

Evaluation of Required Contribution by Residents and Other Entities for Solid Waste Collection: A Study in Kandy Municipal Area

S. Rathnayake and M. Bandara

PGIHS, University of Peradeniya, Sri Lanka

Keywords: *Solid Waste; Residents; Management; Kandy*

Introduction

Municipal solid waste (MSW) is a popular topic in many countries. Management of solid waste has become a broad subject in today's world. Industrial development can be considered a major reason for the increase of solid waste generation in the form of polythene, plastics, and various durable disposals. Solid waste or municipal solid waste can be defined as materials generated from the result of daily human activities in places like households, public places and city streets, shops, offices and hospitals. It can be further defined as any unwanted material intentionally thrown away for disposal (Karunaratna, 2015). Accordingly the management of MSW is defined as the discipline associated with the control of generation, storage, collection, transport or transfer, processing and disposal of solid waste materials in a way that best addresses the range of public health, conservation, economic, aesthetic, engineering and other environmental considerations.

Techniques used to solve the MSW problem varies from country to country. Developed countries use advanced techniques such as recycling, reusing, etc. Underdeveloped and developing countries apply open dumping techniques. However, dumping cannot be considered an appropriate way to solve the MSW problem. During the last two decades, European Union legislation has put increasing pressure on member countries to achieve specified recycling targets for municipal household waste (Xiaoyun, 2015). Sri Lanka still has a very poor system of managing municipal solid waste (MSW). The most common method of MSW disposal still remains to be open dumping (Bandara, 2011).

According to the provisions of the Local Government Act, the Local Authorities (LAs) in Sri Lanka are responsible for the collection and disposal of waste generated by people within their territories. Necessary provisions have been made under sections 129, 130 and 131 of the Municipal Council Ordinance; sections 118, 119 and 120 of the Urban Council Ordinance; and sections 93 and 94 of the Pradeshiya Sabha Act. The National Environmental Act (NEA) of 1980 which was subsequently amended in 1988 provides the necessary legislative framework for environmental protection in the country. The National Strategy for Solid Waste Management (NSSWM) put out by the Ministry of Forestry and Environment in 2002 endorsing the need for integrated solid waste management provides overall guidance for the management of the country's solid waste (Bandara, 2011). The Kandy municipal area, which is highly urbanized, generates huge amounts of solid waste. This area consists of 28.53km² of land. According to a 2012 survey, there are 102,500 permanent residencies in the area and 400,000 people enter the city daily for their requirements. The main MSW dumping site is located at Gohagoda.

Objective

The main objective of this study is to calculate the required contribution by residences and other entities to ensure the proper treatment of solid waste without being a burden to public funds of Kandy Municipal Council.

Methodology

The methodology of this study is based on survey data collected by the Kandy Municipal Council (KMC) Solid Waste Management Department from 2012 up to 2018. Based on the survey data, we calculate the average monthly solid waste generation at household level and for other entities. Then based on the average generation of solid waste, we estimate the average contribution by SWM service receivers. To estimate contribution, data was collected based on budgetary expenses such as wages, maintenance, marketing and purchases of the Department and income generated through various means of SWM are also taken into consideration for the actual cost for SWM.

Results and Discussion

Solid waste generation and collection in KMC area are separated into six zones for ease of management. There are staff and resources allocated to each area under the Solid Waste Management Department of KMC. Table 1 below shows average monthly solid waste generation. It has been calculated through a survey conducted by KMC and using their available data assuming that the rate of increase of solid waste generation is equal. We are considering the generation of solid waste by households, businesses and other institutions. Therefore we have divided the generation of solid waste into two categories as household and other institutions. Then we calculate solid waste generation according to the zone.

