Journal of
Environment
(JE)

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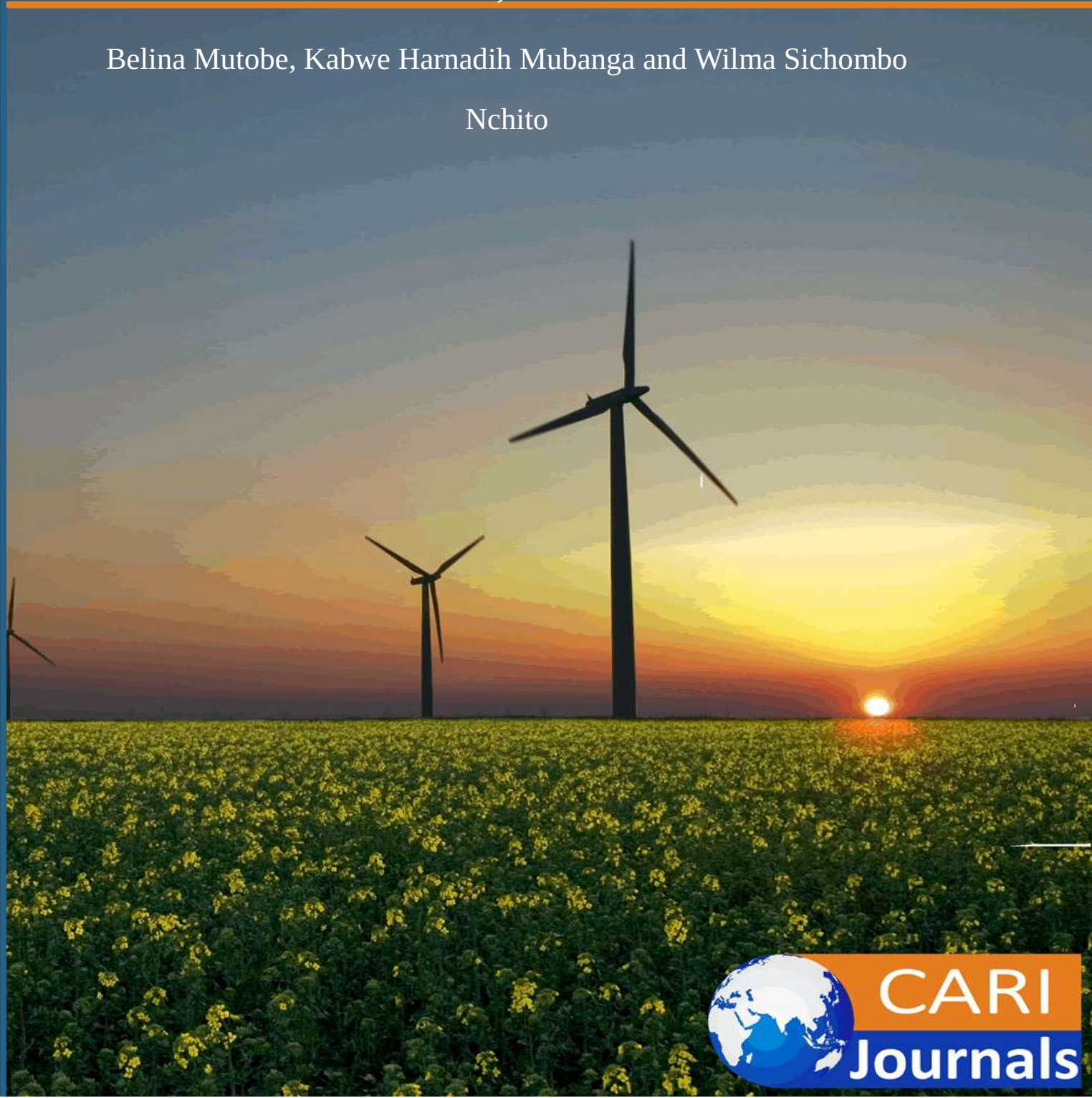
Belina Mutobe, Kabwe Harnadih Mubanga and Wilma Sichombo Nchito



CARI Journals

Journal of Environment
ISSN 2789-3863 (Online)
Vol. 2, Issue No. 1, pp 19 - 38, 2022

www.carijournals.org

Residents' Participation in Solid Waste Management in Solwezi District, Zambia

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Abstract

Purpose*: Community participation in solid waste management is currently seen as a determinant of successful solid waste management. Cases of failed solid waste management are common in areas where the waste management is regarded as a responsibility of local authorities while the community remains indifferent. Research has shown that public participation in solid waste management is marginal in most African countries. The study was aimed at analysing the residents' participation in solid waste management in Solwezi. Results are cardinal in designing more sustainable waste management strategies.*

Methodology*: It utilized systematic random sampling to sample 77 households of which 28 were from Kyawama Township, 23 from Stadium and 26 were from Kandundu Townships. Structured interviews, key informant interviews and observations were used to collect data on methods of waste disposal, residents' perceptions of solid waste management services available, and their willingness to pay for sustainable solid waste management. Data analysis was conducted using descriptive statistics, chi-square, Pearson product-moment correlation and content analysis.*

