Original Article

Household Solid Waste Management Strategies in Urbanizing Areas. A Case Study of Sokoni l Ward, Arusha City, Tanzania

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ABSTRACT

This study analyzed the various solid waste management strategies used by residents of Sokoni I ward, using households as the unit of analysis. This study involved a total of 90 residents from Sokoni I as targeted respondents, with a ward executive officer, ward health officer, and Mtaa executive officers as key informants. A mixed approach was applied in the process of data collection, and then the data were descriptively analyzed. The findings revealed burying (10.4%), sweeping (55.9%), re-sale (4.7%), burning (0.9%), random dumping (20.8%), and re-use (11.3%) as the employed strategies by the residents of the study area in managing solid waste at their households. When these strategies are properly applied, they provide numerous contributions to the handling and treatment of solid waste with a positive impact on the environment and public health. Based on the nature of the findings, local government officers, specifically those at the grass-roots level, should educate their people on the application of proper strategies in managing solid waste in their households to minimize the use of other strategies that lead to the spread of waste, including solid waste.

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INTRODUCTION

The amount of solid waste produced by households worldwide is currently over 2 billion tons annually, but by 2030, it is predicted to reach 75 million tons (By-NC-SA, 2021). The rate of solid waste production is higher in developed countries than in developing countries, where food waste, paper, plastic, rags, metal, and glass are the common categories of solid waste generated at the household level (Unescap, 2002). Solid waste management is also one of the toughest, most complex, time-consuming, and laborious tasks for urban areas of the world. Solid waste is managed in developed countries through the use of the newest automobiles, equipment, machinery, and technologies; however, developing countries' solid waste collection efficiency (40%) is less than half that of developed countries (90%) (Zhang, & colleagues, 2024; Hossain, 2022).

In many developing nations, managing solid waste at the household level is challenging, especially in urbanizing areas (Mukena et al., 2024). The common solid wastes produced at the household level are food wastes, paper, plastic, rags, metals, and glasses from household areas. However, burying, burning, reusing, and recycling are the popular strategies of waste management employed at the household level in most of the developing countries, though in Namibia's capital, Windhoek, each household is provided with a wheelie bin for temporary management of their wastes until collection (Mukena et al., 2024; Fadhullah et al., 2022; Muse et al., 2022). Unfortunately, solid waste management services, which fall within the authority of local government, are ineffective, inconsistent, and unreliable, particularly in low-income neighbourhoods in the majority of developing nations (UN-HABITAT, 2010).

Between 2012 and 2016, the amount of waste produced annually in sub-Saharan Africa (SSA) increased from 81 million tons to 174 million tons, with an estimated 269 million tons produced by 2030 (Adedara et al., 2023). Nigeria, just like every other country in sub-Saharan Africa, is faced with solid waste generation and management. Large quantities of solid waste are indiscriminately deposited on any open lot, near buildings, drainage systems, institutions, playgrounds, roadside areas, and open markets in large cities and towns. The people in this part of the world appear to accept living with solid trash all over the place (Orhorhoro, & Oghoghorie, 2019).

The majority of Tanzanian residences (60%) produce between one and three kilograms of waste each day, including solid waste, however, waste collection schedules are significantly inconsistent (74%). Despite the common use of sacks (97%) for waste storage, an underperforming collection system results in uncertainty among residents, leading to roadside dumping (Kibonde, 2024). But in Tanzania, waste management is becoming a major problem, particularly in squatter communities where 70–80% of the urban population lives without proper services and infrastructure (Komba, 2024). Wheelbarrows and push carts/handcarts are used in some of these locations to collect solid garbage at the household level. Residents pay for waste collection services and occasionally move their rubbish to the enormous skips that are available for public use, but others dump, bury, and burn their waste (Ussi, 2021).

The majority of cities in developing countries, such as Arusha City, have poor solid waste management strategies that have ongoing detrimental consequences on the environment, public health, and climate change (Zhang et al., 2024). About 446 tons are collected daily from Arusha city, which generates 550 tons daily. 30% of the waste is solid,

37% is food waste, 11% is paper, 7% is plastic, 4% is glass, 1% is metal and tin, 2% is textile, and 8% is ash. One of the primary sources of solid waste in Arusha City is residential sources, or households (URT, 2018). Most of the studies conducted on waste management at household levels in Arusha City look only at the strategies employed by waste pickers and government authorities rather than those employed by residents (Onesmo, 2023; Richard et al., 2021; Omar, 2021). The current study, therefore, examined household solid waste management strategies in urbanizing areas, using Sokoni I Ward in Arusha City, Tanzania, as a representative case study. Understanding household solid waste management strategies in urbanizing areas is essential for promoting environmental protection, public health, and urban livability. As urbanization increases waste generation, effective management strategies help prevent pollution, reduce health risks, and improve the quality of life for residents. Additionally, such strategies facilitate resource recovery through recycling and composting, supporting sustainability and mitigating climate change by reducing greenhouse gas emissions. They also provide economic benefits by creating jobs and reducing cleanup costs while guiding policymakers in developing targeted interventions and equitable infrastructure. Ultimately, understanding these strategies ensures urban resilience, addresses service inequities, and fosters community engagement for a cleaner and healthier future.

