

Solid Waste Management Practice and Level of Satisfaction from Related Services among Commercials and Institutions in Jigjiga City, Ethiopia



Tewodros Manyazewal* and Tesfaye Walelgn

Dire Dawa Environment and Forest Research Center, Ethiopian Environment and Forest Research Institute, Ethiopia

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*Corresponding author: Tewodros Manyazewal, Dire Dawa Environment and Forest Research Center, Ethiopian Environment and Forest Research Institute, Addis Ababa, Ethiopia

Abstract

Emerging cities of Ethiopia are characterized by rapid population growth caused by high fertility and migration from rural areas. Rapid growth of cities is mostly accompanied by a fast growth in commercial centers and institutions which contributes high volume of solid waste. The aim of this study was to assess practice of solid waste management and satisfaction level regarding solid waste collection service. A Cross sectional quantitative study was used and stratified random sampling with systematic random sampling technique was employed. Sample size was determined using a population proportion and assumption of 20% of total waste generation from commercials and institutions. Structured questionnaire was used to collect the data from 76 sampled commercials and institutions. The result showed that only 35.5% of commercial centers and institutions were engaged in solid waste separation. Major items separated for sale or exchange were glass, bottles and cans (56.7%) followed by plastics (23.1%). All 76 institutions and commercials had access to door to door waste collection service from small and micro enterprises. Among those with access 80% were satisfied with the service. Factors contributed for the satisfaction level of customers was determined using binary logistic regression. Location of commercial centers and institutions, number of people served per day and frequency of cleaning were identified as major contributors. This study revealed the current practice of solid waste management among commercials and institutions, and available services for waste collection. Thus, it can be an input to improve the service and for other studies in similar towns.

Keywords: Solid waste; Practices; Satisfaction; Commercials; Institutions

Introduction

Municipal solid waste is defined as discarded items from households, including bulky waste, waste from commerce and trade, office buildings, institutions and small businesses, yard and garden, street sweepings, contents of litter containers, and market cleansing [1-3].

Municipal solid waste management (MSWM) is a complex issue which requires a large sum of money, manpower and materials. The issue is more prominent in developing countries with rapid change in lifestyle, urbanization, and under-estimated contributors and stakeholders. In addition, the uncontrolled disposal of solid waste created a nuisance and contamination of water and soil. The limited knowledge and awareness regarding contamination, waste reduction techniques and other solid waste management aspects magnified the problem in developing countries [4-6].

Solid waste in Africa is basically generated from agricultural and domestic activities, marketplaces, institutions, public areas and manufacturing industries [7]. Generators dispose their waste without considering the public health and environmental

impacts; thereby, aggravating the problem in most cities [8-10]. Rapid population growth in a rapidly developing city produces huge amount of waste which needs good infrastructure, institutional setup and community engagement [11,12].

Commercial centers and institutions are major contributors of waste generation in rapidly growing cities. Different types of activities produce a variety of waste items in commercial centers and institutions. Despite their smaller number, the amount of waste generated in a single commercial center or institute per day is larger compared to per household generation [7,12].

As most of developing countries, waste management is a concern in many cities of Ethiopia. Throwing solid waste along the boundaries of roads and in open areas is an issue [11,13]. Lack of sufficient data on community's solid waste management practice and solid waste collection services makes it difficult to identify and implement appropriate actions [12,14].

Commercial centers and institutes are among the front runners in generating large amount of waste in Ethiopia. The practice of uncontrolled waste disposal along the roadsides, near

their working area and in sewer lines are commonly observed issues among commercial and institutions [9,15].

This study focused in one of the major commercial cities of the country. The study was conducted to assess existing municipal solid waste management practices and level of satisfaction regarding solid waste collection services among institutions and commercials in Jigjiga city, eastern Ethiopia. The aim of the study was to identify current practices by the commercials and institutions and the service delivered by micro and small enterprises and the municipality.

