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A STUDY OF SELECTED MUNICIPALITIES' SOLID WASTE MANAGEMENTPRACTICES IN SELECTED DISTRICTS

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ABSTRACT

The rapid pace of urbanization and population growth in India has intensified the challenges associated with solid waste management, necessitating a thorough investigation into the practices employed in municipalities. This study aims to address this imperative by focusing on selected municipalities within specific districts and pursuing four primary objectives. Firstly, it systematically examines the various methods currently in use for solid waste management in India, encompassing collection, transportation, disposal, and recycling initiatives. Secondly, the research conducts a comparative analysis of these methods across different cities in the country, considering their effectiveness, efficiency, and sustainability in diverse urban contexts. Thirdly, the study delves into the landscape of Public Private Partnership (PPP) models operational in solid waste management, analyzing collaborative approaches between governmental bodies and private entities. Finally, it compares these PPP models, identifying strengths and weaknesses in different urbansettings.

The scope of the study is comprehensive, providing insights into the socio-economic, demographic, and geographic factors influencing solid waste management practices. The geographical focus is on selected municipalities within specific districts, allowing for a nuanced understanding of regional variations. The findings aim to inform policy-making and urban planning by identifying best practices, areas for improvement, and effective PPP models. This study contributes to the broader discourse on sustainable solid waste management practices in Indian municipalities, offering valuable recommendations for enhanced environmental stewardship and public health outcomes.

Keywords: Solid waste management, PPP, urban.

1. INTRODUCTION

1.1 Background of the Study

India is one of the oldest civilizations in the world. Spanning a period of more than 4000 years and witnessing the fusion of several customs and traditions, which are reflective of the rich culture and heritage. It covers an area of 3,287,590 sq. km., extending from the snow-covered Himalayan heights to the tropical rain forests of the south. As the 7th largest country in the world, India stands apart from the rest of Asia. It is marked off as by mountains and the sea, which give India a distinct geographical entity. Bounded by the Great Himalayas in the north, it stretches southwards and at the Tropic of Cancer, tapers off into the Indian Ocean between the Bay of Bengal on the east and the Arabian Sea on the west, (Know Your India - Embassy of India). India is the second largest nation in the world, with a population of 1.21 billion, (Census 2011) accounting for nearly 18% of world‘s human population. A total of 181 million people increased from the previous Census of 2001. India is now among the top 10 countries generating the highest amount of Municipal Solid Waste, due to growing urbanization and high consumption. This is primarily because of the large size of the urban population and the city-dwellers adopting high-consumption lifestyles. Hence India is facing a sharp contrast between its increasing urban population and available services and resources. Solid Waste Management (SWM) is one such service where India has an enormous gap to fill. Proper Municipal Solid Waste (MSW) disposal systems to address the burgeoning amount of wastes are absent.

Solid Waste disposal and Management both are urban and rural problems. It is a crucial problem not only for developing countries, but for the developed countries as well. Enormous amount of Waste is generated throughout the world and the most crucially posed question is how to manage these wastes effectively and efficiently to save the environment and the continuous existence of mankind. Every person is a potential generator of waste and thus a contributor to this problem. Waste is generated by, and from different sectors- domestic, commercial, industry and others, but the Waste Management responsibility has been left to the government or administrative authorities only. Hence the municipalities, cities and towns continue to grapple with the problem of Solid Waste Management. Today there is a growing consensus that the immediate stakeholders in the issue of Solid Waste, in this case the residents need to join hands with the authorities in dealing with this problem that has far-reaching environmental and human health effects.

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Fig.1 Overflowing garbage bin in pcmc city

Urban India is facing a massive waste disposal problem which will worsen in the coming years. With increasing population and rising income, the lifestyle of urban residents is also changing. Urban India is becoming a _use & throw society‘. The waste in bigger cities are generally paper, plastics, metal and hazardous materials apart from vegetables wastes. Bio- degradable household waste has far less impact than the waste generated by activities like manufacturing of goods. The industrialization and high level of affluence influences the composition and quantity of waste. 73% to 96% of the typical family‘s waste comprises bio- degradable material in the lower income groups, while in higher income groups it is only about 26%. The per capita waste generation rate in India has increased from 0.44 kg/day in 2011 to 0.68 kg/day in 2021, fuelled by changing lifestyles of _use and throw theory‘. Urban population growth and increase in per capita waste generation have resulted in a 50% increase by Indian cities within only a decade since 2011. There are 53 cities in India with a million plus population. They together generate 86,000 tons per day (TPD) ie.31.5 million tons per year of MSW at a per capita waste generation rate of 500 grams/day. The total MSW generated in urban India is estimated to be 68.8 million tons per year (TPY) or 188,500 TPD of MSW. Such a steep increase in waste generation within a decade has severed the stress on all available natural, infrastructural and budgetary resources. Big cities collect about 70% to 90% of MSW generated, whereas smaller cities and towns collect less than 50% of waste generated (Kumar, 2009). More than 91% of the MSW collected formally and filled on open lands and dumps. MSW rules 2000 made by the Government of India to regulate the management and handling of Municipal Solid Wastes, provide a framework for treatment and disposal of MSW. These rules are the result of a Public Interest Litigation in the Supreme Court of India. The MSW rules 2002 and other documents published by the Government of India (GOI) recommend adoption of different technologies for SWM. Due to lack of data and infrastructural, financial and human resources, the Supreme Court mandate of complete compliance to the rules by 2003 could not be achieved by urban local bodies (ULBs) and that goal still remains to be a distant dream. As aresult, even after a decade since the issuance of the MSW Rules 2000, the state of MSW Management Systems in the country continues to raise serious public health concerns. Although some cities have achieved some progress in SWM, many citiesand towns have not even initiated measures. Initiatives in PCMC were the result of heavy rains in 2006, and consequent flooding due to drains clogged by Solid Waste. Also in 2009 the Arabian Sea did throw back at the PCMC City what the city has been throwing into it for long time. Data compiled by the PCMC shows that the city got as much as 640 tons of waste comprising plastic, polythene bags and thermocol from the sea in three days, (Times of India, dated 28thJuly 2009). Most of the garbage makes its way into the sea through the nullahs and it also reflects our appalling garbage segregation performance. Some of the reasons for this could be the lack of public awareness or insensitivity towards the environment. Thus these two incidents paved the way for enacting state level legislation pertaining to the collection, transport and disposal of urban Solid Waste in the state of Maharashtra. The Bubonic plague epidemic in Surat in 1994, kick started measures to properly manage wastes in Surat, and increased awareness on the need for proper SWM systems all over India. In India, segregation and storage of MSW at source is lacking and the decomposable and non-decomposable wastes are often disposed of at a common communal dustbin/disposal center. The collections efficiencies are also seen to be poor. Around 70% in most Indian cities continue to be predominantly manual in nature. Transfer stations are rarely used and the same vehicle that collects, refuse from the individual communal bins is also responsible for taking it to the processing or the disposal site. Collection and transportation activities constitute approximately 80% to 95% of the total budget of Municipal Solid Waste Management (MSWM). Hence, it forms a key component in determining the economics of the entire MSWM system. On the contrary, disposal and treatment of waste is an underinvested area and open, uncontrolled and poorly managed landfills are a common feature across most Indian cities and towns.

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Fig 2 Vehicle used to carry municipal solid waste

Until now, the problem of waste has been seen as rubbish as one of cleaning and disposing. But a closer look at the current and future scenario reveals that waste needs to be treated holistically, recognizing its natural resource roots as well as health impacts. Waste can be wealth, which has tremendous potential not only for generating livelihoods for the urban poor but can also enrich the earth through composting and recycling rather than spreading pollution as has been the case. Increasing urban migration and a high density of population will make SWM a difficult issue to handle in the near future, if a new paradigm for its management is not created.