RESEARCH METHODOLOGY

Research Design

Based on the fact that this study is self-sponsored and time-limited, the cross-sectional research design was used. Also, a mixed approach was implemented by collecting both, namely qualitative and quantitative data from the field. Normally, this approach allows the collection of data from different respondents, which ensures the effectiveness of the strategies employed by residents in managing solid waste in the household in a study area.

Description of the Study Area

The study was conducted in Sokoni I Ward, one of the 25 wards within Arusha City, which has a total population of 617,631. Sokoni I Ward stands out as the most populous ward, with 93,037 residents and 26,327 households (URT, 2022). The ward was selected as the study area due to its status as the most populous ward in the city, making it a representative location for capturing diverse perspectives and insights.

Sample Size and Sampling Techniques

Study Population

The residents of Sokoni I were the target population for this study, given their critical role in achieving effective solid waste management at the household level. They employ various strategies to ensure proper management of solid waste within their surroundings. The ward has a total household of 26327, which was considered a unit of study.

Research Sample Selection

The sample of this study was obtained through the application of the Taro Yamane formula of 1967 with a 90% confidence level.

Thus, the Taro formula is presented as;

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

Where "n" represents sample size, "N" represents the total population of the target population, while "e" stands for margin of error. That means in relation to our study, N = 26327 and e = 0.1. Therefore, the determined sample size using the Yamane formula (1967) was 90 households.

Sampling Techniques

This study utilized both probability and non-probability sampling techniques to identify and engage respondents, including primary participants and key informants. For the probability sampling, a simple random sampling method was employed to

select residents of Sokoni I Ward. In contrast, non-probability sampling involved the use of purposive sampling to identify key informants, such as ward officers, including Ward Executive Officers, Ward Health Officers, and Mtaa Executive Officers.

Methods of Data Collection

Household Survey

As part of the data collection process for this study, a household survey was conducted using a closed-ended questionnaire as the primary tool. The questionnaire was specifically designed for residents at the household level, prioritizing efficient time management and ensuring that responses aligned with the study's objectives. This method successfully gathered quantitative data from the target population, namely the residents of Sokoni I Ward.

Interview

This method was also used to gather information from key informants, including the Ward Executive Officer, Ward Health Officer, and Mtaa Executive Officers. A structured interview guide with carefully designed questions was utilized to collect qualitative data from this group of respondents. This

approach was chosen because these individuals hold key responsibilities and authority in overseeing the management of solid waste at the household level as part of their daily duties in their roles as public officers.

Observation

In this study, this method was also employed to gather information, particularly concerning the tangible aspects of solid waste. An observation guide was used by the researcher to collect data on the nature and presence of solid waste, as well as the types of equipment used for waste collection at both the household level and collection points.

RESULTS AND DISCUSSIONS

Demographic and Socioeconomic Characteristics of Respondents

Education Level of the Respondents

This study collected information regarding the level of education of the residents of Sokoni I. Therefore, in the process of identifying the education level of the residents, education levels were classified into four levels, namely, primary, secondary, tertiary, and never gone to school.

Table 1: Education Level of the Respondents

Education level	Frequency	Percent
Primary level	51	56.7
Secondary level	26	28.9
Tertiary level	9	10.0
Never attend school	4	4.4
Total	**90**	**100.0**

Source: Field data, 2024

The results in Table 1 show that 56.7 percent of residents have attained a primary-level education, while only 4.4 percent have never attended school. This suggests that the majority of residents in Sokoni I Ward have received at least primary education, which provides a basic level of literacy that enhances their understanding of various issues, including the management of solid waste in their households.

This finding is consistent with a study by Kibonde (2024) in Morogoro Municipality, where it was found that the majority of respondents (41%) had attained primary education, followed by secondary education (39%). This trend indicates that a higher level of education can reduce the likelihood of residents engaging in environmentally harmful practices such as random dumping or burning of waste. Additionally, the level of education appears

to influence how residents generate and manage solid waste at the household level (Mukena et al., 2024).

Nature of the Residence

This was also an important variable in the study, as household members fall into two main categories: homeowners and tenants. Therefore, the nature of the residence for respondents is classified into these two categories.

Table 2: Nature of Residence

Nature of residence	Frequency	Percent
House owner	56	62.2
Tenant	34	37.8
Total	**90**	**100.0**

Source: Field data, 2024

The study findings in Table 2 revealed that 62.2 percent of respondents were homeowners, while 37.8 percent were tenants. Based on the nature of the residence, the majority of respondents in this study were homeowners, which likely provides them with greater experience and commitment to various strategies of solid waste management at the household level.