Findings: *Results showed that 65 % of the residents felt that they did not participate in any formal waste management practices. The 35 % who admitted to being participants felt they did this through waste separation, reuse and through their engaging a formal waste collector. In Solwezi, burying of waste (44.2 %) was the dominant waste management practice followed by formal waste collection (35 %) and burning (19.4 %)., while informal*

waste collectors accounted for 2.6 % of waste disposed of and 1.3 % of waste was disposed of through communal rubbish bins. Solwezi had very low participation of the residents in formal waste collection services with some residents not aware of the existence of such a service in the town (31.2 %). Among barriers to community engagement in solid waste management in Solwezi were a lack of knowledge of the existence of formal waste collection systems (35 %), failure by the local municipal council to provide waste bins either in residential areas or streets (13 %), relatively high costs of engaging in formal solid waste management and a lack of alternative cheaper ways of managing domestic solid waste. There was a general willingness by most residents to pay for sustainable solid waste management (57.2 %) with only 2.6 % indicating they felt that the local municipal council should treat waste management as a service that residents do not have to pay for

Unique contribution to theory, practice and policy: *In conclusion, the low community participation in solid waste management in Solwezi was attributed to failure to adequately sensitize residents by the municipal council. Residents' attitudes towards sustainable management of solid waste and community engagement in decisions related to solid waste management by the local authority was token at best. The study recommended sensitization in community participation as well as incentivizing champions of community waste management as a way of improving community participation in solid waste management.*

Keywords: *Participation, waste, management, residents, practices*

1. INTRODUCTION

Unsustainable solid waste accumulation is a constant challenge in urban environments. Globally, cities are inudated with the challenge of uncollected solid waste (Agwu, 2012). The increasing urban population, and affluent society as well as the ever changing production and consumption modes coupled with an evolution in living standards have contributed to increased solid waste generation (Kijewska et al., 2012). Many municipalities are struggling with the problem of management of solid waste. As such, many municipal authorities spend significant resources on addressing this problem, but the overall situation is reportedly far from satisfactory (Water Aid, 2008). Agwu (2012) reported that urban residents are often confronted with hazardous impacts to their collective health and safety. Thus, an efficient Solid Waste Management planning system is needed which requires an integral waste management strategy that takes into account all the stages from the generation to the final disposal (Aranda et al., 2015).

A study by Sharholy (2007) further reports that municipalities across the globe have failed to manage solid waste due to financial factors. Sujauddin et al. (2008) agree that the huge

expenditure needed to provide the service, the absence of financial support, limited resources, the unwillingness of the users to pay for the service and lack of proper use of economic instruments have hampered the delivery of proper waste management services. As a result, management deficiencies are often observed in municipalities.

Guerrero et al.(2012) reported that some researchers who have investigated the enabling factors to asuccessful SWM have concluded that local waste management authorities lack organizational capacities (leadership) and professional knowledge to conductwell coordinated SWM systems. Chung and Lo (2008) said that the information available on solid waste management systems is very scanty from the public domain. The limited information is either not complete or is scattered around various agencies concerned, makingit extremely difficult to gain an insight into the complex problem of municipal solid waste management.

In most developing countries, solid waste management is made more complex because there is no practice of storing the waste generated at source in a segregated manner. Citizens have not been educated to keep domestic, trade and institutional bins for storage of waste at source and stop littering on the streets. There is no primary collection from the source of waste generation (Asnani, 2005). Success stories that have ever been recorded across the world especially in developing countries are those that involved local initiatives with extensive participation of local communities and the private sector in addressing the problem of solid waste management in urban areas (Water Aid, 2008).Hence, as waste is generated by people, their participation becomes essential to ensure a well managed system. Thus, it requires participation of government, private sector and the residents (Ezbilo and Animasaun, 2011). Some municipalities have realised this fact and initiated programmes to educate local communities and involve them in waste management (Water Aid, 2008). Kurian (2006) agrees to this by making a point that people's participation is essential for the success of the municipal solid waste management. With greater public participation, the community can cooperate with the public or private entities to set payment rates for service charges and this gives the community authority and control over operation of solid waste management.

Community participation in waste management yields several benefits, including health and social benefits such as proper disposal of waste in special bins outside the homes, reduction in the quantity in the refuse dumped in rivers, on streets or burned and many other benefits (African Development Bank (ADB), 2002).Thus, most municipalities have developed community-based urban waste management systems that involve communities, households, community-based organizations and small, informal enterprises engaged in collection and disposal, re-use and recycling of waste materials (ADB, 2002). However, it

has been seen that most community initiatives in solid waste management operate up to the stage of primary collection. Community contributions to small area-based organizations, informal payments to municipal sweepers exist because the community needs a regular and reliable primary collection system and does not like to see waste in the immediate vicinity (ADB, 2002).