The ever increasing urban population has put tremendous pressure on the budgetary resources of States/Urban Local Bodies (ULBs), underscoring the necessity of private sector participation in urban development. The unbundling of services and ethnological innovations have opened up these areas to private sector participation. Also in order to overcome the technical and financial deficiencies associated with the current system, state and local governments in India are increasingly resorting to these of private ntractors for collection, transportation and disposal and private capital to supplement the mechanization/improvisation process.

In fact, private participation in the provision of MSW services is not new India and corporation/municipalities have employee private contractor secondary transportation from the communal bins or collection points to the disposal sitessince1985. However, the services provided for by the private sector then were contractual in nature and were confined to one or two segments of the MSW value chain. In recent times, the engagement of private sector participation has increased from short term contracts to long-term partnerships. Close to 31 long-term Build- Operate-Transfer concessions have been awarded to the private sector till March, 2011to Manage Solid Waste in the country. In spite of this, the involvement of Public Private Partnership (PPP) is in a nascent stage.

Solid waste management has become a major environmental issue in India. The per capita of MSW generated daily, in India ranges from about 100 gm in small towns to 500 gm in large towns. Although, there is meager information at national level for MSW generation by specific source. Whereas, much details are available about collection and disposal. The increase in solid waste generation has been reported after the studies for a few urban centers. For example, the population of PCMC grew from around 8.2 million in 1981 to 12.3 million in 1991, registering a growth of around 49%. On the other hand, MSW generated in the city increased from 3,200 tons per day to 5,355 tons per day in the same period registering a growth of around 67% (CPCB, 2000b). This clearly indicates that the growth in MSW generation in our urban centers has outpaced the population growth in recent years. This trend may be ascribed to our changing lifestyles, food habits, and change in living standards.

Traditionally, waste management services in India had been far from optimal as compared to waste management services from developed countries. On the basis of physical and chemical characteristics of the city refuse, it has been estimated that a transport capacity of 320 m3 per day would be required to transport the garbage generated per million of the population. A study on 44 Indian cities in mid-nineties revealed that majority of them failed to qualify on this account (Bhoyar et al., 1996). Another survey of 157 Indian cities depicted that, most of the local bodies did not satisfy the prevailing benchmark of optimum workforce requirement in garbage collection and disposal.

1.2 Definitions and Classification of Solid Wastes

In order to plan, design and operate a solid waste management system, a thorough knowledge of the quantities generated the composition of wastes and its characteristics are essential. As a first step, a proper definition of the terms is necessary to avoid the general confusion that is common in the usage of these terms.

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Definition of waste

Wastes are substances or objects, which are intended to be disposed of, or are required to be disposed by the provisions of national laws. Additionally, wastes are such items which people are required to discard, for example by law because of their hazardous properties. Many items can be considered as waste like household rubbish, sewage sludge, wastes from manufacturing activities, packaging items, discarded cars, old televisions, garden waste, old paint containers etc., Thus, all our daily activities give rise to a large variety of different wastes arising from different sources. The rising quality of life and high rates of resource consumption patterns have had an unintended and negative.

impact on the environment- the generation of wastes far beyond the handling capacities of governments and agencies

Waste means —

a) any discarded, rejected, abandoned, unwanted or surplus matter, whether or not intended for sale or for recycling, reprocessing, recovery or purification by a separate operation from that which produced the matter; or

b) Anything declared by regulation (after consultation under section 5A) or by an environment protection policy to be waste. Whether of value or not.

Solid waste

Garbage, rubbish, trash, refuse, or sludge, as well as other discarded materials produced by agricultural, community, industrial, home, medical, mining, or municipal processes. Efforts to limit the environmental impact of solid waste, from the point of production through recovery processes to disposal and recycling, are known as solid waste management

Municipal Solid Waste Definitions

It is difficult to present a single comprehensive and universal definition of Municipal Solid Waste.

Municipal Solid Waste (MSW) more commonly known as trash or garbage consists of everyday items we use and then throw away, such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paint, and batteries. This comes from our homes, schools, hospitals, and businesses. Municipal solid waste (MSW), commonly known as trash or garbage in the United States and as refuse or rubbish in Britain, is a waste type consisting of everyday items that are discarded by the public. "Garbage" can also refer specifically to food waste, as in a garbage disposal; the two are sometimes collected separately. Solid waste is also defined as _Any garbage, refuse, sludge from a waste treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolids or contained gaseous material resulting from industrial, commercial, mining and agricultural operations and community activities.

In legal terms, the term "municipal solid waste" is defined so as to means waste material- (i) generated by a household (including a single or multifamily residence); and

(ii) generated by a commercial, industrial, or institutional entity, to the extent that the waste material

is essentially the same as waste normally generated by a household;

is collected and disposed of with other municipal solid waste as part of normal municipal solid waste collection services; and contains a relative quantity of hazardous substances no greater than the relative quantity of hazardous substances contained in

waste material generated by a typical single-family household.

(B) Examples.

Examples of municipal solid waste under subparagraph

(A) include food and yard waste, paper, clothing, appliances, consumer product packaging, disposable diapers, office supplies, cosmetics, glass and metal food containers, elementary or secondary school science laboratory waste, and household hazardous waste.

(C) Exclusions. The term "municipal solid waste" does not include—

combustion ash generated by resource recovery facilities or municipal incinerators; or (ii) waste material from manufacturing or processing operations (including pollution control operations) that is not essentially the same as waste normally generated by households. Municipal Solid Waste (MSW): means and includes solid waste resulting from the operation of residential, commercial, industrial, governmental, or institutional establishments that would normally be collected, processed, and disposed of through a public or private solid waste management service. Municipal solid waste does not include hazardous waste, sludge, or solid waste from mining or agricultural operations.13 Solid wastes are all the wastes arising from human and animal activities that are normally solid and are

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discarded as useless or unwanted. The Municipal Solid Wastes (Management and Handling) Rules, 2000 has defined municipal solid waste_ as commercial and residential wastes generated in a municipal or notified areas in either solid or semi-solid form excluding industrial hazardous wastes but includes treated bio-medical wastes._ Under the Municipal Solid Waste Management Rules 2016, "solid waste" is defined so as Tomean and include solid or semi-solid domestic waste, sanitary waste, commercial waste, institutional waste, catering and market waste and other nonresidential wastes, street sweepings, silt removed or collected from the surface drains, horticulture waste, agriculture and dairy waste, treated bio-medical waste excluding industrial waste, biomedical waste and e-waste, battery waste, radio-active waste generated in the area under the local authorities and other entities mentioned in rule 2 and residual solid waste means and includes the waste and rejects from the solid waste processing facilities which are not suitable for recycling or further processing. The objective of the study is to compare the various PPP models operative in Solid Waste Management in different cities of India. The escalating challenges posed by rapid urbanization and population growth in India necessitate a comprehensive examination of solid waste management practices in municipalities across selected districts. Despite the increasing awareness of the environmental and public health implications associated with improper waste disposal, there exists a critical gap in understanding the diverse methods employed for solid waste management in different regions of the country. This study aims to address this gap by focusing on selected municipalities within specific districts and pursuing four primary objectives. Firstly, it seeks to systematically investigate and document the various methods currently in use for solid waste management in India. Secondly, the study aims to compare these methods, evaluating their efficacy and environmental impact, across different cities in the country. Thirdly, it intends to analyze the landscape of Public Private Partnership (PPP) models operational in the realm of solid waste management, shedding light on collaborative approaches involving governmental bodies and private entities. Finally, the research endeavors to draw comparisons among the diverse PPP models, discerning their strengths and weaknesses in varying urban contexts. By delving into these aspects, this study aspires to provide valuable insights and recommendations that can inform policy-making and contribute to the enhancement of solid waste management practices in India's

2. LITERATURE REVIEW

Extensive literature exists in urban solid wastes management. These studies help us to understand the issue and its impacts on the environment. Majority of the studies conducted in this area of research is in respect of developed countries as regards Kerala, the impact assessment studies have done by researchers which highlight the seriousness of the issue. More micro level studies are needed to address the issue. A brief review of the available literature sheds light into this area of research.

