

An Economic Analysis of Solid Waste Management in Sivagangai District

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Abstract: *Solid waste management planning is a very critical and problematic concern of urban and semi-urban areas. The environmental problem and health hazards are the most prominent consequences of the improper of solid waste management. In Sivagangai district, door-to-door collection and segregation of the wastes are performed. The wastes are segregated either at source or at the compost yard manually. The collected wastes are transported by the tractor with a net cover. Finally, the collected wastes are disposed of in open dumpsites or in landfills. In the present study 38 Panchayats were selected from Sivagangai district which were among 2,000 selected Panchayats across the State. Environment guards in the name of Thooimai Kavalars were appointed for the implementation of the solid waste management programme in these districts. The analysis of the data on Thooimai Kavalars reveals that the appointment of Thooimai Kavalars is not proportional to the number of households in different village Panchayats. Therefore, to improve environmental cleanliness the appointment of Thooimai Kavalars should be in proportional to the number of households in the habitats. In addition, it has been observed that nearly 30% of the solid wastes generated were not cleared and stay on the street corners and temporary dump yards. To clear these wastes contribution by the generators in terms of willingness to pay is inevitable. In the study area, it has been estimated the required amount of contribution interns of willingness to pay to completely remove all the generated wastes is Rs. 300/- per annum. The yearly rate of willingness to pay this will certainly improve the employment chances not only in Sivagangai district but also nationally.*

Keywords: Solid waste, Solid Waste Management, Households, Habitations, Thooimai Kavalars, Employment Generation, Mahatma Gandhi National Rural Employment Scheme (MGNREGS) and Swachh Bharat Mission-Gramin (SBMG) Scheme

I. INTRODUCTION

Solid waste management is a crucial problem for not only developing countries but also developed countries as well. Waste management practices, especially in the case of municipal solid waste, may differ between developed and developing nations, urban and rural areas and among residential, commercial and industrial units. Environmental service strategies in general, and solid waste management strategies in particular solely depend on government funding, which are not sustainable and therefore waste generators' contributions in funding waste collection activities are crucial. The residential solid waste fee covers the cost for the municipal institution to provide collection, segregation, disposal and recycling services of household garbage and yard wastes.

II. WASTE COLLECTION METHODS

Household wastes are separated daily into different bags into different categories of wastes such as wet and dry waste. Wet waste consists of leftover foodstuff, vegetable peels, etc. Dry wastes consist of cans, aluminum foils, plastics, metals, glass and paper materials. Wet waste materials could be separated and used to produce organic manures. The dry waste materials could be recycled and its fraction could find profitable industrial usages and can generate income and employment. A Door-to-door collection of wastes is another method of segregation, but it is not a common practice yet in India except in the metros where some private organizations are doing such work.¹ The rag pickers play a very important role in the segregation of waste by going round in the municipal area and picking out the recyclable plastic,

glass materials, and metal wastes. Thus, they not only generate value from wastes, but also help to have a clean environment.

2.1 Reasons for Higher Levels of Waste Generation

The increasing population, the inability of agricultural sectors to generate gainful employment, non-availability of basic infrastructure facilities, in the rural areas result in the migration of large chunks of labourers from rural to urban area. Migration of labourers along with rapid urbanization and changing trend of consumption behavior of the people are the major reasons for the generation of voluminous solid wastes. The collection service to clear the wastes eats out major portion of funds allocated to the local bodies. At present, the local governments are levying different charges on solid waste generators on a daily basis or monthly basis or event basis, but the cost of clearance of such wastes is proportionately higher. The financial resources of the local governments are not sufficient to clear solid wastes above 70% of the total wastes generated. In the study area, the unclear wastes are assumed to be around (209.25 tonnes). To clear these 30% waste the researcher has calculated the fund required to clear this waste completely is rupees 300 per household.

Local governments often are responsible for the effective management of their community's solid wastes. Governments that bear this responsibility often are required to make important decisions in connection with their waste management activities, including the selection between various alternative treatment options (eg. Burial vs. Recycling) and the determination of outsourcing all or a portion of such activities which are feasible. Governments need reliable information on the full costs of solid waste management activities, if they are to make informed decisions on these and similar matters.² Each municipality is following its own waste management methods in the following areas: Waste Segregation and Storage at the Source, Primary Collection, Street Sweeping, Secondary waste Storage, Transport of waste, Treatment and Recycling options for solid waste Disposal.

