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WILLINGNESS TO PAY (WTP) FOR AEROBIC TREATMENT OF MUNICIPAL SOLID WASTE: A STUDY AT ALAPPUZHA, KERALA

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Abstract

Safe and environment-friendly handling of municipal solid wastes is one of the most important issues in world today. This is essential for preserving the purity of the environment and hence the health of individuals. Growth of industries like tourism has a direct bearing on an efficient solid waste management system that maintain the cleanliness of the nature. This paper studies the handling, treatment and disposal of the municipal solid waste in Alappuzha municipality in Kerala. It is based on primary data collected from 200 households of the municipality and is aimed at assessing the willingness of households to pay for the aerobic treatment of the biodegradable wastes. Linear regression model has been used for obtaining the estimation results. Interestingly, 55 per cent of the households were willing to pay for safe disposal. It is noted that income of households, their education, size of household, waste generation quantity and environmental consciousness are the major factors affecting their willingness to pay (WTP).

Keywords: Municipal Solid Waste, Scientific Disposal, Willingness to Pay (WTP).

1. INTRODUCTION

Environmental and public health problems arise from the unscientific disposal of municipal solid waste. Like most of the developing countries of the world, solid waste management has so far been given less care in India, but now government and private agencies have taken some positive steps to consider this area for the improvement of public health. Developing countries have scarcity of resources and in most cases it is not possible for the governments to make effective arrangements for the safe disposal of solid waste. For a developing country like India, it is not possible for the government alone to tackle the problem of environmental hazard. Rather, the active support of the public is essential. If some monetary contribution is made by the public, it will help the government to manage the waste disposal problem more effectively. This study assesses the civic willingness to pay (WTP) for processing of solid waste through aerobic composting units, with reference to Alappuzha municipality in Kerala.

2. REVIEW OF LITERATURE AND RESEARCH GAP

Solid waste management is a challenging task. The main point is to bring about change in public behaviour in order to minimise the volume of the waste with combined effort and to dispose the waste in a scientific way. For this purpose several policies and programmes have been proposed with different incentives. In order to follow various policies and programmes in solid waste management the public compliance is essential. (Anderson, 2006) [5]. Thus it is important to investigate the citizens' perception before implementing any incentives or schemes regarding solid waste management. In this study, the direct assessment technique like contingent valuation (CV) is used to directly ask the community about their willingness and their preferences (B.C.Field & M.K.Field, 2006) [7].

According to Aggrey & Douglason (2010) [12], age affects WTP in waste management negatively. Old people may consider waste collection as government's responsibility and could be less willing to pay for it. While the younger generation might be more familiar with cost sharing and could be willing to pay.

Household size is another factor that influences WTP for waste management. Chuen-Khee & Othman (2002) [3] found that the more the number of people in the household, the more willing the household will appreciate a clean environment. Tamura (2005) [4] studied the individual attributes of the demand for solid waste collection in Accra, Ghana found that the more income people have, the more willing they are to pay for solid waste collection.

The quantity of waste generated by a household also influences WTP for waste management. Aggrey & Douglason (2010) [12] pointed out that, the higher the generation of waste, the more the household faces the challenges of waste disposal and the greater the willingness to pay.

Satisfaction on waste collection services also influences WTP for improved waste management. People who are more satisfied with waste collection services are willing to pay more than dissatisfied people according to Afroz et al, 2009 [10] and Kassim & Ali, 2006 [6].

In spite of a number of studies, mostly at the international level, those in the Indian context, particularly with reference to Kerala state are virtually nil. Hence, this paper seeks to bridge this research gap by making an empirical study focusing on Alappuzha municipality in Kerala – a prominent town with tremendous tourism potential with the predominance of a large number of lakes, water bodies, lengthy beach and other serene environments; but heavily underutilized because of large scale pollution of land as well as water.

3. RELEVANCE AND SIGNIFICANCE OF THE STUDY

The throwaway habit of civic bodies on waste disposal is now slowly changing scenario in most of the cities and towns. In Alappuzha municipality the civic are searching for alternate solutions to dispose the waste in scientific way. For long time the waste generated in the municipality was being collected and dumped in the Sarvodayapuram dumping yard. In 2012 this practice was resisted by the people in and around Sarvodayapuram. Alappuzha municipality in particular has made several attempts at addressing the waste menace which is on the rise as a result of increase in population, rapid industrialization and the attitudes of the public. The municipality, with its efforts and strategies, has implemented some waste management techniques to handle waste collection and disposal effectively.

