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Constraints of Community Participation on Domestic Solid Waste Management in Sodo City, Wolayita Ethiopia

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ABSTRACT

This study was undertaken to assess the constraints of community participation on domestic solid waste management activities in sodo city, Ethiopia. Both qualitative and quantitative data were collected from primary and secondary sources. The primary data were collected from 204 households who were randomly selected from four kebeles (Fana, Gebeya, Gido and Selame) of wolayita-sodo city. The primary data were gathered through survey questionnaire, key informant interview, focus group discussion, and field observation. The secondary data were collected from central statistics authority, city municipality, published and unpublished sources. The collected data were analyzed by using descriptive statistics and binary logistic regression model. The result shows that participation of communities on domestic solid waste management was low. The result from binary logistic regression model revealed that the probability of household participation on domestic solid waste management was positively and significantly constrained by educational level of households, household income, and household access to main road, small-scale enterprise service coverage and supply of waste facility. On the other hand, sex of household head and marital statuses were negatively and significantly constrained the probability of household participations on domestic solid waste management. As a result, widening the horizon of education and training, expanding small-scale enterprise service coverage, supply of waste facility and provision of road infrastructure within the community was suggested to reduce constraints of community participation on domestic solid waste management.

Keywords: Community participation, Domestic Solid Waste Management, Binary logistic regression, Households, Constraints

INTRODUCTION

Globally, waste production has practically doubled over the last one decade and it is also expected to reach 2.5 billion tons per year in 2025 as a result of the combined effect of urban development and changes in consumption patterns of city community [1]. In addition to this increasing industrialization and fast growth of urbanization does not only pose problems related to the resources allocation and powers but also severely challenges the natural environment. Environmental degradation such as contaminated water, sinking ground water levels, Unhealthy soils and polluted air has become a harsh reality in many parts of the world [2].

Solid waste management is a complex task which depends on organization and cooperation between households, private enterprises and governments up on sorting, collection, recycling, transportation and final disposal activities [3]. Many different actors have experimented with various technological options to find viable alternatives for appropriate collection and disposal of solid waste. Urban areas in Ethiopia are in a state of expansion without the standard plan; this paved the way for challenging municipal service delivery. Like in many developing cities, a rapid population growth and high rural-urban migration poses many urban development challenges for towns in Ethiopia. One of these challenges is community participation in domestic solid waste management [4].

Community participation is a key factor attaining the goal of solid waste management (SWM) [5, 6]. In developing countries, community participation plays an important role in achieving SW management [7, 8, 9]. In developing countries with large population, the human resource is the potential resource for development. Human resources play the key role in SW management in developing countries. The rapid population growth is one of the major challenging factors that enhances waste management problem in urban area. As ill-managed wastes generation leads to a big environmental hazard, the inabilities of societies to manage waste generation play a significant role in increasing environmental pressures [6].

According to [10] community participation defined as getting involved in, or taking part in an activity by individuals and groups at all levels; participation also includes activities related to domestic solid waste segregation, storage, recycling, transportation and final disposal practice. Community participants may include residential associations, charitable organization, welfare societies, and self-help groups who participate in collection or picking, transportation, storage, disposal and recycling of solid waste [10].

Poor coordination of community in solid waste management practices within the town has resulted in the accumulation of wastes on open lands, on streets, in drainage channels (ditches), on the riverbanks and around residential area of the town [11]. This in turn, causing huge problems especially unclean smelling pools, water and soil pollution and burning of waste leading to air pollution, blockage of drains, and consequently aggravates the spread of diseases. This situation presents a formidable threat to health and productivity of the town dwellers [11].

The current solid waste collection, transportation and disposal capacity of Sodo City are miss-much with the growing number of population. Because, low level of community participation, absence of adequate planned disposal site (land fill site), shortage of public storage facilities (large sized containers),small distribution of communal bin installations, absence of data about the nature of solid wastes, inadequate financial and skilled manpower, few number of small scale intersperse service coverage create difficulty for municipality to provide adequate services for the town in general and for communities in particular (Sodo Town Administration Annual Report [11]. This shows that the integration with formal settlement development and solid waste management is very less and community participation is not going parallel with the municipality effort.

According to the data obtained from the annual report of the town administration (2016), about 350m^3 per day of solid waste generated. Out of this 149.8 m^3 per day or only 42.8% of solid waste collected and properly managed. The remaining 200.2 m^3 (57.2%) of solid waste is either disposed to riverbanks or along roads, avenues, drainage channels (ditches), open spaces (greeneries), around residential areas in environmentally unsound manner [12]. Municipalities carried out a few survey and studies in 2006 and 2010 E.C about the generation and composition of solid waste in Sodo City, but not about the constraints of community participation in domestic solid waste management (DSWM) at the household level.

As far as the level of community participation of Sodo City is concerned there was low status of community participation in domestic solid waste management practices, in the town not only generating large quantity of waste but also, community participation on the methods of waste disposal and management practice was in poor state of disposal system[12].

Moreover, commercial solid waste generation and composition analysis on disposal site selection and impacts of uncollected waste on the natural environment were the challenges of solid waste management in urban areas [13, 14, and 6]. In addition that as scholar [15, 16] give an emphasis to the challenges of municipal solid waste management and the demand for improved solid waste management services. However, a constraint of community participation on domestic soid waste management (DSWM) is emphasizing less and all; which was conducted very far distant from now and even special emphasis is given to solid waste management aspects. Hence, comprehensive studies those investigate the different variables that influence community participation on domestic solid waste management is needed [17, 18].