2.2 Willingness to Pay

Willingness to Pay (WTP) is the maximum amount a person would be willing to pay for the sacrifice or exchange in order to receive a good or to avoid something undesired, such as pollution. Thus, WTP is the amount of payment combined with the presence of the good which gives the person the same level of utility as would occur if there were no payment and no acquisition of the good.

2.3 Solid Waste Management

Environmental Pollution and solid waste management are the serious problems faced by the people in the country. Environment pollution refers to the ways by which people pollute their surroundings. The wastes generated in solid state because of various human activities are normally discarded as useless or unwanted is termed as solid waste. It consists of day-to-day waste items such as paper, plastics, metals, glass, vegetables and fruit waste, etc. It also includes any discarded solid fractions, generated from domestic units, trade centers, and commercial establishments. The Solid waste management system includes Collection, Segregation, Transportation, Processing and Safe Disposal of Waste.³

2.4 Study Area

Sivagangai district is an administrative district of Tamil Nadu State in Southern India. The total geographical area of the district is about 4189 sq.km. Pudukottai District is on the North, Ramanathapuram is on the south, Virudhunagar is on South West and Madurai is on the West. The district headquarter is located in Sivagangai.

It is connected by road and rail with all important towns in the State. Sree Viswanatha and Sree Subramaniya Temples, Pillaiyarpatti and Kandadevi temples, Thirukostiyur Temple, Idaikattur Church and Kundrakudi Temple are the important temples in Sivagangai district. A Government Medical college is situated in Sivagangai. Karaikudi is an educational center wherein CECRI, Alagappa Chettiyar Engineering College, Alagappa University and many higher education institutions are situated. Every suburban town in the district almost has one higher education institution.

Table 1: Population Data in Sivagangai District

S.No.	Category	Male	Female	Total	Percentage
1.	Rural	4,62,210	4,64,046	9,26,256	69.1%
2.	Urban	2,06,462	2,06,383	4,12,845	30.9%
	Total	6,68,672	6,70,429	13,39,101	100

Source: http://sivaganga.tn.nic.in/district_at_aglance.html&hl=en-IN

According to the Census 2011, Sivagangai district had a population of 13, 39,101 in which the number of males was 6, 68,672 (49.9%) and females was 6, 70,429 (50.1%). Here it has been calculated that, in Sivagangai district, the sex ratio was 1002.6 females for 1000 males which are comparatively very high above the national average of 929 females for 1000 males. The average literacy rate was 83.86% compared to the national average of 72.99%, which is also very high. Since a majority of people (i.e) 69.1% of the population live in rural areas and only 30.9% live in urban area, Sivagangai district may be considered primarily as a rural and agricultural district.

III. STATEMENT OF THE PROBLEM

Solid waste management planning is a very critical and problematic concern of the urban and semi-urban areas. Environmental problem and health hazards are most prominent consequences of the improper solid waste management methods in these areas. The uncollected waste, which is often also mixed with human and animal excreta, is dumped in the streets and drains. Therefore, it is contributing to flooding, breeding insects, rodent vectors, and the spread of diseases. In addition, collected waste is often disposed of in uncollected dumpsites and/or burnt, which are polluting water resources and air. One of the main reasons for this is the lack of awareness and lack of financial resources to carry out complete clearance of solid wastes generated.



According a report by the daily (Dinamalar, March 17,31, April 22, 2017) In Sivagangai district, Sangarapuram in Karaikudi Municipality, Thiruppuvanam, and Singampunari solid waste management activities were not carried out to clear all the solid wastes immediately. *Thooimai Kavalars* were given employment opportunities for only 100 days. The remuneration for them was not also disbursed regularly. In Singampunari town panchayat often the waste materials are heaped in the streets because of insufficient staff to transport the trashes to the spots of landfills and the waste materials are burnt. The news indicates the presence of improper management of solid wastes in Sivagangai district. Therefore, mustering financial resources is a dare necessity in order to create more employment opportunities in the field of solid waste management to achieve a clean environment, and to mitigate the effects of solid wastes upon the surrounding environment.

3.1 Objectives

1. To know the source and generation of solid waste in the study area
2. To explain the holding methods in waste collection in the study area
3. To analyze the clean India Schemes and to give suggestions for better solid waste management practices in the study area.

IV. METHODOLOGY

This paper is based on secondary data and simple percentage analysis is being carried out. The secondary data were collected from various Government reports and Journals. In Sivagangai district, there are 3 Municipalities and 12 Panchayats. .