In most third world countries, there is an absence of community participation and this has a direct bearing on efficient Municipal Solid Waste Management (MSWM). The municipal authorities often fail to mobilize the community and educate citizens on the rudiments of handling waste and proper practices of storing it in their own storage bins at the household, shop and establishment-level. As a result, citizens are prone to dumping waste on the streets, open spaces, drains, and water bodies in the vicinity creating insanitary conditions (Asnani, 2005). In most African countries, community participation in solid waste management is influenced by apathy of municipal authorities. Elected representatives as well as the municipal authorities generally relegate the responsibility of managing municipal solid waste (MSW) to junior officials such as sanitary inspectors. This has affected the level of residents' participation in solid waste management in most African countries including Zambia (Asnani, 2005).

In Zambia, a study on SWM in Ngombe and Kamanga settlements by Nchito and Myers (2004), revealed that community based organizations in Lusaka worked hand in hand with the Lusaka City Council in the area of refuse removal. Some community-based organizations operated in refuse removal and the work accomplished or community participation successes related to donor agenda priorities and thus were donor-driven. Programmes of this nature in SWM involving community-based non-governmental organizations have been concentrated in large citiessuch as Lusaka. Although in the last few years, the Ministry of Local Government and Housing in 2008 had launched the 'Keep Zambia Clean Campaign', whichgenerally yielded positive results. However, in some parts of the country such as Solwezi, the programme was not successful due to due lack of funding, as well as lack of political will.

Kamaruddin (2013) suggests that the many processes and activities characterizing waste generation to disposal entail that this is a collective responsibility for all communities. The extent to which the residents were involved or participated in SWM in Solwezi is not known.The objectives of this study were threefold;

(i) to identify the solid waste management practices in Kandundu, Kyawama and Stadium residential areas of Solwezi town,
(ii) to rate residents' participation in solid waste management in Kandundu, Kyawama and Stadium of Solwezi town,

(iii) to examine the role of residents in solid waste management in Kandundu, Kyawama and Stadium areas of Solwezi, and;
(iv) to establish the barriers to community participation in solid waste management in the three residential areas.

1.1. Theoretical Framework

The study follows the Integrated Sustainable Waste Management (ISWM) model used by Klunert and Anschutz (2001) which is a model that allows studies of the complex and multi-dimensional systems integrally. The model was developed by waste advisers on urban environment and development (Anschutz et al., 2001), and partners or organizations working in developing countries in the mid-1980s and further developed by the Collaborative Working Group (CWG) on solid waste management in the mid-1990s (Anschutz et al., 2004). CWG is an informal association of donors, international organisations, non-governmental organisations, municipal personnel, experts from NGOs and others with a particular interest in solid waste management in developing countries. The model acknowledges the importance of three (3) dimensions when analyzing, developing or changing a waste management system. The dimensions include the stakeholders that have an interest in solid waste management, the elements or stages of the movement or flow of materials from the generation points towards treatment and final disposal and the aspects of "lenses" through which the system waste management is analyzed (Muller et al., 2002).

The study is set within this adapted Integrated Solid Waste Model framework. It focuses on identifying the stakeholders who have an interest in the waste management system, identifying the nature of participatory solid waste management activities that take place in the three residential areas of Solwezi, the residents' action/behaviour and factors that influence the elements of the town's solid waste management system. It further investigates the awareness of the role residents can play in solid waste management of Solwezi town.It also seeks to establish the barriers of community participation in solid waste management in Kandundu, Kyawama and Stadium residential areas.

2.0. Methodology

2.1. Sampling

Sampling is a procedure a researcher uses to gather people, places or things to study. It is a process of selecting individuals or objects from a population such that the selected group contains elements representative of the characteristics found in the entire group (Kombo and Tromp, 2011). The three residential areas in Solwezi were purposively selected because

of their proximity to Solwezi town and also based on the income levels (low for Kyawama, medium for Kandundu and high income for Stadium). Simple and systematic random sampling was used to collect data from households. Systematic random sampling was used only in the two planned settlements Kandundu and Stadium residential areas. The first household selected was randomly sampled while the rest of the sample was selected systematically based on the calculated sampling unit. As indicated by Tshuma and Mafa (2001) in a systematic sampling, the researcher identifies a random starting point on the population list and thereafter selects every n^{th} unit from the starting point. Hence, in this study, simple random sampling was used to determine the starting household while the selection of the subsequent households was done using the calculated sampling unit of five. This means that every fifth house was chosen starting from the first house.

Simple random sampling was adopted to be used in Kyawama compound because the area is an unplanned settlement. A total of 77 for households were sampled of which 28 households were from Kyawama, 23 from Stadium and 26 households from Kandundu townships. Purposive sampling was used to select 2 key informants one from Solwezi Municipal Council and one from Wana Cleaning Services. In this study, the key informants were purposively selected based on their knowledge of solid waste management in Solwezi town. One of the key informants that were purposively selected was the Director of Housing and Social Services at Solwezi Municipal Council and was in-charge of solid waste management at the municipality level. It was also expected that the key informant would provide useful information on which area among the three study sites had the highest participation in solid waste management. The key informant was also expected to give out information on the role of the residents in solid waste management in the three residential areas. The barriers to community participation in solid waste management were also expected to be established during the interview. The second key informant selected was the Director for Wana Refuse and Cleaning Service Company. This key informant was chosen because she would give out vital information concerning the levels of participation of the residents and their willingness to participate in formal solid waste management as well as the barriers to community participation.

