed was found to be extremely inadequate and containing critical deficiencies. The methods consisted of street sweeping, collection of road side garbage heaps using wheel barrows from which it is transferred into bigger garbage vats[7]. At present there are 15 vats in and around the major market place. The garbage was then manually transferred into bamboo baskets and loaded into conservancy trucks. None of the municipality conservancy workers were given protective clothing and footwear. Such method of waste disposal imposes a great health risk to the workers and public at large. More than 90 per cent of the collected solid wastes were being disposed by filling up low lands scattered within the municipal areas in uncontrolled, haphazard and un-sanitary manner.

Fig. 4.4: Waste dumped indiscriminately in lanes and roads

Source: Primary Source

[7] Big fixed cemented dustbins

Fig. 4.5: Waste littered in different parts of Kalimpong Town

Source: Chinlop Fudong Lepcha

Whatever little sorting of recyclable materials is done is done manually by the informal sector consisting of waste pickers (kabadiwalas) and scavengers. The informal sector is indirectly playing an extremely important role for their own monetary benefits by helping the town of Kalimpong curb at least a part of the problem. They go around collecting waste from households and other dumping sites and sell it to the scrap dealers for some amount of money. The scrap largely consists of plastic items, cardboard paper, iron goods, old electronic goods, papers and bottles. There is a total of 10 scrap dealers in the Kalimpong town and around 50-60 waste pickers and around 50 scavengers. Approximately 20 quintals of plastic, 20 quintals of card board paper and 20 quintals of iron goods are brought in by the waste pickers and the scavengers on a daily basis. The iron materials are bought by the waste pickers at Rs 14 per kg, plastics at Rs. 10.00, Rs.6 .00 and Rs.5.00 per kg depending on the quality of the plastic and paper and cardboard at around Rs 6.00 to Rs 7.00 per kg. The waste pickers are mostly migratory labourers and mostly come from the neighboring states of West Bengal. The scrap dealers then pack the waste and transport the packages to Siliguri by truck to resell the collected material to a handful of recycling companies in Siliguri.

Therefore proper waste management in Kalimpong town in the recent years has become a necessity for the betterment of the town as well as for maintenance of environmental quality. The municipality as well as the people should play active part to overcome this problem and to maintain the ecological, environmental and aesthetic value of the town.

4.9 Future Plans for Waste Management by Kalimpong Municipality

Kalimpong Municipality is currently working on solving the problem of solid waste management. During an interview with the municipality officials, on 12th June 2014 the respondents informed that the municipality was going to start house to house collection of waste soon and also organizing workshops, rallies and house to house visits on educating the people about waste management and segregation. The health official of Kalimpong Municipality, Dr. S.D Zimba, informed that the municipality will be developing a new biogas plant in Bhalukhop to address the waste management issue and

will collaborate with a private firm, Prayas Group of Kolkata to develop the plant. The project would be developed on a plot of land owned by the Kalimpong Municipality in Bhalukhop area of Kalimpong town. The plant will have a capacity of 3 lakh MT per year and the project is expected to start at the earliest. The plant would be used to convert waste into biogas and fertilizer. Meanwhile, the Vice Chairman, Mr. Zion Lepcha informed that the project had been delayed due to the unavailability of funds and lack of revenue generation.

The municipality will collect all the waste generated in Kalimpong on a daily basis and transfer it to the plant. The initial cleaning work will be conducted in two phases. In the first phase, waste from ward number 1-12 will be collected, while in the second phase the remaining wards will be handled. Each household will be provided with different bags for their dry and wet waste. Separate bags are given in the hope that the people will segregate their waste Mixed garbage is extremely difficult to recycle and has little or no value addition. The collection will be done by casual labourers employed by the municipality. Each ward will have around four to five waste collectors depending on the population and household concentration. Each ward will also have a supervisor who will supervise waste collectors as well as proper handling of waste and its loading to the trucks for final disposal.

Table 4.2: Monthly fee charges going to be charged to different parties by Kalimpong Municipality for providing waste management services.

Households(Above poverty line)	Rs 100 per month
Households (Below poverty line)	Rs 50 per month
Vendors holding permanent vegetable and other miscellaneous stalls	Rs 150 per month
Vendors holding temporary vegetable and other miscellaneous items stalls (during the main market day i.e., Saturday and Wednesday)	Rs 5 per day
The Hotels (depending on the rooms)	Rs 30 per room per month
Restaurants (depending on the size and location)	Rs 250 to Rs 300 per month
Shops	Rs 150 per month

Source: Kalimpong Municipality, 2014

Kalimpong Municipality hopes to charge user fee to various users of the services in the rates shown in Table 4.2 in order to acquire revenue to meet the cost of providing waste management services. The municipality plans to extend the services to other remaining wards if the first phase turns out to be feasible and sustainable.

At the time of my survey the households were not receiving any such waste management facility and therefore it has been unaccounted for in my study.

CHAPTER V
RESULTS AND DISCUSSIONS

5.1 Brief Overview

This chapter presents and discusses results obtained after interviews with Kalimpong Municipality officials and from 170 household representatives that participated in the study. Presentations of the results are divided into eleven sections:

Waste generation in Kalimpong town, various factors influencing its generation, socio-demographic and economic profile of households, level of public awareness and participation for MSWM, methods of solid waste disposal being followed, health problems reported due to improper waste management, households WTP for improved MSWM services, descriptive statistics and Turnbull Mean Willingness-To-Pay, factors affecting the WTP decisions of households for an improved MSWM services, revenue earned and operational cost incurred by Kalimpong Municipality for waste management, and the economic prospects of WTP and other probable waste management activities in the town of Kalimpong.

5.2 Waste Generation in Kalimpong Town

Table 5.1 below, represents waste generation in the town of Kalimpong. Waste generation in Kalimpong town has been increasing with each passing day with piles of garbage seen to be littered all over the town. The Table below, gives us information regarding waste generation in each of the 23 wards under the four Zones (A, B, C and D) and the different sources from where they are generated.

Table 5.1: Waste Generation by different zones and different sources in the town of Kalimpong

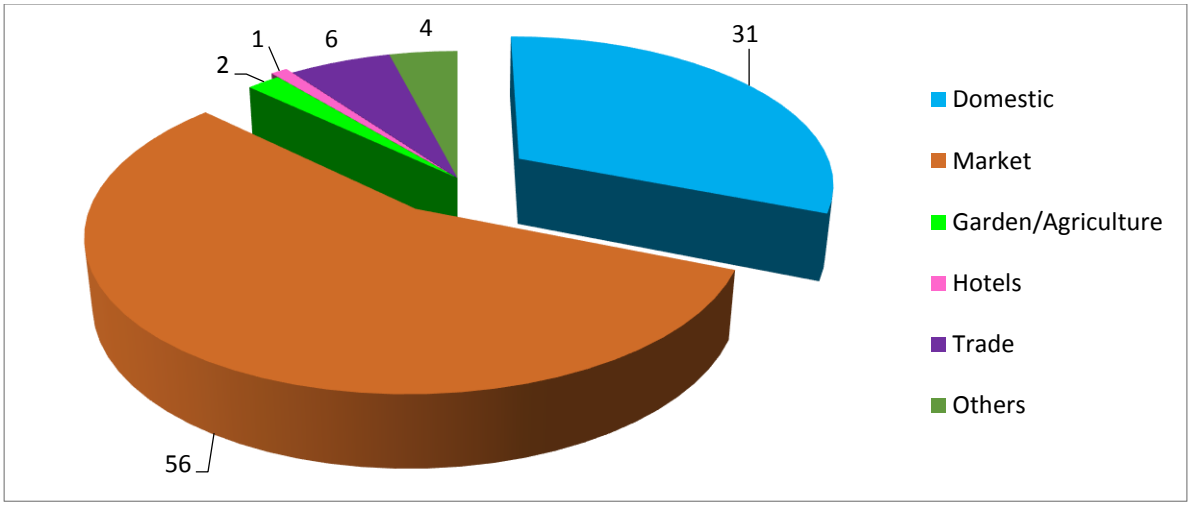
Zone No	Ward No	Domestic Waste Generated in Million Tonnes	Daily & Wholesale Market		Commercial Centers		Hotel		Total Quantity of Waste (MT)
			No.	SW Quantity(MT)	No.	SW Quantity (MT)	No	SW Quantity(MT)	
A	1	0.36	2	0.98	1	0.6	6	0.045	1.98
	2	0.36	5	0.89	1	1.2	7	0.051	2.50
	3	0.32	2	1.8	1	0.2	5	0.004	2.35
	10	0.31	2	5.5			0	0	5.80
	11	0.78	5	3.5			4	0.03	4.31
	12	0.24	4	2.7			12	0.092	3.03
Sub Total		2.36	20	15.37	3	2.00	34	0.26	19.99
B	4	0.52	4	0.4			1	0.00075	0.92
	5	0.79	2	0.05			0		0.84
	6	0.30	2	0.1			0		0.40
	7	0.94	3	0.2			0		1.14
	8	0.58	3	0.25			1	0.009	0.84
	9	0.39	2	0.8			0		1.19
Sub Total		3.52	16	1.80			2	0.02	5.33
C	13	0.78	4	2.3			3	0.02	3.10
	14	0.28	1	0.06			0	0	0.34
	15	0.62	2	0.15			1	0.01	0.78
	16	0.47	2	0.18			0	0	0.65
	22	0.33	2	0.05			3	0.024	0.40
	23	0.46	2	0.1			1	0.01	0.57
Sub Total		2.93	13	2.8			8	0.06	5.83
D	17	0.21	1	0.02			0		0.23
	18	0.37	3	0.09			1	0.01	0.47
	19	0.82	3	0.2			6	0.041	1.06
	20	0.68	2	0.18			7	0.05	0.92
	21	0.64	3	0.4			9	0.06	1.10
Sub Total		2.72	12	1			23	0.17	3.77
TOTAL		11.53	36	20.90	3	2.0	67	0.50	37.27

Source: Kalimpong Municipality Annual Report, 2013.