Methods and Materials

Study area and period

The study was carried at Jigjiga city, in Eastern Ethiopia. According to the Central Statistics Agency, Jigjiga has a population of 159,300. The study was conducted from February to March 2018.

Study design

A quantitative descriptive cross-sectional study design was applied to assess the practice of solid waste management and level of satisfaction regarding solid waste collection service among commercial and institutional waste generators.

Source and study population

All commercials and institutions in the city were the source population from which the required sample size was drawn. The study population was all commercials and institutions selected through the sampling technique used. The study units were individuals available at the time of data collection.

Sample size determination and sampling technique

The sample size of the institutions and commercials included in the study was calculated using a single population proportion. The assumption used to estimate the sample was through considering households and institutions waste generation contribution. Literatures indicate 80% of the waste came from households and the rest 20% came from commercials and institutions. Therefore, the initial step was to calculate the household sample size. Then we have calculated 20% and took it as the required commercials and institutions sample size.

$$n = \frac{\left(\frac{z\alpha/2}{2}\right)^2 pq}{d^2} \dots\dots\dots(1)$$

Where n= sample size

$\alpha /2$ = confidence limit

$Z\alpha/2$ = confidence level= (95% confidence)

$$n = \frac{(1.96)^2(0.5)(1 - 0.5)}{(0.05)^2} = 384$$

d= margin error=0.05

p =population prevalence q= 1-P

Although the total households in the included strata were below 10,000, we have used 384 as the final sample size to increase the likelihood of increasing representative commercials and institutions. Thus, we have taken the final sample size for commercial and institutions as 20% of the total households (384). The sample size of commercials and institutions = 384*20% = 76.

For selection of representative samples, first the town was divided in to two distinct strata as center of the city (close to the center) and periphery (part of the city away from the city) based on their geographical location, population density and availability of different infrastructures. All institutions and commercial centers within a radius of 1.5 kilometer from the center of the city (as marked by the city administration) were included in strata 1 (center of the city) and the rest were considered as strata 2 (periphery of the city). A total of 1153 registered commercials and institutions were found in both strata. Among these, 728 were found in strata 1(at the center of the city) and 425 of them found in strata 2 (periphery of the city).

The calculated sample size was distributed to each stratum using proportional allocation based on the number of commercials and institutions in each stratum as indicated below.

For strata 1= 76*(728/1153) = 48

For strata 2= 76*(425/1153) = 28

The commercials and institutions included in this study were selected by systematic random sampling method using the list of registered commercials and institutions in each stratum. We have determined the sampling interval (K) by dividing the number of commercials and institutions in the stratum by the desired sample size. Thus, for each stratum the K value was 15. Therefore, commercials and institutions at the 15th interval in the sampling frame were taken as study population.

Method of data collection

The data was collected using a structured questionnaire through face to face interview. The questionnaire was prepared in English and translated to three local languages (Amharic, Oromiffa, and Somali). Owner, manager or representative of the commercial or the institute was interviewed. Pre-test was conducted in 24 commercials and institutions at Harar city, eastern Ethiopia.

Data analysis

The data was analyzed using the Statistical Package for the Social Science (SPSS) software version 20.0. The results are presented in the form of frequencies and percentages. Binary logistic regression was used to identify factors which determine

level of satisfaction regarding solid waste collection service by micro and small enterprises. The level of satisfaction was dichotomized as satisfied and unsatisfied to perform the binary regression. For all statistical significance tests, the cut of value set was $p < 0.05$ as this is considered statistically reliable for analysis of this study.

Results and Discussion

Characteristics of institutions and commercial centers

A total of 76 institutions and commercial centers were included in this study. The characteristics of selected commercials and institutions were presented in Table 1.

Table 1: Socio-demographic characteristics of institutions/commercials.