Furthermore, there were few researches undertaken in urban areas of Ethiopia but they were limited to the level of major cities; Addis Ababa, Mekele, Jigega and other major and capital cities of regional states of the country to evaluate the impact of different factors on solid waste collection, transportation, disposal service and household willingness to pay for solid waste management options those works by [18] in Mekele city, [21] in Jigega city and [6] in Addis Ababa city, [19] was among the few. However, those previous works that focused in the above-mentioned cities of Ethiopia did not tell the constraints of community participation in domestic solid waste management activities of Sodo City.

Against to the entire back drop, this study was to assess constraints of community participation in domestic solid waste management activities of Sodo City. The research was done as follow: the first part is describing the existing household participation in domestic solid waste management of Sodo City; then, identifying demographic, socio-economic and institutional variables that influence community participation in domestic solid waste management in Sodo City;

RESEARCH DESIGN AND METHODOLOGY

Descriptions of the Study Area

Wolaita Sodo City is one of the oldest Cities in the South Nations, Nationalities and people's Regional state, which ranks the second-class City out of 22 reform towns in the region (Soddo city Municipality, 2016 Annual Report). Wolaita Sodo is a seat for Wolaitta Zone Administration. Astronomically, the City is located between 6^{o} 48^{1} 30" N latitude and 37^{o} 43^{1} 30"E to 37^{o} 47^{1} 30"E longitude. It is located west of the regional capital, Hawassa at a distance of 167 km and south west of Addis Ababa at a distance of 378km (through Shashemen) and 327km (through Butajira, Hosanna) and even a little shorter distance, than the later through the recently constructed Butajira- Wulbareg- Alaba road 307km. The City occupies a total area of 3,204.6 hectare of land .The City is crossed by the federal high ways from different direction and there are seven gateways that created a grater geographical connectivity to the City with other Zonal administration and regions. The City is situated on effectively central position to all Woredas of the zone.

Sampling Techniques and Sample Size Determination

Multi-stage sampling technique was employed to select sample from the study population of the residential households. At the first stage sodo city was selected to conduct the research. At the second stage three sub-cites was selected and, sub-cites having11 *Kebeles*. Therefore, the researcher purposely selected four *Kebeles* to undertake the study, the reason why choosing four kebles is the severity of the problems and the existence of high concentration of solid waste. Hence, according to drawing samples for the study *Gebya (*market*)* & *Fana Kebeles* were selected from Mercato Sub-City, Gido Kebele from Mehal Sub-City and Selam Kebele was selected from Arada Sub-City to conduct the sample survey. The four Kabeles have 8897 residential households in total. Finally in the third stage, the required number of households was selected through simple random sampling procedure from the household registry of each kebeles to compute sampling units for study from the study area.

To determine appropriate sample size simplified formula which was developed by [22], was used. The reason why is its simplicity, flexibility and reliability. The mathematical formula present below:

$$n = \frac{N}{1 + N(e\ )^2}$$

Where n= is the required sample size
N= Total number of household size
e= margin of error (7%)

Therefore, applying the population size to the formula, the following sample size was obtained:

$$n= 8897 / (1+8897X (0.07)2) =204$$

Therefore, with the help of the above formula the sample size of 204 respondents was selected randomly from the household registry of each *kebele by* using simple random sampling technique*.* Thus, the primary data for this study were collected from 204 households selected from four kebele (Fana, Gebeya, Gido and Selame) of sodo town. Finally, the simple random sampling with proportionate allocation was used to select 204 respondents from the above four mentioned *kebeles.*

Table.1 Population and Sample size Determination by Proportional Allocation of Selected *Kebeles.*

Kebele name	Household size	Proportion	Sample size
Fana	2620	0.29	60
Gebeya	2480	0.28	57
Gido	1984	0.22	45
Selam	1813	0..21	42
Total	8897	1	204

Source: Based On CSA, 2007 Projection Adopted by Sodo Town Health Office Annual Report (2017).

Data Sources and Method of Data Collection

This study used two main streams of data sources. These two sources were primary and secondary data sources. The primary data sources were data obtained from sample survey response, focus group discussion, key informant interview and field observations supported by photographs etc. Primary sources used for collecting data to carry out this study, survey techniques such as questionnaire, key informant interview, focus group discussion, and personal observation were made to identify the demographic, socio-economic, and institutional variables that influence community participation in domestic solid waste management activities in the City to attain the research objectives.

Questionnaire was prepared for 204 residential households and before the final data collection activity carried out the pre-test was done in the other *Kebeles* with similar conditions to check the validity of the instrument. Based on the result of pre-testing the questionnaire was adjusted accordingly and then the final survey was conducted. Focus group discussion was made for purposely-selected *Kebele* administrators, managers, health extension workers and representatives from the community totally 12 participants were assembled at *Kebele* level and FGD conducted one times in each *Kebele* sum up of 4 time FGDs done by the guidance of the researcher to list the community view, attitude and practices of community activities in solid waste segregation, collection, transportation and disposal of their locality. Furthermore, to collect the information related to constraints of community participation in solid waste management activity because they are involved on the facilitation activity of solid waste segregation, collection, transportation and disposal activities within the community.