At present, the town generates about 37,268 kg (37.27 MT) of waste per day with a per capita waste generation estimate of 250 gm/day taking an average household with five members (Kalimpong Municipality Annual Report, 2013). Out of the four Zones in which the municipal wards are divided, Zone B has the highest population of 14,068 and Zone C has the most number of households at 3,265. Zone A generates the highest amount of waste per day with a total of 19.99 MT, with almost 76.89 per cent of waste coming from the 20 daily and wholesale markets. Out of the 23 wards, Zone B generates the highest amount of domestic waste, contributing 30.53 per cent of the total domestic waste generated with ward no.7 having the highest share at 0.94 MT per day.

Fig. 5.1 represents, waste generated from various sources in Kalimpong town. It can be seen from the figure that total waste generated from the market area is highest with a total generation of 20.91 MT per day, followed by domestic sources (households) with a total generation of 11.53 MT per day, 6 per cent come from commercial centers, 4 per cent from other sources, 2 per cent from agriculture and 1 per cent from hotels. Biodegradable solid waste generated per day was 24.97 MT i.e., approximately 70 per cent of the total waste generated as shown in Table 5.2.

Fig. 5.1: Generation of waste from various sources (Percentage Share)



Source: Kalimpong Municipality, 2013

Table 5.2: Types and waste generated from various points of Kalimpong Town per day

Generation Points	Total(in Kg)	Quantity of Waste (in Kg)	
		Waste Type	
		Bio-degradable	Non-biodegradable
Domestic	11535	6921	4614
Daily and Wholesale Market	20900	16720	4180
Hotels	499	200	299
Agricultural/ Garden	825	825	0
Sub-Total	33759	24666	9093
Commercial Centers	2000		2000
Bus Stand	50		50
Sub-Total	2050		2050
Street Sweepings	300		300
Drain Cleanings	200		200
Sub-Total	500		500
Cess pool	300	300	
Clinical	660		660
Total	37268	24966	12303

Source: Kalimpong Municipality, 2013

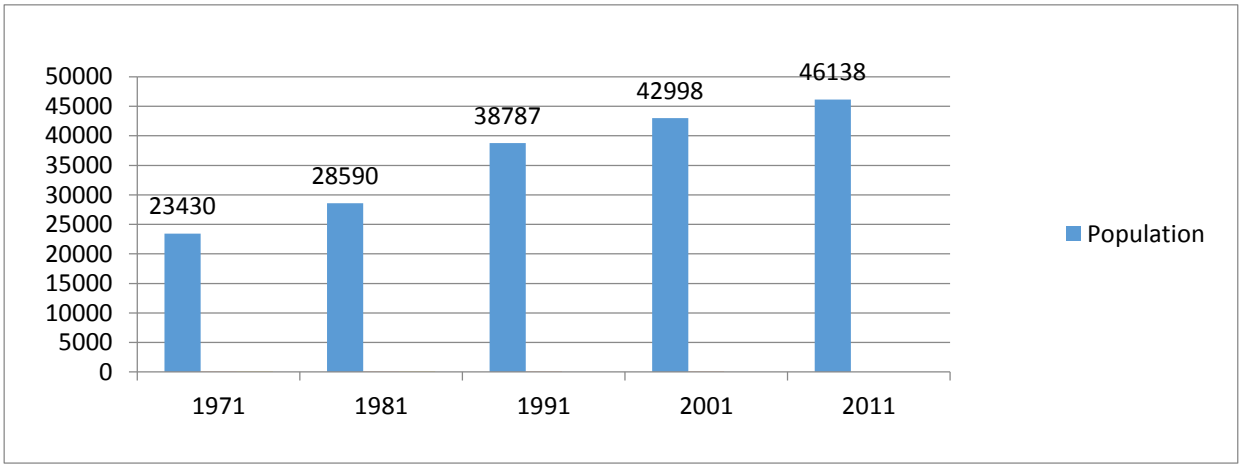
5.3 Factors Influencing Waste Generation in Kalimpong Town

Waste generation has been said to increase along with the population and rise in economy of a nation. In terms of economic activities and population Kalimpong town has seen a rapid increase over the past decade thus adding the town's waste generation in the recent years. Population figures of the town have been presented in Fig. 5.2.

The growth rate of population has been calculated to be 18.46 per cent in the past 5 decades. Along with the population growth there has been a rapid increase in the number of household holdings in the town area, recording almost 90.63 percentage growth in the

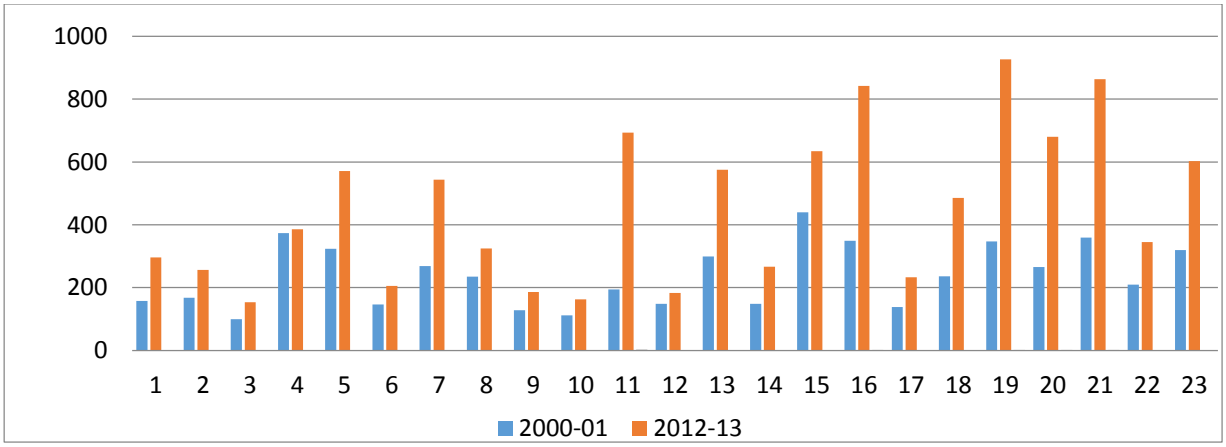
past 13 years with almost 4900 households added in the 23 wards with a present total of 10366 households which is shown in Fig. 5.3.

Fig 5.2. Population of Kalimpong Town from 1971-2011



Source: Census of India, 1971-2011

Fig 5.3: Number of Households in 23 wards in 2000-01 and 2012-13



Source: Kalimpong Municipality Annual Report, 2013

Thus the figures above indicates that in one decade the town has experienced not only growth in terms of population but also in terms of economy as is reflected by the increase in the number of households, which can be taken as an indicator for the increase in the living standards of the people. Urbanization in the hills is being characterized by uncontrolled and unplanned haphazard growth mushrooming of squatter colonies through

illegal and forceful occupation of land, inadequate urban facilities like water supply, sewerage and congested unhealthy living condition (Bhuimali & Das, 2011).

Along with the towns permanent residential population the floating population comprising of migrant laborers from neighboring states and rural areas who come in search of jobs and better living opportunities, school children who board in school hostels and private hostels also add up to the town's population. Since Kalimpong town and surrounding areas is quite a popular tourist spot in the West Bengal region, it has many visitors (both domestics and international) flocking in for recreational purposes. The seasonal tourist inflow along with the students and laborers add significantly to the demands on resources and add considerably to the amount of waste generated. Lack of proper rules and regulations and the inability to evaluate the waste generated by tourists prevents the Kalimpong Municipality to levy special conservancy taxes to be imposed on hotels and restaurants.

Lack of proper infrastructure available for waste management with the Kalimpong Municipality adds more pressure to the problem of waste management in the town. Solid waste generation in the town of Kalimpong has exceeded current infrastructural capacity of the municipality and the resulting effect has been the steady degeneration in the quality of SWM. Many of the town's infrastructures were built during the British era and are not yet upgraded with time and growing population. Infrastructural deficiency has diverse implications on the health of the residents.

Kalimpong Municipality has only two trucks for the whole 23 wards for waste collection thus making it impossible to collect waste on a daily basis from each ward. The trucks are not specially designed for waste pick-up and are normal goods carrying trucks. Laborers engaged in handling waste do not get any kind of protective gear when sorting and loading and unloading of waste which is done manually. Table 5.3 represents the list of needed infrastructure for SWM in Kalimpong town as formulated by Kalimpong Municipality.

Table 5.3: List of needed infrastructure for solid waste management in Kalimpong town

Particulars	Total requirement	Existing nos.	Additional Requirement
Litter Bins	353	Nil	353
Hook Lift Dumper Container	18	Nil	18
Hook Lift Dumper Carrier (Hydraulic)-HLD	2	Nil	2
Community Bins (200 lit capacity	169	Nil	169
House to House collection bucket	20732	Nil	20732
Mini Truck	10	2	8
Covered Refuse Trailer with hydraulic system	14	Nil	14
Pay Loader/Bull Dozer	1	Nil	1
Hydraulic Dumper Truck-HDT/Ordinary Truck	3	1	2
Road Sweeping Machine	1	Nil	1
Wheel Barrow	208	Nil	208
20 lts Container	1750	Nil	1750
Shovels	150	Nil	150
Spade	150	Nil	150

Source: Kalimpong Municipality, 2014
**rates given are approximate figures*

It can be seen from Table 5.3 that, at present the municipality only has two mini-trucks and one ordinary truck for collection and disposal of waste for the whole 23 wards. The municipality faces critical infrastructural deficiencies as it lacks even the basic infrastructures needed for managing waste in the town. Therefore, rapid urbanization and increasing population has led to generation of huge amount of MSW in Kalimpong town and with inadequate infrastructure for waste management services, the town with waste dumps presents a desolate and pathetic picture.