Bhattarai. R. C. (2000) analyzed the household behavior on solid waste management in Kathmandu metropolitan city and found household size and income as the major determining factors for the total quantity of wastes generated.

Salhofer (2001) has dealt with four different approaches to analyze waste generation rates.

i) Input –output models: In input –output models the input of the waste generator is assessed by using production, trade and consumption data about products related to the specific waste stream; ii) Factor models: These models consider analyzing factors like income, housing types etc which describe the processes of waste generation; iii) Region specific classification iv) Single point of generation based classification and v) Macro level classification.

P. Beigl et al (2003) has identified the parameters that explain the present situation and to assess the future amount of municipal solid waste generated per capita in different European cities. Gross domestic product was found to be a significant factor in cities with high prosperity but not for cities with a lower economic output. Of the social indicators, a positive relationship existed between the percentage of the medium age group (15-59) and municipal solid waste generation while a negative relationship existed between the average household size and the solid waste generation.

Pratt. R. M. et al (2000) has analysed the impact of Waste minimization clubs on waste minimization. Waste minimization clubs are formed to encourage industry and commerce to adopt waste minimization methodology. A good majority of the clubs have helped in achieving a significant reduction in solid, liquid and gaseous waste along with financial savings due to higher efficiency.

Mongkolnchaiarunya, J. (2005) explains the new practices that were introduced in the city of Yala in Southern Thailand to deal with the problem of solid waste management. One of the practices was known as _Garbage for Eggs in which the residents were allowed to exchange recyclable material for eggs. The important objectives of the project were waste reduction, community empowerment through self-reliance, establishing new relationships of equality and less dependence between poor communities and the municipal administration.

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Kaseva et al (2005) considered the effect of privatization on solid waste collection and disposal in Dar es Salaam city, Tanzania. The total solid waste generation was around 2425 tons/day. It was found that with privatization the solid waste collection improved by 10% to 40% of the total waste generated in the city daily in 2001. The study recommends the use of waste recycling and composting activities in order to attain sustainability in waste management.

Ogedengbe et al (2006) has examined the effect of waste management method on property values in Ibadan city, Nigeria. Eleven firms of estate surveying and valuation out of thirty- six registered estate surveying and valuation firms in the study area were selected using systematic random sampling technique. In addition, 15 properties within the axis of three refuse dump sites were selected using stratified random sampling technique to know how their rental values are affected by the generation and management of these dump sites. The results showed that the waste dumps have significant negative impact on the property values in the area.

Pushpakumari (1997) analysed the effects of pollution of Travancore Titanium Products and brings out the adverse impacts of pollution from the factory. The areas very close to the factory were more prone to the pollution hazards. It was found that 19% of the people in the experimental group were affected by respiratory and related diseases. Other effects include low coconut yield, declining fish yield and fish species, corrosion of fishing crafts and gears, increasing trend of the locals leaving their traditional fishing to other occupations.etc.

Shameer Das et al (2000) in their study examined the health impacts of environmental pollution by solid waste disposal from Grasim Industries, Kerala. The effluents from the industry were found to pollute the river Chaliyar and thus directly affecting the population living nearby. It was also found that the discharges from the factory was degrading the ecological quality of the area in the form of contaminated water, polluted air, solid wastes and noise. Around 56% of the people surveyed were affected by some diseases caused by pollution. The lower and lower middle income group were most affected. The main health problems were in the form of the occurrence of diseases like persistent coughs, bronchitis, asthma, headache, cancer and eye irritation.

Nilanthi et al (2003) has analysed the environmental impacts associated with current waste disposal practices in Moratuwa, Sri Lanka, a suburb municipality in SriLanka. Municipal officials, over 300 households and landfill operators were interviewed to examine current practices and related environmental problems. Groundwater samples from the vicinity were analyzed and it showed levels of certain chemical parameters well above acceptable limits. Landfill gas emissions and possible green house gas contributions were theoretically calculated using Scholl Canyon Model for gas estimations. The main environmental problems identified in the study were the release of landfill gas and leachate. The significant amount of landfill gas which is generated from the site is released to the atmosphere contributing to global warming. Leaching of pollutants into ground water has also been found to be a significant concern due to the high use of ground water for residential purposes and due to the possible illegal disposal of industrial waste along with MSW. From the public perception worst impacts of present solid waste disposal practices are seen as direct social impacts such as odor, breeding of pests and loss in property values.

Elma Torres et al (2004) has analysed the health risk perception of communities located in Metro Manila airshed in Philippines. Majority of the respondents recognized environmental factors as sources of various diseasesymptoms and illness. The community considered proper disposal of solid waste as more important than clean air. The respondents had a positive attitude towards pollution control as majority of them were willing to pay for clean air.

N. Raman et al (2008) have analysed the impact of solid waste on groundwater and soil quality on places closer to Pallavaram solid waste landfill in Chennai. The physical and chemical parameters like Ph, electrical conductivity, total dissolved salts, total suspended solids, alkalinity calcium, magnesium, chloride and metals like sodium, potassium, lead, cadmium were studied. It was found that parameters like pH, hardness of water, calcium, and manganese were beyond the acceptable limits in accordance with the IS 10500 drinking water quality standards. In the case of alkalinity, and metals like copper, manganese, cadmium, nickel and chromium their presence were beyond the acceptable limits.

Utpal Goswami et al (2008) analysed the impact of municipal solid waste dumping on soil quality in Guwahati city. Soil samples were collected from different depths of the abandoned municipal solid waste dumping groundat Adabari in Guwahati city. The study found that the experimental value for the physico-chemical parameters increased for the solid waste treated soli when compared with the control soil. The soil pH and electrical conductivity were high and the presence of phosphorous pentoxide and calcium carbonate were found to be high.

Viniegra et al (2001) determined the economic value of an improvement in environmental quality due to an alternative household garbage collection and selection system for the inhabitants of San Pedro Choula in Central Mexico using C.V. method. The average monthly willingness to pay (WTP) for the improved collection system was

estimated at $1.85 /month /household. The income elasticity for environmental quality was found to be 0.13. The significant variables affecting the WTP were income, age and trust in government. Education, wealth, children, gender and environmental ethic were found non-significant.

Chutrat et al (2007) estimated the willingness to pay (WTP) to pay environmental taxes and their opinions on the environmental management of thehouseholds of Khon Kaen in Thailand using C.V method. It was found that the households were willing to pay taxes for their environment up to 20.88 Thai Baht per month. Their willingness to pay the taxes depended upon the education and income levels.

P. B. Anand (1999), examined how households in Madras view garbage problems, their preferences for improved services and the extent to which they would pay for them. It also includes a comparison between areas served and not served by Civic Exmore units where neighborhoods organize their own primary collection. Information was collected from focus group discussions, household interviews from across a range of income levels and spatial locations and in-depth interviews with those who manage the Civic Exnora units. The findings highlight that people are willing to cooperate and pay only for waste collection. Analysis also shows that concern for waste management cuts across all income groups. Of all the waste management services, households seem to be least concerned with final disposal. They also show how the financial viability of neighborhood collection schemes such as the Civic Exnora units depends on having transfer stations close by, to which the collected wastes can be taken.