2.2. Instruments for Data Collection

2.2.1. Semi-Structured Interviews

A semi-structured interview was conducted to residents who were available for the interviews in Stadium, Kandundu, and Kyawama townships. The first part of the semi-structured interview was made up of questions on socio-demographics. The second part comprised of questions about the residents' awareness of the role they could play in solid waste management and questions directed towards gaining information regarding the

barriers that the residents thought hindered their participation in solid waste management. The third part comprised of questions about what the residents thought were the measures that could encourage them in solid waste management in their residential areas.

The questions in the structured interview were in the English language but during the interviews, questions were interpreted into *Kaonde, Lunda,* and *Bemba* by the researcher and research assistants. The semi-structured interview had been chosen as a data collection instrument because the researcher could probe for more information where insufficient information had been given by the respondents. It is also a good method of data collection because as the interview progresses, the interviewee is allowed to elaborate or provide more relevant information if he or she opts to do so. Furthermore, interviews can be very productive since the interviewer can pursue specific issues of concern that may lead to focused and constructive suggestions. During interviews, the selected respondents were asked several other questions which included methods of waste disposal, residents' perceptions of the solid waste management services the local authority provided to the residents and their willingness to embrace sustainable ways of disposing of their waste, such as formal waste collection.

2.2.3. Key Informant Interviews

A key informant interview involves a loosely structured conversation with people who have specialised knowledge about the topic one wishes to understand. Thus, in-depth interviews were used to collect data from the key informants. The study had two key informants, an official from the local government at Solwezi Municipal Council, and another official from Wana Refuse and Cleaning Service Company. To be consistent with all participants, the interviewer had a set of pre-planned core questions for guidance. The key informants were purposively selected through snowball sampling based on their knowledge about solid waste management systems in Solwezi.

2.2.4. Direct Field Observation

According to Kawulich et al. (2012) observation is defined as accurate watching and noting of phenomena as they occur in nature with regards to cause and effect relation. Observation can be done while letting the observing person know that he is being observed or without letting him know. In the course of the field study, the observations undertaken were unobtrusive and photographs were taken of waste scenes such as street litter, choked drains,

and waste storage containers. This was done in ways that did not attract the attention of people around. Thus, observations of waste disposed at the market area and residential areas especially Kyawama were used as ground-truthing instruments in ascertaining the level of participation in solid waste management.

2.2.5. Data Analysis

Qualitative data from questionnaires, semi-structured interview schedule, key informant interview guides, and focus group discussions were analyzed using content analysis to draw out themes and patterns. Descriptive statistics involving means, and standard deviations were used to describe the data and assess its characteristics. Data presentation was done through the use of tables, figure and text. When comparing and rating residents participation in solid waste management, the chi-square test for association was used while the Pearson Product Moment was used to test for the correlations in waste generation among the three residential areas of varying income levels. When analysing data to establish roles and barriers for resident's participation in solid waste management, cross-sectional research techniques such as semi-structured interviews were used. Data were collected in three different study sites at the same time to determine the residents' roles and barriers. This was later coded in SPSS 22 and analysed using thematic analysis with verbatim and content analysis. All the quantitative analyses conducted in this research was done in SPSS 22 (IBM Corp., 2013).

2.2.6. Verbatim Analysis

This was used when analysing data collected through key informant interviews and a focus group discussion. Lavrakas (2008) described verbatim analysis as one which involves responses an interviewer records as an answer to an open-ended question when writing down the exact words spoken by the respondent. Open-ended questions are those that do not provide a respondent with predetermined response choices and instead allow, expect, and encourage a respondent to answer in his or her own words. In this study, verbatim analysis was used to strengthen data analyzed thematically by presenting experiences of respondents in their own words. Data presentation techniques utilised for verbatim data was by in-text quotes from respondents and reciting experiences.

2.2.7. Content Analysis

Content analysis involves both quantitative and qualitative content analysis. Quantitative

content analysis (enumerative content analysis) entails identifying the core words, concepts, themes, phrases, or sentences within a set of text data (Grbich, 2007). It involves the reporting of frequencies of occurrences of certain responses in the data. Qualitative content analysis on the other hand which is also referred to as thematic analysis involves a systematic process by which data such as field notes and photographs are analysed for themes. It involves identifying the underlying core consistencies and meanings in a text. Data from content analysis was presented in form of literature review as a way of validating the results of the study.

3.0. Study Area

Solwezi district is located between 24045' to 27037' E and 11032' to 13028'S in the North-Western part of Zambia (Figure 1). The district covers an area of approximately 30.360 kilometres squared (km²) and is bordered by Mwinilunga, Mufumbwe, Kasempa, Lufwanyama and Chingola districts. It also shares an international boundary with the Democratic Republic of Congo in the north. Solwezi is the provincial headquarters for North-Western Province and is located 175km west of Chingola District in the Copperbelt Province. Solwezi town has two Chiefs, Kapijimpanga and Mujimanzovu. The local district administration is made up of the local authority management and five wards namely; Kamalamba, Kimasala, Kapijimpanga, Tunvwang'anai and Sandan'gombe.