Alappuzha municipality initiated comprehensive garbage management programme as a mission in the Alappuzha city with an objective of 'Clean Home, Clean City'. It was all about keeping the city waste free. Then the municipality had decided to concentrate on biogas plant, pipe compost and aerobic units. Households having enough space had been provided with $1m^3$ and ½ m^3 biogas plants to the subsidy of 50 per cent. Those who had no space had opted pipe composting which was cost effective and an easy method of waste disposal. Then through technological intervention, aerobic composting units were set up in eight places specially for disposing biodegradable waste. Through aerobic composting units nearly 1200 households are able to dispose their waste scientifically. By seeing its effectiveness the remaining households are also raising their voice to promote scientific disposal of waste in their wards.

In fact, Alappuzha has got excellent prospects for developing as a prominent tourism destination in the whole of India. In terms of tourism potential, Alappuzajor ha is comparable or even better than any topmost tourism destination in India because of it is endowed with vast coastal areas, large number of lakes and other serene environments. Hence it is a miniature of India, which in turn is "a geographical location, natural resources as well as historical and cultural background which are quite conducive for development of tourism" (Manoj P K) (2008)[8]. While pointing out the excellent prospects of tourism for economic development of India Manoj P K (2008) [11] has noted a few negative factors which deter the tourism growth and impede its prospects; and these negative factors include, inter alia, the lack of cleanliness because of poor wastage disposal.

Referring to the problems faced by Kerala from a wider perspective ('Kerala model of development'), Oommen (2008)[9] has studied Kerala's ecological problems in detail, and has called the current scenario as 'Ecological Overkill'. Thus, the utmost need for preserving the environment has been highlighted. Similarly, in his study on the prospects of ecotourism in Kerala, Manoj P K (2010) [13] has pointed out poor cleanliness as one of the major weakness that Kerala tourism is facing at present. Thus, effective solid waste disposal is a vital need sustainable tourism development in Kerala, particularly in locations like Alappuzha – one that is worst affected by poor waste disposal. In the above context, some efforts are being made to educate the public and to create awareness as to how to reduce waste and handle waste efficiently. But, the level of achievement of this objective leaves much to be desired as is evident from the presence of piles of wastes on the streets, market centres and surroundings of the households. In short, waste management still remains as a herculean task to the municipality as it has not been able to manage and deal with waste problem to the expected level.

This situation according to Alappuzha municipality is due to inadequate finance for acquiring land to clear the solid waste in the municipality. The assumption is that if households pay more, then the services would be improved. Very little has been done to assess the households' willingness to pay (WTP) for improved waste management services. Here lies the relevance and significance of this study because it seeks to make an empirical analysis of the WTP with reference to a sample of 200 households in the municipality area.

4. RESEARCH QUESTIONS

1. The question is that, are the households ready to pay for scientific treatment of solid waste through aerobic composting units?
2. How much are they prepared to pay?

3. What all are the factors influencing willingness to pay for aerobic composting units for improved solid waste management services?

5. OBJECTIVES OF THE STUDY

1. To study the existing techniques of solid waste management (aerobic units) and to understand the expected service from aerobic units in the study area.
2. To evaluate the factors influencing willingness to pay for aerobic treatment units.
3. To analyze the socio-economic and environmental aspects of aerobic units.

6. METHODOLOGY

Primary data was collected through structured questionnaire. 200 households were selected randomly for the sample survey. The study was conducted for a period of 3 months from January to March 2015. Secondary data had been collected from Alappuzha municipality, Suchitwa mission, Nirmala Bhavanam Nirmala Nagaram, Pollution Control Board and Town Planning Office to study the existing techniques of solid waste management in Alappuzha municipality. Statistical tools like SPSS and correlation had been used to analyze the data. In addition simple statistical tools such as means, ranges and frequency distributions chi-square test had been computed for all variables and selected variables had been used in multivariate analysis. The significance between more than two means had been tested by one-way ANOVA tests. The ordinary least squares method had been used to estimate the parameters in the multiple linear regression models. The F-statistics had been used to test the significance of the R^2 statistics in the multiple linear regression models.

