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AN ECONOMIC STUDY OF SOLID WASTE MANAGEMENT WITH SPECIAL REFERENCE TO THOOTHUKUDI DISTRICT

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ABSTRACT

Man is the cause for pollution and ultimately man himself has become the victim of it. There are different types of pollution i.e., air pollution, water pollution and solid waste pollution etc. Among these three important types of pollution, this study concentrates its attention on solid waste pollution. Solid waste pollution means the unwanted organic and inorganic, plastic, wood, Iron, steel sand etc., are thrown into the environment, ultimately that leads to pollution because that causes number of health hazards to human beings so it is called solid waste pollution. In the present study, an attempt has been made to provide a comprehensive assessment of the public participation on solid waste management in Thoothukudi district. The data relates to the month of November



2016. Percentage analysis, averages, correlation coefficient and chi-square test were used. The study shows that the age, education, employment, income, household size does not play any significant role in decision making regard to WTP. Nature of Employment shows a positive significance with .892 at 0.05 percent level of confidence. Distance is a significant factor in 50-60 feet being the most significant with regard to WTP with .953 at 0.01 percent level of confidence. Nature of employment shows a significance with .892 at 5 percent level, and distance, also plays a significant role, in 50-60 feet being the most significant at 1 percent

level. The independent variable income when correlation shows an insignificant value (.562) which means that irrespective of the level of income to WTP. Public awareness should be created among the masses to inculcate the health hazards of the wastes. Littering of MSW should be prohibited in the city areas notified by the Thoothukudi Corporation.

KEYWORDS: environment, pollution, waste generation, hazardous waste, compostable waste, combustible waste.

INTRODUCTION :

Solid waste management represents a heavy financial burden for local

governments in developing countries. Many of environmental goods and services are provided freely. Therefore, they have zero prices because no market place exists in which their true values can be revealed through acts of buying and selling. Projects and programmes appraisal cannot be sufficient or adequate without valuation (Pearce, 1993). Increasing population, changing income and consumption patterns, economic development, urbanization and industrialization result in increased generation of solid waste and also a diversification of the types of the solid waste generated (Banu, 2011). Municipal corporations of the developing countries are not able to handle the increasing quantity of waste, which leads to uncollected waste on roads and other public places (Begum 2001). In developed countries, per capita waste

generation increased nearly three-fold over the last two decades, reaching a level five to six times higher than that in developing countries. With increase in population and living standards, waste generation in developing countries is also increasing rapidly, and may double in volume in the current decade. If current trends continue, the world may see a five-fold increase in waste generation by the year 2025 (Palczynski et.al 2002).

Generation of MSW has an obvious relation to the population of the area or city. Bigger cities with more population generate huge quantity of waste. In 2011 the metropolitan area of Kolkata generated the largest amount of MSW (11,520 tonne per day (TPD) or 4.2 million tonne per year (TPY)). Among the four geographical regions in India, Northern India generated the highest amount of MSW (40,500 TPD or 14.8 million TPY and 30 percent of all MSW generated in India) and Eastern India generated the least (23,500 TPD or 8.6 million TPY and 17 percent). Among the states, it was the order of Maharashtra (22,200 TPD or 8.1 million TPY), West Bengal (15,500 TPD or 5.7 million TPY), Uttar Pradesh (13,000 TPD or 4.75 million TPY), Tamil Nadu (12,000 TPD or 4.3 million TPY) and Andhra Pradesh (11,500 TPD or 4.15 million TPY) which generated waste. Among Union Territories, Delhi (11,500 TPD or 4.2 million TPY) generated the highest and Chandigarh (486 TPD or 177,400 TPY) generated the second highest amount of waste (Annepu 2012).

The principal sources of solid waste are household waste, commercial waste, institutional waste, hospital waste, non-biodegradable waste, bio-degradable waste, hazardous waste, compostable waste, combustible waste, inert waste. Urban solid waste is normally a mixture of household, commercial and construction. The municipal solid waste refers to all waste generated by domestic, institutional, commercial, industrial, construction and street source and collected by local authority (Anand 2010).

The amount of willingness to pay or sacrifice to get the products or services usually depend on wealth of a person, or in other words the wealthier he is, the greater his willingness to pay for the improved services (Field and Field, 2006). Economic valuation of environmental goods has found vast application in determining compensatory payments for environmental damage (Willis and Corkindale, 1995). The waste is transported mostly by municipal vehicles; though, in some large towns, private vehicles are also hired to augment the fleet size (Shekdar, 1999).