Lastly there is negligible participation in waste management from the residents of the Kalimpong town who are the main generators of waste. Kalimpong Municipality is expected to take full responsibility for waste management services till date. It was found that proper disposal practices were not followed by the public at large. It was observed during the course of the survey that maximum of the residents litter around the town and do not follow practices like throwing waste in the dustbin, but rather dispose it off

indiscriminately in roads and lane leading to waste pile ups in and around the vicinity of the town. Also most of the shops and commercial centers did not have dustbins and therefore the areas were littered with plastic wrappers, food items, papers etc due to lack of proper disposing bins.

5.4 Socio-Demographic and Economic Profile of Households

Table 5.4 below, represents the personal profile of household participants based on selected socio-demographic characteristics.

Table 5.4: Distribution of respondents according to their personal profile

Individuals Personal Profile	N=170	Percentage
Gender		
Male	113	66.47
Female	57	33.53
Occupation		
Self Employed	76	44.71
Government Employee	32	18.82
Private sector Employee	14	8.24
Non-working	48	28.23
Educational Qualification		
Post Graduate	19	11.18
Graduate	55	32.35
Higher secondary	26	15.29
Secondary	26	15.29
Below Secondary	39	22.94
Illiterate	5	2.94
Marital Status		
Married	133	78.24
Single	37	21.76
Age group		
20-30	58	34.12
31-40	62	36.47
41-50	33	19.41
51-60	16	9.41
61-70	1	0.58

Source: Primary Data

Table 5.4, shows that majority of the respondents who took part in the interview were male (66.47 per cent). This can be attributed to the fact that being a patriarchal society, males are considered to be head of the family and hence the main decision maker. Age of the respondents varied from the oldest respondents with an age of sixty years to the youngest respondents with an age of twenty two with the majority of the respondent falling in the age group of 31-40 (36.47 per cent). Most of the survey participants were married, consisting of 78.24 per cent of the total study sample. Results show that majority of the study participants were either college graduates (32.35 per cent) or had an education below the secondary level (22.94 per cent). Most of the respondents were found to be engaged in some kind of occupation (71.77 per cent) out of which majority of the respondents were self employed (44.71 per cent) followed by government office employee (18.82 per cent).

The distribution of respondents according to their household profile is represented in Table 5.5.

Table 5.5: Distribution of respondents according to their household profile

Household Profile	**N=170**	**Percentage**
Family Type:		
Joint Family	56	32.94
Nuclear Family	114	66.06
Residency type:		
Permanent Resident	148	87.06
Temporary Resident	22	12.94
House Ownership Type:		
Own	131	77.06
Rented	39	29.94

Source: Primary Data

From the data collected, presented in Table 5.5 it was found that, most of the respondents were from a nuclear family type (66.06 per cent) with the remaining 32.94 per cent respondents belonging to joint family. Out of the total sampled households 148 (87.06) respondents were permanent residents of the town, while 22 (12.94) households were temporary residents who had come to town is search of work and some were government

employees transferred for their duties in Kalimpong. Majority of the respondents (77.06 per cent) lived in their own houses.

5.5 Level of Public Awareness and Participation for Solid Waste Management

As has been discussed earlier in the given literature, public participation and awareness is one of the most pivotal elements in determining better or successful working of a SWM program. In the conducted survey, questions which helped in understanding the level of public participation and awareness regarding waste generation and management were asked to the respondents. Out of 170 sampled households who were interviewed, 90.58 per cent of the respondents agreed that waste management was one of the major problems in Kalimpong town.

Table 5.6, shows the distribution of participating households on the basis of their level of awareness that they have about the current waste disposal practices undertaken by Kalimpong Municipality. Around 1/4th of the respondents were aware of the waste disposal practices undertaken by Kalimpong Municipality while 3/4th of the respondents surveyed had no idea.

Table 5.6: Distribution of respondents on the level of awareness about waste disposal practices undertaken by Kalimpong Municipality

Particulars	**Number of Households**	**Percentage**
Aware about the current waste disposal practices undertaken by the Kalimpong municipality	35	20.59
Having no idea regarding waste disposal practices undertaken by the Kalimpong Municipality	135	79.41

Source: Primary Data

Table 5.7, deals with the distribution of respondents according to the stakeholders they think are responsible for the problem of waste pile-ups in Kalimpong. These questions were asked during the survey in order to understand the response of the interviewed participants towards taking up accountability for waste they have generated.

Table 5.7: Distribution of respondents according to the stakeholders they think are responsible for the problem of waste pile-ups in Kalimpong

Responsible Parties	**Number of Households**	**Percentage**
All (The Municipality, Lack of Proper Infrastructure, Lack of Public concern and Participation)	25	14.71
The Municipality	90	52.94
Lack of Proper Infrastructure	19	11.18
Lack of Public concern and Participation	48	28.25

Source: Primary Data

Out of the total households surveyed 52.94 per cent of the respondents believed that it was the lack of proper functioning and efforts by Kalimpong Municipality that had led to this foul scenario of waste pile-ups everywhere in the town, they did not consider it to be the consequences of their activities and felt strongly that the municipality had failed in its workings as shown in Table 5.7. They believed that the sole responsibility of waste management should be undertaken by the municipality, 28.24 per cent of the interviewed respondents agreed that it was the lack of public concern and participation that had caused the problem, 11.18 per cent of the respondents blamed the lack of proper infrastructure for proper waste management that had led to this problem and 1.71 per cent considered that the current situation of improper waste management reached its culmination point due to the amalgamation of all the factors ranging from lack of proper

infrastructure, lack of public concern and participation and lack of efforts by the municipality.

Data on priorities the surveyed households attached to the given three physical infrastructures: proper drainage, waste management and proper sanitation were collected as shown in Table 5.8 below. Respondents were asked to rank: first, second and third according to their choice of what they thought were the matters of greatest importance to them. This question was included in the survey in order to understand the priority people attached to proper waste management.

Table 5.8: Distribution of respondents on the basis of their ranking in order of priority (1st, 2nd and 3rd)

Physical Infrastructures	Rank I (Percentage)	Rank II	Rank III
Proper Drainage	61 (35.88)	61	67
Proper Sanitation	53 (31.18)	53	55
Waste Management	56 (32.94)	56	48

Source: Primary Data

Out of the total sampled households, 61 respondents ranked proper drainage as their number one priority, 56 respondents ranked effective waste management as their 1st priority and 53 respondents ranked proper sanitation as their 1st priority as shown in Table 5.8. On further questioning the respondents, it was found that they considered proper drainage as the most important infrastructure as, lack of this facility in a hilly area like Kalimpong leads to flooding, water logging, hill slope erosion, land slide and subsidence, traffic problems and health hazards. Furthermore the town does not have proper drainage system and is mostly dependent on natural jhoras and the topography of the town which acts as a natural drainage system. Also most of the respondents believed that the problem of waste management, though prevalent, could be controlled if the municipality introduced a system of collecting wastes from households on a daily basis.

They seemed to be having little or no knowledge regarding the hazardous consequences of waste mishandling and its environmental and health effects.

Fig. 5.4 a, b below represents the distribution of respondents on the basis of their knowledge and practice of waste segregation. Segregation means simply the process of separating waste into bio-degradable and non-bio degradable. Questions regarding segregation were made in order to understand the awareness of people about the basic tools of waste management like segregation. Also while interviewing the Kalimpong Municipality officials; they informed that waste segregation at source would solve almost 75 per cent of the waste management problem which the town was facing. Segregation would automatically reduce waste generation as the organic waste could be composted and the dry inorganic waste could be given up for recycling.

Fig. 5.4 a, b: Distribution of respondents on the basis of their knowledge and practice of segregation

Fig. 5.4 a

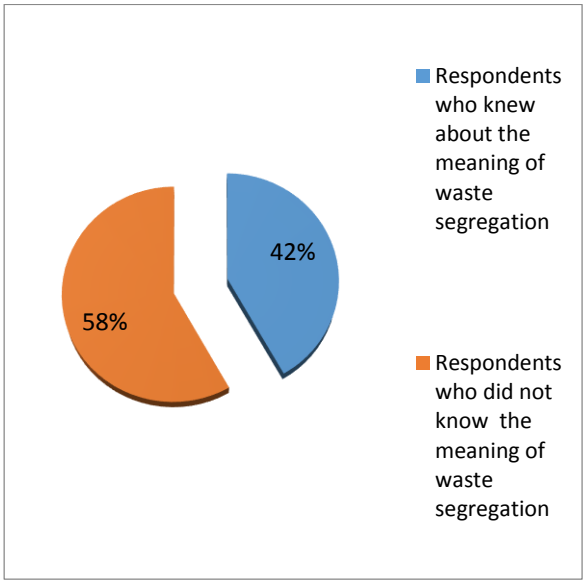
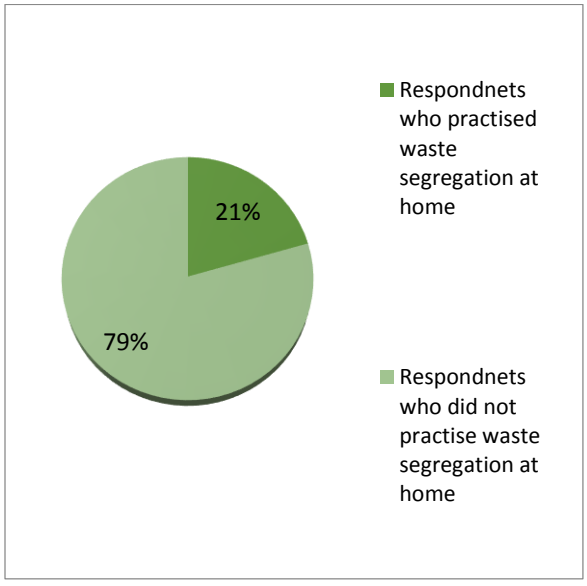