Key informant Interview: in addition to RHHs survey and FGD, key informant interview was made with 6, SBPD work process, and 4, officials from town concerned offices (municipality, Health and Environmental protection) who were selected purposely by the researcher to acquire relevant information related to the study that can more strengthen the validity and reliability of the study meaningfully. Observation: Finally, personal observations were made by the researcher in the existing conditions of the community participation in domestic solid waste management activities in selected areas of the City. The researcher used personal field observation to validate some of the data collected through questionnaire and focus group discussion. Besides, the actual reality on the ground was supported by photo pictures.

Secondary source of data was gathered from library books, journals, thesis, and online searches about issues related to the constraints of community participation in domestic solid waste management and to establish a conceptual and theoretical background of the study. In addition, different documents on solid waste management in Ethiopia in general and in Wolita Zone, Sodo City administration in particular were used. Most of the data were from regional and local government offices especially; offices like Sodo-City administration, municipality, Wolayita zone town's development, and housing department, environmental protection authority were helpful sources of secondary data.

Model Specification and Method of Data Analysis

Before any analysis can commence the questionnaire first edited and coded. The data were analyzed using descriptive analysis and binary logistic regression model analysis. The data were both qualitative and quantitative to ensure objectivity; this assisted in ensuring the data were free from any selective perception that can dilute its validity and reliability. For qualitative and quantitatively collected data average ranking, percentile expression and analysis was done. For Likert scale questions, the ranking styles were categorized under maximum weighted values out of 5 or 4. The descriptive statistics were the frequencies, percentage, and mean values. The analysis was done using STATA software version 11. The study used binary logistic regression statistical technique to test the hypothesis and to predict the probability of household participation in domestic solid waste management. According to [23] this type of regression was used when either variable that the researcher wishes to study are measured at ratio or interval scales and dependent variables was found to be binary outcomes. The results were presented in the form of tables.

As far as the study were concerned, objectives stated and the type of data decided to identify the probability observe by the community participation in domestic solid waste management activities in Sodo Town, a binary logistic regression model was developed. Logistic regression was applied to measure public opinion about the public involvement in a selection, storage, transportation, recycling and final disposal scheme [24]. Logistic regression analysis studies the association between a categorical dependent variable (community participation in DSWM) and a set of independent (explanatory/predictor) variables. The name logistic regression is used when the dependent variable has only two values, such as zero and one or Yes and No. Therefore, community participation in domestic solid waste management activities is a categorical dependent variable that discriminate the household participation on solid waste management activities analyzing

categorically responded variable, contented measuring of 'Yes or No'. The logit model gives parameter estimates that are asymptotically efficient and consistent. The logit approaches were known to produce statistically sound results (Gujarati, 2004).

The functional formula of the logistic regression equation is
[P (logist)] = log [= ß$_0$ +ß$_1$X$_1$ + ß$_2$X$_2$ + ß3X3 +… ß$_{12}$X$_{12}$--------- (1)
P (2)
Where:
P -Is the probability that a case is in a particular category;
Exp- Is the base of natural logarithms (approximately 2.72);
a- Is the value of a constant
ß- Is the coefficient of the predictor variables and
X1, X2, X3… are independent variables.

The mathematical transformation (log transformation) is needed to normalize the distribution. Where log transformation and square root transformation moved skewed distribution closer to normality. This log transformation of the p values to a distribution enables to create a link with the normal regression equation. The log distribution (logistic transformation of p) is also called the logist of p or logist (p). Logist (p) is the log to base (e) of the odds, ratio or likelihood ratio that the dependent variable is I in symbol as it is defines as:
Logistic regression (p) log /p/ (1-p)/ in [p/ (1-p)] ---------- (3)

Whereas p can only range from 0 to 1 logit whereas (p) scale ranges from negative to positive infinity and is symmetrical around the logistic of 0.5 (which is zero). Formula below shows that relationship between the usual regression equation (a+bx…etc), which is a straight-line formula and the logistic regression equation.

Diagnostic Tests

Model specification test: the assumptions of logistic regression analysis are not met it lead to our estimation incorrect outcome, such as biased coefficient estimates or very large standard errors for the logistic regression coefficients, and these problems may lead to invalid statistical inferences. Therefore, before we use our model to make any statistical inference check that our model fits sufficiently well and checks for influential observations that have impact on the estimates of the coefficients [25].

To detect a specification error after the regression command, Link test used to test the linear predicted value(_hat) and linear predicted value squared(_hat^{sq}) as the predictors to rebuild the model. The variable _hat should be a statistically significant predictor, since it is the predicted value from the model. This will be the case unless the model is completely miss-specified. On the other hand, if our model properly specified, variable _hat^{sq} should not have much predictive power except by chance. Therefore, if _hat^{sq} is significant, then the link test is significant. This usually means that either we have omitted relevant variable(s) or our link function is not correctly specified. In this study link test report that the model is correctly specified, because (_hat) is significant and (_hat^{sq}) is not significant.

The p value associated the chi- square with "n" degrees of freedom and Hosmer and Lemeshow was used to test goodness of fit test. In this study p value associated the chi-square with 5 degree of freedom. The value of .0000 indicates that the model as a whole is statistically significant i.e the model fit the data well.

