

Assessment of the Status of the Existing Solid Waste Collection, Transportation Disposal and Treatment Practices in Soroti District, Uganda

Omoding Jacob and Suzan Luyiga

Department of Biological and Environmental Sciences, School of Natural and Applied Sciences, Kampala International University

ABSTRACT

Municipal solid waste management has emerged as a significant concern in numerous regions, particularly with the escalating volume of waste generated daily due to population growth. This environmental issue is particularly acute in developing economies like Uganda. Consequently, a study was undertaken to assess the state of existing practices regarding solid waste collection, transportation, disposal, and treatment in Soroti District. Employing a cross-sectional survey design, data was gathered from 314 individuals, including employees, councilors, traders, and household members. Questionnaires, interviews, and observations were utilized for data collection, with informants selected through simple random and purposeful approaches. The Statistical Package for the Social Sciences (SPSS) was employed to analyze the data and formulate frequency percentage tables. The investigation revealed a myriad of challenges concerning solid waste management planning and organization. In Soroti Municipality, various methods are employed for collecting, transporting, and disposing of solid waste in designated sites. The study determined that private individuals and businesses operating within the municipality are primarily responsible for solid waste disposal, typically utilizing bags for collection. However, these methods were found to be largely inadequate in addressing current challenges, underscoring the necessity for improved and innovative waste management and monitoring strategies in Soroti, Uganda. Such measures are crucial for preventing disease outbreaks and associated public health issues.

Keywords: Soroti Municipality, Solid waste, Population, Transportation, Disposal, Collection.

INTRODUCTION

Solid waste management has been centralized in East African cities for a long time with imported refuse vehicles collecting rubbish from various sources and moving it to designated waste sites [1]. The municipal solid waste management system in East Africa has evolved since colonial times, when it was efficient due to a small urban population and abundant resources [2]. Nonetheless, trash management is one of the most visible urban services in the majority of developing countries, including Uganda, and successful urban reforms, strong local government, and solid municipal management are all indicators of waste management's effectiveness and long-term profitability [3]. As a result, waste management is an excellent measure of a municipality's overall effectiveness. As a result, in most Ugandan districts and cities, including Soroti Municipality, solid waste management is the most visible environmental

concern, and is becoming increasingly important as the country's population grows [4]. Rapid urbanisation is one of the elements that has contributed to an increase in the volume of solid waste generated, among other factors that have made this growth possible [5]. From a theoretical perspective, several authors have developed different theories in an effort to identify answers for solid waste management; in this study, emphasis was placed on the Institutional Theory and the Waste Management [6]. Several authors such as Mungure [7] and Scott [8] attempted definition of institution from differing perspectives. But it's crucial to comprehend how institutions function in light of the three pillars. These three systems are cultural-cognitive, normative, and regulative. It is crucial to take into account how each of these three contributes in a mutually reinforcing manner to a social framework when examining solid waste

management from an institutional perspective [9]. The three pillars don't operate independently of one another; rather, they cooperate. As a result, Soroti Municipality establishes its own laws, customs, and traditions. The whole Soroti Municipality community must participate completely in the solid waste management process [7]. A community free of trash is the result of the pillars working together as an institution to achieve the goal of fostering a clean environment. Towns become more urbanised as a result of industrialization, the development of social and economic infrastructure and services, and town expansion. The expansion of these services justifies population growth in places like Soroti Municipality because growing populations inevitably result in higher demand for consumables and social services, both of which could provide a bigger source of waste generation—mostly solid waste. It has also been demonstrated that the rise in trash volumes is directly related to the "new lifestyles associated with greater affluence," which lead to higher levels of consumption and, thus, increased waste production despite changes in waste composition [10].

According to the United Nations Environment Programme (UNEP), companies in a capitalist society frequently overlook environmentally sensitive packaging in favour of profit over environmental responsibility. As a result, consumers externalise the costs of solid waste management by disposing of waste packaging material on their own. Manufacturers frequently fail to offer adequate guidelines for waste management, which makes things more difficult and exposes the absence of corporate social responsibility in garbage management.