Babu Ambat (2000), identified the types and estimated the quantities of waste generated in each ward of Thiruvananthapuram City Corporation. It was estimated that a total of 290-300 tons of solid waste were generated in the city. The contribution of the households was 181 tons followed by markets (40 tons) and hotels and restaurants (30 tons). The medical waste was about 13 tons. The non-degradable waste like plastics, paper, metals and glasses were collected from the source or from the disposal sites by a group of rag pickers. They sell these wastes to the wholesale dealers who will transport these wastes to Salem and Coimbatore for recycling. The technology optimization study considered composting as the best method for disposing waste in Trivandrum since the degradable waste content (50%) is high in the solid waste stream. Biomethanation was suggested for institutions, hotels and marriage halls. The important aspects of the solid waste management action plan included a) segregation and characterization of the wastes at the source itself b) decentralized collection from the primary source and centralized collection from secondary sources c) strengthening the existing informal waste collection sector

d) Detailed transportation network planning.

Reghunandhan (2001) studied the generation, composition, disposal methods and collection and transportation problems of solid waste management in Chalakudy town and Pattambi town. The Chalakudy Municipality generated on an average 1.5 to 2 tones of waste per day which was dumped on two open landfills.. The proportion of organic waste was found to be around 73%.Pattambi town generated around 2 tons of waste per day whose organic component was found to be 66%. Slaughter houses (35%) and shops (21%) were the main sources of waste while households contributed around 6% to the total waste generated. The main methods of disposal of wastes were by dumping in pits (49%) and into common bins (22%).

P. R. SreeMahadevan Pillai (2002) in his study on the disposal and management of waste in Palakkad municipal area analysed the composition of waste, waste generation and disposal habits of the people. Laboratory experiments were done on the waste to understand the chemical composition of the waste. The proportion of organic waste was found to be 35.4%. Dumping of waste in ones own premise was found to be very common in Palakad (around 65% of the households did that). The utilization of municipal waste bins was considered to be very low at 15%. The study recommends the installation of a completely mechanized solid waste treatment plant for processing mixed waste.

C. N. Ray (2003), examined the present solid waste management scenario in the city of Ahmedabad and has identified the problems of the existing systems and analysed the steps taken by the city corporation to rectify the problems.

Babu Ambat (2003), analysed the current practices of solid waste storage, the present waste management practices, the communities perception on the existing collection and management system in Thiruvananthapuram city. The study also examined the changed attitude of the community, people_s preference and willingness to cooperate and pay for an improved solid waste management practice and also identified the new initiatives at the local level for waste management. Lack of space and practice are considered to be the main reasons why wastes are not segregated and thrown on the road side. People are not willing to do any segregation of waste except the newspapers. Majority of the hospitals dump the waste in the dumper placer containers or burn it in the hospital premises. It was found that 55% of the households reduce, reuse and recycle the waste materials. Majority of the low-income and middle income houses burn 60% of the waste generated and sell the rest for a nominal rate. 88% of the people feel that they have a role to play in solid waste management showing the change in the attitude of the people towards solid waste management.

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People prefer a door to door collection system and were willing topay for an improved service of solid waste collection.

Varkey Mathew (2003), examined the quantity and quality of the solid waste generated in Kottayam town. Random and cluster sampling methods were used for selecting the households. The total waste generated per day was about 52.3 tons and the per capita generation was 0.62 kg/per day. It was found that the storage capacity of the community bins being inadequate. Vermicomposting was considered as the most effective method for organic wastes.

Madhushree Sekher (2004), analysed the process of municipal waste management in the city of Bangalore while focusing on the situation in Karnataka. The paper considers the characteristics of municipal waste generated, the management practices involved and the role of the stakeholders in the overall process. Inadequate municipal service, unscientific disposal system, lack of civic awareness in waste management lack of a proper market for recycled waste products .etc. are found as the most important deficiencies in the waste management system. The review shows that solid waste management has emerged as a subject of great interest and various aspects of the issue have been looked into. One of the glaring deficiencies is the lack of studies focusing on densely populated small towns in developing countries and the absence of studies analysing the socio economic and environmental impacts of solid waste management. In this context, the present study intends to bridge a gap in this area of research.

The extensive literature review on solid waste management practices in selected municipalities across various districts reveals a comprehensive understanding of the subject, predominantly drawing on studies conducted in developed countries and a few impact assessment studies in Kerala. However, a noticeable research gap exists in the lack of studies focusing on densely populated small towns in developing countries. The majority of existing research predominantly targets urban areas, and there is a scarcity of micro- level studies that specifically address the intricacies of solid waste management in smaller towns. Additionally, the literature review highlights the importance of examining the socio-economic and environmental impacts of solid waste management, but it does not delve into specific findings or studies that address this crucial aspect comprehensively. Therefore, this research aims to bridge the identified gap by conducting a detailed investigation into the solid waste management practices in selected municipalities within smaller towns, focusing on their socio-economic and environmental implications.

3 METHODOLOGY

3.1 Methodological approaches to environmental valuation

Economic valuation of resources needs to be undertaken, when the market fails to generate the true prices of the resource in question. An economic valuation helps compute the true price of a resource. Market failures are common for environmental resources mainly due to externalities which cause difficulties in valuation. Economic valuation of environmental resources can help make decisions on resource utilization and allocation more meaningful. The price paid for an economic good or service shows the consumer_s Willingness to Pay (WTP). An economy provides a mix of marketed and non- marketed goods. Environmental goods and services come under the category of non-marketed goods. Economic valuation means giving monetary values to the non -market goods and services and the economic valuation of the environment means giving monetary values to environmental goods and services. In a market the individual will buy a good when he finds that the WTP is greater than the price.

Assigning monetary values for environmental goods means finding a measure of WTP or WTA (willingness to accept a compensation for giving up the benefit) for an environmental good. Economic valuation is all about finding a WTP or WTA measure when market is incapable of providing that information.

3.2 Economic values of environmental assets

To find out the economic value of the environment, the concept of Total Economic Value (TEV) is used. Identifying and determining the economic values of environmental resources and measuring these values is a difficult process. The goods and services provided by the environment include recreation and tourism, plant and wildlife habitat, genetic resources, water supply, protection against natural disasters, etc. Many of these goods and services are not traded on commercial markets and therefore have no market value. The values of non-market goods and services have to be measured and expressed in monetary terms, so that they can be treated as commercially traded components. Figure: 3.1 show the various concepts associated with TEV.