Table 1 Average monthly generation of solid waste

	Number of households	Solid waste generation (Kg)	Number of Businesses and other Institutions	Solid waste generation (Kg)
Zone 1A	1,412	63,087	3,067	2,194,074
Zone 1B	4,126	162,590	473	414,042
Zone 2	5,357	215,939	544	380,243
Zone 3	5,255	284,396	961	587,974
Zone 4	4,761	227,946	1,324	531,055
Zone 5	4,652	194,224	222	33,852

Note: Solid waste generation of businesses and other institutions include hotels, shops, private and government institutions, schools, hospitals and religious places.

Then based on average daily generation, we have calculated monthly solid waste generation according to the zone by household and other institution categories as indicated in Table 2. Total number of solid waste tons per month as well as the zone wise solid waste generation has been calculated in this table for further analysis. There are several modes of income generation by solid waste management such as Gully service charges, Sampath piyasa income, refused rubbish charges, extra solid waste disposal charges, income for sale of plastic cubes, and income from selling compost. Likewise the total calculated income is Rs. 19,819,316.00 (Rs.19 million) and monthly average income is Rs. 2,202,146 (Rs. 2 million).

Table 2: Average monthly cost estimation for households and other entities

	Cost per household (Rs.)	Cost per Business or other entity (Rs.)
Zone 1A	302	4,840
Zone 1B	267	5,922
Zone 2	273	4,729
Zone 3	366	4,139
Zone 4	324	2,713
Zone 5	282	1,032

Note: These costs for the KMC or contribution by service receivers are estimated using solid waste collection data, cost of dumping them under present rate and number of HHs/institutions in each zone as well as the income generated by several means.

Costs such as labor, machinery, advertising and community activities are incurred when implementing proper management of solid waste in Kandy Municipal Council area. Those costs are taken into consideration when calculating the average monthly cost for solid waste management which is Rs. 38,788,194 (Rs. 38 million). Then, the net loss for solid waste management is calculated by deducting average monthly income from average monthly cost which equals Rs. 36,586,048 (Rs. 36 million) per month. After that, the average cost per solid waste kilogram is calculated by dividing the monthly average loss by monthly average solid waste collection and that is 5,408,137 kg (5.4 MT) which equals Rs.7 per kilogram. Monthly cost for the household unit and businesses and other institutions are calculated based on the average percentages calculated for cost per household unit and shown in Table 6.

Conclusion

Solid waste management incurs huge costs for operation and maintenance of facilities. A municipality's solid waste expenditure can be analyzed most simply by its average cost. Average Cost requires that the service be divided by some metric, usually tons or number of household units. There is a cost that cannot be recovered from solid waste or solid waste management by KMC. Therefore that net loss from solid waste management which is Rs. 36,586,048 is covered by other tax revenue of the KMC. Therefore it should be taxed as environment tax from both households and businesses and other institutions

separately in this study. The institutions can be further divided into hotels, private and government institutions, shops, religious places, hospitals, etc. Future studies could improve the analysis further by estimating their contribution according to the type and magnitude of institution. Though the budget has allocated provisions for municipal solid waste management, there are an ineffective/inefficient implementations of the rules to get community participation for solid waste management. There should be a mechanism to influence community to reduce their waste by sharing cost with them for their waste generation which will be more effective on solid waste reduction as well as the management in future.

References

- Xiaoyun, B., Jacqueline, M. B., Ramos, T. R. P., Pova, A. P. B., Wong, C.Y., Vorst, V. D. (2015). Research Challenges in Municipal Solid Waste logistics Management. *Waste Management*, 48, pp 584-592
- Zhang, D.Q., Tan, S.K., Gersberg, R.M. (2010). Municipal Solid Waste Management in China: Status Problems and Challenges. *Journal of Environmental Management*, 91, pp 1623-1633
- Bandara N. J. G. J. (2011). Municipal Solid Waste Management – The Sri Lankan Case', Conference on Developments in Forestry and Environment Management in Sri Lanka, Department of Forestry and Environmental Sciences, University of Sri Jayewardenepura, Sri Lanka, Research gate