7. STUDY AREA

Alappuzha municipality has a population of 177029 (according to 2011 census) with the households of nearly 40000 families generating about 53 tonnes of waste per day. It comprises of 52 wards. Alappuzha municipality has been carrying out the scientific disposal of solid waste using 824 biogas plants, 525 pipe compost units and 112 aerobic composting units. 4 tonnes per day of bio-degradable municipal solid waste is being collected, segregated and processed in the municipality. Food waste from restaurants is collected by a private agency and is used as animal feed. Regular streets sweeping is done by the municipal workers and the biodegradable waste thus collected is segregated and processed in the aerobic units of the respective wards.

8. DESCRIPTION OF THE AEROBIC UNITS

'Thumburmuzhi model' of aerobic composting units developed by Dr. Francis Xavier, which is becoming the model of decentralized waste management in Kerala, includes a box like structure with a ferro-cement floor of 4x4x4 feet with the layers filling of cow dung 6 inch, dry leaf 6 inch and waste 6 inch. This principle of composting waste which uses microbes isolated from cow dung. Oxygen is essential for microbes. By disintegration of waste in addition to compost, carbon-dioxide, Nitrate and ammonia are produced. The temperature of 70-75^{o}C build up destroys many pathogenic microbes. It will take 90 days for composting. The advantages of aerobic units include (a) A new layering system for Kerala agro zones. (b) Cost-effective (c) Not labour intensive and (d) Eco-friendly technique with low carbon dioxide and methane emission.

9. RESULTS AND DISCUSSION

9.1Existing Solid Waste Management

Majority of the households (51.30 per cent) have generated >1000gm of municipal solid waste per day. 43.58 per cent of the households have generated 500-1000gm per day and 5.12 per cent of the households generated<500 g of waste. 47.43 per cent of the respondents opinion about collection practices of waste were very serious (not satisfied with collection services), 27.35 per cent of them were somewhat serious (somewhat satisfied) and the remaining respondents were not serious about the collection.

Majority of the respondents (51.38 per cent) were not using any container to store the waste, instead they were using plastic carry bags to store the waste which was easy for them to dispose the waste in the aerobic plant unit. 37.17 per cent of the respondents were using metal/plastic container to store the waste and the remaining respondents were using basket/carton container to store solid waste. Due to the influence of aerobic composting units 56.41 per cent of the respondents were disposing the waste daily, 26.92 per cent of the respondents were disposing thrice a week, 12.53 per cent of the respondents disposing twice a week and the remaining respondents were disposing the waste once in a week. Majority of the respondents (48.70 per cent) preferred to empty the waste at the final disposal site and the waste stays there. In fact, 42.30 per cent of the respondents preferred to empty into the larger container in the same building while 3.24 per cent of them preferred to empty

into open pile of the waste in the neighbourhood. The rest 2.56 per cent preferred to empty into the community container near neighbourhood.

The municipality has aerobic plants at 8 places only. In the remaining places 45.74 per cent of the respondents said that the community container is emptied less than once in 2 weeks. According to 37.76 per cent of the respondents the community container is emptied daily. 10.25 per cent of the respondents said that the community container is emptied three times a week. 1.25 per cent emptied twice a week and 1.2 per cent emptied once a week. 57.56 per cent of the respondents were using the aerobic plant since less than a year. 24.50 per cent of the respondents were using it for 1-2 years and 17.94 per cent of the respondents were not aware of the system. Besides, it is noted that 58.12 per cent of the respondents' kerbside waste was collected by local government 36.88 per cent by private company, 3.8 per cent by neighbourhood group and 1.2 per cent by local public authority. Majority of the respondents viewed that the same organisation had been collecting the waste for the past 5 years and 66.66 per cent of them were very satisfied of the service from aerobic plant. Further, 26.92 per cent of them were reasonably satisfied and the remaining respondents were not satisfied at all.

