THE IMPACT OF SOCIO-ECONOMIC FACTORS IN MANAGING THE HOUSEHOLD SOLID WASTES CASE STUDY : PULIYANTHEVU (BATTICALOA TOWN)

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ABSTRACT

About hundreds of tons of solid wastes are generated monthly in Batticaloa town. Most of it ends up in open dumps and wetlands, contaminating surface and groundwater and posing major health hazards. In some areas uncollected wastes accumulated at road sides, are burned by residents or disposed in illegal dumps which blight neighborhoods and harm public health.

Can indirectly calculate generation rates are approximately 0.5 kilograms per person per day. Most waste in Batticaloa town is not regularly collected by municipal collection systems because of poor management, fiscal irresponsibility, equipment failure, trucks breakdown, or inadequate waste management budget. This study was conducted in Batticaloa town with the objective of estimating the impact of socio-economic factors in generating the types of solid wastes, sorting (point separation),and composting .

For this study the variables used were family size, household income, educational level, amount of waste, age, environmental education, garden size and sex.

For data analysis MINITAB and SAS statistical packages were used. ***Multiple regression*** and ***probit*** econometric analysis were run in these packages.

The results show family size and income of households had a significantly correlation with the generation of solid wastes. Secondly, family size and income level show significantly correlation with the sorting of household wastes while variable age show non-significant. Thirdly, family size show significantly correlation with the composting of household wastes, while income of households shows non-significant. .

This research clearly leads to develop several waste management policies that can be implemented by the Municipal council, Batticaloa as efficient waste management tool on sustainable manner. Creating a market for sorted out waste, promoting recycling and, reusing. Introducing a new house hold tax system, reduce annual tax payment to promote sorting and composting of household wastes. Formation of waste pickers' cooperatives. Setting up of quality control criteria for compost and conducting of waste disposal awareness programs.

Key words: Solid waste, Sorting, Composting

INTRODUCTION

Background

Batticaloa district is in the Eastern province of Sri Lanka .Batticaloa district stretches from Verugal in the North to Thuraineelavanai in the South ranging about 110 kilometer in length. It is narrow and long district where most of the coastal strip and the paddy fields and forest are found in the western flank, Inter connected system of three lagoons separate the eastern flank from the west.

The Batticaloa town is bounded on North by the Eravur Pattu , on the East by bay of Bengal , on the South by Kattankudy and on the West by Batticaloa lagoon (MDGS Profile-2005). Puliyanthevu is the study area which is an Island bounded by Batticaloa lagoon. Puliyanthevu covers land area of 116.79 hectare with a population of 7246 comprising of all ethnic groups of Sri Lanka, (DS.MN-.2007).

In Puliyanthevu the solid waste management is associated with social, economical and environmental

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issues, to a considerable extent. However rate of generation of solid wastes also increasing with the increase of population, technology, and change of life styles of the people (Diaz, Golueke-1985).

The present haphazard disposal practices of solid waste also create a negative image to Puliyanthevu, depriving development opportunities including the tourism. To over come this problem if compost being produced using sorted out solid wastes and later it can be used to the home gardens as a fertilizer (Nath-1993). The urban solid wastes can be grouped into three main groups, Such as domestic wastes, commercial refuse, and institutional refuse. The main task of the Municipal Council of Batticaloa in solid waste management should be the safe, reliable and cost-effective removal and disposal of solid waste. Before the waste reach the disposal site, need to collect items that can be reusable. This activity needs intensive scavenging (Calrecovery-2005).

Availability of land is a pre-request for all form of solid waste disposal (Draft report, Tokyo-1985). The most common methods are land filling, incineration and anaerobic digestion. In Puliyanthevu land area is limited to cater all these methods of disposal. Some other agencies or NGOs are also involved in solid waste management in Batticaloa collaborating with Batticaloa Municipality, but remarkable changes were not achieved.

Objectives of the study

1. To estimate the impact of socio-economic factors in managing the types of solid wastes generated.
2. To study the composition and quantity of solid waste generated by the households in the study area.
3. To study the factors affecting the amount of solid waste generated by the households.
4. To study the factors affecting the point separation and composting of solid wastes generated by the households.

METHODOLOGY

Study area and sampling

Puliyantheevu Island in Batticaloa was selected as study area for this study. It is located within the Batticaloa Municipal area. A field survey was conducted to collect primary data. During the survey 125 household was interviewed. Primary data collection was carried out during January to April 2009. Secondary data were collected from the records which were maintained by the Municipality Batticaloa and Manmunai North Divisional Secretariat(MN-DS).

Households were selected randomly from Adigar Road, Central road, Covington Road, Lake Road- 1 & 2, Vanniyas Street, Mudaliyar Street, Sinnalebbe Street, and Sooriya Lane by using the G.S's(Grama Sevaka) list by using random number table. Households were selected from the above densely populated eight streets in Puliyantheevu.

Analytical Procedure

Statistical regression and probit analysis

For multiple regressions analysis and for probit analysis used MINITAB and SAS packages respectively. From the data, family size, age, general education, income, garden area, environmental education, amount of wastes generated, distance to the waste dump, and sex were tabulated. Several dummy variables were included in this analysis. For example sex, for male given 1 and female given .