Waste collection includes high occupational health risks mainly risk from contact with human faecal matter, paper that may have become saturated with toxic materials, bottles with chemical residues, metal containers with residue pesticide and solvents, needles and bandages from hospitals etc. The most commonly experienced diseases among waste pickers are Tuberculosis, Bronchitis, Asthma, Pneumonia, Dysentery, Parasites and Malnutrition. They were also exposed to fumes of highly concentrated acid. Safety gear such as gloves, face masks and ventilation fans are virtually unheard of, and waste collectors often have little idea of what they are handling (Devi, 2014). In the present study, an attempt has been made to provide a comprehensive assessment of the public participation on solid waste management.

Per Capita Quantity of Municipal Solid Waste in Indian Cities

Municipal Solid Waste in Indian Cities		
Population Range (in millions)	Waste Generation	Rate
	Kg/capita/day	
Cities with a population < 0.1 million (8 cities)	0.17-0.54	
Cities with a population of 0.1–0.5 million (11 cities)	0.22-0.59	
Cities with a population of 1–2 million (16 cities)	0.19-0.53	
Cities with a population > 2 million (13 cities)	0.22-0.62	

Source: NEERI, 2010

The above table suggests the per capita quantity of municipal solid waste in Indian cities. It also suggests

that average municipal solid waste production from 0.21 to 0.50 Kg per capita per day in India. The urban population of India is approx. 341 million in 2010.

Solid Waste Management in Tamil Nadu

In Tamil Nadu solid wastes generated from the major cities and towns are also not properly disposed. After recovery of materials by the road pickers the wastes are mostly collected through Municipal Lorries and are dumped in the low lying areas. The status of solid generated in major cities in Tamil Nadu is furnished as below.

Quantity of solid waste generated in major cities in Tamil Nadu

Cities	T/ day
Chennai	3500
Madurai	711
Coimbatore	710
Thiruchirapalli	408
Salem	330
Tirunelveli	210
Tuticorin	180

Source: Report on Status of Environment in Tamilnadu, TNPCB

The Board has directed the corporations, Municipalities and Town panchayats to comply with the provisions of the Municipal solid waste (Management and Handling) Rules 2000 and directed all the municipal corporations and municipalities in the State to apply for the consent of the Board with time bound proposals for action plan for collection, transportation, treatment and disposal of sewage and municipal solid waste. The local bodies represent that the financial constraint is the main problem in implementing sewage and solid waste management plans.

Solid waste generation in Tuticorin district

Presently, the population in the Tuticorin town (municipal limits) stands at 2, 16,058 as per 2001 census and the income is just Rs.18 crores. The solid waste generation of municipalities and town panchayats is to the tune of 35.10 tons and 23.45 tons respectively. The solid waste collection in municipalities and town panchayats is claimed to be 82.50% as of 1995-96, with manpower of 432 for the solid waste management. This study focuses on Solid Waste Management in Tuticorin area.

The city generates about 23.40 Tons of waste per day. The Tuticorin City municipal council meeting decided to augment the on-going solid waste management project on an outlay of Rs.8.5 crores during the next financial year. The administration would establish lights, compound wall and introduce windrows method of waste treatment, at the compost yard situated at Tharuvaikullam all at a cost of Rs.1.95 crores. Besides, sanitary landfills would be set up on 15-acre plot situated inside the 25 acre-compost yard at Rs.3.80 crores.

A total of 300 tricycles would be purchased at Rs.84.6 lakhs. The remaining amount would be utilized to buy 25 bins. Of the total project cost envisaged, Rs.6.8 crores would be obtained as grants from the Central Government, Rs.85 lakhs as the State Government grants and the remaining Rs.85 lakhs would be taken from the corpus earmarked under the urban Infrastructure Development Scheme for Small and Medium Towns.

Increased difficulty in disposing the municipal solid waste due to lack of co-operation among the public have made many municipality to go in for clean Development Mechanism (CDM). One among the techniques is preparation of compost/vermi compost from municipal solid waste by Kovilpatti municipality. In this method, as an initial step the non-biodegradable waste is removed thoroughly from the collected municipal solid waste manually. The remaining biodegradable/organic waste is sun dried to kill germs and to reduce the foul odour from the waste.

COMPOSITION OF SOLID WASTE IN TUTICORIN DISTRICT

It was observed that 10% of rubber and leather, 11% of plastics, 52% of compostable matter, 6% of wooden matter, 9% of glasses, 6% each metal and bricks & stones are the composition of municipal solid waste on wet basis in the district.