TEV is the sum total of the use and non-use value of the environmental good. The use value refers to the values derived from the actual use of the resource and includes direct use values, indirect use values and the option values. Direct use values refers to the direct use of a protected area, for instance, for activities such as recreation, tourism, natural resource harvesting, hunting, gene pool services, education and research. These activities can be commercial, meaning they are traded on a market or non-commercial, meaning there is no formal or regular market on which they

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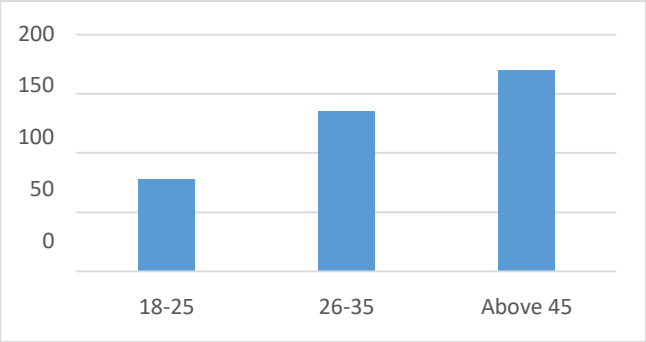
are traded. Indirect use value means the values derived from the indirect use of a protected area and option values are derived from using the good in the future. Non-use value refers to the values that are not associated with the actual use of the resource include existence values and bequest values. The existence values is the value derived from the knowledge that a good is existing and bequest values are those which is derived by the fact that others are benefiting or will benefit from the good. Non-use values are particularly difficult to measure. With the emergence of environmental economics the link between ecology and economics is more visible. Economists and ecologists have now a common interest in understanding the economic contribution of the environment.

3.3 Non-market valuation

The valuation of environmental issues like biodiversity loss, global warming, and species extinction is highly complex. Economists have developed new ways for calculating the economic and social values of environment. In the environmental context, it is necessary to impute a value to the environmental good or service. Economic valuation tries to measure human preferences for or against changes in the state of environments (Pearce1992). In economic valuation the theoretical statement is that preferences are already formed and economists try to find out the true underlying preference about environmental goods and services (Clive L.Spash et al 2001). Environmental economics has developed techniques whereby such values can be imputed. In the market place individuals exercise choice by comparing their WTP with the price of the product. They purchase the good when their WTP exceeds the price, and not otherwise. Imputing values involves finding a measure of WTP for environmental quality. Economic valuation involves finding a WTP measure in circumstances where markets fail to reveal that information directly. The purpose of economic valuation is to reveal the true costs of using up scarce environmental resources. Environmental valuation is thus forms an integral part in the determination of the balance between conservation and development and in the choice of environmental standards.

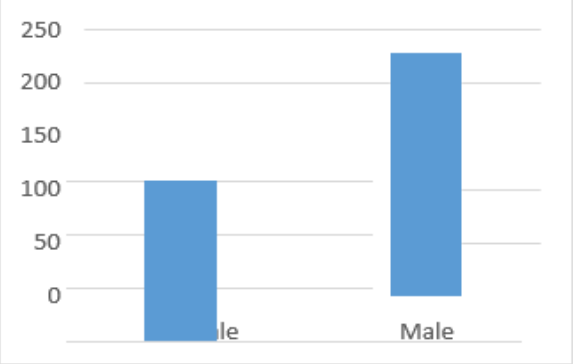
4 RESULTS & DISCUSSION

4.1 Data Analysis



Graph 1: Age

Analysis : As we can see in above graph the respondents who are age between 18-25 are 20.3%, respondents who are age between 26-35 are 35.4% and the respondents who are age of above 45 are 44.3% Interpretation: As we can see there are more no of respondents who are age of above 45 and rest are less.



Graph 2: Gender

Analysis : As we can seen in above graph there are 40.6% respondents who are Female , 59.4% respondents who are Male

Interpretation: There are more no of male respondents i.e 59.4% as compared to female who responded.

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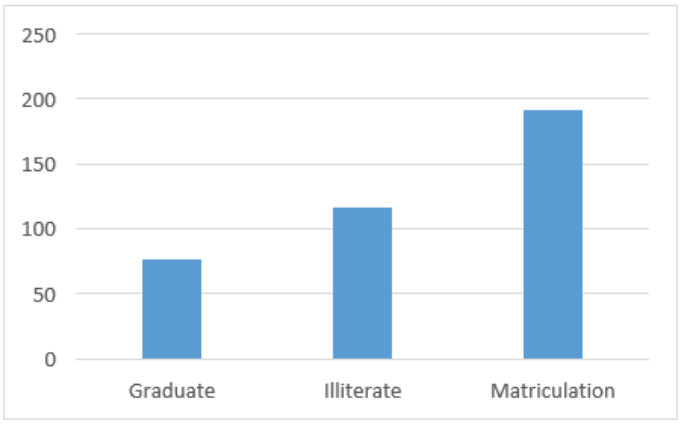
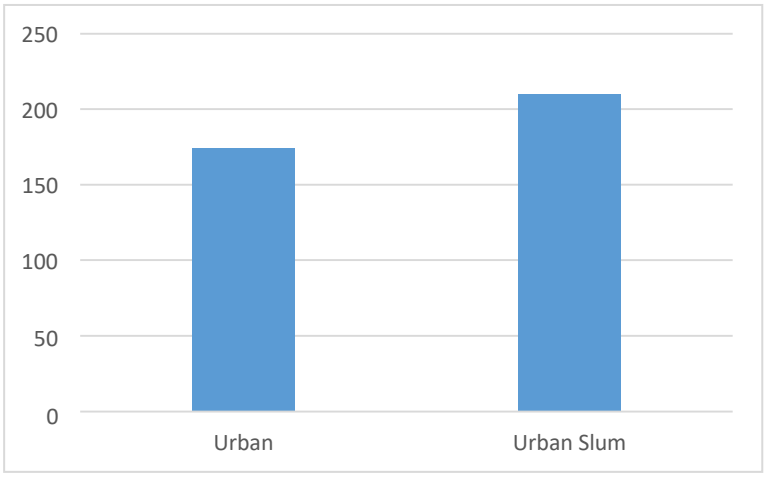


Graph 3: Education

Analysis: As we can seen in above graph there are 20.1% respondents who are completed their graduation, 30.2% respondents who are illiterate, 49.7% respondents completed their matriculation

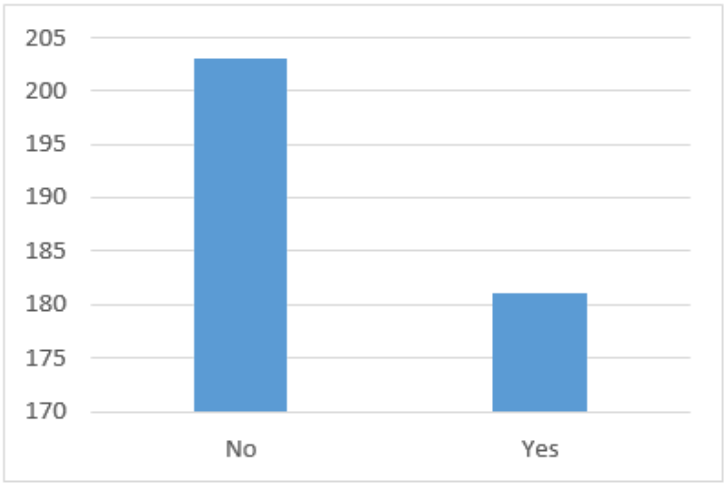
Interpretation: There are more no of respondents who are completed their matriculation as compared to other.



Graph 4: Area

Analysis: As we can seen in above graph there are 45.3% respondents who are from urban area and there are 45.3% respondents who are from urban slum area

Interpretation: There are more no of respondents who are from urban slum area as compared to other who responded.



Graph 5: Waste segregation happen in your area?

Analysis : As we can seen in above graph there are 52.9% respondents who responded ‒No‖ i.e. in their area waste segregation is not happen, 47.1% respondents who responded ‒Yes‖ i.e. in their area waste segregation is happen

Interpretation: There are more no of respondents who says ‒No‖ i i.e. in their area waste segregation is not happen.