To find the factors affecting the amount of generation of wastes, Sorting of solid wastes, Composting of wastes, multiple linear regressions was carried out. The general linear regression model with **k** explanatory variables is the form, used throughout the analysis (Koutsoyiannis-1977).

$$Y = (\beta_{0+} \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots\ldots + \beta_k X_k) + (U)$$

(Systematic component) (Random component)

Family Size	$=>X_1$
Age	$=>X_2$
Education	$=>X_3$
Income	$=>X_4$
Environmental education	$=>X_5$
Garden Area	$=>X_6$
Sex	$=>X_7$
Amount of wastes	$=> X_8$
Distance to waste dump	$=> X_9$
Sorting of wastes	$=> X_{10}$

Generation of solid wastes

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7)$$

Sorting of solid wastes

$$Y_1 = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7 X_{8,} X_9)$$

Composting of solid wastes

$$Y_2 = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_{8,} X_{10})$$

Table 1: Number of samples from each street

Name of street	Number of Households (sample)
Adigar Road	15
Central Road	15
Covington Road	15
Lake Road-1 & 2	35
Vanniyas street	15
Mudaliyar street	10
Sinnalebbe street	10
Sooriya lane	10
Total number of sample	125

(Source: Survey data)

Table 3.0 shows that, how the generation of house hold solid waste influenced by the socio economic factors and their significance. These results were obtained by running a multiple linear regression analysis. Only two variables found significant for the generation of solid wastes such as family size and house hold income. If the household income level is increasing, the generations of household wastes also increasing according to Table 3.When consider the variable family size it is significant. As family size is increasing consumption of household will increase as a result waste generation will also increase.

Table 2: Comparison of solid waste characterization streetwise (% wet weight)

Street	Bio degradable	Paper	Metals	Glass	Plastics Rubber Leather	Textiles	Ceramics Dust Stones
Adigar Road	75.2	1.5	0.1	0.2	10.9	3.1	9.0
Central Road	74.5	5.5	4.9	2.7	8.6	1.3	7.5
Covington Road	60.8	12.2	2.3	4.6	4.4	2.5	13.2
Lake Road-1&2	60.8	10.2	4.1	8.6	9.6	3.8	6.4
Vanniyas street	74.8	6.9	1.1	3.3	3.5	0.4	10.0
Mudaliyar street	74.4	5.8	3.5	4.4	9.6	1.0	1.3
Sinnalebbe street	73.8	4.0	4.3	5.5	7.5	2.0	2.9
Sooriya lane	53.6	9.1	6.6	8.0	9.9	2.2	9.0

(Source: Survey data)

The data in Table 2.0, shows information related to the quantity and composition of municipal solid waste generated in several selected households streets in Puliyantheevu.

Wastes generated in streets are characterized by a high concentration of plant debris and animal wastes where those generated in households streets. The wastes usually are more or less contaminated with soil.

Solid wastes collected for analysis found mostly contaminated with fecal matter or urine and mixing of these materials with household waste.

Table 3: Variables influencing amount of waste generation

Variables	Probability	Significant (S)/ non-significant (NS) at 5% Level
Familysize	0.0056	S
Family Income	0.0159	S
Sex	0.0761	NS
Age	0.0875	NS
Education	0.5964	NS
Garden area	0.0576	NS
Env. Education	0.6719	NS
R-Squared	56.68	Significant at 5 % level

Table 4: Variables influencing sorting of solid wastes (point separation)

Variables	Probability	Significant (S)/ non-significant (NS) at 5% Level
Familysize	0.3612	S
Family Income	0.5716	S
Sex	0.1446	NS
Age	0.8142	S
Education	0.1709	NS
Garden area	0.9847	NS
Env. Education	0.2463	NS
Amount of wastes	0.1342	NS
Distance to waste dump	0.8086	S
R-Squared	56.68	Significant at 5 % level

Table 4.0 shows that only four variables such as family size, age, family income and distance to waste dump were found significant. Numbers of family members are increasing; there is a positive tendency towards sorting out of household wastes. They may have adequate members to spend on sorting. If the family size become larger generation of waste also will increase. In case of Age, when people are older they

do not show any interest on sorting of wastes. This may due to their lack of interest or environmental awareness.

When the income level increases they like to sort the wastes. But throughout the study we could not observe at any collection point sorted wastes. Higher income earning groups maintain a high degree of social status and show that they are environmental concern.

Distance to the waste dump has significant with sorting of wastes. If the waste dump is away from the households they do not like to sort the wastes, if it is closer to the household they show interest on sorting, depends on the distance to the waste dumping point or waste collection frequency.

Table 5: Variables influencing composting of wastes.

Variables	Probability	Significant (S)/ non-significant (NS) at 5% Level
Familysize	0.3495	S
Family Income	0.6288	S
Sex	0.1067	NS
Age	0.6499	NS
Education	0.8372	NS
Garden area	0.5808	NS
Env. Education	0.6719	NS
Amount of wastes	0.0235	NS
Sorting	0.2777	NS
R-Squared	56.68	Significant at 5 % level

Table 5.0 shows that family size and family income are significant to composting of solid wastes, while other variables are non–significant. When the family income and family size increase they may involve in compost making.

CONCLUSION AND RECOMMONDATION

When family size is large, food consumption and possibility to sorting and composting also is increasing as expected.

This research clearly leads to develop several waste management policies that can be implemented by the Municipal council of Batticaloa as efficient waste management tool on sustainable manner.

Creating a market forsorted outwaste, promoting recycling and, reusing. Introducing a new house hold tax system, reduce annual tax payment to promote sorting and composting of household wastes. Formation of waste pickers' cooperatives. Setting up of quality control criteria for compost and conducting of waste disposal awareness

Recommendation for policy initiatives

Develop and enforcing regulations Planning and evaluating municipal waste management activities by system designers, users and other stake holders. Physically handling of wastes and recoverable materials including separation, collection, composting and land fillings. Marketing recovered materials to brokers or to end-users for industrial, commercial or small scale manufacturing purposes. Establishing training programs for municipal solid waste management workers carrying out public information and education programs.

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