SOLID WASTE GENERATION IN TUTICORIN DISTRICT - MAJOR TOWNS

Thoothukudi	53.40 in tons per day
Kovilpatti	31.70 in tons per day
Tiruchendur	22.99 in tons per day

Source: The Hindu, 2015

OBJECTIVES

- 1.To collect data on the socio-economic structure of the respondents in Tuticorin area.
- 2.To study the types of environmental health hazards, solid waste management in India and Tamilnadu and solid waste generation in Tuticorin district.
- 3.To find out the public participation on solid waste management.

METHODOLOGY

This study focuses on Solid Waste Management in Thoothukudi district. The city generates about 53.40 Tons of waste per day. The empirical study is based on both primary and secondary data. While the secondary data are to a large extent documentary, the primary data have been collected on an interview schedule. Through random stratified method of sampling i.e., 115 respondents have been stratified, those living in and around the surrounding locality of compost yard. Fielding separate questions involving people participatory attitude approached the problem of the municipal waste management. The interview schedules were compiled, coded and subsequently transferred to a database. The data relates to the month of November 2016. Percentage analysis, averages, correlation coefficient and chi-square test were used.

AGE WISE CLASSIFICATION OF THE RESPONDENTS

S. No	Age (in years)	No. of Respondents	Percentage
1.	20-30	35	30.44
2.	30-40	50	43.47
3.	40-50	30	26.08
	Total	115	100

Source: Primary data

A total of 115 respondents were surveyed. Above table shows that 30.44% of the sample respondents are in 20-30 age group 43.47% of the respondents are in 30-40 age group 26.08 the respondents are in 40-50 age group in the study area.

SEX WISE DISTRIBUTION OF SAMPLE RESPONDENTS

S.No	Sex	No. of Respondents	Percentage
1.	Male	45	39.14
2.	Female	70	60.86
	Total	115	100

Source: Primary Data

From Table 2 it is inferred that the majority of sample respondents, that is 39.14 percent were males and 60.86 percent are female respondents.

EDUCATIONAL QUALIFICATION OF THE RESPONDENTS

S.No	Educational Qualification	No. of Respondents	Percentage
1.	Secondary	65	56.52
2.	College	45	39.13
3.	Technical	5	43.48
	Total	115	100

Source: Primary data

Above table shows that 56.52 of the respondents are secondary education, 39.13 of the respondents have completed college education and 43.48% of the respondents have finished technical education.

RELIGION WISE CLASSIFICATION OF THE RESPONDENTS

S.No	Religion	No. of Respondents	Percentage
1.	Hindu	80	69.57
2.	Christian	35	30.43
	Total	115	100

Source: Primary data

Above table shows that 69.57% of the sample respondents are Hindus, 30.43% of the respondents are Christians.

COMMUNITY WISE CLASSIFICATION OF THE RESPONDENTS

S.No	Community	No. of Respondents	Percentage
1.	BC	70	60.87
2.	SC	20	17.39
3.	MBC	25	21.74
	Total	115	100

Source: Primary Data

Above table shows that 60.87% of the respondents are BC 17.39% of the respondents are SC, 21.74% of the respondents are MBC.

FAMILY TYPE OF RESPONDENTS

S.No	Family Type	No. of Respondents	Percentage
1.	Nuclear Family	65	56.52
2.	Joint Family	50	43.47
	Total	115	100

Source: Primary Data

Results on family type revealed that 56.52 percent of the respondents belong to the nuclear family and 43.47 percent of them belong to the joint family.

MARITAL STATUS OF THE RESPONDENTS

S.No	Marital Status	No. of Respondents	Percentage
1.	Married	85	73.92
2.	Unmarried	30	26.08
	Total	115	100

Source: Primary Data

When marital status is concerned 73.92 of the respondents are married and 26.08 are unmarried.

HOUSING OF THE RESPONDENTS

S.No	Housing	No. of Respondents	Percentage
1.	Own	80	69.56
2.	Rent	35	30.43
	Total	115	100

Source: Primary Data

From the table, it is revealed that almost all the sample respondents have own houses (69.56%).

OCCUPATION WISE CLASSIFICATION OF THE RESPONDENTS

Occupation	No. of Respondents	Percentage
Teachers	19	16.52
Fishing	23	20.00
Private enterprises	27	23.48
Agriculture	32	27.83
General worker	13	11.30
Unemployed	1	0.87
Total	115	100.00

Source: Primary data

As far as, the occupation of the respondents is concerned 16.52% were teachers, 23.48% of the respondents were employees in private enterprises, 27.83% of the respondents were agriculture, 20.00% of the respondents were fishing, 11.30% of the respondents were general worker and only 0.87% of the respondents were unemployed respectively in the study area.