A study conducted in Kisumu, Kenya, by Simiyu et al. (2019) identified two types of residences and noted that landlords or homeowners play a significant role in basic service provision, while tenants also have a role in improving their living conditions. The study found that residences with landlords tended to have better living conditions compared to those without them (Yeasmin et al., 2020).

Similarly, studies conducted in Nigeria by Ebekozien & Aigbavboa (2021) and Akinpelu et al. (2021) support the presence of both tenants and homeowners/landlords. These studies also found that homeowners/landlords and tenants often collaborate with each other, as well as with private waste collectors, to manage solid waste in their residences (Ebekozien, & Aigbavboa, 2021).

Types of Solid Waste at the Household

Solid waste generated at the household level can typically be categorized into different typologies, based on various sources of research. In this study, eight (8) types of solid waste were presented to primary respondents through a data collection tool used in the field.

Table 3: Type of Solid Wastes

Nature of waste produced at the household	Responses	
	N	**Percent**
Plastic	30	20.3%
Food remains	56	37.8%
Metal wastes	3	2.0%
Textiles	4	2.7%
Wood	3	2.0%
Electronic wastes	1	0.7%
Glasses	3	2.0%
Packaging materials	48	32.4%
Total	**148**	**100.0%**

Source: Field data, 2024

The results from Table 3 indicate that 37.8 percent of the respondents identified food as the most common type of waste generated at the household level, while 0.7 percent cited electronic waste as the most common. This suggests that food remains are the primary category of solid waste generated in the households of Sokoni I Ward in Arusha City Council.

A study conducted by Kabir and Kabir (2021) in four major cities in Bangladesh supports these findings, showing that food waste and green vegetables accounted for the largest percentage of solid waste generated by households in the area. Other types of solid waste identified included paper, plastics, metals, wood, grasses, leaves, rags, textiles, jute, glass, non-compostable organic waste, and others.

Furthermore, Franco & Iglesia (2022) conducted a study on household solid waste management, which included data from 275 households across 29 localities in the municipality of Puñal. The study found that the most significant type of waste produced by households was organic waste, followed by plastic waste and paper.

Nature of Dustbin used at the Household

Dustbins are among the collection vessels used by people in various locations, including the residents of Sokoni I. These dustbins come in different forms, primarily nylon bags and plastic buckets. Respondents were then asked to choose between these options based on their experience in managing solid waste in their households.

Table 4: Nature of Dustbin used at Household Level

Nature of dustbin	Frequency	Percent
Nylon bags	60	66.7
Plastic buckets	30	33.3
Total	**90**	**100.0**

Source: Field data, 2024

The results from Table 4 show that nylon bags accounted for 66.7 percent of the dustbins used by respondents, compared to 33.3 percent for plastic buckets in the study area. This indicates that the majority of dustbins used by the residents of Sokoni I Ward in Arusha City Council are nylon bags, which are utilized to transfer solid waste from households to collection points.

This finding is also supported by a study conducted by Kongnso et al. (2024), which noted that nylon bags and plastic buckets were commonly used for waste management in households and restaurants. In the study area, nylon bags are more frequently used as waste receptacles than other types of dustbins, such as plastic buckets and TS buckets. The use of dustbins contributes to a positive attitude

and intention toward waste management, promoting acceptance and integration among household members. Dustbins have been integral in the collection and management of domestic waste (Denyo et al., 2024). Additionally, dustbins serve as temporary storage for solid waste before disposal (Dimoso, 2024; Safo-Adu, 2019).

Causes of Solid Waste at the Household

The reasons for the generation of solid waste in households were a key component of this study. Respondents were presented with a closed questionnaire listing factors such as the use of fabricated materials, daily operations, and poor handling, allowing them to select more than one option.

Table 5. Causes of Solid Waste at the Household

	Responses	
Cause of waste generation	**N**	**Percent**
Refabricated materials	1	1.3%
Daily operations	58	77.3%
Poor handling	16	21.3%
Total	**75**	**100.0%**

Source: Field data, 2024

The findings from Table 5 reveal that daily operations accounted for 77.3 percent of the causes of solid waste, while refabricated materials represented only 1.3 percent, making it the least significant cause at the household level in the study area. These results indicate that the primary cause of solid waste generation at the household level in Sokoni I Ward, Arusha City, is strongly linked to daily operations.

Strategies Employed by Residents to Manage Solid Waste

The process of managing solid waste at the household level involves various strategies. In this study, six different strategies were presented to the respondents, who provided their responses based on their daily experiences with solid waste management in their households.