The current state of solid waste collection

"The collection, transportation, treatment, and disposal of garbage, as well as the after-care of disposal sites" is one definition of waste management [11]. Building a facility for the processing and disposal of garbage is the responsibility of every municipal city or town authority in the world. In a number of cities around the world, including Soroti, rising rates of rural-to-urban migration have resulted in massive demographic explosions [12]. This is also true in Uganda, where the majority of the population is transitioning away from agriculture and toward a service and industrial economy [12, 13]. The central government and district administration are in responsibility of enforcing the rules and regulations within their jurisdiction's territorial bounds. In most African towns and metropolitan centers, solid waste accumulation is estimated to be 0.5 kilogram per

capita per day, with densities ranging from 205 to 370 kg m⁻³, and research found that cities with populations of 3.5 million people generate one million tons of solid garbage each year [14][15][16]. Households, commercial centers, institutions, hotels, and health facilities are the most prominent sources of solid trash in poor countries, particularly in Africa [17].

Daily attempts to collect and transport solid trash to disposal sites have been made despite weak infrastructure and labor capacity; however, some divisions, such as the Northern Division, have far-flung disposal locations that frequently hinder such efforts. Door-to-door, curbside, block collection, and street sweeping are all examples of less frequent collection tactics used by different municipalities [18]. This is because the workers do not believe they are being watched and do not have the necessary equipment to complete the job. According to the EPA, door-to-door collection is the most popular method for collecting solid waste in metropolitan areas. The report argues that the frequency and regularity of solid trash collection are not always maintained due to a lack of workers and inadequate compensation [11].

The curbside collection system, involves the city administration or other delegated private companies placing various sized containers near street corners and street crossings for residents to deposit trash in on a regular basis using baskets, plastic bags, sacks, or other appropriate materials. According to Rogerson [19], many city residents trash carelessly and clutter the containers' surrounding areas, resulting in an ugly and unattractive appearance and attracting scavengers from all across town, despite the scavengers having their own site. The setout collection system is only used in places without door-to-door collection systems, such as apartments and condominiums, which are largely occupied by the city's middle and upper classes. Collectors in this system or technique, according to, usually blow horns or ring bells to signal that they are on their way to collect rubbish [20]. Others frequently request that residents deliver rubbish so that it can be moved to the proper location. When the signals are received, residents of the housing complex collect their trash and place it in pushcarts positioned in a suitable location, which are then delivered to the transport vehicles. This is primarily done by private enterprises from various stations and commercial buildings such as hotels, hospitals, schools, and other service delivery and production facilities [21].

According to Shivashankara and Rekha [22], massive amounts of solid waste are collected from three major sources: door-to-door, institutions via commercial organizations, and street cleaning. Micro and small enterprises pick up a significant portion of the trash; the rest is picked up by private companies and city employees. Since most division councils and local governments view solid waste collection and transportation as a way to maintain corrupt practices in their budgets, private business engagement in solid waste management and collection is limited inside the district. This is a regular occurrence in developing countries, particularly in East Africa [23]. According to the Ugandan government, a lack of garbage bins is one of the challenges that most districts and metropolitan regions in Uganda confront, despite attempts by a number of groups to solve the issue [24]. As a result, some households in particular places are unable to collect solid garbage. According to the United Nations Development Programme [25], international donors have been sponsoring programs to improve efforts to clean up the city, but they have all remained at the grassroots level due to a lack of public awareness. Rathana [26] acknowledges that the majority of developing nations, including those in Africa, do not have a collecting system that encompasses all places of residence, institutions, and economic hubs, especially those that are outside of city centres. One of the study's main objectives was to see how far the Soroti Municipality could go in collecting garbage from even the most remote businesses.

Two more solid waste collection procedures that are now commonly employed are recycling and composting. Recycling, according to Medina, can be used as a source of money for low-income people [27]. These people are employed by the city in order to keep the environment clean. Composting is the natural decomposition of organic waste in a controlled setting. In congested locations where solid wastes are accumulating on a daily basis as a result of population increase, recycling and composting are advantageous in terms of taking up less land and resulting in low pollution levels. Municipalities and cities in Uganda, for example, use the incineration technique of trash disposal, which is advantageous in areas where land for land filling is limited due to topographical constraints, densely populated areas, or environmental concerns. Despite the fact that this method has proven to be effective, developing cities require multiple techniques to be used at the same time. According to the EPA, incineration reduces the weight and volume of solid waste by 75 and 90 percent, respectively [28]. The

high energy requirements of incinerators in Africa mean that they are not given priority. In Soroti Municipality, there are multiple landfills where solid waste is disposed of. After collecting, waste pickers prey on vulnerable regions, and the only place to dispose of the material is a landfill. For municipal solid waste to function, proper management is essential.