Fig. 5.4 b



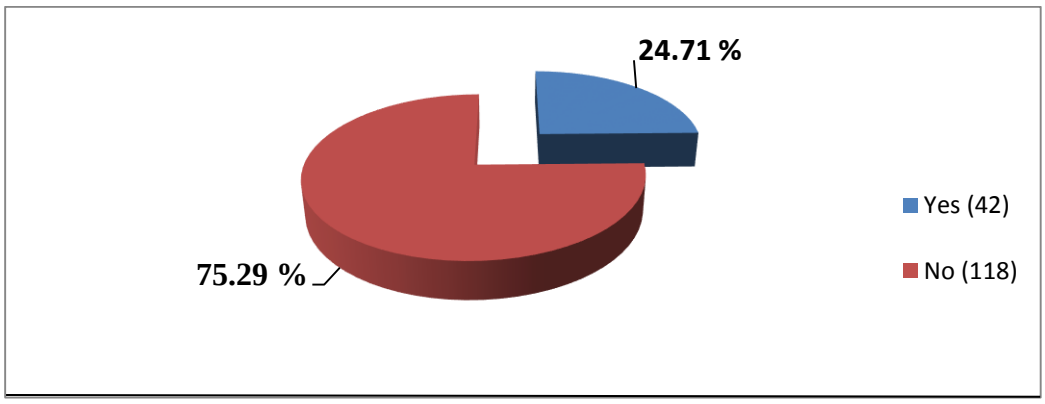
Source: Primary Data

The figures above represent the distribution of the respondents on the basis of their knowledge and practice of segregation. On conducting the survey it was found that 41.77 per cent of the surveyed respondents knew the meaning of segregation while 58.23 per

cent of the respondents had no idea or had never heard about segregation before. Approximately 1/5th of the total interviewed respondents practiced segregation at their houses whereas around 4/5th did not. It was found that even respondents who knew theconcept of household waste segregation did not practice it. Out of 71 households who knew about segregation only 49.30 per cent (35 households) practiced it. Each household surveyed had proper sanitation at their homes and each owned at least one dustbin. Average number of dustbins per household was calculated to be approximately 2.

The following pie chart shows the distribution of households on basis of having separate dustbins for dry and wet waste. This question was asked in order to understand the consciousness of the respondents in separating their waste and playing a part in waste management.

Fig. 5.5: Distribution of households on the basis of separate dustbins used for dry and wet waste



Source: Primary Data

A total of 118 out of the total surveyed households did not have separate dustbins for dry and wet waste and thus households produced mixed garbage represented in 5.5. Mixed garbage is very hard to segregate and render little or no value for recycling and composting. Out of the total surveyed households 42 households had separate dustbins for their dry and wet waste. What is important to see here is that in the above figure we showed that 35 out of the total respondents practiced segregation but according to this pie chart we see that 42 households have separate dustbins for dry and wet waste. Thus it can

be inferred that 7 of the total surveyed households do not have knowledge about waste segregation but practiced it unknowingly.

5.6 Methods of Solid Waste Disposal

Household solid waste disposal methods were also examined as shown in Table 5.9 below. Questions regarding waste disposal methods were asked to the respondents in order to understand the waste disposal methods respondents were practicing in absence of house-to-house collection or ward wise collection of waste by Kalimpong Municipality.

Table 5.9: Distribution of participating households by the waste disposal methods they followed

Waste Disposal Practices	Number of Households	Percentage
Composting	30	17.65
Open Burning	94	52.94
Throwing in dumpsite, Municipal Vats	30	17.67
Open dumping	72	42.35

Source: Primary Data

Table 5.9, shows that open burning of waste is the most common practice with 52.94 per cent of the surveyed households following this method of waste disposal. The method of open burning cause's great environmental pollution due to emission of harmful gases which causes health problems to people living in and around the area. The second most common practice followed by the surveyed respondents was open dumping with 42.35 per cent using this method of disposal. Some of the surveyed respondents used both open burning and open dumping as the waste disposal method. Composting of their organic waste was followed by 17.65 per cent of the total surveyed households. Composting was done by these households on their own personal initiative and interest. No support was provided till date by Kalimpong Municipality for urging the people to practice composting as a method for organic waste disposal and hence a large share of the interviewed households remained unacquainted rather than ignorant about this alternative method of waste disposal.

Respondents were surveyed on the basis of the areas or places they used to dispose their waste as shown in Table 5.10.

Table 5.10: Distribution of households by the waste disposal sites they used to dispose their waste

Mediums used for Waste Disposal	Number Households	Percentage
Municipality Vats	21	12.35
Roadside	52	30.59
Nearby lane	24	14.12
Inside their own premises	45	26.47
Jhora	25	14.71
Barren lands or forest area	36	21.18

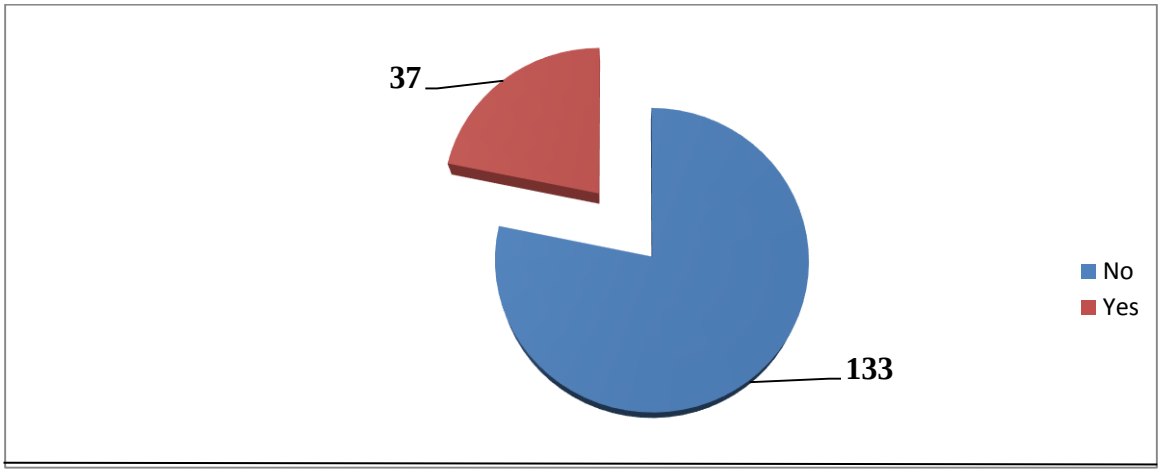
Source: Primary Data .

The primary area that the surveyed households used to dump their waste was the roadside with 30.59 per cent (52) out of the total interviewed households following this method. On further questioning about the reasons behind roadside dumping it was found that they had no alternative to this method. Roadside dumping was more prevalent in wards which were the main market area as there was no barren land or other secluded area, where they could dispose off their waste. The second most common method followed was burning or dumping the waste inside their own premises with 26.47 per cent (45) disposing their waste in such fashion. Dumping of waste in barren lands or forest area where there was not much human habitation was carried on by 21.18 per cent (36) of the surveyed households. Though this method kept the vicinity clean, it had an externality effect as the dumped waste caused environmental pollution in the forests area disturbing the natural habitats of many birds and animals as well as leading to loss of aesthetic appeal of the forests. Disposing waste on barren lands leads to loss of the lands productivity as the chemicals secreted form the waste leads to soil pollution, thus rendering the soil unproductive for further use.

5.7 Health Problems Reported Due to Improper Waste Management

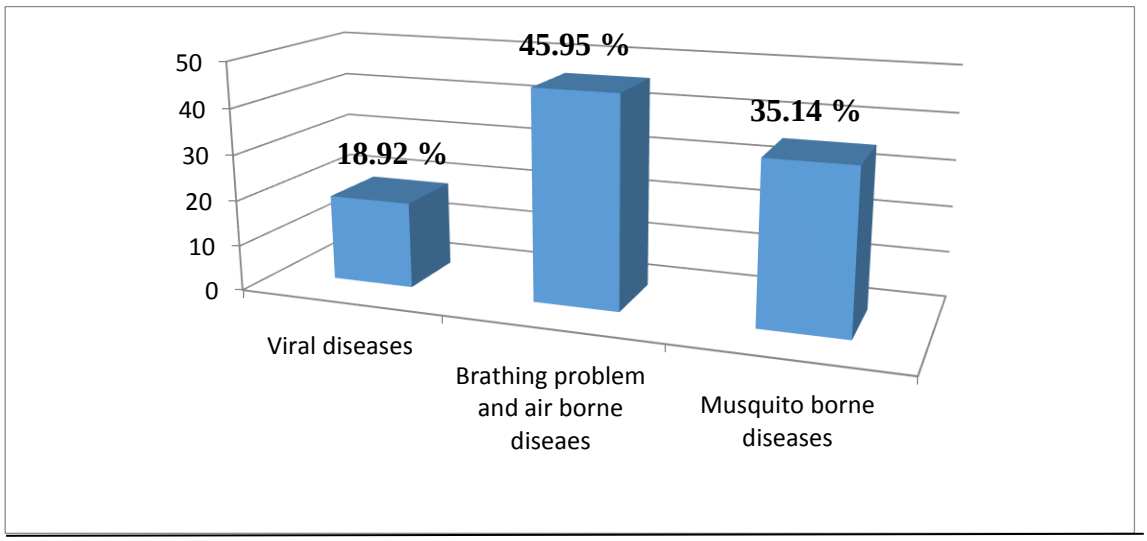
Improper waste disposal and handling can lead to various ill effects one of which is health problems. Fig. 5.6, below shows the distribution of households on the basis of health problems reported due to improper waste management.