Multicollinearity test: in the logistic regression solution is detected by examining the standard errors for the β coefficients. A standard error larger than 2.0 indicates that there exist numerical problems, such as multicollinearity among the independent variables, therefore in our case there is no problem of multicollinearity. Heteroscedasticity test*:* to control for heteroscedasticity in binary outcomes model robust logistic regression was used. Heteroscedasticity in binary outcome models will affect both "Betas" and their standard errors (Wooldrige, 2001). In this study, both the regressions i.e earlier regression and robust logistic regression have the same result. None of the coefficient estimates changed, but the standard errors and the Z values are little different had there been more heteroscedasticity in this data, there would have seen bigger changes. Therefore, this data is free from heteroscedasticity problem.

RESULTS AND DISCUSSIONS

Socio-economic Analysis of the Study

This section described the major socio-economic and demographic characteristics of the households. The variables illustrated subsequently were sex, age, marital status of the household heads; family size and educational level attained by the household heads were included as well. In addition socio-economic and demographic characteristics of the households such as annual income of the household and house ownership of the households were also analyzed.

Sex

Table 2 showed that sex of the household heads. In general, Male Household number was found to be higher than females; nevertheless, there was no considerable difference in the number of headship in both sexes. According to table 4.1 male heads accounted for 53 % of the households and females was found to be 47 % of the sample households. Sex of the household heads had an influence on the process of waste handling in respect to labor division. Most of the time females are engaged in the process of residential waste collection and disposal. This may be due to the fact that women traditionally are more responsible for domestic solid waste management within the house.

Table 2: Frequency Distribution of Household Head Respondents of Sodo City, 2018

Sex	Frequency	Percent
Female	96	47
Male	108	53
Total	204	100

Source: Own survey result, (2018)

Age

The age distribution of the household head is important for determining his/her ability to participate in the process of solid waste management. Table 3 revealed that the current age distribution of household heads. It indicated that most of the household heads were found in the working age group. The household heads that were found in old age group made for 19 % of the total respondents. About 24.5 % of the heads were belong to the age group of 51-60; those who were aged in between 41-50 make 28.5 % and 21 % of the household heads were in the age group of 31-40. The rest 7 % of the household heads were aged below 30 years. About 43.5 % of the respondents were in the age group greater than 50, which were highly, influenced the process of waste management however; it might be compensated by income amount generated from various sources like house rent, business activity, and others.

Table 3: Frequency Distribution of Age of Household Head Respondents of Sodo City

Age	Frequency	Percent
30 and below	14	7
31-40	43	21
41-50	58	28.5
51-60	50	24.5
61 and above	39	19
Total	204	100

Source: Computed from surveyed data, (2018)

Marital Status

Family is central to income maintenance, economic status, and social adjustment. Therefore, marriage value has economic and social implications. Table 4. gives the distribution of marital status in the sample household heads. As table 4.3 revealed that about 63.2 % of the household heads were married currently. While the other 22.6 % were never married or single, 8.3 % divorced or separated and 5.9 % widowed

Table 4: Frequency Distribution of Marital Status of the Respondent Households of Sodo City

Marital status	Frequency	Percent
Married	129	63.2
Single	46	22.6
Divorced	17	8.3
Widowed	12	5.9
Total	204	100

Source: Computed from surveyed data (2018)

Household Family Size

Table.5 shows the average household size in the study area. It is used as a measure of crowdedness of population and has great implication on health and collection of DSW. A little below half of the population was found to have 4-6 member of the household (46.6%).

The second highest was 24.4% less than or equal to 3 member and lesser amount 21.5% of the household 7-9 members. The remaining 7.5% of the household had more than 10 members. The maximum HH family size was 4-6 that accounts for 95 (46.6%) of the respondents. This increases their understanding, as the amount of DSW generation depends on the size of the HHs. Increase in the number of family increases consumption that also increases waste generation and contributed to the creation of pressure on its managements.

Table 5: Distribution of Family Sizes of the Respondent Households of Sodo City

Household family size	Frequency	Percent
1-3	50	24.4
4-6.	95	46.6
7-9.	44	21.5
10<	15	7.5
Total	204	100

Source: Computed from surveyed data (2018)

Amount of Income Distributions with in the Community

Household income is the other socio-economic factor that leads to the increasing volume of solid waste, as well as increasing problem of household participation on domestic solid waste management. From the socio-economic conditions amount of annual income of the household has an impact on solid waste management. Socio-economic changes, consumption patterns, waste prevention, and demographic dynamics are the main factors that affect the domestic solid waste generation, composition and handling, which in turn affects the waste management practices at household level.

Table 6 Frequency Distribution of Monthly Income of the Respondents of Sodo City, 2018

Monthly income	**Frequency**	**Percent**
1-1500 birr	50	24.51
1501-2500 birr	50	24.51
2501-3500 birr	38	18.63
3501-4500 birr	31	15.20
4501-5500 birr	23	11.76
5501 Above birr	12	5.39
Total	204	100

Source: Computed from surveyed data (2018)

Education

The majority of the households in Sodo City had low educational background. This educational background of the respondents might influence their active participation and handling of household solid waste. Therefore, to upgrade their understanding about the problems caused by mismanagement of domestic solid wastes permanent and organized training and awareness campaigns are needed. Table .7 shows the highest grade completed by the sample household heads. It revealed that those household heads that never attain formal education system makes for about 49(23.8%). The largest proportion 72(34.8%) of

the respondents completed only their primary school education, while about 52(25.7%) of the household head completed secondary school education. A relatively smaller proportion of the household heads followed and completed college level. The remaining (8.8 %) of the respondents are university and above graduates.