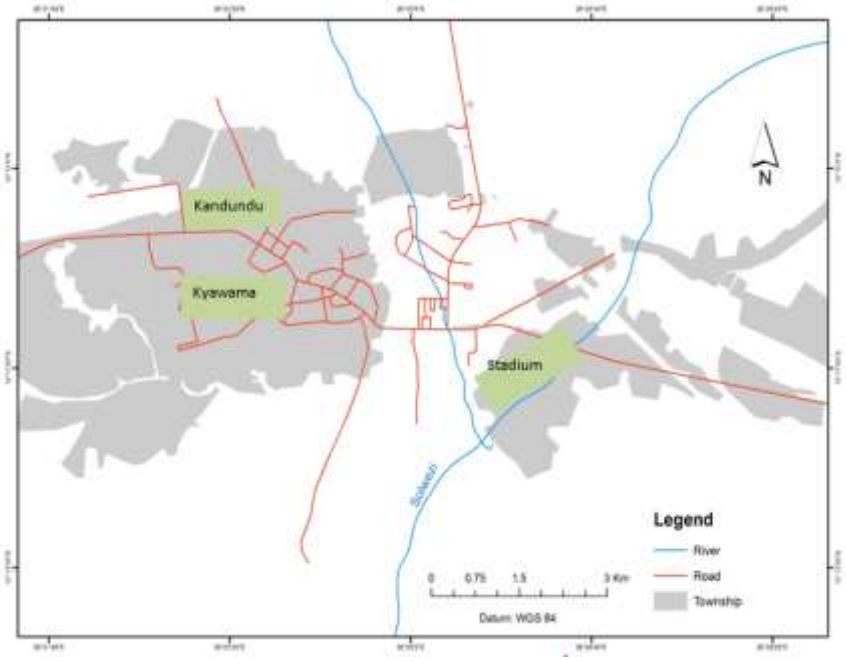

Figure 1: Location Map of Study Sites in Solwezi Town

Journal of Environment
ISSN 2789-3863 (Online)
Vol. 2, Issue No. 1, pp 19 - 38, 2022

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4.0. Results

4.1. Participation of Residents in a Formal Waste Collection Service

There was a significant difference in the levels of participation in formal waste collection service among the residents of three townships (χ^2=46.93; p=0.001) (Table 1). The three townships were delineated into different income levels. Kyawama which was a low-income residential area recorded low participation while Kandundu and Stadium had higher participation.

Table 1: Chi-square analysis showing participation among residents in Solid Waste

Township	Observed and Expected Counts	Participants	Non-Participants	Total	Test Statistic	Chi-square Value	Df	P-value
Kandundu	Count	18	8	26	Pearson Chi-Square	46.936	2	0.001
	Expected Count	13	13	26				
Kyawama	Count	0	28	28				
	Expected Count	14	14	28	Likelihood Ratio	60.425	2	0.001
Stadium	Count	21	2	23				
	Expected Count	11.5	11.5	23				
Total	Count	38.5	38.5	77				
	Expected Count	38.5	38.5	77				

Journal of Environment
ISSN 2789-3863 (Online)
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Residents of the high-income area of Stadium generally had higher participation compared to the other two areas (Table 1), while residents of the middle-income Kandundu also participated more than the residents in low-income areas of Kyawama.

Table 2: The Least Square Difference showing the Levels of Participation in Solid Waste Management among the Residents in Kandundu, Kyawama and Stadium

Township		Mean Difference	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Kandundu	Kyawama	-.692	.086	.000*	-.86	-.52
	Stadium	.221	.090	.017*	.04	.40
Kyawama	Kandundu	.692	.086	.000*	.52	.86
	Stadium	.913	.089	.000*	.74	1.09
Stadium	Kandundu	-.221	.090	.017*	-.40	-.04
	Kyawama	-.913	.089	.000*	-1.09	-.74

*The mean difference is significant at 0.05 level

The Least Square Difference (LSD) method was used to compare the significance of differences in levels of participation in solid waste management among the three townships. The level of participation was assessed through residents' willingness to pay for waste collection service and the adoption of sustainable waste management practices. There was a significant difference in the levels of participation in a formal waste collection service among the residents of three townships (χ^2=46.93; p=0.001) (Table 2). Therefore, the null hypothesis which says that there was no significant difference in the levels of participation among the residents of Solwezi in solid waste management has been rejected. The three townships were delineated into different income levels. Kyawama which was a low-income residential area recorded low participation while Kandundu and Stadium had higher participation.

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4.2. Solid Waste Management Practices in Kandundu, Kyawama and Stadium Townships

The commonly practised method of SWM in the low-income area of Kyawama was burying (28.6%), while the high-income areas of Kandundu and Stadium commonly utilised formal waste collectors(Stadium = 22.1 %; Kandundu = 12.9 %) (Figure 1). Burning was practised on a small scale in all the three areas of Kandundu (10.4 %), Kyawama (6.5 %), and Stadium (2.6 %). Informal waste collectors, where individuals were contracted to collect waste on a small-scale using wheelbarrows was also a management activity that was practised in Kyawama (1.3 %) residential area but was not practised in middle and high-income residential areas.