Landfilling and uncontrolled open dumps are inefficient ways to dispose of municipal solid waste, contaminating the air and water. In Uganda and other African nations, there exist filthy landfills. Incineration is a better option, but it is costlier because of the high expenses of operation and maintenance. Reusing items is a popular approach of recycling.

Solid waste transportation and disposal procedures

Because it is made up of a variety of products produced by households, businesses, and markets, such as mixed paper, plastic, cloth, metal, glass, and biological waste, the gathered solid trash is heterogeneous in nature. The quantity of various waste ingredients varies by place and season, depending on living standards, lifestyle, eating habits, and the level of active industrial and commercial activity in the area [29]. This category includes all solid wastes produced by human and animal activities that are discarded as useless or unwanted. They are biological and inorganic waste products that have lost their value to their original consumers due to societal activity.

Air, land, and water contamination are all results of improper solid waste transportation and disposal. Waste is produced in urban places like Soroti, which presents aesthetic and health risks [30, 31]. This is due to the fact that municipal solid waste contains a large amount of dangerous and destructive substances that, when exposed to moisture, generate leachate, which can contaminate neighboring land and groundwater [32]. As a result, in comparison to the developing world, solid waste management in various districts and municipalities throughout the developed world has considerably improved. Infrastructure development is a public concern, and public expectations, as well as people's health, have prompted governments all over the world to consider waste management.

Despite city officials' best attempts to collect and eradicate solid waste, there are still locations in developing countries with excessive waste due to a lack of suitable transportation [33]. This is due to the fact that there are only so many people who can collect and dispose of such items. It was also established that in growing cities, faster rates of

Omoding and Suzan

population growth and economic development are frequently detrimental. They argue, however, that inefficient garbage collection and transportation are to blame for the solid waste buildup. The process of conveying solid waste involves preparatory treatment, which is carried out at many levels for recycling reasons [34]. Prior to disposal, treatment processes must be used to remove recyclable and reusable goods from garbage. Residents in cities and urban regions must be aware of the importance of properly collecting garbage and ensuring that it is delivered to an open disposal site without being separated. At this time, it is also not necessary to separate recyclable or reuse products from municipal waste. On the other side, small-scale informal recyclers do some manual recycling on occasion, albeit insignificantly. Craftspeople recycle metal, wood, rubber, and clay to meet the needs of a diverse range of buyers in a variety of regions [35]. According to the World Bank, cities in low-income nations typically lack the trucks and equipment to

Study Area

Soroti is a district in eastern Uganda named after the region's administrative, commercial, and municipal hub. Soroti District, is bordered in the East by Katakwi District, the South by Ngora District, Serere District, and the West by Kabermaido District. The district headquarters is around 116 kilometers (72 miles) north of Mbale, accessible by road.

Soroti municipality is the largest Municipality in Uganda's Eastern Area, located in the Teso sub-region North of Lake Kyoga and in the country's Eastern region. On the Tororo-Mbale-Soroti Road, 326 kilometers (203 miles) northeast of Kampala, at

www.iaajournals.org

collect and transport waste [36]. This is especially true in Sub-Saharan African countries. They take Addis Ababa as an example, where garbage collection vehicles are in short supply and even those that are available do not all work to their full potential on a daily basis due to lengthy distances, numerous accidents, and mechanical issues. Solid waste management companies, on the other hand, transport the collected garbage to the disposal site with only one container per vehicle, with a maximum capacity of 8 m³ or 2160 kg. Because most garbage trucks lack coverings, debris is thrown all over the city on their way to the landfill [37]. Gbekor [11] emphasizes proper disposal of solid waste, including organic waste, as the final stage in solid waste management. The majority of low-income countries, such as Uganda, rely on open dumping for land disposal, and the practice is widespread across Africa.

METHODOLOGY

1°42'54.0"N, 33°36'40.0"E, Soroti District is located (Latitude:1.715000; Longitude:33.611111). Soroti is 1,130 meters (3,707 feet) above sea level.