Table .7 Education Levels of the Respondents of Sodo City, 2018

Level of education	Frequency	Percent
Illiterate	49	23.8
Primary education(1-6)	72	34.8
Secondary education(7-12)	52	25.7
College	15	6.9
University and above	16	8.8
Total	204	100

Source: Author's computation 2018.

House Ownership of the Respondents

House is very important for life and if people are not having their own house they forced to live in rental house and this can affect the people's continuous participation in domestic solid waste management activities. Because people live in rental, houses had a high possibility to change their homes and they are not participating consistently in community development activities like solid waste management practices such as campaign cleaning, regular meeting, and awareness creation training is mandatory for good community participation [26].

Table 8. Housing Condition of the Respondents of Sodo City, 2018

Housing condition	Frequency	Parentage
Rental	109	53
Private	95	47
Total	204	100

Source: Computed from surveyed data (2018)

In this study house ownership was considered by assessing the people living on their house and rented. Among the study population 47% disclose that they live in their own private houses and the rest of 53% households rented houses from private owners and government housing agency.

Description of Community Participation on Domestic Solid Waste Management Activities of the Town

The horrific practices of a community in relation to domestic solid waste management in most urban areas of the country have been manifested mainly in three ways: dumping of solid waste illegally anywhere in the city, improper handling of waste at home, and improper use of community waste bins & containers. Domestic solid wastes are generally poorly treated or handled at home, and this has partly aggravated the problem of solid waste management in cities and towns. Therefore, the bad practice of the community has greatly contributed to the poor community participation on domestic solid waste management. However, it may not be the only reason; sometimes negligence or lack of awareness among the community towards community participation on domestic solid waste management play a significant role for poor solid waste management practice.

Local residents, individuals attempt to manage the waste they generate, their collective activities to have a clean village environment and their capacity to move the waste to communal collection points all have an impact on the overall waste management system. As it is explained in the interview from SBPD work process and RHH informants in the study area, there is no sufficient stationary communal pit disposal and communal containers for the communities' usage, no regular and full services coverage of SSE, low access to waste disposal facility. Such conditions may contribute to illegal dumping and hinders active participation of the community in their domestic solid waste management practice. The participation level of HH "strong and above strong" in source collection are 43(21.1%) and below average 64(31.6%), the remaining 97(47.3%) is average. However, the overall average obtained by the finding is 2.9 out of 5. That is almost average value, and in activity of source collection, a good participation was observed (Table. 9).

The household practice to store DSW properly were108 (52.75%) and 30(14.89%) above average and below average respectively, and the average achieved value was 3.7 out of 5 is at better performance of participation. The finding indicates that in recycling/reusing, burying, transporting, and disposing to disposal site of solid waste, the community participation was very poor or weak. Therefore, their average achieved values out of 5 were 1.4, 0.3 and 0.2 respectively. Burying, transporting and disposing at disposal site are at very poor participation level. As an average of overall seven participation variables of in-house DSWM practices, the residents achieved1.8 out of 5. This was considered as weak/poor level of participation (Table 9).

Table.9 Extent of Community Participation on Domestic Solid Waste Management at HH Level

Items	Extent of participation						
	Very strong (5)	Strong (4)	Average (3)	Poor (2)	Almost none(1)	Not at all(0)	Mean
I segregate &collect waste from the source	13(6.2)	30(15)	97(47.3)	45(22.4)	19(9.2)	-	2.9
I properly store all the wastes at home	48(23.3)	60(29.4)	66(32.1)	23(11.3)	7(3.6)	-	3.7
I recycle and reuse the solid waste from my home/compost/ preparation	-	-	21(10.2)	81(39.8)	82(40.4)	20(9.6)	1.4
I burn the waste from my home	19(9.5)	38(18.7)	59(28.7)	61(30)	17(8.1)	10(5.1)	2.6
I bury the waste from my home	-	-	-	12(5,9)	39(19.2)	153(74.9)	0.3
I transport and dump the stored waste myself	-	-	-	-	48(23.7)	156(76.3)	0.2
Total	80(6.5)	128(10.4)	243(19.8)	222(18.1)	212(17.3)	339(27.6)	1.8

Note: the numbers outside the bracket refers frequencies; the number inside the bracket refers percentage
Source: Own survey result, (2018)

Table 10. Community Participation Status of the Household on Domestic Solid Waste Management Activities of the City

Kebele Name	Sample Household	Participated On DSWM		Not Participated On DSWM	
		Frequency	%	Frequency	%
Fana	6o	36	61	23	39
Gebeya	57	35	61.4	23	38.6
Gido	45	32	51.1	22	48.8
Selam	42	23	53.5	20	46.5
Total	204	117	57.5	66	42.5

Source: Own survey result, 2018

The result investigate that Proportion to population size 60, 57, 45, and 42 of the towns was drawn in order from four *kebele* which in total 204. Based on the community participation in DSWM activity, the study found that 157(57.5 %) of households of the total population are participated and the rest 87(42.5%) are not participated in solid waste management activities. From the total of 204 households in the study, the community participation status of each respective *kebeles* was also presented in the table .10 with Gido lowest (51.1 percent) and Gebeya the highest (61.4 percent) level of participation.

Household Waste Collecting Materials

Respondents were asked about their materials for collecting waste by giving them alternatives in the form of choices. The findings indicated that materials for collecting waste vary from households to households. Table 4.10 shows the details about this issue.

Table: 11 Materials used for collecting household waste in the City.