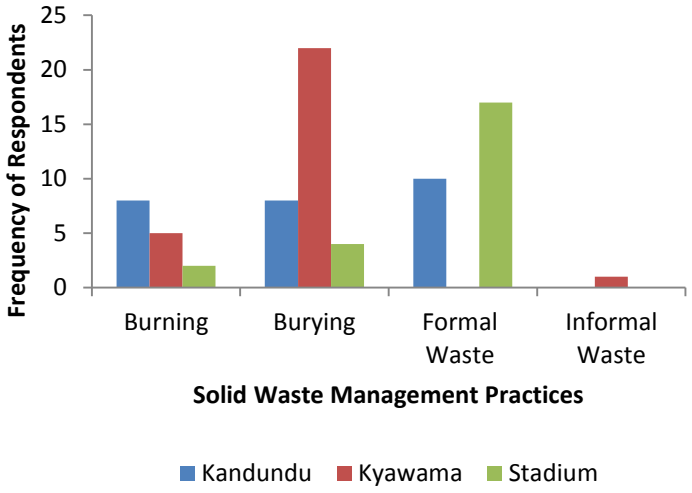

Figure 1: Solid Waste Management Practices

4.3. Willingness of Residents in Solid Waste Management

Residents in the two high-income residential areas, Kandundu (28.6 %) and Stadium (28.6 %) expressed the same willingness to participate in formal solid waste management. However, fewer residents were willing to participate in formal solid waste management in the low-income area of Kyawama (14.3 %). On the other hand, some residents in Kyawama (10.4 %) and Kandundu (2.6 %) were willing to participate only if the fee attached to the formal waste collection was reduced from the US$ 2.7/ month charged during the period of data collection to somewhere in the range of US$ 0.5 to US$ 1[1]. Kyawama residential

[1] At the time of the study 1 US dollar was equivalent to ZMW11

area had a higher number of residents who were not willing to participate in any formal waste management system because they felt the monitory charge attached to it was too high. In the high-income residential areas, only a small percentage of the residents in Kandundu (1.3 %) and Stadium (1.3 %) were unwilling to participate.

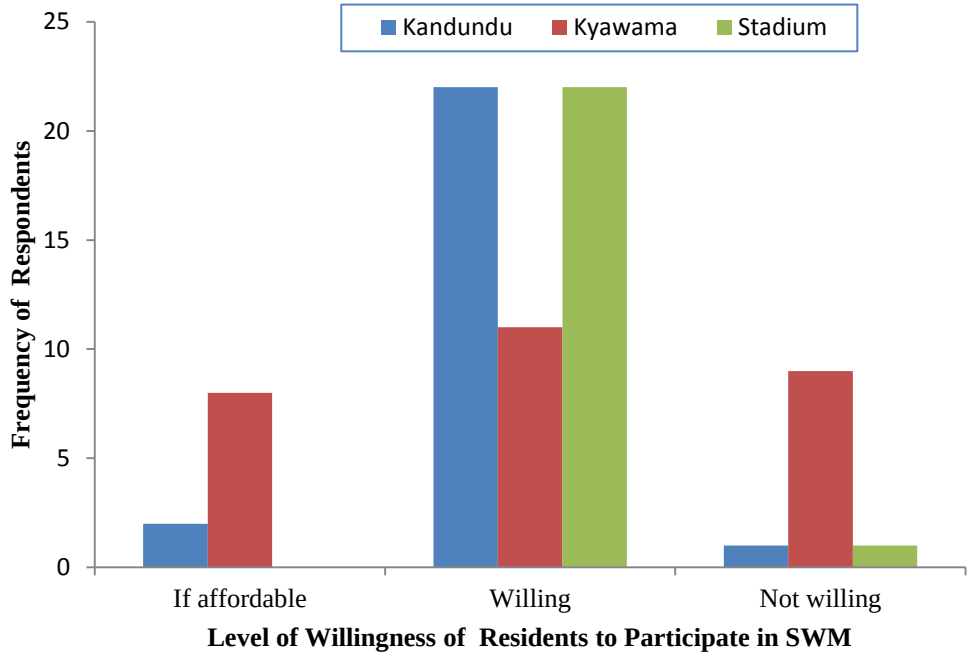

Figure 3: Residents Willingness to Participation in a Formal Waste Collection

4.4. Gendered Awareness of the Role of Residents in Solid Waste Management in Solwezi

Nearly half of the female residents (50.6 %) in all the three residential sites were aware of the roles they could play in waste management (Kandundu = 16.9%; Kyawama =16.9 %; Stadium = 16.9 %), which was higher than their male counterparts (Kandundu and Kyawama =11.7 %; Stadium = 5.2 %). This could have been because most waste management issues in the area were better dealt with by women rather than men. In fact, during data collection, on three occasions, the male respondents deferred the waste management questions of the interview to the women of the household.