Fig. 5.6: Distribution of households according to reports of health problems faced due to improper waste management



Source: Primary Data

Fig 5.7: Types of health problem reported (percentage share)



Source: Primary Data

Out of the total surveyed households 37 reported that they were facing some kind of health problems. The types of health problems they were facing as shown in Fig. 5.7 were viral diseases with 18.92 percent of the 37 respondents having reported to have suffered from some kind of viral disease or infection. Breathing and respiratory infections was reported to be suffered by the highest percentage (45.95) and mosquito borne diseases was reported by 35.14 per cent with recent cases of dengue being reported in the Kalimpong Hospital.

On interviewing the hospital officials it was found that cases of Dengue was rare in hilly areas like Kalimpong and non prevalent a couple of years back. They considered improper waste management and improper waste handling coupled with improper drainage leading to stagnant water pools to be one of the major causes of occurrence of dengue. Respiratory infection or breathing problems is another externality that arises from improper waste management. The foul smell of the rotting garbage leads to various air borne diseases.

5.8 Willingness-To-Pay of Households for an Improved Municipal Solid Waste Management Services

Table 5.11, shows the distribution of households by their WTP for an improved MSWM services. WTP is a method used in the CVM, through which demand for an environmental good that has no proper market is quantified in terms of monetary figures. Higher the proportion of people who are willing-to-pay for proper MSWM, higher is the demand for those services. Higher demand means that people are ready to let go of a part of their income, in order to acquire those services as they are acquiring some utility from consuming these services. As pointed above in the literature, SWM is considered as a public good leading to overuse and nonpayment for acquiring those services. In case of Kalimpong town too there is negligible or no financial participation by the people for waste management, thus this study aims to understand whether the people have a demand for waste management services in the study area or not.

Table 5.11: Distribution of households by their decision to pay for an improved municipal solid waste management services

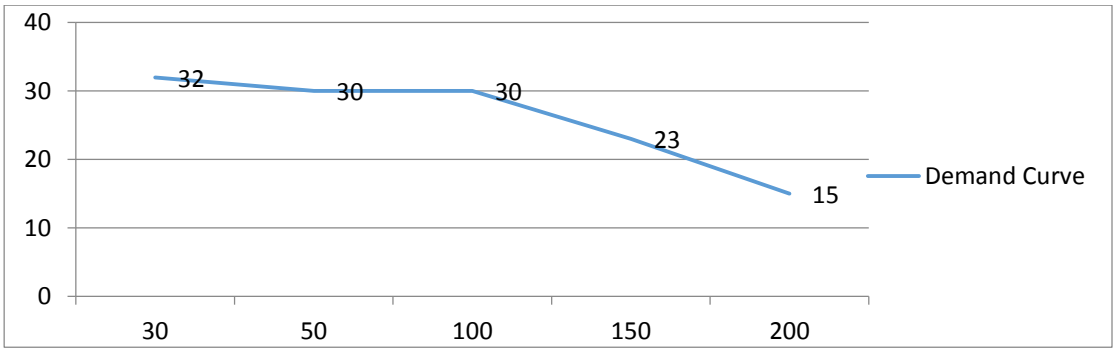
Household Type	N=170	Percentage
Willing-To-Pay	130	76.47
Not Willing-To-Pay	40	23.53

Source: Primary Data

Out of the 170 participants interviewed, 130 (76.47 per cent) were found willing-to-pay and 40 (25.53) were not willing-to-pay for improved waste management services. Thus from the results we can infer that majority of the respondents had a demand for better SWM services for which they were willing to give up a part of their income to attain these services.

Fig. 5.8 below represents a graph tracing the 130 respondents who agreed to pay for proper waste management in the town of Kalimpong at different rates of monthly charges (bid price) that were stated to them. The graph below shows the demand curves for proper waste management. The graph is seen to be downward sloping which means that the demand for proper waste management decreases as the bid prices (stated price for attaining waste management services) increases.

Fig. 5.8: Number of respondents willing-to-pay at different bid price level



Source: Primary Data

The respondents were classified according to their gender, civil status and level of educational attainment as shown in Table 5.12 below.

Table 5.12: Distribution of respondents by their decision to pay for improved waste management

Particulars	WTP(Male)	Not WTP(Male)	WTP(Female)	Not WTP(Female)
Civil Status				
Single/Others	15 (40.54)	8 (21.62)	7 (18.92)	7 (18.92)
Married	73 (54.89)	17 (12.78)	35 (26.32)	8 (6.02)
Total	88	25	42	15
Educational attainment				
Post Graduate	14 (73.68)	4 (21.05)	1 (5.26)	0
Graduate	27 (49.09)	7 (12.73)	19 (34.55)	2 (3.64)
Higher Secondary	15 (57.69)	3 (11.54)	8 (30.77)	0
Secondary	14 (53.85)	5 (19.23)	5 (19.23)	2 (7.69)
Below secondary	14 (3.84)	8 (21.05)	8 (21.05)	8 (21.05)
Illiterate	2 (40)	2 (40)	0	1 (20)

Source: Primary Data

Figures in the parenthesis represent the respective percentage

From Table 5.12 above it is seen that majority of the respondents who were married were willing-to-pay for better MSWM services. Out of the married respondents, majority of males (54.89 per cent) and majority of females were willing-to-pay (26.32 per cent). Similarly in case of the respondents who were single a total of 59.46 per cent (male and female) respondents were willing-to-pay for better waste management services. The highest educational attainment that was found during the course of the interview was post graduation. Most of the respondents were graduates out of which 27 male graduates were willing-to-pay and 7 were not. On the other hand out of 21 female graduate respondents 19 of them were willing-to-pay. Out of 19 Post graduate respondents 14 respondents who

were male and 1 female post graduates were willing-to-pay, 4 of the male post graduates were unwilling to make any financial contribution for MSWM services. In case of respondents who had the highest educational attainment of higher secondary 15 male and 8 female respondents were willing-to-pay while 3 male respondents were not willing-to-pay. Out of 26 respondents who had attained education till secondary 53.85 per cent male and 19.23 per cent females were willing-to-pay while 19.23 per cent of male and 7.69 per cent of females with educational attainment till secondary were not willing-to-pay. The respondents who were educated below the secondary level were 38, out of which 41.1 per cent of the respondents (male and female) were not willing-to-pay. Lastly 5 of the sampled respondents were found to be illiterate, out of whom 3 respondents were not willing-to-pay. It can be pointed out in this context that since females are considered to be more concerned about the cleanliness of their households and the surroundings would be more willing-to-pay than their male counterparts as has been found in this study.

The distribution of respondents WTP according to their occupation was calculated in the study and is shown in Table 5.13.

Table 5.13: Distribution of respondents by their willingness-to-pay according to their occupation

Occupation	WTP	Not WTP	Total
Government Employee	28	4	32
	(87.5)	(12.5)	
Self Employed	60	16	76
	(78.95)	(21.05)	
Private Employee	12	2	14
	(85.71)	(14.29)	
Non- Working	30	18	48
	(62.5)	(37.5)	

Source: Primary Data

Majority of the respondents were self employed with 78.95 per cent of them willing-to-pay. Respondents who were employed at a government office had the highest percentage

of people willing-to-pay at 87.5 per cent. Out of 14 respondents who were privately employed 85.71 per cent were willing-to-pay some amount for better SWM services. The respondents who were non-working had the highest percentage (37.5 per cent) of people not willing-to-pay. The unemployed/ non-working respondents comprised mostly female of respondents who were housewives.

Non willing respondents were asked to state their reasons behind their unwillingness to pay during the course of interview. It was found that only 40 out of the total 170 sampled households were not willing-to-pay any amount for MSWM in the town of Kalimpong. Table 5.14 shows the distribution of respondents who were not willing-to-pay and the reasons stated behind their non willingness.

Table 5.14: Distribution of respondents by their reasons for non willingness-to-pay

Reasons given by the respondents	**Number of Respondents not WTP (40)**
Already Paying the Sweepers for cleaning	6
Already paying taxes to the Municipality	10
The responsibility of the Municipality	18
Uncertainty regarding the use of money after it is paid	6

Source: Primary Data

The mindset of respondents who considered it to be the responsibility of the municipality solely was found to be the major reason behind their unwillingness to take part in any monetary contribution for better SWM (18 respondents), on the other hand 6 respondents did not want to pay because they were already paying the street sweepers for cleaning the area, 6 respondents were found to be uncertain about usage of the money if any financial contribution was made by them, and hinted that maybe the money would not be utilized for the said purpose. Lastly 10 respondents believed that the taxes they were paying to the municipality were enough and no further amount should be paid solely for SWM purpose.