9.2 About Aerobic Unit

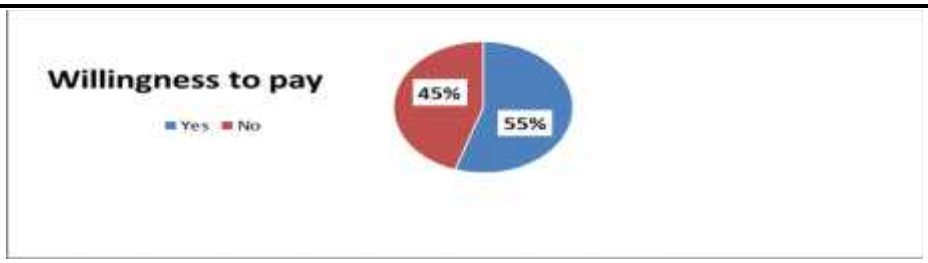
Majority of the respondents (46.15 per cent) preferred the distance of aerobic unit as 50m from their house, 37.17 per cent preferred 100 m distance and the remaining respondents preferred >100m. Nearly 55 per cent of the householders indicated that they are be willing to pay for improved solid waste collection and disposal services of aerobic units in their residential areas. This indicates the aerobic units motivate the residents to live healthily irrespective of their economic status and lifestyles.

Table I: Willingness to Pay (Rs) per month

Fee details per month	Per cent
30-50	23.64
50-100	19.73
>100	18.45
Won't (0)	19.73
Don't (0)	18.45
Total	100.00

It is noted that 23.64 per cent of the respondents were willing to pay Rs.30-Rs.50 per month. 19.73 per cent of the respondents were ready to pay Rs.50-Rs.100 per month and 18.45 per cent of them were willing to pay Rs.100 and above per month. Majority of the respondents (51.45 per cent) were not willing to pay full cost for private agencies in solid waste management services. 31.92 per cent of the respondents were willing to pay full cost for private solid waste management agencies. (Table I and Figure I).

Figure II: Willingness to Pay (Rs) per month



Source: Based on Field Data

According to the survey, the reason for not willingness to pay is that 40.70 per cent of the respondents could not afford to pay for full cost for the private agencies. 30.45 per cent of them believed that general taxes would cover the cost of the solid waste management services. Further, 19.22 per cent of the respondents were willing to separate the recyclable materials and to compost kitchen waste in their garden/yard. Another 19.22 per cent respondents were willing to separate the recyclable waste and bury the kitchen waste in their backyard or garden. And the rest of the respondents were neither willing to pay nor to follow do it yourself method.

It is noted that 26.92 per cent of the respondents suggested selection of method that has a lower cost as an alternate method of solid waste management. Another 26.92 per cent of the respondents suggested walking a longer distance to empty or place their container as an alternate method of waste disposal. 12.82 per cent suggested less frequent collection of waste. 16.67

per cent suggested the alternative method as participation as a volunteer in community efforts to regularly clean up uncollected waste. Another 16.67 per cent of the respondents suggested other cost saving suggestions as their solution. Besides, 58.01 per cent of the respondents prefer local government services in solid waste management. 10.58 per cent preferred private company involvement in solid waste management services. Remaining respondents found no difference in services.

9.3 Socio-economic and Environmental Aspects of Using Aerobic Compost Plants

Majority of the respondents (37.23 per cent) using aerobic treatment plants were in the age group of above 50. 33.33 per cent of the respondents belong to 40-50 age groups. 25.64 per cent of the respondents were in the age group of 30-40 and only 3.8 per cent were in the age group of less than 30. It is noted that 71.80 per cent of the respondents are male and the remaining 28.20 per cent are female. Assuming other factors remain the same, this result indicates that male of household are more likely to have disposed the waste in Aerobic units than their female counterparts. The result can also be attributed to a social perspective within which the men, in general, have the habit of doing most of the work outside home and have taken responsibility to dispose the waste in the aerobic unit.