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Vol. 2, Issue No. 1, pp 19 - 38, 2022
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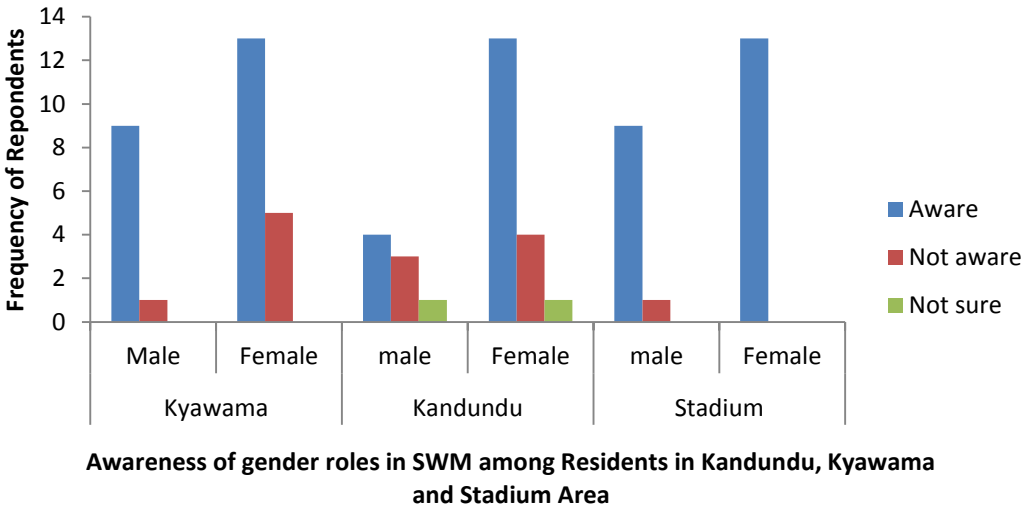

Figure 4: Awareness of gender roles in SWM among residents in Solwezi

4.5. Factors that Hinder the Residents' Participation in Solid Waste Management

Several factors hindered residents' participation in informal waste management in Solwezi (Figure 5). Some residents in Kyawama (18.2 %) felt that "no formal collection waste service was available in their residential area", and this hindered them from participating in formal solid waste management systems. Only1.3% in Stadium were not aware of the existence of such a service. The second hindrance was that waste was not collected in good time by the waste collectors and the greater percentage of those who felt this hindered them was in Stadium (15.6%) and Kandundu (6.5%). A few residents of Kyawama (12.9 %) felt that a "lack of money" was their greatest hindrance while Kandundu had the fewest who felt monetary constraints were a hindrance (6.5%). In Kandundu and Stadium, about 10.4% and 2.6%, respectively, felt that lack of street bins around town hindered them from participating in a formal waste collection. On the other hand, 5.2% of the residents in Kyawama, 10.4% in Kandundu and 10.4% in Stadium felt that lack of communal rubbish bins in the residential area hindered them from participating in formal waste collection.

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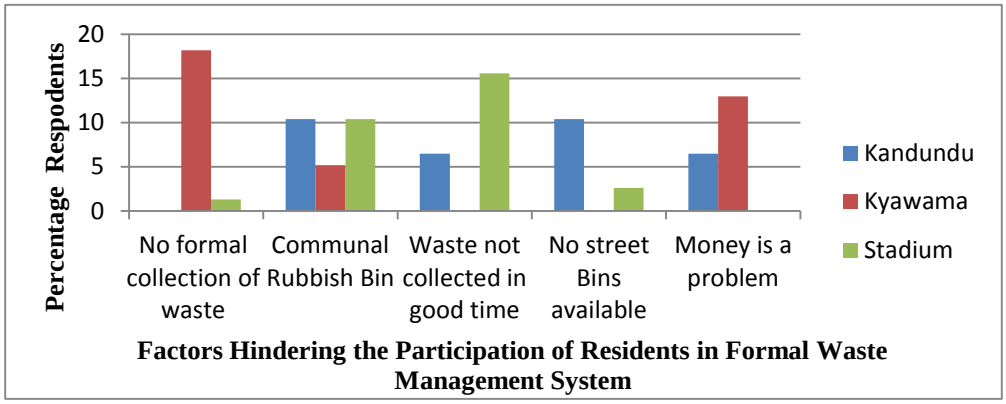

Figure 5: Factors Hindering the Participation of Residents in Formal Solid Waste Management