5.9 Descriptive Statistics of Important Variables and Turnbull Mean Willingness-To-Pay

Table 5.15, represents the mean and standard deviation calculated for some important socio-economic variables which have been collected during the course of the survey. This will help in giving us a general picture of some important socioeconomic variables of respondents who took part in the survey.

Table 5.15: Descriptive statistics of some important variables

Variables	N	Minimum	Maximum	Mean	Std. Deviation
Income	170	3000	55000	15594.12	9664.95
Education	170	0	17	11.54	4.34
Age	170	22.00	66.00	37.59	9.40
Waste Generated	170	100.00	500.00	288.12	99.68
Family Size	170	2.00	9.00	4.44	1.60

Source: Primary Data

Average age of the respondents was calculated to be 37.58 years with the age ranging from a minimum of 22 to a maximum age of 66. Average years of education that had been attained by the respondents was 11.54 years which is close to the value of 12 taken for the educational attainment till higher secondary while computing the data. Therefore it can be said that on an average the respondents had attained education at least till higher secondary, even though the values varied from 0 i.e., having no education at all to 17 i.e., post graduation . The average monthly income of the households was Rs 15594.12 with the incomes ranging from the lowest of Rs 3000 per month to the maximum of Rs 55000. Since the study was conducted in the town area of Kalimpong which is the main urbanised area in the whole of Kalimpong Sub-Division it can be said that most of the town's population are well educated and also the level of income falls in the range of medium income group in comparison to other areas of the Kalimpong Sub-Divion.

The standard deviation for years of education, age and family size are calculated to have small values, therefore we can confer that most of the respondents age, family size and

years of education are more concentrated near the average, whereas in case of waste generated and total monthly income, high standard deviation value implies that the data are more dispersed from its mean value.

Turnbull Mean Willingness -to - Pay estimates:

The mean WTP was calculated using the Turnbull Willingness-To-Pay estimation that provides a lower bound mean WTP. The Turnbull estimator provides an estimate of the fraction of the population who would answer yes at each bid amount used (Ahtiainen, 2007)

The mean WTP of the study participants calculated with the Turnbull estimator amounted to Rs 170. The value calculated is much higher than the amount of Rs 100 per household the Kalimpong Municipality plans to charge once the municipality initiates its waste collection program. Computation of mean willingness-to-pay estimates are shown as follows:

Table 5.16: Computation of Mean Willingness-To-Pay of households for an improved municipal solid waste management services

t_j	N_j^*	T_j	F_j^*	f_j^*
30	2	34	0.06	0.06
50	4	34	0.12	0.06
100	4	34	0.12	0
150	11	34	0.32	0.2
200	19	34	0.56	0.24
200+	---	---	---	0.56

Source: Primary Data

Turnbull Mean Willingness-To-Pay:

$$\sum t_j * f_j^* + 1$$

= 0(0.06) + 30 (0.06) + 50 (0) + 100 (0.21) + 150 (0.24) + 200 (0.56) +1

= 169.41+1

= Rs 170.41

The mean willingness-to-pay calculated using the Turnbull Mean Willingness-To-Pay is larger in comparison to other mean willingness-to-pay calculations. This can be attributed to the fact that the Turnbull estimator restricts the WTP to be positive, while other mean willingness-to-pay estimators assume that some respondents have negative WTP (Ahtiainen, 2007).

5.10 Factors Affecting the Willingness-To-Pay Decisions of Households for an Improved Municipal Solid Waste Management Services

Table 5.17, shows the binary logistic regression result for an improved MSWM services in the town of Kalimpong. The statistical software Stata 10.0 was used to carry on the logistic regression. WTP was taken as the dependent variable and the various socio-economic factors as the independent variable. Results show that bid price (amount that the household will be willing-to-pay for an improved municipal solid waste management service) and income were found to be significant at 1 per cent level of significance. Awareness regarding waste management being a serious problem in the town of Kalimpong and household ownership was found to be significant at 5 per cent level of significance. Other factors like age, gender, years spent on education, number of family members, amount of waste generated by the families per day (weighed only during the day of survey) and the marital status of respondents were found to be insignificant and thus not discussed further. Income has also been found to be significant in influencing the WTP decisions in similar studies of waste management undertaken by (Ahmad, Khan, & Naeem Ur Rehman, 2009), (Deb & Roy, 2013)and (Das D. , 2011) but not in study undertaken by (Genzago & Guillermo, 2013). However education which is calculated to be insignificant in this study has been found to be significant in studies undertaken by

(Ahmad, Khan, & Naeem Ur Rehman, 2009) but not found to be significant in study undertaken by (Genzago & Guillermo, 2013). Household size was found to be significant in studies undertaken by Ahmad et al and Deb et al, whereas gender was found to be a significant factor in study undertaken by (Ojok, OkotOkumu, Koech, & Tole, 2012) which is found to be insignificant in this study. (Deb & Roy, 2013) also considered the importance of environmental awareness as a variable in their study which was found to be significant in this study as well. The difference of results obtained can be attributed to the fact that that these studies were undertaken in different areas at a different time frame, cultural pattern and lastly with different people under different environments.

Table 5.17: Determinants of the willingness-to-pay of households for improved municipal solid waste management services

Variable	Coefficients	Z	Odds Ratio
Bids	-.08*** (0.020)	-3.81	.920
Income	10.72*** (146856.1)	3.31	4529.4
Total years of Education	-.17 (0.18)	-0.81	.841
Age	-.13 (0.067)	-1.65	.883
Gender	1.45 (5.48)	1.13	4.266
Number of members in the family	-.67 (0.23)	-1.52	.509
Waste Generation/day	2.45 (21.53)	1.32	11.57
Awareness	12.17** (1349893)	1.73	1924.5
Household Ownership	2.83** (25.21)	1.89	16.88
Marital Status	1.20 (4.24)	0.94	3.33
Constant	-108.912*** (35.09)		.000
Pseudo R^2 = 0.83			

Source: Primary Data

Interpreting the regression results in Table 5.17, each slope coefficient in this equation is a partial slope coefficient and measure the change in the estimated logit for a unit change in the value of the given regressor, holding other regressors constant (Gujarati, 2004). The coefficient of bids was calculated at -0.83 which means that with other variables held constant, if bids increases by a unit, on an average the estimated logit decreases by 0.83 units. The most fundamental of the expectations of the economic theory is that as price of good increases, demand or consumption of the good should fall (Ahtiainen, 2007). Similarly, with other variables held constant a unit increase in income leads to 10.72 unit increase in the estimated logit. Economic theory predicts a positive association between WTP and respondents income (Ahtiainen, 2007). Other variables held constant a unit increase in house ownership leads to 2.83 increases in the estimated logit and lastly a unit increase in awareness regarding waste management problems in the town leads to 12.17 units increase in the estimated logit.

However this interpretation is not sufficient and in case of a logistic regression a more meaningful interpretation is given in terms of odds, which is obtained by taking the exponential value of the various slope coefficients (Gujarati, 2004). Thus taking odds ratio of bid price we get the value 0.92 which suggests that as bid price increases respondents are 0.92 times less likely to be willing-to-pay, likewise respondents who have a higher income are 4529.4 times more likely to pay for SWM services, the odds ratio of house ownership suggests that the respondents who have ownership of houses are 16.88 times more likely to pay for SWM. Lastly, respondents who were aware about the waste management issues and its problem in the town of Kalimpong are 1924.5 times more likely to pay for waste management services than respondents who were not, other things remaining the same.

The Pseudo R^2 is reported in this study since the conventional measures of goodness of fit are not particularly meaningful in binary regression models (Gujarati, 2004). The goodness of fit measure is given by the Pseudo R^2 which is calculated to be 0.83. Interpreting the Pseudo R^2 like the conventional R^2 it can be said that 83 percent of the

variation in the dependent variable is explained by the explanatory or independent variable.

5.11 Revenue Earned and Cost Incurred by Kalimpong Municipality for Waste Management

Providing any kind of service requires the provider to incur some form of cost, and the benefactor in turn to pay some amount for acquiring those services. In case of environmental good too there is some cost that needs to be incurred be it in monetary terms, environmental quality or loss of aesthetic value; likewise there is a cost that needs to be incurred for providing SWM in an area. SWM is considered by the public at large as the duty of their respective municipalities and therefore little or no cost is incurred by the service getter. The cost for SWM makes up the largest share in any Indian Municipality budget, of which the collection services alone makes up 60 to 70 per cent of the total budget allocated for SWM, 20 to 30 per cent being spent on transportation leading to little or no finance for scientific or proper disposal of waste which is the most important aspect of proper waste management (Annepu, 2012). Likewise in case of Kalimpong Municipality too SWM services makes up the largest portion of the municipality budget, with collection and transportation of waste saturating the entire budget allocated for waste management leaving no budget for scientific or proper waste disposal. SWM is the single largest item of expenditure in the municipal budget in Kalimpong and this service suffers from critical deficiencies (Kalimpong Municipality Annual Report, 2013).

Kalimpong Municipality of lately has been facing the burden of the ever growing population and urbanization as it has not been able to provide the waste collection and disposal facility they had been providing during the past years due to insufficient funds. The indiscriminate dumping of waste with no post handling has led to the overuse of landfills which have run out of its capacity leading to landslides and air pollution thus leading to public protests. The lack of funds available for post handling of waste has been the reason for the situation. Even if the Kalimpong Municipality wants to it cannot set up

a proper waste disposal facility because proper disposal of waste requires huge amount of investment, which the municipality lacks.