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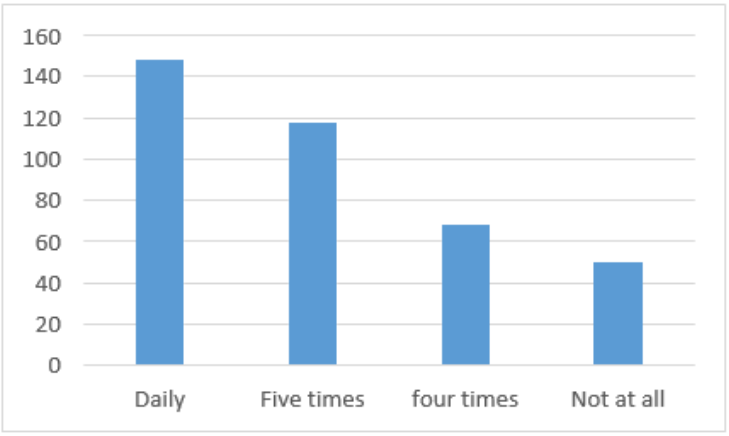
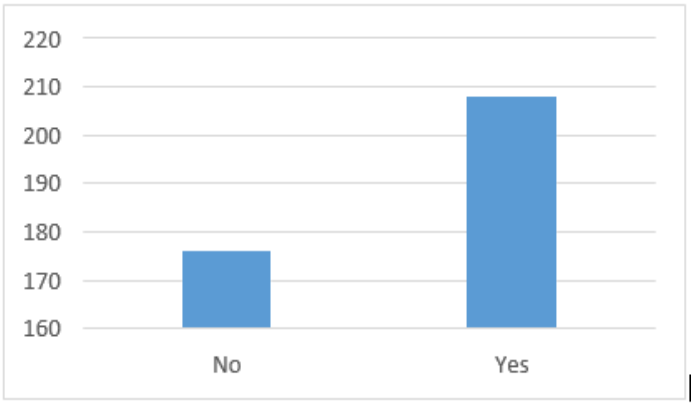


Graph 6: How many times was the waste collected in a week?

Analysis: As we can see in above graph there are 38.5% respondents who responded ‒Daily‖, 30.7% respondents who responded ‒Five times‖, 17.7% respondents who responded ‒Four times‖, 13% respondents who responded ‒Not at all‖

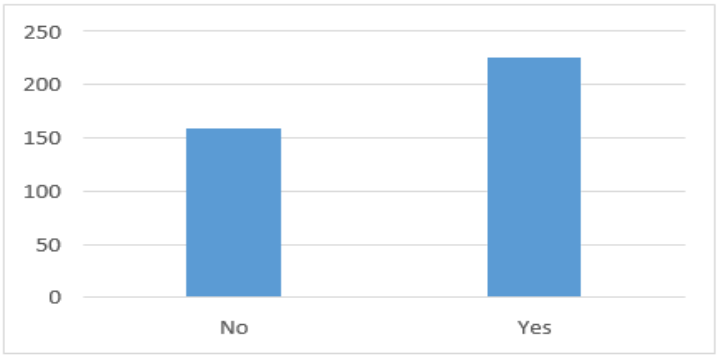
Interpretation: There are more no of respondents who says ‒Daily‖ means waste collection happen in daily basis as compared to other.



Graph 7: Did you have access to solid waste collection services provided by PPP?

Analysis: As we can seen in above graph there are 45.8% respondents who responded ‒No‖ i.e. they don‘t have access to solid waste collection services provided by PPP, 54.2% respondents who responded ‒Yes‖ i.e. they have access to solid waste collection services provided by PPP

Interpretation: There are more no of respondents who says ‒Yes‖ i.e. they have access to solid waste collection services provided by PPP.



Graph 8: Did the Waste collectors provided by PPP execute their task well ?

Analysis: As we can seen in above graph there are 41.4% respondents who responded ‒No‖ i.e. they think waste collectors provided by PPP didn‘t execute their task well, 58.6% respondents who responded ‒Yes‖ i.e. they think waste collectors provided by PPP execute their task well

Interpretation: There are more no of respondents who says ‒Yes‖ i.e. they think waste collectors provided by PPP execute their task well.

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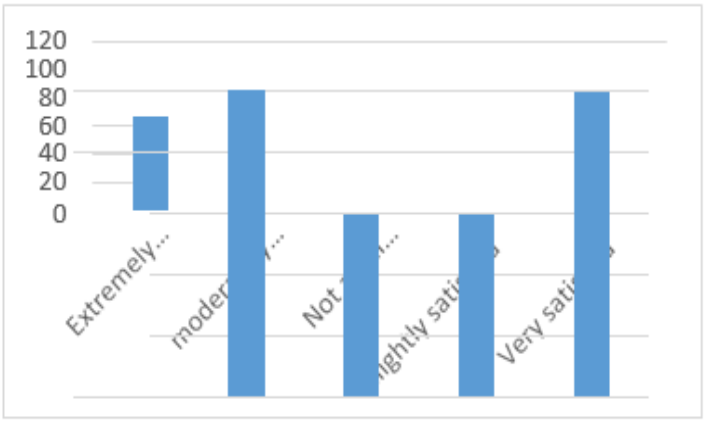
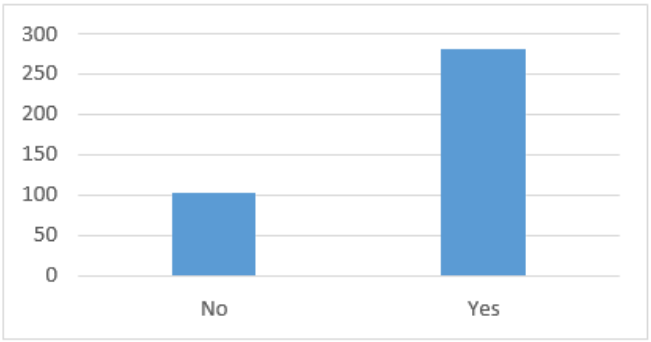


Graph 9: How satisfied were you with service delivery of PPP?

Analysis: As we can seen in above graph there are 17.4% respondents who responded ‒Extremely satisfied‖, 27.6% respondents who responded ‒moderately satisfied‖, 15.4% respondents who responded ‒Not at all satisfied‖, 14.1% respondents who responded

‒slightly satisfied‖, 25.5% respondents who responded ‒Very satisfied‖

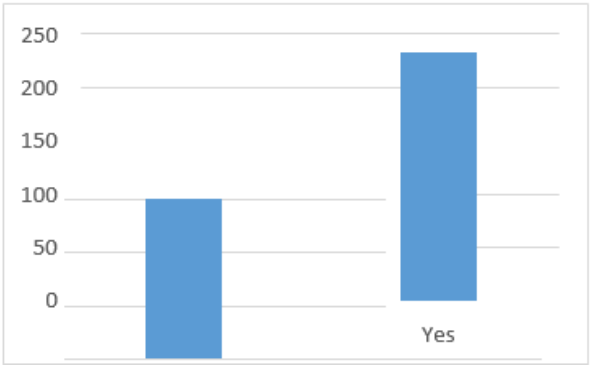
Interpretation: There are more no of respondents who says ‒moderately satisfied‖ i.e they moderately satisfied with service delivery of PPP



Graph 10: Did the PPP for waste collecting redress your complaints timely and efficiently?

Analysis : As we can seen in above graph there are 32% respondents who responded ‒No‖ i.e. they think PPP for waste collecting didn‘t redress complaints timely and efficiently, 68% respondents who responded ‒Yes‖ i.e. they think PPP for waste collecting redress complaints timely and efficiently

Interpretation: There are more no of a respondent who says ‒Yes‖ i.e. they think PPP for waste collecting redress complaints timely and efficiently



Graph 11: Do you think involvement of private sector in solid waste services has been useful?