Type of material	Frequency	percentage
Local basket	20	9.8
Sacks	70	34
Plastic bags	56	27.4
Others	58	28.4
Total	204	100

Source: Own survey result, 2018

The above result in table .11 shows that only 9.8% of the respondents use basket. The majority of the respondents (34%) use sacks locally known as 'Madaberia', 27.4% respondents use hard festal or small plastic bags and 28.4% of the respondents use other collecting materials such as metal pails and plastic pails. The above solid waste collecting materials in almost all households serve to transport the waste from residential areas to the waste collecting containers.

Supply of Waste Facility on the Usage of the Service

Despite the present concerns of individuals and the government about community participation on domestic solid waste management in Ethiopia, the practices are seen

insignificant. Woliyta Sodo City still is facing serious CPDSWM problems. From observation, household domestic wastes only seen in the study area. Most of the domestic wastes come from activities such as cooking and household activities. Municipal wastes come from the trashes from commercial establishments, small industries, and households' waste origin together. These, include tins, plastic products, and polythene bags. Solid waste, when treated well, can be turned into a resource, but the greater part of wastes generated in Sodo City seem not to undergo any treatment before their final disposal sites. Solid wastes generated in Sodo were most often disposed of in open dumps, gutter, and at back of houses probably due to lack of awareness, low level of institutional capacity including inadequate solid waste management equipment or the long distances to the sanitary sites those factors highly influence household participation in waste management practice.

Households in the study area were asked about sufficient supply of waste collecting containers and the result was shown in Table .12

Table: 12 Sufficiencies of Solid Waste Containers with in the Community

Sufficiency of containers	Frequency	Percentage
sufficient	47	23
not sufficient	157	77
Total	204	100

Source: Own survey result, 2018

From the above Table 12 only 23% of the households stated that they were satisfied with the existing containers. However, 77 % of the respondents affirmed that they were not satisfied with the number of containers that were in use within their locality. In relation to the above question, households were asked where they usually dispose their household wastes. The result of the response was summarized as follows:

Table: 13 Disposal Trend Share of Household Solid Waste in the Sodo City

Disposal site trend share	Frequency	Percentage
Along the road	8	4
In open filed	5	2.3
Burning inside the compound	55	27.2
In open canals(ditches)	51	24.8
In municipal containers	77	37.7
In nearby rivers	8	4
Total	204	100

Source: Own survey result, 2018

As noted above on table13, the total container users in the sampled respondents were 37.7%. The remaining 27.2% of the respondents used other methods like burning waste inside the compound, in open canals and etc, the reason why the option for other alternatives was because containers were not available in short distance to get the sufficient service.

Awareness and Knowledge of Community Towards Domestic Solid Waste Management in Wolaita Sodo City

The operational efficiency of solid waste management depends up on the active participation of both the municipal agency and the citizens (Sharhily et al., 2008). Community participation on domestic solid waste management may depend on their awareness and knowledge about the issues of domestic solid waste management. The sample RHHs informants in the study area forwarded their view in different ways.

Table .14 Respondents Level of Awareness and Knowledge Towards DSWM

Items	Very aware(4)	aware(3)	un aware(2)	totally unaware(1)	Mean value
I participate in any awareness creation training about DSWM	7(3.3)	46(22.5)	98(48)	53(26)	2
How much are /were you distinguish/know about sodo city municipal Solid waste management rules and regulations?	-	54(26.4)	113(55.3)	37(18.3)	1.85
Do you know about your responsibility concerning domestic solid waste management practices like; segregation, storage, transportation, and final disposal of DSWM of the town?	11(5.5)	91(44.6)	61(29.9)	41(20)	2.02
Total	18(2.9)	191(31.3)	272(44.4)	131(21.4)	1.95

Note: the numbers outside the bracket refers frequencies; the number inside the bracket refers percentage.
Source: Own survey result, (2018)

As indicated on the table14, above 53 RHHs (26%) exposed to some kind of training, the remaining 151RHHs (74%) did not exposed to any kind of training. Those respondents provided with training about solid waste handling, trained by the health extension workers of the locality, by the leader of 1 to 5 groups and even some of the households trained by Wolaita Sodo University. Majority of the respondents informed that they did not know about the waste management rule and regulation of the town 54RHHs (26.4%) informants informed the presence of a body that control and supervise illegal dumping in their respective village; whereas the other 150 RHHs (73.6%) informed that there was no control on illegal dumping.

The control activity performed by different bodies such as the leaders of one to five groups, the locality leaders, the health extension workers, and the municipality workers. In addition, awareness of their responsibility in domestic solid waste management, half of the respondents 102 (50%) aware their responsibility and the remaining 102 (50%) respondents had no awareness and they were expected municipality service.

Constraints of Community Participation in domestic solid waste management practice econometric Regression Results

The binary logistic regression model result shows that the chi-square value with LR chi square value with (12) =33.12 at significant level of zero shows that inclusion of explanatory variables contributed to the improvement of the model. As a result, out of the incorporated variables in binary logit model, 7 variables shows statistically significant relationship with household participation on domestic solid waste management practice. The results described below.

In table 4.14, out of 12 predictor variables, seven of them: sex, marital status, education, income, access to main road, small-scale enterprise service coverage and supply of waste facility significantly affect household's participation in domestic solid waste management practice. The above logistic regression analyzed the variable that are positively and significantly correlated with the probability of household participation was education, household income, and household access to main road, small-scale enterprise service coverage, and supply of waste facility. The variables that were significantly, but negatively correlated with the probability of household participation were sex and marital status.