Table 2: Municipal Solid Waste Generations in Sivagangai District

Name of the District	Municipalities		Town Panchayat		Total	
	Nos.	Municipal Solid Waste Generated Tonnes Per Day (TPD)	Nos.	Municipal Solid Waste Generated Tonnes Per Day(TPD)	No. of ULB	Municipal Solid Waste Generated Tonnes Per Day (TPD)
Sivagangai	3	69	12	36	15	105

Source: www.tnpcb.gov.in

Table-2 shows that the Sivagangai district consists of 15 urban local bodies, in which 3 are municipalities, 12 are town Panchayats. The 3 municipalities are generating municipal solid wastes of 69 tonnes per day, 12 town Panchayats are generating municipal solid wastes of 36 tonnes per day, and in total all the Urban Local Bodies(ULBs) are generating municipal solid wastes of 105 tonnes per day in Sivagangai District.

Table 3: Waste Collection Methods in Town Panchayat in Sivagangai District

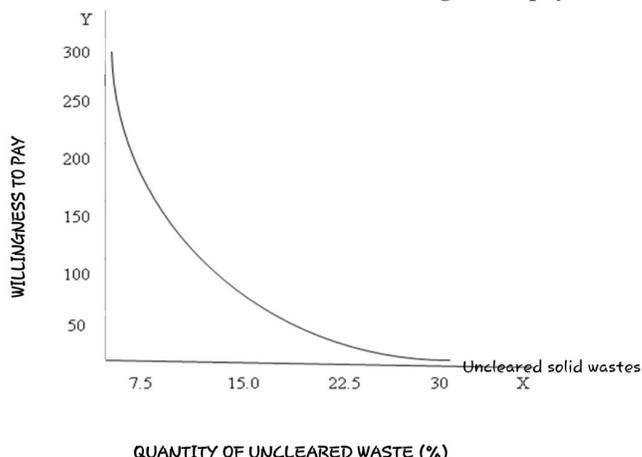
S.No.	Details of waste collection	Methods of waste collection
1.	Number of Town Panchayats	12
2.	Municipal Solid Waste collection	Door-to-Door Collection
3.	Municipal solid waste segregation	Source segregation/manual segregation at composite yard
4.	Storage	-
5.	Transportation	Through tractor with net cover
6.	Processing	Composting
7.	Disposal of municipal solid waste	Open dump

Source: www.tnpcb.gov.in

Table-3 explains the waste collection methods followed in Sivagangai district. In 12 town Panchayats, door-to-door collection and segregation of the wastes are performed. The wastes are segregated either at source or at the composite yard manually. The collected wastes are transported by the tractor with a net cover. Finally, the collected wastes are disposed of in open dumpsites or in landfills.

Sivagangai district Collector told that 38 Panchayats were selected from Sivagangai district among the 2,000 Panchayats selected across the State for the implementation of the solid waste management programme, under the Scheme, "Thoaimai Kavalars". The Sanitary Guards would be appointed per 150 families, and in total, 187 such sanitary guards in the 38 Panchayats would be appointed. They would be paid Rs. 183 per day for the first 100 days under the Mahatma Gandhi National Rural Employment Scheme (MGNREGS) and from 101st to 300th day, the payment would be made under the Swachh Bharat Mission-Gramin (SBMG) Scheme.⁴ The sanitary guards would collect wastes, and segregate organic and inorganic wastes and dump the organics in a separate compost pits. Recyclable plastic materials would be segregated separately. The selected Panchayats would be given tricycles, shredders and other types of equipment for cleaning.

Demand curve for the solid waste clearance service based on willingness to pay



It has been found from the previous studies that, on an average, the efficiency of solid wastes clearance is around 70% (provide a related review). Hence, it has been deduced that 30% of the solid wastes generated are not cleared. The financial resources of the local governments are not sufficient to clear solid wastes above 70% of the total wastes generated. In the study area, the unclear wastes are assumed to be around (209.25 tonnes). To clear these 30% waste the researcher has calculated the fund required to clear this waste completely is rupees 300 per household. If the actual willingness to pay is less than rupees 300 then it is not possible for the local governments to clear the wastes completely. The rates of willingness to pay for the solid wastes are Rs. 225, 150, 75 to clear unclean wastes are 7.5%, 15%, 22.5%. A curve has been fitted for the willingness to pay and percentage of wastes unclean.