Analysis : As we can seen in above graph there are 39.6% respondents who responded ‒No‖ i.e. they It is not helpful to believe private sector engagement with solid waste operations, 60.4% of respondents who said yes, i.e. they consider private sector participation in the services of solid waste has been beneficial

Interpretation : There are more no of respondents who says ‒Yes‖ i.e. Considered beneficial was private sector participation with solid waste services.

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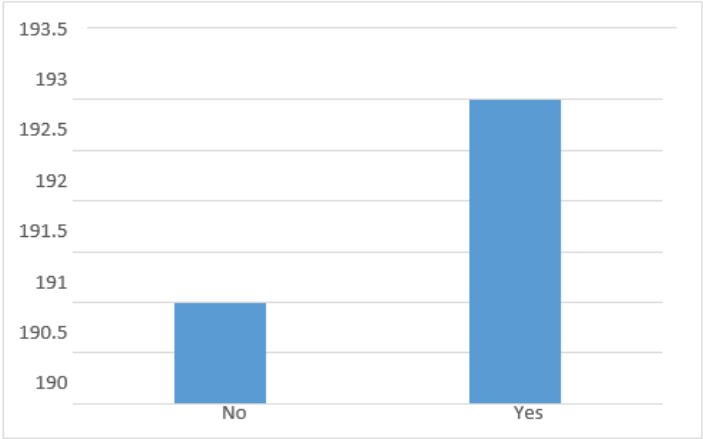
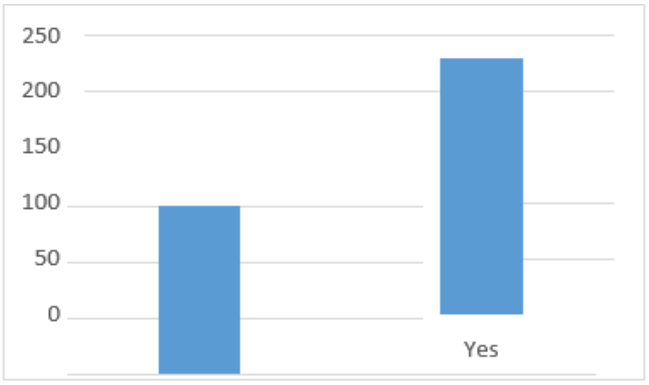


Graph 12: Do you think public private partnership is a better alternative for management of solid waste in your city?

Analysis : As we can seen in above graph there are 49.7% respondents who responded ‒No‖ i.e. They believe that public-private partnerships are never a better option for their municipal trash management, 50.3% of those answering 'Yes' that they believe that public-private partnering is a better alternative to solid waste management within their city.

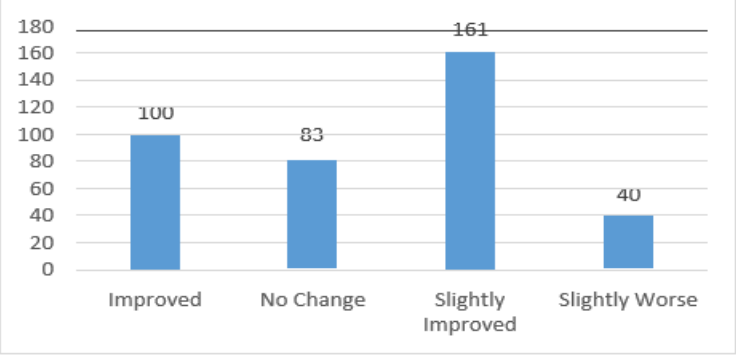
Interpretation: There are more no of respondents who says ‒Yes‖ i.e. they Consider public private partnership as a better option for solid waste management in your community.



Graph 13: Have you ever complained about the waste collection service provider ?

Analysis : As we can seen in above graph there are 40.1% respondents who responded ‒No‖ i.e. they haven‘t complained about the waste collection service provider , 59.9 % respondents who responded ‒Yes‖ i.e. they complained about the waste collection service provider

Interpretation: There are more no of respondents who says ‒Yes‖ i.e. they complained about the waste collection service provider.



Graph 14: How do you compare the period when Solid Waste was collected only by the PPP ?

Analysis: As we can seen in above graph there are 26% respondents who responded ‒Improved‖, 21.6% respondents who responded ‒No Change‖, 41.9% respondents who responded ‒Slightly Improved‖, 10.4% respondents who responded ‒Slightly Worse‖

Interpretation: There are more no a of respondent who says ‒Slightly Improved‖ i.e. they think waste collected by PPP is slightly improved.

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4.2 Reliability Analysis

Table 1: Case Processing Summary			
		N	%
Cases	Valid	384	100.0
	Excludeda	0	.0
	Total	384	100.0
a. List wise deletion based on all variables in the procedure.			

Table 2: Reliability Statistics

Reliability Statistics	
Cronbach's Alpha	No of Items
.721	11

The alpha coefficient for the four items is .721, suggesting that the items have relatively high internal consistency. (Note that a reliability coefficient of .70 or higher is considered ‒acceptable‖ in most social science research situations.)

4.3 Hypothesis Testing

H10: PPP do not have a significant impact on solid waste management.

H11: PPP has a significant impact on solid waste management.

Table 3: Model Summary

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.653	.006	.001	.30434
a. **Predictors: (**Constant), In your area door-to-door service is there? Waste segregation happen in your area? Are you from which resident?				
b. **Dependent Variable:** PPP				

Where R refers to the link between direct and separate variables. This means that the relationship among independent & dependentvariables is 65.3% positive.

The entire variance for the dependent variable, explained by such an independent variable, is shown as R-Squared. The value is 0.006, which would be excellent in that instance.

It indicates the normalization of a adjusted R-squared findings, i.e. the population variation results in numerous regressions. The R-squared & the adjusted R-squared minimum should be distinguished. In this instance, it's a value of 0.001 not far from 0.006.

Table 4: ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.044	3	.015	1.158	.024b
	Residual	35.196	380	.093		
	Total	35.240	383			
a. Dependent Variable: PPP						
b. Predictors: (Constant), In your area door-to-door service is there ?, Waste segregation happen in your area ?, Are you from which resident?						

P-value/Sig value: 95 but rather 5 percent ranges of confidence were selected for the level of significance analyses. The p-value should thus be less than 0.05.

The table above would be 0.024. The result is important as a result.

F-ratio: This indicates that the computation of variables is increased by the formulation by taking into account the imperfection of the model. The f-ratio output is higher than on the effective system. This is acceptable. The meaning of the table above is 1.158.