Characteristics	Number (Un-weighted)	% (Weighted)
Location		
Center of the city	27	35.5
Periphery of the city	49	64.5
Type of Institution		
Health institutions	7	9.2
Hotels/Restaurant/cafeteria	21	27.6
Educational institutions	10	13.2
Internet café/stationary	4	5.3
Offices	14	18.4
Shop/supermarket	18	23.7
Beauty salon	2	2.6
Number of Employees		
Less than 10	44	57.9
10-20	25	32.9
Greater than 20	7	9.2
Number of people served per day		
Less than 100	49	64.5
100-200	14	18.4
Greater than 200	13	17.1

Onsite Solid waste storage and separation

The respondents were asked about frequency of cleaning their institutions and commercial centers. From the total respondents 74 (97.4%) of them claimed to clean their institute or commercial center every day; while the rest two were cleaning between two to three days interval. Once they cleaned, 31(40.8%) of them used metal containers for onsite solid waste storage. The other 23(30.3%), 15(19.7%) and 6(7.9%) of the respondents used plastic container, sack and basket storage materials respectively. The findings in this study were similar with another study in Gonder [16]. The preference of materials for onsite solid waste storage is mainly based on the characteristics of solid waste, collection equipment, generators financial power, collection frequency, and space for storage materials [17]. Thus, the results in this study reflected the diversity of waste generators. Frequent waste generators may use easily available and cheap storage materials like plastic containers, while offices and stationaries may use more of permanent waste collection materials than disposable items such as plastics.

Onsite solid waste separation practice of respondents was also assessed. It showed that, only 27 (35.5%) of them separate items which are salable or exchangeable in the local market. The majority or 49(65.5%) didn't separate solid waste at all. Although, 27(35.5%) of the respondents practiced solid waste separation, only four of them, sort the waste regardless of salable and exchangeable items in the waste stream. The rest 23 of them never performed waste separation, if items were not valuable for sale or exchange. The major items separated for sale or exchange were glass, bottles and cans (56.7%) followed by plastics (23.1%). The rest items including metals, textiles and electronic wastes account 20.2%. The waste types identified were similar with another study at Dessie [18]. This can explain the similarity in the type of waste generated from commercials and institutions in the other part of the country. The smaller percentage of waste separation practice maybe due to lack of market for recyclable items or poor institutional organization in the solid waste sector [19]. According to a study [20], the absence of a clear organized approach and mechanism of solid waste separation at household

level makes solid waste separation tough for waste reduction through recycling and disposing it safely.

Accessibility and frequency of solid waste collection service

The municipality and micro and small enterprises (MSE) were the formal solid waste collection service providers for the institutions/commercials of Jigjiga city. In addition, some respondents used to get service from informal solid waste collectors. All the institutions/commercials had access to door to door waste collection service from small and micro enterprises (MSE). In addition, 93.4% and 5.3% of them have additional service access from the municipality and informal waste collectors respectively. Regarding frequency of the service from the municipality, 30(42.3%) of the respondents had access to collection within 8-15 days and 27(38%) of them had between 4-7days. The rest 7(9.9%), 4 (5.6%) and 3(4.2%) got service within 1-3 days, 3-4 weeks and above a month respectively. Similarly, the service delivery frequency from MSE were also within 8-15days 30(39.5%) and 4-7days 25(32.9%). The remaining 14(18.4%), 4 (5.3%) and 3(3.9%) had access within 1-3 days, 3-4 weeks and above a month respectively. The results indicated that, in average majority of commercials/institutions should have to wait four days to two weeks for waste collection service. Major urban centers in Africa have shown that the problem of waste management has become serious issue due to inefficient collection of the generated solid wastes [21]. Despite the huge sum of money spent, most collection activities are a failure. Viewing waste collection as a one-size-fits-all situation without considering local factors is a main reason for the failure. In the current study, this was exhibited as similar collection service by the MSEs was provided without considering the difference among the commercials and institutions.