Table 6: Strategies of Solid Waste Management at Household

	Responses	
Strategies of waste management	**N**	**Percent**
Burying	11	10.4%
Sweeping	55	51.9%
Resale	5	4.7%
Burning	1	0.9%
Random dumping	22	20.8%
Reuse	12	11.3%
Total	**106**	**100.0%**

Source: Field data, 2024

As presented in Table 6, sweeping was identified by 51.9 percent of respondents as a method for managing solid waste while burning was mentioned by only 0.9 percent. This indicates that sweeping is the most commonly practiced household solid waste management method among the residents of Sokoni I Ward in Arusha City.

These findings align with a study by Regency (2024), which revealed that sweeping is one of the strategies employed by households in Indonesia, particularly those with low incomes. However, much of the household solid waste in such contexts ends up in landfills, despite its potential to be processed into materials of economic value.

Additionally, Gross (2021) provides corroborative evidence, noting that road sweeping is a widely practiced method for managing solid waste. The study highlights that waste collected from households is sometimes sold to tradespeople for use in manufacturing processes. For example, in Senegal, over 1,000 kilometers of roads require daily sweeping.

Further support comes from a study by Chattopadhyay et al. (2009), which focused on Kolkata, one of India's four metropolitan cities. It highlighted that solid waste management is a major cost-intensive service, with manual sweeping identified as a significant method for waste collection and disposal.

Moreover, the report by Pires & Martinho (2019) identified sweeping as one of the most popular strategies used to manage solid or semi-solid waste generated through the general activities of a population. Typically, such waste originates from households, commercial establishments, services, and institutions.

However, qualitative information was collected through Key Informants (KI) in Sokoni I Ward, Arusha City, as outlined below:

> *"The residents of Sokoni I Ward employ various strategies for handling waste in their surroundings, including at the household level. Common strategies include sweeping, random dumping, and burying. However, burning is highly restricted by the council's by-laws. Residents are also responsible for transferring their solid waste to designated collection points, from where contractors relocate it to the dumping site KI₁.*

Also, the other Key Informant responded the same question by saying;

> *"Most residents of Sokoni I Ward primarily use the sweeping method to manage solid waste, while others adopt mixed approaches, including resale and reuse. Only a few residents resort to random dumping and burying, despite these practices being prohibited. Violations can result in penalties if residents are caught by municipal officers, including MTAA executive officers and ward health officers." KI₂.*

Lastly another KI reported that;

> *"In managing solid waste in residential areas, household members employ various strategies, including sweeping, which helps gather waste in one location. The waste is then transferred using plastic bags to designated collection points, from where waste trucks transport it to the municipal dumpsite within the city." KI₃.*

A study on solid waste management conducted by Mwakaje (2010) in Dar es Salaam, Tanzania, found that sweeping was a common waste management method among residents in informal urban settlements. However, due to limited access to waste collection services, random dumping in public spaces, roadsides, and vacant lots was also observed as a widespread practice.

Limitation

Sokoni I Ward is one of the 25 wards that make up Arusha City in the Arusha Region. With six mitaa, Sokoni I Ward serves as the focal point of this study, which explores the various strategies employed by residents at the household level. The study was conducted over a short period, during which targeted respondents were contacted for data collection on the strategies used to manage solid waste. Therefore, the findings of this study should not be generalized to represent the overall status of waste management across the entire city council or region. Instead, these findings should be viewed as preliminary insights into the strategies employed by residents of the study area, although they may not fully encompass the broader spectrum of waste management practices throughout the region.

Nonetheless, this study is unique to Arusha City and the region as a whole, highlighting the need for further research in this area. Future studies, including those examining the performance of environmental management committees at the grassroots level, will be essential for exploring their roles in managing solid waste both at the household level and across the city.

CONCLUSION AND RECOMMENDATIONS

Conclusion

The study explored various strategies employed by households in Sokoni I Ward, Arusha City Council, to manage solid waste. Notable strategies included burying, sweeping, resale, burning, random dumping, and reuse. These strategies were applied in different ways, with residents sometimes using

more than one method in the process of managing solid waste at the household level.

Recommendations

In the process of attaining the goals of this study, residents of the study area employ different strategies in managing solid waste in households. Unfortunately, there is still an existence of solid waste in the surroundings of the household in most of the area of study. Thus, this study recommends the following:

Local government officers of Arusha city councils including those at the ward level of Sokoni I should collaborate in educating the residents at the household level through different community meetings. The education should enable the residents to employ environmentally friendly strategies in managing solid waste in their households.

Residents in the study area should work collaboratively with public officers and other waste collectors to ensure that they employ environmentally friendly strategies to manage solid waste in their households. Also, residents in an area of the study should be aware that they have an important contribution in the process of managing solid waste in their surroundings including in households so they should offer effective collaboration.

Conflicts of Interest

Authors of this study declared no conflicts of interest concerning the publication of this article.

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