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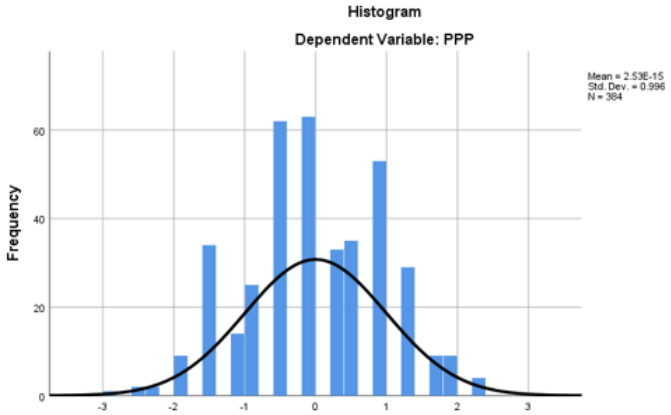
Table 5: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.920	.088		21.717	.000
	Are you from which resident?	-.001	.031	-.001	-.020	.984
	Waste segregation happen in your area ?	-.010	.031	-.016	-.314	.754
	In your area door-to-door service is there ?	-.019	.031	-.032	-.622	.535

a. Dependent Variable: PPP

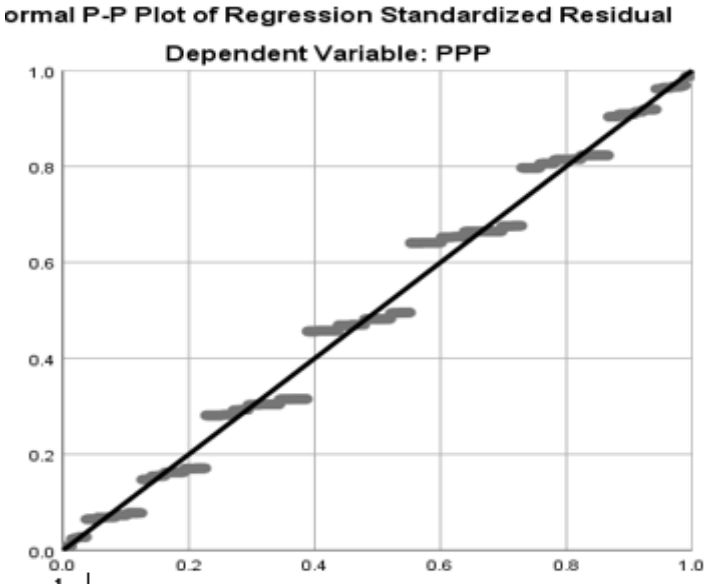
In our case P, the value (sig. Value) is 0.024, which is < 0.05 which means that our null hypothesis is rejected. Our null hypothesis H10: PPP do not have a significant impact on solid waste management. H11: PPP has a significant impact on solid waste management.

So we can conclude that PPP has a significant impact on solid waste management.



Graph 15 Regression Standardized Residual

Above histogram graph shows about dependent variable: PPP Frequency vs regression standardized residual. Maximum frequency shows in 0 regression.



Graph 16 Observed cum probe

Above normal p-p plot graph shows about dependent variable: PPP Expected cum probe vs. observed cum prob.

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5 CONCLUSIONS

5.1 Finding

As we can seen in above graph there are more no of respondents who are age of above 45 and rest are less. 20.1% respondents completed their matriculation, 30.2% respondents are illiterate and 45.3% are from urban slum area. Survey asks respondents if They consider a preferable option for solid waste management within their city to be public private partnership (PPP). There are more no of respondents who says "Yes" than those who say they are extremely satisfied with the service provided by PPP. There are more no of respondents who say they think waste collected by ppp is slightly improved. This means that the relationship among independent & dependent variables is 65.3% positive. According to the statistics, PPP seems to have a major effect upon solid waste management.

5.2 Conclusions

With a populations of 1,21 billion, India is the seventh biggest nation in this world (Census 2011). Out of the previous census in 2001, 181 million people grew. India is currently one of the 10 nations that produce Municipality Solid Waste with the largest quantity. Urban India has a major garbage disposal issue that will deteriorate in the next few years. Above and beyond vegetable waste, trash is usually paper, plastics, metal and hazardous stuff.

Bio-degradable home trash it has less repercussions than waste from activities such as production. Most of the garbage makes its way into the sea through the nullahs and it reflects our appalling garbage segregation performance. Some of the reasons could be the lack of public awareness or insensitivity towards the environment. Deposits which are unregulated, uncontrolled & poorly managed in most Indian cities are a frequent characteristic. These fields have finally opened to private sector involvement through unbundling service and technology innovation.

Nearly 31 long-term concessions in the field of buildings and transfers to a private sector have been granted till March 2011. PPP is on a new stage.

Public Private Partnership. MSW's composition and amount are the foundation for planning, design and operation of the management systems. In a number of major cities there are 285 million urban residents & 32 metropolitan cities account for 34.5% of a urban population expected to exceed 341 million by 2010. Environmental economic assessment may help make resource use and resource allocation choices more relevant.

Environmental products and services include leisure and tourism, animal and plant habitat, genetic resources, water supply & natural catastrophe prevention. It is a challenging task to identify and determine the economic worth of natural assets. TEV seems to be the entire sum of a environmental good's use & non-use value. Value of use refers to values generated from a actual resource usage, including values for direct use, indirect use, and choice options. Existence values & bequest values are included among non-use values.

For environmental assessment, a variety of economic methods & models have been created. Figure:3.2 illustrates the different environment assessment techniques.

Hedonic Pricing Technique, travel cost method and contingent assessment methods are the most frequently utilised. The Contingent Method of Assessment (CVM), in particular environmental valuation, is commonly employed in assessing public goods. In a poll, CVM includes asking respondents how much they will be willing, or willingness to admit in compensation, to pay for such a special environmental service.

The primary objective of the C.V surveys is to establish, as near as possible to a genuine market, a hypothetical market in order to get hypothetical offers that correspond to actual bids if an actual market was existing. WTP should represent the value a community has for improved environmental quality as per the relevant literature on assessment. Two elements of the validity and the dependability of the findings and the impact of biases & mistakes were questioned in particular. CV technique.

There are three main causes of bias: knowledge, automobiles and methods for bidding games. Most CVM research did not detect any substantial strategic bias.

An open-ended question and an iterative bidding format were used for the CV survey. The goal was to obtain an understanding of each problem's unique perspective and to provide a backdrop for the assessment activity. WTP data have been gathered in the style of a home interview.

The factors for determining the differences in solid waste operations were followed project in Ghana's capital, Accra (Ghana), which was followed by a questionnaire to assess their willingness to pay for the project and the impact on health and the environment. Ordinal models of regression are often referred to as cumulative models. The answer is supposed to really be numerical, because changes inside the response level are equal all across the range of replies. Using the logit link function, ordinal regression usually utilizes additional functions.

6 REFERENCES

[1] Babu Ambat (2000), ―Preparation of action plan for solid waste management of Thiruvananthapuram city and establishment of an environmental information system‖, Kerala Research Programme on Local Level Development, C.D.S, Trivandrum.

[2] Babu Ambat (2003), ―Study of the Attitude and Perception of Community towards Solid Waste Management-A Case Study of Thiruvananthapuram-Phase II, Kerala Research Programme on Local Level Development, C.D.S, Trivandrum.

[3] Bacud F. Sioco and J. Majam (1994), ―A descriptive study of the water quality of drinking wells around the Payatas dumpsite‖ (student thesis), College of Public Health, University of Philippines, and Manila.

[4] Beigl P., Wassermann G., Schneider F. and Salhofer S. (2003) ―Municipal Waste Generation Trends in European Countries and Cities‖. In: CISA Environmental Sanitary Engineering Centre, Cagliari (Ed.): Proceedings Sardinia 2003, Ninth International Waste Management and Landfill Symposium, Paper No. 319.

[5] Bhattarai R.C (2000), ―Solid Waste Management and Economics of Recycling: A Case of Kathmandu Metro City‖, Economic Journal of Development Issues 1(2):9-106.

[6] Chutrat Boontho, Somchat Boontho, Laksana Puenchompoo (2007), ―Khon Kaen Households Willingness to Pay for Environmental Taxes, Thailand‖, ABR and TLC Conference Proceedings, Hawaii, USA. SEDD.

[7] Elma B.Torres and Buenalyn Teresita M. Ramos (2004), ―Health Risk Perception of Communities Located in Metro Manila Airshed‖, Environment and Occupational Health Office, Department of Health, Manila, Philippines.