The payment per month for door to door solid waste collection service from municipality and small and micro enterprises (MSE) was also investigated. The maximum fee claimed to be paid by 9(11.8%) of the respondents was 250 ETB (equivalent to 10.87 USD during the time of data collection). The majority, 31(40.8%) paid 100 ETB; while 17(22.4%) paid 150 and another 17(22.4%) paid 200 ETB. The minimum payment was 50 ETB (2.6%). On the other hand, institutes/commercials that used informal sectors, 4 (5.3%) paid 40 ETB or 50 ETB per month depending on the volume of the solid waste to be disposed. The payment for solid waste disposal was more or less similar with the study at Gonder [16] and somehow greater than the price paid by households at Mekele city [22]. This can be due to large volume of waste from commercials and institutions compared to households.

Level satisfaction on solid waste collection service

The level of satisfaction regarding solid waste collection service was assessed and presented in Figure 1. Among the respondents who had access from small and micro enterprise and municipality respectively, 73.7% and 63% of them said the service was satisfactory. The other 20% said they were unsatisfied with the service delivery from the municipality and 9.2 % were unsatisfied by the service provision from micro and small enterprises. Delayed collection frequency (10) and poor service quality (6) were mentioned as major reasons of dissatisfaction. Among those who were unsatisfied with the service, 11 of them were forced to use illegal dumping. A similar study in Addis Ababa, Ethiopia also revealed dissatisfaction in solid waste collection services due to delayed collection frequency and poor service quality [23]. All waste generators don't generate equal amount of waste per day. Thus, identifying large volume generators and providing collection service in a daily basis may solve the issue of dissatisfaction.

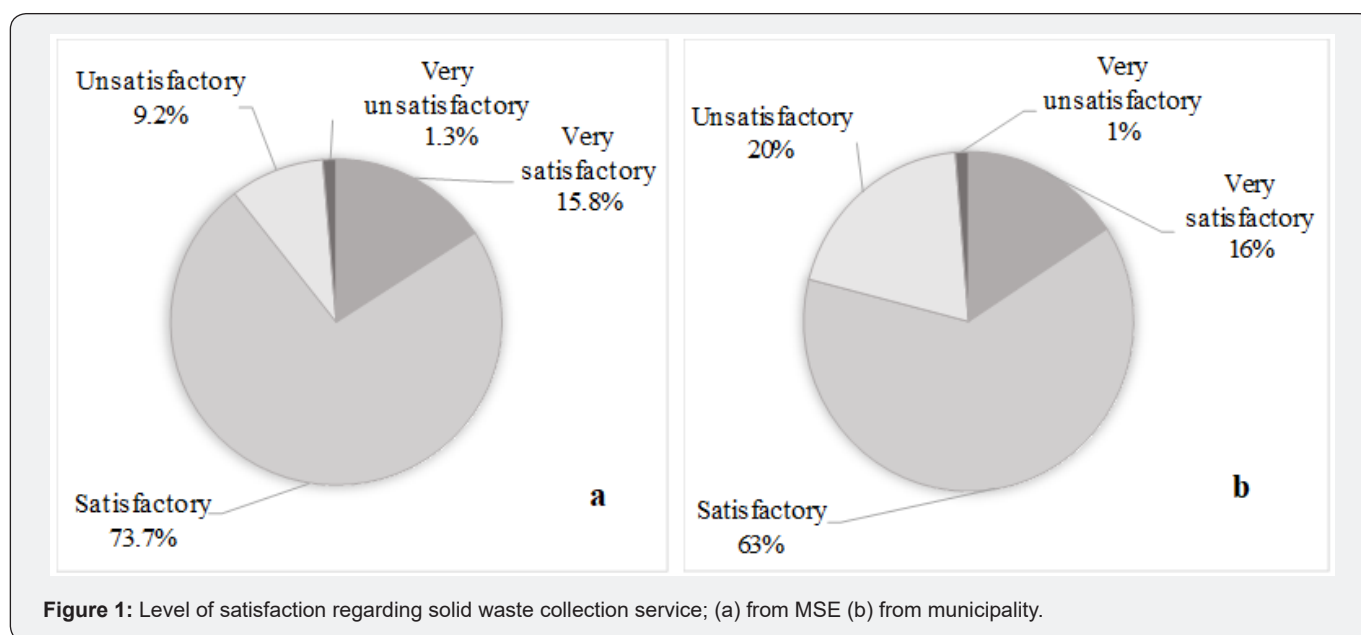


Figure 1: Level of satisfaction regarding solid waste collection service; (a) from MSE (b) from municipality.