Further, 29.04 per cent of the respondents are from the income group of Rs.10000 – Rs.20000. 24.35 per cent of the respondents are among Rs.5000 – Rs.10000. Only 12 per cent of the respondents belong to <Rs.5000 category. Assuming other factors constant, this finding indicates that the higher the number of income earning members in a family, the greater the total income earning capacity. The condition leads to a higher WTP. Majority of the respondents (38.48 per cent) have qualified high school, 38.46 per cent have completed Degree, 11.53 per cent have completed the middle school and 6.41 per cent of the respondents have completed primary school. It is observed that 51.28 per cent of the respondents have >4 members in a family. 43.60 per cent of the respondents have 2-4 members in their family and only 5.12 per cent have 0-2 members. Further, 70.53 per cent of the respondents are very serious about littering and illegal piles of solid waste in the environment 16.66 per cent of the respondents were somewhat serious and the remaining were not serious about littering and illegal piles.

9.4 Factors Influencing Willingness to Pay

The results of the regression model show that the major influence on householders' Willingness To Pay (WTP) is likely to be their level of satisfaction with the present service from aerobic unit. The independent factors that have a positive influence on householders' Willingness To Pay are monthly income of heads of household, education, number of members in the household, quantity of waste generation and the environmental consciousness of the respondents. The regression model shows that two factors are negatively associated with the householders' WTP: (a) Distance: For every unit increase in the distance (coefficient is .028) of aerobic composting unit from the house, decrease in WTP is predicted holding other factors constant. (b) Age: age affects WTP waste management negatively.

Based on the above observation, it may be predicted that for every increase in age there is a decrease in WTP. It is because the old people may consider waste collection as government's responsibility and could be less willing to pay for it. High income group with household size of 4 shows higher frequency to WTP as the waste generated by them is high compared to other groups. The coefficient of income is .048 i.e. for every unit of increase in income .048 increase in WTP is predicted holding all other variables constant. The study hypothesizes the willingness to pay to be positively related with the quantity of solid waste generated, since the higher the generation, the more would be the problem households' face in storage and taking waste for collection and they would be willing to pay more.

Correlation was used to find the relation between education and WTP. Result shows that education and WTP are strongly correlated. The mean of education (3.57) is higher than WTP (1.14) and the Standard deviation for education is 1.24 which is greater than .34. This means that education has a strong impact on WTP.The problem of waste collection and nuisances occurred from other forms of waste collection are pretty serious in the study area. Illegal piles of waste have been accumulating in particular areas disturbing the environmental balance and creating other ecological problems. 70.94 per cent of the households are aware about the environmental safety and are deeply concerned about it. 51.38 per cent of the respondents were not using any container to store the waste; instead they were using carry bags to store the waste. Most of the households preferred plastic container for storing solid waste and where the plastic container is taken to aerobic plants. They also showed high positive response to scientific waste disposal aerobic units by local government and they are completely satisfied with their service. The only reason for not dumping the waste to aerobic plant is distance which can be remedied by using any other alternative measure.

Out of the 200 households taken for the study, 32.07 per cent of the households preferred door to door collection and 52.23 per cent in disposal in aerobic plant while the rest were interested in dumping the waste in the yard. And the respondents were willing to dump the waste by them if the aerobic plant is 50m- 100m distant from their houses. The amount they were willing to pay ranges from Rs.30 to Rs.100 and there is perfect relationship between variables and the model is a good fit. Due to the influence of aerobic composting units 56.41 per cent of the respondents were disposing the waste daily. Most of the respondents (66.66 per cent) of this study have indicated that local solid waste management could be improved through municipal waste collection and disposal services. The analysis of data shows Municipality is the most preferred service provider.

10. RECOMMENDATIONS BASED ON THE FINDINGS OF THE STUDY

- Citizens should be educated on effective segregation at source through regular sensitization programmes by the collaboration of stakeholders such as local government, the private sector, NGOs and residents association.
- Citizens should be strengthened on willingness to pay for the service delivery thereby the households maximize their utility from improved services.
- The municipality should concentrate on awareness campaigns about the consequences of waste mishandling and benefits of payment for decentralized waste management services.

11. CONCLUDING REMARKS

This study on "willingness to pay for aerobic treatment of municipal solid waste in Alappuzha municipality" revealed that about 66.66 per cent were satisfied with the aerobic composting system. Results from the regression model revealed that income of household, education, size of household, waste generation quantity and environmental consciousness significantly influence the willingness to pay for the aerobic composting services. Presently the aerobic system is taken as a pilot unit in Alappuzha municipality. Large scale coverage of aerobic units in all the wards in the Municipality will pave the way for efficient decentralized waste management.

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