In table 4.14, the negative value of the coefficient in the independent variable shows that when independent variable increased by a unit, the probability of being participation decreased by about the value of the coefficient, this suggests that negative relationship between household participation and the variable. As explained above, the variable that was negatively correlated with household participation and significant at the same time.

Table: 15 Logistic Regression Result

Logistic Regression Results					
Independent variables	**Coef.**	**Std. Err.**	**Z**	**P>|z|**	**Odds Ratio**
SEX	-.7148003	.3809153	-1.88	0.061*	0.4892898
MS	-.4184393	.2213907	1.89	0.059*	0.6580731
FS	-.1046627	.1010033	-1.04	0.300	0.9006282
ED	.6750587	.1804365	3.74	0.000 ***	1.964148
AMR	.8544431	.428923	1.99	0.046 **	2.350065
HHI	.689266	.3944345	1.75	0.081*	1.992252
ASSESC	.8473023	.4453235	1.90	0.057 *	2.333343
SWFWC	.7072874	.3768359	1.88	0.061*	2.028481
HO	.2518507	.4265267	0.59	0.555	1.286404
UA	-.0582404	.3654655	-0.16	0.873	0.558553
AG	.0006716	.1228481	0.01	0.996	1.000672
ATF	.2487072	.4491091	0.55	0.580	1.282366
- cons	.1661599	.8293756	0.20	0.841	
Number of obs = 204 Log likelihood = -115.88259 LR chi^2 (12) = 33.12 Prob > chi^2 = 0.0009 Pseudo R^2 = 0.1251					
NB, * Significant at 10% ** Significant at 5% *** Significant at 1%					

Source: STATA output for Logistic Regression

The odds ratio result shows that the probability of different variables that influences community participation in domestic solid waste management activities in Sodo City. Therefore, the odds ratio results were summarized as follows: Sex of the household: Sexes of the household head were negatively influenced community participation at less than 10% probability level. Keeping all other variables remain constant, when household head is male the odds ratio of being participated decreases by a factor of 0.489 times lower than their female counter parts. The possible explanation for this result was that if the household head was male the probabilities of participation were lower than that of female-headed households.

This may be due to the fact that women traditionally more responsible for solid waste management in the household this is because of the cultural practices of woman proximity to SW collection and house cleaning activity in our country; particularly in the study area the finding is similar to the study conducted by (Solomon, 2017) The results also strongly conform to hypothesized relationships between HHs sex and HHs participation in domestic solid waste management practice.

Marital status of the household: marital status of the household head was negatively related to the probability of households being participated and the coefficient is significant at 10% level of confidence, holding other variables remains constant, when household head is not engaged in marriage institution, the odds ratio of being participated decreased by a factor of 0.658 than their counter parts. The possible explanation for this result was that married households had practiced better participation than that of single, widowed, and divorced ones. The finding was similar with [27]. The results also strongly conform to hypothesized relationships between HHs marital status and HHs participation in domestic solid waste management.

Education: education is one of the factors influencing the level of household participation in domestic solid waste management. The variable was positively correlated with the probability of being participated and a coefficient is statistically significant at 1% level of significant. Keeping all other variables remain constant, the odds ratio result indicate that educated household head participated by a factor of 1.964 probability level from that of none educated household head. This is connected with the fact that when people level of education increases their level of understanding, skill, living standard etc increases and this in turn brings opportunity to be engaged in proper domestic solid waste management. The finding was consistent with studies conducted by [28, 29]. The results also strongly conform to hypothesized relationships between HHs level of education and HHs participation in domestic solid waste management.

Access to main road: the finding revealed that the relationship between households distance from main road was positively related with community participation at 5% level of significance. The odds ratio result indicate that households having an access to main road participated on domestic solid waste management practices increases by a factor of 2.350 probability level from their counter parts. The assumption was that the nearer the home to the main road, the better accesses to supply of collected wastes to private collectors, streets wipers or SSESC. So that ease of accessibility to main roads could affect

household participation positively on domestic solid waste management practices [30]. However, since distance and access to paved roads is often still an impediment to service delivery. This result associated with [30]. The results also strongly conform to hypothesized relationships between HHs access to main road and HHs participation in domestic solid waste management.

Household income: In this study, income of household was positively related with community participation at 10% level of significance. The odds ratio result indicates that high-income and middle income group members of household participation on domestic solid waste management practices by a factor of 1.9501 probability level of significant than those low income group households. The possible assumptions are income has a significant effect on proper handling of wastes. This is in agreement with common understanding that solid waste quantities generated are directly proportional to household income level and household participation on domestic solid waste proper handling practices. The finding was consistence with studies conducted elsewhere [31]. The results also strongly conform to hypothesized relationships between HHs level of income and HHs participation in domestic solid waste management.

Access to small-scale enterprises service: Households having access to small-scale enterprises service is positively influenced community participation at 10% level of significance. The odds ratio result indicates that households having an access to small-scale enterprises had a probability of participating in solid waste management activity by a factor of 2.33 probabilities than their counter parts. The possible reason is small-scale enterprise businesses usually collect materials from the stream, at low cost, saving the government expenditure and increases the level of community participation through multiple job creation and brings an opportunity to households that could be engaged in proper domestic solid waste management practice. This finding was related with the study conducted by [6]. The results also strongly conform to hypothesized relationships between HHs access to SSESC and HHs participation in domestic solid waste management.