MONTHLY INCOME OF THE RESPONDENTS

S.No	Monthly Income	No. of Respondents	Percentage
1.	5000-6000	46	40
2.	6000-7000	44	38.26
3.	7000-8000	25	21.73
	Total	115	100

Source: Primary Data

The study revealed that 40% of the respondents are earning an income up to Rs.6000 monthly, 38.26% of the respondents are earning Rs.6000-7000 monthly and the others 21.73 of the respondents are earning Rs.7000-8000 monthly and the mean monthly income of the sample respondents is Rs. 6,317.39 respectively.

MONTHLY INCOME DETAILS OF THE RESPONDENTS

Null hypothesis: There is no significant difference between the incomes of the sample respondents between sexes.

RELATIONSHIP BETWEEN SEX AND MONTHLY INCOME OF THE RESPONDENTS (Percentage)

S.No	Income (Rs.)	Male	Female
1.	5000-6000	23.45	53.07
2.	6000-7000	49.01	34.34
3.	7000-8000	27.45	12.59
	Total	100	100

Source: Computed from Primary Data.

From the above table reveals that 23.45% of the male respondents acquire income between Rs.5000-6000, 49.01% of the respondents obtain income between Rs.6000-7000 and 27.45% of the respondents receive income Rs.7000-8000. In the case of female respondents 53.07% obtain income between Rs.5000-6000, 34.34% of the respondents acquire income between Rs.6000-7000 and 12.59% of the respondents get income Rs.7000-8000 respectively.

In order to find out whether there is any correlation between the sex and income of respondents, chi-square test has been applied. The results of the Chi-square test are furnished below.

Calculated value of Chi-square = 73.13

Table value at 5 per cent level = 5.991

Degrees of freedom = 2

As the calculated value of Chi-square is greater than the table value at 5 per cent level of significance, there is a relationship between income of the respondents and sex of the study area.

AREA WISE WILLINGNESS TO PAY AND NOT WILLINGNESS TO PAY (Percentage)

Area	Yes	No
Thoothukudi	53.2	42.1
Kovilpatti	25.4	21.0
Tiruchendur	15.4	14.0

Source: Compiled from primary data

The table indicates that 94 percent of the sample (115 persons) as being willing to pay. In Thoothukudi 53.2 percent of the respondents are willing to pay. Kovilpatti and Tiruchendur follow with 49 persons i.e. 25.4 and 15.4 percent of the respondents willing to pay. 77.1 percent of the sample not willing to pay.

Correlation

The study has identified independent variables such as age, education, nature of employment, income, distance and size of family and the dependent variable WTP. The study has used the correlation to arrive at the levels of significance.

Correlation

Variables	Pearson Correlation	Significance (2 tailed)
WTP	1.000	-
Age	-.721	.316
Education	.813	.233
Employment	.892*	.134
Income	.562	.537
House	-.284	.804
Distance	.953**	.013

* correlation is significant at the 0.05 level (2- tailed)

** correlation is significant at the 0.01 level (2-tailed)

The above table shows that the age, education, employment, income, household size does not play any significant role in decision making regard to WTP.

Nature of Employment shows a positive significance with .892 at 0.05 percent level of confidence. Distance is a significant factor in 50-60 feet being the most significant with regard to WTP with .953 at 0.01 percent level of confidence. Nature of employment shows a significance with .892 at 5 percent level, and distance, also plays a significant role, in 50-60 feet being the most significant at 1 percent level. The independent variable income when correlation shows an insignificant value (.562) which means that irrespective of the level of income to WTP.

CONCLUSION

Public awareness should be created among the masses to inculcate the health hazards of the wastes. Littering of MSW should be prohibited in the city areas notified by the Thoothukudi Corporation. Moreover, house-to-house collection of MSW should be organized through methods like collection on regular pre-informed timing and scheduling. The collection bins must be appropriately designed with features like metallic containers with lids, and to have a large enough capacity to accommodate more than the expected waste generation in the area, with a design for mechanical loading and un-loading, placement at appropriate locations, etc. Municipal authorities should maintain the storage facilities in such a manner that they do not create unhygienic and unsanitary conditions. Proper maintenance of the MSW transportation vehicles must be conducted, and the Dumper Placer should replace the old transportation vehicles in a phased manner. Municipal agencies will have to plan and execute the system in keeping with the increasing urban areas and population. There has to be a systematic effort in the improvement in various factors like institutional arrangement, financial provisions, appropriate technology, operations management, human resource development, public participation and

awareness, and policy and legal framework for an integrated SWM system.

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