Respondents have also given their suggestion in order to overcome the constraints and to improve the service. Organized monitoring and control of MSEs (4) and community participation, and awareness (12) were mentioned as appropriate solutions.

In relation with it, they were inquired about an access to information regarding solid waste management. Majority of respondents (92.1%) obtained training, education or information about solid waste management, impact of illegal solid waste dumping and related consequences. Among these respondents; solid waste management campaign (43.4%) and open seminars (31.6%) were chosen as favorable methods to gain additional information. Exhibitions presenting good practices in solid waste management and recycling activities were also mentioned (11.8%) as favorable approaches to deliver information. The opinions of the respondents exhibited the importance of a continuous effort to create awareness regarding solid waste management as mentioned in previous studies as well [23].

Under access to information, the respondents were asked if they know the rules and regulations related to solid waste management. About 88.2% of them didn't know the city's rules and regulations related with solid waste management. Lack of communication between the municipality and citizens does not motivate residents to handle waste properly and to keep rule and regulations of the town. To answer level of communication, the respondents were asked whether they ever seen the solid waste management department of the city perform supervision and control on illegal dumping of solid wastes. About 72(94.7%) of the respondents observed supervision activities but suggested for a frequent supervision and control. This study showed similarity with the findings in some cities of Ethiopia [22]. Therefore, suggestions/recommendations of respondents should be considered in order to improve solid waste management services.

Factors affecting level of satisfaction regarding solid waste collection service

We have performed a binary logistic regression to determine the effects of location, frequency of cleaning, separation of items for sale and exchange, and number of people served per day on the likelihood that commercial centers and institutions satisfaction regarding solid waste collection service by MSE. The logistic regression model was statistically significant, $\chi^2(6) = 23.2$, $p < .001$. The model also explained 51.2% (Nagelkerke R²) of the variance in level of satisfaction and correctly classified 89.3% of cases. Commercials and institutions which located further away from the center of the city were 1.4 times less likely to be satisfied with the service compared to those located around the center of the city. Commercials and institutions serving more than 200 customers per day showed an increased likelihood of dissatisfaction with the odds of 1.3 times than those serving below 200 customers. Frequency of cleaning and separation practice of items for sale and exchange were also

associated with level of service satisfaction. Commercials and institutions located at the periphery had less access to solid waste collection. This may be due to the availability of higher number of institutions and commercials around the center of the city which shifted the attention of micro and small enterprises to focus in these parts of the city compared to the periphery. In similar way, serving higher number of customers may lead to the generation of larger volume of waste in these areas. This is more visible in commercial centers such as hotels, restaurants and shopping centers.

Conclusion

The study has identified the problems related to solid waste management practice among commercial centers and institutions. The low level of solid waste separation practice was one of the major issues found in this study. The availability of items for sale or exchange in the solid waste stream was mentioned as major reason to perform onsite solid waste separation. Therefore, creating a market which demands recyclable items can promote separation of waste among the commercials and institutions. Despite the availability of solid waste collection service, there was a difference in the level of satisfaction among commercial centers and institutions. The findings showed location, number of people served per day and frequency of cleaning were the factors which determined the level of satisfaction regarding solid collection service. Thus, the distribution and frequency of collection by micro and small enterprises should be based on these factors rather than random distribution. Low level of access to information and rules and regulations regarding solid waste management among respondents created a gap in solid waste management practice. Therefore, conducting solid waste management campaigns, open seminars and exhibitions can be solutions. In general, a holistic approach must be adopted to achieve a meaningful and lasting solution. Hence, the municipality should work together with commercial centers, institutions, informal waste collectors and micro and small enterprises for an effective solid waste management.

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