Supply of waste disposal facility: supply of waste disposal facility within the community is significantly affects the probability of household participation on domestic solid waste management activities at 10% level of significance. The odds ratio result indicates that a household having an access to waste disposal facility had a probability to participate on domestic solid waste management activity by a factor of 2.02 probabilities than their counter parts. This finding was consistent with [15]. The results also strongly conform to hypothesized relationships between HHs access to waste disposal facility and HHs participation in domestic solid waste management.

CONCLUSION AND POLICY IMPLICATION

This study was conducted to identify constraints of community participation in domestic solid waste management activities in Sodo City. Data were collected from 204 sample households from four kebeles (Fana, Gebeya, Gido, and Selam). The study focused on household participation in domestic solid waste management practices through demographic, socio-economic, and institutional variables that influence household participation on domestic solid waste management activities of the City. To attain the

stated objectives, the researcher used both descriptive and econometric model analysis i.e. binary logit model.

The descriptive inference of this study demonstrated that from 204 household head were included in the study population. Out of this 42.5%, households were not participated and the remaining 57.5% households were participated on proper domestic waste management activities (i.e. segregation, storage, transportation, and final disposal practice) The descriptive result shows that comparable number of households in the town characterized by weak/poor level of participation (42.5%).This means that significant number of households in the City who were not fully participated in their domestic solid waste management practices (segregation, storage, transportation and final disposal) at home, rater than they disposed their waste indiscriminately to river banks or along roads, avenues, drainage channels (ditches),open space (Greeneries) and around residential area environmentally unsound manner.

The binary logit regression result shows that out of 12 explanatory variables included in the study to determine the influence of independent variable on the probability of HH participation on domestic solid waste management activities, 7 variables were found significant at 1 percent, 5 percent, and 10 percent probability levels. The influential significant variables were HH education, HH income, HH access to main road, HH access to small scale enterprise service and HH access to supply of waste facility is positively affect the probability of household participation. On the other hand, HH sex and HH marital status were significant but negatively affected the probability of household participation in domestic solid waste management practices.

Based on descriptive and econometric analysis, the following policy implications are forwarded to raise the level of community participation in domestic solid waste management for the town: Since the overall waste management practices of the town is so poor, establishing municipal structures at *kebele* level to work with the community based organizations and traditional institutions like *"Idir"* in educating the public on proper handling and disposal as well as its enforcing regulations enacted by the government is preferable than being silent.

This study found that community participation was significantly influenced by households' attitudes; knowledge and perception towards domestic solid waste management. Therefore, these factors need immediate responses by City administration to teach the community in collaboration with stalk holders to bring better community participation in the City. City administration is also responsible to teach the community through meetings, displaying poster, disseminating broacher and the need for more efforts to increase environmental education campaigns in order to get people involved in domestic solid waste management. As to how residents should participate in domestic solid waste management in their locality. Hence, awareness creation should get priority in community participation in domestic solid waste management practice of the City is crucial.

- Promotion of environmental education, information and capacity building training within the communities is crucial to improve the future status of community

participation in domestic solid waste management by the City Environmental Protection Office and Municipality.

- Promotion and provision of support for community-based initiatives to seek solutions to waste management, sanitation, and access to resources. By City Administration in collaboration with City Health Office.
- Creation of community forum that is responsible for facilitating community participation, developing integrated environmental developmental and spatial plans in relation to domestic solid waste management. By Municipality and Environmental Protection Office.
- The study found that educated households experience better participation than those households fall under illiterate and primary education level. Therefore, promotion of education is central to address problems of community participation in the City. Specifically, the responsible body widens the horizons of education, for the coming generation the creation of human capital in the sphere of better education increases the participation of the community, and it has been seen as the most effective indirect way of addressing the problem of community participation on domestic solid waste management.
- The study found that small-scale enterprise service coverage throughout the City significantly affected community participation in domestic solid waste management activities. Because one of the best ways to enhance society's involvement in solid waste management is to strengthen private waste collector, the society serve by them by making payments. Hence, it reduces the burden of governmental agency (municipality). Presently in the City, only two SSE served 1,731 permanent clients that were below 10%. This clearly indicates that low service coverage by SSE. Therefore, City municipality provides adequate number of SSE to enlarge service coverage with some sort of subsidy in order to attract them. Finally, these businesses activity usually remove materials from the waste stream at low cost, saving the government budget and increase the level of community participation through multiple job creation to the youth. Therefore, City Administration organizes SSE on the field of domestic solid waste collection because the existing service coverage is not sufficient on its sizes and scope.
- The study found that supply of waste facility within the community significantly affects household participation on domestic solid waste management activities. Because, the existing inadequate supply of waste containers and longer distance to those containers increase the probability of domestic waste dumping in open area and along roadsides in relation to use communal containers, So that the City Administration create convenient access to this units for the dwellers will cut down improper littering and alleviate some of the pressure on municipalities.
- Lastly, the study identified that households having an access to main road significantly affect household participation on domestic solid waste management activities through transporting the collected waste to private collectors, SSE and street wipers at the source. Therefore, the responsible bodies (City administrators & Municipality) widening road infrastructure provisions with standard quality is essential to raise household participation on domestic solid waste management. Finally, community participation on domestic solid waste management activity is

not only the problem of Sodo City; rather it is the problem for the country as well. Therefore, the community themselves, government, NGO and other stakeholders should strengthen their involvement to raise the level of community participation in near future

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