Kalimpong Municipality is responsible for funding waste management in each ward from its revenue source. Revenue is collected through levying various taxes and other service charges as shown in Table 5.18 below. Kalimpong Municipality generated approximately Rs 26 lakhs as revenue from various sources for the year 2013. On interviewing the Vice Chairman of Kalimpong Municipality he pointed out that revenue collection was extremely difficult, low and insufficient as the people at large did not pay the specified amount on time and also the payment was prone to fluctuation on a year to year basis. They also highlighted the fact that insufficient revenue collection is what has stopped the municipality form initiating any proper waste management program. The rates at which the municipality charged the taxes were found to be very low as it had yet to be upgraded from the rates that were fixed during 1990's, i.e., almost more than two decades ago resulting in low volume of revenue collection.

Table 5.18: Various sources and amount of revenue earned by Kalimpong Municipality

Revenue Sources	**Revenue Earned Per year (Rs)**
Different Forms*	100920
Building Application Forms	57000
Rent of Municipal Buildings	575898
Levy Fees	602436
Development Fees	576120
Mutation	36000
Site Plan Fees	90906
Integrated Housing and Slum Development Program.	466200
Meat and Fish Shop owned by the Municipality	92700
Total	2598180

Source: Kalimpong Municipality, 2013
**Death Certificates, Residential Certificate, Birth Certificate, Drivers License etc.*

Table 5.19 below, shows the operational cost that the Kalimpong Municipality is going to incur for providing waste collection services from ward 1-12 wards which is covered under the first phase of the Kalimpong Municipalities waste management program. The monthly operational charge is calculated to be at Rs 6, 04,500 and comprises of the working staffs salary, telephone charges of the same, vehicle charges which include the petrol cost and the driver's salary and other miscellaneous expenses. The total operational cost for all 23 is calculated to be Rs 11,58,625 per month or Rs 1,39,03,500 per year with an average cost for 1 ward being calculated at Rs 50375 per month and each household cost coming at Rs 111.78 i.e., around 00.96 per cent of the total cost.

Table 5.19: Operational Cost undertaken by Kalimpong Municipality

Particulars	**N**	**Per month* (Rs)**	**Cost for 1 ward (Rs)**	**Cost for 23 wards (Rs) per month**
Labour wages	61	244000	20333.33	467666.67
Supervisor	15	75000	6250	143750
Senior Super Visor	2	14000	1166.67	26833.33
Co-ordinator	1	12000	1000	23000
Executive Director	1	30000	2500	57500
Telephone Charges		4500	375	8625
Vehicle Charges		200000	16666.67	383333.3
Other Expenses		80000	6666.67	153333.3
Total		604500	54958.34	1264042

Source: Kalimpong Municipality, 2014
**of 12 wards*

Comparing the per year operational cost to the revenue earned per year by the municipality, we can calculate the total profit earned or loss incurred using the formula:

Profit or Deficit = Revenue – Cost

=2598180 - 15168504

Revenue Deficit = -12570324

The above calculation shows that at the present amount of revenue that is collected, the revenue deficit is calculated to be more than 80 per cent of the total amount needed to finance only the operational cost for providing waste collection services in the town, due to which the Kalimpong Municipality is not being able to initiate any waste management program. To overcome this situation a well defined structure for collection of revenue should be planned by the Kalimpong Municipality in order to overcome such deficiencies and also the rates at which the taxes and other service fees are being charged needs to be increased taking into account the inflation rate of the past 2 decades and current value of the money.

From the revenue table we can see that no fee is charged for SWM services solely, leading to overuse and over exploitation of the resource as people consider it free and have no sense of responsibility. The municipality must implement user charges for the services in order to reduce the gap between the revenue earned and cost incurred, also it must charge each households, commercial centers, market places, shops and hotels accordingly so that these charges can at least cover the operational cost and hence the municipality can use their revenue source for proper disposal of waste rather than using it up just for waste collection.

5.12 Economic Prospects Of Waste Management Activities

Waste is no longer treated as a burden but a resource. There are tremendous economic values that can be extracted from different waste management activities be it in the form of public participation to make financial contribution for proper waste management or activities like composting that helps in revenue generation as well as employment generation. This study has looked into the economic prospects of people's participation for MSWM in the town of Kalimpong, the estimated value generation form composting as well as recycling activities from the informal sector in Kalimpong Town and lastly the estimated employment generation form waste management activities .

Considering the mean amount the households are WTP obtained from using Turnbull Mean Willingness-to-Pay in Table 5.20 below, it shows the number of sampled households that were willing-to-pay for SWM services in the town of Kalimpong.

Table 5.20: Estimation of the total amount of revenue that could be generated from the total households in Kalimpong town

Sampled households found WTP (N=170)	**Turnbull Mean WTP (Rs) per household**	**Total Households**	**Households WTP**	**Amount generated by total households/ month (Rs)**
130 (76.47)	170	10364	7926 (76.47)	13,47,420

Source: Primary Source

Figures in the parenthesis represent the percentage share

Taking the sample percentage of 76.47 in the Table above, and using it to estimate the total number of households that would be willing-to-pay for the entire population, the number of households is estimated to be approximately 7,926. Multiplying the total number of households willing-to-pay of the entire population with the mean WTP amount that was calculated using the Turnbull estimator, the total amount is estimated to be Rs 13, 47,420 per month.

Comparing the amount that can be collected from the households who are willing-to-pay and the operational cost per month for the waste management services from Table 5.19, it can be seen that the revenue collected from the 7926 households on an average of Rs 170 will be able to meet the operational cost that is being incurred by the Kalimpong Municipality for providing SWM services. This is undoubtedly a large amount of contribution that is being made from the households. Revenue earned from other sources like commercial centers, hotels, market places etc. can be further used to improve the present infrastructure for improved waste management and establishing scientific waste management services. Thus from the findings it can be said that people of Kalimpong consider waste management services as an economic good for which they are willing-to-

pay. On an average they are ready to give up 0.7 per cent of their income. The current state of waste mismanagement and littering of garbage all around Kalimpong town had lead to the households decision for their WTP as they were concerned about their towns well-being. Majority of the respondents complained about having no place to dispose off their waste and therefore were willing-to-pay if the municipality would provide waste disposal services.

Composting can act as another source of revenue that the municipality can use. Lots of developed countries are turning towards recycling and in case of developing countries where the organic fraction in the total MSW generated is more composting; bio gas plant to extract methane is seen as a viable option. In case of Kalimpong Town too biodegradable waste accounts for more than 50 per cent of the total waste generated. Various methods are being adopted according to the waste type and composition, all around the world, to divert waste from being dumped in landfills. In case of Kalimpong Town with more than 50 per cent of the waste being bio degradable composting of waste comes as the most feasible solution to divert it from being land filled. The compost generated can be used as a source of revenue by the Kalimpong Municipality through selling the compost.

Table 5.21 below, represents the amount of biodegradable waste generated in Kalimpong Town and the estimated figures of compost generation and revenue generation from the compost. It is estimated that for every 100 tonnes of MSW around 20 tonnes of compost is generated i.e., 20 per cent of the total intake and sold at approximately Rs 5 per kg (Damodaran, 2011)this study will be using the above given figure for estimating the compost production and revenue generation in Kalimpong town.

Table 5.21: Estimated Value of revenue generation through composting in Kalimpong Town

Bio degradable waste generated (Metrric Tonnes)	Total Compost Generation (20 per cent) (tonnes)	Selling Price (Rs)	Total revenue generated (Rs)	Per Year
24.97	5	5 per kg	25000	300000

Source: Primary Source

Kalimpong Municipality can therefore generate an estimated revenue of at least Rs 3 lakhs per annum from its biodegradable waste that was otherwise being dumped and generating no value, leading to environment degradation. Composting also has other benefits as it diverts a large volume of waste from being land filled and hence reducing the pressure from the lands and thus the need for Kalimpong Municipality to spend their funds on purchasing land for landfills. Since the municipality does not have many funds for setting up large waste management projects, aerobic composting can be considered as the best way to manage waste in the area. Anaerobic pertains to organisms, such as bacteria, that can live in the absence of atmospheric oxygen. Anaerobic composting" is terminology often used to refer to such organisms living in a compost bin and influencing the quality of its decomposition; it also refers to the conditions under which such organisms thrive in the bin (Beaulieu, u.d).

There is also no problem regarding finding a market for the generated compost as it has a ready market in Kalimpong with flower nurseries, vegetable growers and other agricultural groups and nearby tea gardens. Lastly community participation can play a key role is this aspect as waste segregation is absolutely crucial in order to generate a quality compost that can be sold at a higher price. Kalimpong town can produce quality compost which will be an added advantage over other compost producers as in India a large share of compost that is produced from mixed waste which does not produce quality compost and has little or no value. Also the recent trends of organic farming and organic products becoming more popular and consumers demanding items free of chemical fertilizers and pesticides, the use of compost has become increasingly important and the demand for it has risen. For waste to safely and completely compost, it must be organic. Unless the waste is thoroughly sorted at its source, workers at the compost site would be required to do this, much of it by hand (CMAP, 2008). The key to success of generation of good quality compost is segregation of waste at the source of the generation i.e., the household.

The total quantity of different waste products procured by the waste pickers in a day was estimated after doing interviews with them and visiting different scrap dealer’s form that

information an approximate value was obtained. Considering primary data that was collected regarding amount of waste that is being procured by the informal sector and the amount at which it is bought from the households, Table 5.22 below, shows the total estimated value in rupees terms of waste that is generated on a daily basis, on a monthly and yearly basis.