Above curve explains the relationship between demand for waste clearance service and willingness to pay in terms of rupees when other things are remaining constant. The above curve explains different levels of willingness to pay and the quantities of wastes uncleaned. When, willingness to pay increases then the quantity of uncleaned wastes is getting reduced. On the other hand, when, willingness to pay decreases then the quantity of uncleaned wastes increases.

Table 4: Implementation of *Thooimai Kavalars* Scheme for Solid Waste Management in Sivagangai District

S. No	Name of the Block	Name of the 38 Village Panchayat	No. of Habit ations	No. of Househ olds	No. of <i>Thooimai Kavalars</i> (Selected)	No. of <i>Thooimai Kavalars</i> Working	Average number of households per <i>Thooimai Kavalars</i>	Estimated Number of <i>Thooimai Kavalars</i>
1.	Sivagangai (Pts.-5, TK. 49)	Arasanoor	9	828	5	6	138	8
		Kanjirangal	10	1,870	11	3	623	18
		Madhagupatti	9	885	5	4	221	8
		Okkur	3	595	3	5	119	5
		Vaniyangudi	19	2,421	20	9	269	24
TOTAL			50	6,599	44	27	244	65
2.	Kalayarkovil (Pts-4, Tk-39)	Kalayarkovil	5	3,192	20	14	228	31
		Kattendhal, Sukkamooran i	9	1,311	11	4	328	13
		Kollangudi	12	1,150	7	4	288	11

		Maravamangalam	6	943	9	6	157	9
	TOTAL		32	6,596	47	28	236	65
3.	Ilayangudi (Pts-,TK-6)	Karaikulam	21	998	8	7	143	9
	TOTAL		21	998	8	7	143	9
4.	Manamadurai (Pts-2, TK-13)	Idaikkattur	1	851	6	6	142	8
		Soorakulam, Pillarutha	10	725	7	6	121	7
	TOTAL		11	1,576	13	12	131	15
5.	Thiruppuvanam (Pts-3,TK-29)	Ladanendhal	2	532	5	6	89	5
		Poovanthi	8	1,159	8	8	145	11
		Thiruppachetti	6	1,415	10	16	88	14
	TOTAL		16	3,106	23	30	104	31
6.	Devakottai (Pts-2, TK-7)	Thanavayal	5	663	3	2	332	6
		Sarukani	7	526	4	3	175	5
	TOTAL		12	1,189	7	5	238	11
7.	Kannangudi (Pts-1, TK-8)	Hanumandhaku	10	906	8	0	0	9
	TOTAL		10	906	8	0	0	9
8.	Sakkottai (Pts-3, TK-33)	AmaravathiPudur	12	1,616	10	2	808	16
		Ariyakudi	6	1,110	12	6	185	11
		Iluppakudi	12	1,045	12	7	149	10
	TOTAL		30	3,771	34	15	251	37
9.	Kallal (Pts-8, TK-47)	A.Siruvayal	12	884	6	6	147	8
		Kallal	4	1,173	8	7	168	11
		Kandramanicam	5	1,096	7	7	157	10
		Kovilur	4	764	5	6	127	7
		Kundrakudi	4	777	5	9	86	7
		K.Vairavanpatti	1	268	2	2	134	2
		Siravayal	11	1,065	7	0	0	10
Thalakkavur	3	1,075	7	8	134	10		
	TOTAL		44	7,102	47	45	158	71

10.	Thiruppathur (Pts-4, TK-22)	Keelasevalpatti	1	719	5	6	120	7
		Pillayarpatti	2	248	2	2	124	2
		Poolankurichi	8	1,020	7	7	146	10
		Thirukostiyur	9	1,159	8	5	232	11
TOTAL			20	3,146	22	20	157	31
11.	Singampunari (Pts-3, TK-20)	A.Kalappur	6	835	6	5	167	8
		Eriyur	7	556	6	6	93	5
		Piranmalai	10	954	8	8	119	9
TOTAL			23	2,345	20	19	124	23
12.	S.Pudur (Pts-2, Tk-11)	Pudur	4	416	6	6	69	4
		Pulidhipatti	6	444	5	5	89	4
TOTAL			10	860	11	11	78	8
GRAND TOTAL			279	38,194	284	219	175	389

Source: DRDA Report (2015) in Sivagangai District

Note: Pts - Panchayats, Tk- Taluk

From Table - 4 it is evident that the total number of *Thooimai Kavalars* appointed is 284 and the actual number working is 219 which is well above the proposed number of appointment (i.e.) 187 as stated by the Sivagangai District Collector.