6.0. Discussion

6.1. Solid Waste Management practices in Solwezi

The most common solid waste management practices in the three different income level areas of Solwezi were burying, burning and waste collection service. In low-income residential areas such as Kyawama, the most common Solid Waste Management (SWM) practised is burying and burning. This is because low-income residents have less disposable income for them to engage in paying for formal waste collection services. Further, few low-income residents are engaged in formal employment. Hence, some residents contracted informal waste collectors whose fees were relatively lower than the formal waste collectors. In the middle and high-income residential areas, a formal solid waste collection using waste collectors approved by the local authorities is usually the main solid waste management strategy utilised. However, residents of middle-income areas also engage in burning and burying of waste as a disposal mechanism despite the availability of formal waste collection services at a cost. This implies that income is a factor in determining the nature of solid waste management practice to be utilised by residents. In high income areas, residents usually hired waste collectors and minimal burning of waste was done. The residents in high income residential areas were also most likely to have acquired formal or informal environmental education which made them more likely to engage in sustainable solid waste management practices compared to the residents of low-income areas. Additionally, it was found that burning was being practised in all the three residential areas, but it was more commonly practised in Kandundu and Kyawama and on a very small scale in Stadium. This method of waste disposal is unsustainable and is discouraged in the Environmental Management Act (EMA) of 2011 for Zambia. The fact that this was a

common method of waste disposal in Solwezi puts the town at high risk of substantial negative environmental impacts such as pollution of air, soil and water. This study agrees with Nemerow et al. (2009) who wrote that the methods currently applied by the residents to manage MSW which involve open dumping or open burning, have a negative impact on both the environment and public health.

6.2. Willingness of the Residents to Participate in Formal Waste Management System

Residents of high and middle-income residential areas are more willing to participate in formal solid waste management than those in low-income areas. For example, this study showed that in the low-income area of Kyawama, few residents were willing to participate in formal solid waste management compared to high residential areas. A study by Ebikapade et al. (2015), revealed that higher public involvement in environmental issues is empowered by the willingness of the people to do so and is likely to ensure a clean and healthy environment. This becomes more of a challenge when low and medium-income areas are involved as their willingness to participate is usually conditioned on the fee attached to formal waste collection. Usually, these residents only participate when the charge is very low.

Most of the residents in the low, middle and high-income residential areas are willing to pay for waste collection services as it was a way of keeping their residential areas clean. Further, the majority of the residents in the low and middle-income areas were interested in participating in the free aspects of formal waste management such as waste separation, as few were willing to pay for the service. The lack of willingness to pay for waste management revealed an attitude among residents that could contribute to unsustainable environmental management of waste. This is because there were still residents who felt that they would continue to either bury or burn their waste as this was a cheaper method of waste disposal. While these residents felt that by burning or burying, they were also participating in sustainable solid waste management, such participation represents maladaptation and is unsustainable and illegal.

In as much as some residents were willing to participate in a formal waste management system, they were hindered by several factors. Some residents in the low-income area of Kyawama felt that “no formal waste collection services were available in the area”. In the high and middle-income level areas of Stadium and Kandundu, the greatest hindrance was that waste was not collected in good time by the waste collectors. Rana et al. (2014) report that most solid waste management systems in developing countries have reflected poor collection efficiency of the municipal solid. Studies by Gujarat Cleaner Production Centre-

Environmental Information System (GCPC-ENVIS) (2014), Asnani (2005) and Annepu et al. (2012) reported that for an effective solid waste management system, the collection capacities should be greater than or equal to the solid waste generation rates. However, in most developing countries collection capacity provided is often less than the actual waste generated.

In the middle and high-income level areas, residents felt that lack of street bins around town hindered them from participating in a formal waste collection. This was confirmed by the observations made at the time of the study in 2016. The streets in the town of Solwezi did not have any waste bins. As a result, there was a lot of littering especially in the street roads. Studies done by Guria et al.(2010), Das et al. (2014) and Bhoyar et al. (1999) revealed that in India and other developing countries, generally common bins are provided for collection of decomposable and non-decomposable waste. This was not the case for Solwezi town.

The residents' awareness of the availability of public awareness campaigns in the communities of the three residential areas varied tremendously. Public awareness and education are important tools capable of increasing public participation in sustainable waste management programs.

According to Ebikapade et al. (2015:191),

> *The attitude and awareness of the participants are likely to be positively influenced by increased publicity on waste management issues. The more the public is informed on waste management the better their perception and attitude towards environmental issues.*

In the case of Solwezi, it was found that awareness campaign activities were being conducted by the local municipal council that was aimed at educating the local community in Solwezi on the need to be involved in a formal waste collection management system. In as much as the local authority thought that it had done its duty of educating the public on practising environmentally friendly SWM activities, many of the residents expressed ignorance on such knowledge. It was reported that educational awareness campaigns were part of the local authority's policy to ensure that the residents were well informed about sustainable methods of SWM. Since this was the case, the local authority needed to do more since awareness is one way people learn on various forms of sustainable SWM activities. Therefore, the local authority can carry out campaign activities through local drama programmes using available media platforms such as the North-western television, community radio stations, flyers and press releases.

7.0. Conclusion

Solwezi town in Zambia lacks efficient solid waste management resulting in an absence of a well-coordinated solid waste management system. Because of this, serious environmental problems are likely to continue putting the environment and the public health at risk in the town. Since solid waste is an environmental health hazard, its effective management by local authorities should be the priority. Despite these negative implications, residents' participation in solid waste management is required to help the local authority deal with the ever-increasing waste generation in Solwezi town.

Since the study found that unsustainable methods of waste management like burning and burying are the most commonly practised, the local authority should involve the residents and other key stakeholders in coming up with programmes that will sensitize the residents. The study also concludes that the local authority should encourage more private partnerships to help with the waste management system from collection to disposal sites.

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