Table 5.22: Quantity of waste procured by the waste pickers and the estimated rates at which they are bought

Materials	Quantity (Quintals)	Rs/Kg	Revenue Generated**	Per month***	Per year
Plastics	20	10,6,5*	6853	205590	2467080
Cardboards	20	6-7	6853	205590	2467080
Iron Products	20	14	13706	411180	4934160
Total			27412	822360	9868320

Source: Primary Data,

***Depending on the quality of the plastic, **Taking an approximate figure of Rs 7 for 1 and 2, *** considering 30 days in each month*

From the Table 5.22 above, it can be seen that there is almost a market of worth Rs 1crore per annum in the small town of Kalimpong given the fact that much of the waste is indiscriminately dumped by the people and only a very small share of waste is being procured by the informal sector. Thus the Kalimpong Municipality as well as the public at large should understand that waste can be a source of revenue generation if managed properly rather than treating it as a burden.

Another important and positive impact of undertaking a waste management program is the creation of employment opportunities. Waste management requires employment of labourers in order to get the task done thus creating employment opportunities for the local people. Estimated employment generation from the waste management program going to be undertaken by the Kalimpong Municipality is shown in Table 5.23. The data obtained from Kalimpong Municipality, regarding the number of officials and labourers needed for waste management activities in the 12 wards was used to estimate the employment that would be generated in the total 23 wards.

Table 5.23: Estimated employment generation from the waste management program going to be undertaken by the Kalimpong Municipality

Particulars	N (12 wards)	Total Wards
Labour wages	61	117
Supervisor	15	30
Senior Super Visor	2	4
Co-ordinator	1	1
Executive Director	1	1
Total	80	153

Source: Kalimpong Municipality, 2014

From Table 5.23, it can be seen that a total of 80 new employments are going to be generated when the municipality will start the first phase of its waste management program going to be undertaken by the Kalimpong Municipality for the 12 wards. Using this data obtained from the municipality to estimate the employment generation in the whole of the 23 wards. The estimated figures give us a total of 153 new employment opportunities that would be generated from the waste management activity in the town of Kalimpong.

CHAPTER VI
CONCLUSION AND RECOMMENDATIONS

The economic analysis for SWM services conducted in Kalimpong town has made the following conclusions:

a) MSWM services at present are not up to the mark in Kalimpong town and Kalimpong Municipality suffers from financial as well as infrastructural shortcomings.

b) Majority of the households (76.47 per cent) were willing-to-pay for better MSWM service and regarded waste management as a major problem in the town. This finding suggests that MSWM is considered to be an economic good by the respondents for which they are willing to let go a part of their income in order to acquire these services.

c) According to regression results bid price, income, house ownership and awareness regarding waste problems in Kalimpong town were important determinants of households demands and consequently their WTP for better MSWM service.

d) Most households did not know about the concept of waste segregation and its importance.

e) The share of bio degradable waste was larger in total waste generated.

f) Composting was practiced by very less households.

g) Disposal of waste through burning and open dumping was found to be the most common practice. Most of the commercial establishments did not have proper dustbins.

The following recommendations are suggested on basis of findings made during the course of the study:

a) Majority of the households were found to be wiling-to-pay. Kalimpong Municipality thus must use this information for incorporating the households to make financial contributions for SWM which will in turn help the municipality overcome financial constraints.

b) The task of educating the mass at large should be undertaken by Kalimpong Municipality by organizing awareness programmes, workshops and also training staff who go for house-to-house collection so that they can in turn educate households about the importance of waste segregation and the value that can be generated.

c) Composting of waste should be made one of the major tools for waste management as the organic share of total waste generated is higher. The municipality must take active initiative to educate households about benefits of composting. Households should be given small composting bins by the municipality so that they can practice composting at their own households thus reducing a large amount of waste at the source.

d) The issue of open dumping and burning should also be taken into account by Kalimpong Municipality and awareness should be generated regarding ill-effects of burning waste in open dumps as well as open dumping.

e) Each ward commissioner should be given responsibility to see that proper waste disposal takes place in their respective wards and no indiscriminate dumping is done in the forests and barren lands which leads to environmental and health issues as well as loss of aesthetic values. Each commercial establishment should be asked to keep at least one dustbin in their premises for exclusive use of their customers.

f) Lastly Kalimpong Municipality must develop a strong administrative set up and a waste management system taking into consideration the various factors specifically unique to this region.

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ANNEXURE A

Type of Waste Composition by Income Level

CURRENT ESTIMATES						
Income Level	**Organic (%)**	**Paper (%)**	**Plastic (%)**	**Glass (%)**	**Metal (%)**	**Other (%)**
Low income	64	5	8	3	3	17
Low Middle Income	59	9	12	3	2	15
Upper Middle Income	54	14	11	5	3	13
High Income	28	31	11	7	6	17

2025 Estimates						
Income Level	**Organic (%)**	**Paper (%)**	**Plastic (%)**	**Glass (%)**	**Metal (%)**	**Others (%)**
Low income	62	6	9	3	3	17
Low Middle Income	55	10	3	4	3	15
Upper Middle Income	50	15	12	4	4	15
High Income	28	30	11	7	6	18

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Annexure B

Estimated Solid Waste Management Cost 2010 and 2025

Country Income Group	2010 Cost(US $ Billions)	2025 Cost (US $ Billions)
Low Income Countries	1.5	7.7
Low Middle Income Countries	20.1	84.1
Upper Middle Income Countries	2.5	63.5
High Income Countries	159.3	220.2
Total Global Cost (US $)	205.4	375

Source:http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1334852610766/What_a_Waste2012_Final.pdf.MSW Disposal by Income (Million tonnes)

Annexure C

Share of Population living in Urban and Rural areas of India

Year	Rural	Urban
1901	89.2	10.8
1951	82.7	17.3
2011	68.8	31.2

Source: Census of India 2011.

Annexure D

Municipal Solid Waste Generation in India (State-wise)

States/ Union territories	Municipal solid Waste MT/ day 1999-2000			(Municipal solid Waste MT/ day (2009-12)
	Class – I Cities	Class – II Towns	Total	
Andaman and Nicobar				50
Andhra Pradesh	3943	433	4376	11500
Arunachal Pradesh				93.80
Assam	196	89	285	1146.28
Bihar	1479	340	1819	1670
Chandigarh	200			380
Chhattisgarh				1167
Daman Diu and Dadra				41
Delhi	4000		4000	7384
Goa				193
Gujarat				7378.78
Haryana	3805	427	4232	536.85
Himachal Pradesh	623	162	725	304.3
Jammu and Kashmir	35		35	1792
Jharkhand				1716
Karnataka	3118	160	3278	6500
Kerala	1220	78	1298	8338
Lakshadweep				21
Maharashtra	8589	510	9099	19.204
Manipur	40		40	112.9
Meghalaya	35		35	284.6
Mizoram	46		46	4742
Madhya Pradesh	2286	398	2684	4500
Nagaland				187.6

Orissa	646	9	655	2239.2
Pondicherry	60	9	69	380
Punjab	1001	265	1266	2793.5
Rajasthan	1768	198	1966	5037.3
Sikkim				40
Tamil Nadu	5021	382	5403	12504
Tripura	33		33	360
Uttar Pradesh	5515	445	5960	11.585
Uttaranchal				752
West Bengal	4475	146	4621	12557
Total	48134	3991	52125	127485.107

CPCB (2012) "Status Report on Municipal Solid Waste Management"

INTERVIEW SCHEDULE

Name: _____

Age: _____ Gender: ____

Community: _____ Ward no: ___

Educational qualification

Below Secondary	Secondary	Higher Secondary	Graduation	Post graduation and above

Marital status of the respondents:

Married	Single	Separated	Widowed

Whether a permanent resident of Kalimpong:

Yes		No	

If not then state reason for stay in Kalimpong:

No of family members: _____

Household ownership:

Own	Rented	Informal Settlement

Do you have a proper Sanitation facility at Home?

Yes		No	

If not then state the reason

_____

_____

_____

Occupation Status:

Unemployed	Self Employed	Government Employee	Private Employee

Total Household Income: _____

Do you use dustbins?

Yes	No

If yes, please state the number of dustbins in your household: _____

Do you have different dustbins for wet and dry waste?

Yes	No

Quantity of waste generated per day: _____

Waste composition:

Bio-degradable waste	Non- biodegradable waste

Waste Disposal Practices Followed:

Open burning	Composting	Throwing in the Dumpsite	Open dumping

Where do you throw your waste?

Inside your own premises	On other peoples premises	Nearby lane	Jhora	The roadside	Municipality Vats	In some barren land or forests

Who do you think is responsible for this problem?

The Municipality	The lack of public concern and participation	Lack of proper Governance	Lack of proper infrastructure

Whether facing any kind of health problem due to improper waste management

Yes	No

If yes, state the kind of health problem you are/ you did face:

_____

_____

_____

_____

Do you have availability of proper sanitation, waste disposal services and drainage system in your ward?

Yes	No

If yes rank in order of preferences: 1st, 2nd and 3rd according to your priority:

Particulars	Rank
Sanitation	
Waste Management:	
Proper Drainage System:	

Do you know about the current waste disposal practices in Kalimpong?

Yes	No

	Particulars	Yes	No	If no then please State your reasons for 2 and 5.
1	Whether making any payment to the Municipality or other Private firms at present for waste management services			
2	Whether you are willing to pay some amount for improving waste management problems in Kalimpong:			
3	If they know about segregation:			
4	Do you practices segregation:			
5	Do you think waste management is a problem in Kalimpong			
6	Whether contended with the current workings of the Municipality			

If Willing-to-Pay choose the maximum amount that you would be Willing to Pay per month:

Amount	Yes	No	Maximum amount willing to pay
10-50			
100-200			
200-300			
300-400			
400-500			
500-600			
600-700			
700-1000			

Any Recommendations or Suggestions:

_____

_____

_____

_____

_____