Here it has been calculated that in Sivagangai district for the 12 blocks, on an average, for every 175 households there is one *Thooimai Kavalars*. Among the different blocks, in S.Pudur block only has the sufficient number of *Thooimai Kavalars*. Here, for every 78 households, there is one *Thooimai Kavalars*. In Ladanendhal and Thiruppachetthi Panchayats, one *Thooimai Kavalars* is working for every 89 and 88 households respectively. In Kallal block there is one *Thooimai Kavalars* for every 86 households in Kundrakudi village and in Singampunari block, there is one *Thooimai Kavalars* for every 93.

The number of households allotted per *Thooimai Kavalars* indicates the effectiveness in the implementation of the solid waste management programme. If the number of households allotted per *Thooimai Kavalars* increases, then it denotes the poor maintenance in the sphere of solid waste management. In this respect, Kannagudi block exhibits no maintenance or the solid waste management activities are not at all carried out because, there is no *Thooimai Kavalars* in the block. Likewise, in Siravayal panchayat of Kallal block, there is no *Thooimai Kavalars* for cleaning the solid wastes. The average number of households per *Thooimai Kavalars* is high (251 in Sakkottai block and is very high (808 households) in Amaravathipuram panchayat. The poor performance in solid waste management activities is indicated by the large number of households allotted per *Thooimai Kavalars*. In Kanjirangal panchayat it was 623, and Vaniyangudi panchayat it is 269 in Sivagangai block. In Kattendhal panchayat the number is 328, and in Kollangudi panchayat it is 288, in Kalayarkovil block and Thannavayal panchayat it is 332 in Devakottai block.

In order to achieve efficiency in the management of solid wastes and to have the clean environment, the present research study suggests at least one appointment of *Thooimai Kavalars* in every habitation of 150 households. For an increase of the number of households above 150, for every additional 100 households, one more *Thooimai Kavalars* may be appointed.

On the basis of this assumption, the actually required numbers of *Thooimai Kavalars* are estimated for all the Panchayats in different blocks excepting the municipalities. On the basis of estimation, it is here found that 389 *Thooimai Kavalars* are required to be appointed. At present, the total number of *Thooimai Kavalars* working in the 38 village Panchayats is 175 which is less than 50% in the required number of *Thooimai Kavalars*.

V. CONCLUSION

Sivagangai District consists of 3 municipalities and 12 town Panchayats. The district had a total population of 13, 39, 101 during 2011. The solid wastes are collected from households of 12 town Panchayats through door-to-door collection method. The Sivagangai district consists of 3 municipalities, 12 town Panchayats and in total 15 Urban Local Bodies. The 3 municipalities are generating municipal solid wastes of 69 tonnes per day, 12 town Panchayats are generating municipal solid wastes of 36 tonnes per day, and in total all the Urban Local Bodies(ULBs) are generating municipal solid wastes of 105 tonnes per day in Sivagangai District. The waste materials are either segregated into degradable and non-degradable at the point of collection or at the dumpsite manually. Degradables are being used for composting and non-degradable are disposed on open dump sites. The data on the appointment of *Thooimai Kavalars* in 38 selected village Panchayats shows that there is a vast deviation in the number of appointments of *Thooimai Kavalars* to different village Panchayats on the basis of the number of households. In two village Panchayats, no *Thooimai Kavalars* are working for cleaning purposes. In the total of 38 village Panchayats in 15 places, one *Thooimai Kavalars* is appointed to maintain cleanliness for a household strength of more than 150. This is greater than the prescribed level of 150 households per *Thooimai Kavalars*. Here, the appointment of *Thooimai Kavalars* is not only disproportional to the number of households but also the total number of actual appointments, 175 which is for less than the required number (i.e.) 389. The actual appointment is found to be less than 50% in the required number. Therefore, to improve environmental cleanliness, the appointment of *Thooimai Kavalars* should be in proportionate to the number of households in the habitats as well as in sufficient numbers. This will certainly improve the employment chances not only in Sivagangai district but also nationally. The additional financial burden of appointing more numbers of *Thooimai Kavalars* may be met out by raising the present solid waste management charges on basis of either full cost of managing wastes or on the average willingness to pay by the consumers.

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