The municipality's major sources of waste included open markets for fresh foods, hotels, educational institutions, shops, motor vehicle garages, carpentry workshops, hospitals, dispensaries, clinics, and residential areas, with vegetable matter, glass, clinical wastes, waste paper, and plastic accounting for a large portion of the generated waste from Soroti and the immediate catchment. The Municipal Council currently dumps garbage in the open dumping site in Aminit, but it makes an effort to gather as much waste as possible.

Table 1: Sample size from the study population and sampling techniques

Respondents Category	Accessible Population	Sample Size	Sampling Techniques
District Officials	15	14	Purposive Sampling
Municipal Officials	15	14	Purposive Sampling
Divisions Officials	40	36	Purposive Sampling
Divisions Chairpersons	10	10	Purposive Sampling
Owners of Hotels and Restaurants	30	28	Purposive Sampling
Households	200	132	Simple Random
Shop Keepers	100	80	Simple Random
Total	410	314	

Sources of Data

Questionnaires, interviews, and observations were also used to collect data, which was then evaluated to find answers to the research problem [42]. Secondary data was gathered from books, journals, newspapers, reports, and the internet, which was utilized to give the researcher literature and knowledge based on theories, as well as make comments and aid in the interpretation of the data collected. Secondary data gathering, on the other hand, has disadvantages such as becoming out-of-date over time [43]. In this study, which included both primary and secondary data gathering methods, the two types of data collection were used to complement one another throughout the research process.

Data Collection Methods

The study used three data collection methods, as given below: interview, questionnaire, and observation.

Interview Method

Interviewing is a type of conversation in which the purpose is to collect specific information through spoken words [44]. This strategy was used to acquire qualitative data.

The interviewer strives to understand as much as possible about the research topic. It offers the advantage of adaptability and versatility in any setting.

Questionnaire survey method

A questionnaire is a group of questions that a person is asked to complete in order to offer information for a specific purpose [45]. It's also a piece of paper with well-structured questions to which responders respond with precisely defined choices and pre-written responses. Respondents request that questionnaires be completed, which increases the possibility of receiving correct data while also preserving privacy [46].

The study used structured questionnaires with a list of possible alternative answers of strongly agree, agree, disagree, and strongly disagree to acquire qualitative data on respondents' attitudes toward solid waste management methods in Soroti municipality. The questionnaires were self-administered and featured a variety of alternative alternatives such as highly agree, agree, disagree, and strongly disagree [47]. Self-administered questionnaires are preferred by the target audience.

Observation method

In this strategy, the researcher used observation to look at what was going on in a real-life environment, then classifying and recording persistent observations [48].

This strategy provided firsthand information in explaining reality in its natural setting, as well as assisting in the supplementation of respondents' comments.

Instruments for Data Collection

Interview check lists, Structured Administered Questionnaires, and Observation check lists were the main instruments utilized to collect data from the field.

Interview Checklist

Only face-to-face interviews with important informants such as district, municipal, and divisional authorities, village chairpersons, and hotel owners were conducted using an interview guide with unstructured questions.

Structured Administered Questionnaire

Structured questionnaires with questions designed and delivered to community members, with homes and shopkeepers accounting for the majority of those who responded to the questionnaires.

Observation checklist

The observation checklist was also used to supplement on the reality of collection of data in

the field mainly in garbage collection, storage, transportation and disposal.

Validity and reliability

Validity and dependability were utilized to ensure the instrument's quality control, as stated below;

Validity

Validity entailed gathering the most accurate data in order to determine whether the questions

were capable of capturing the desired information. Prior to the administration of the study instruments, a validity test was conducted.

Reliability

In this study, an instrument was only considered dependable if it consistently gave the same results when applied to the same objects [49].

RESULTS

Response rate

During the study, 314 questionnaires were distributed and all of them were returned.

Table 2 Response rate

Instrument	Planned	Actual	Percentage
Interview guide	314	314	100%
Questionnaire	314	314	100%
Total	314	314	

The findings from the table above reveals that there was an overall response rate of 100% that was obtained from the return of the questionnaires from the respondents.

Respondents' demographic characteristics

Respondents' Gender

The investigator asked the respondents to declare their gender with the sole purpose of determining whether gender plays a significant impact in solid waste management practices and the results are presented in the figure below:

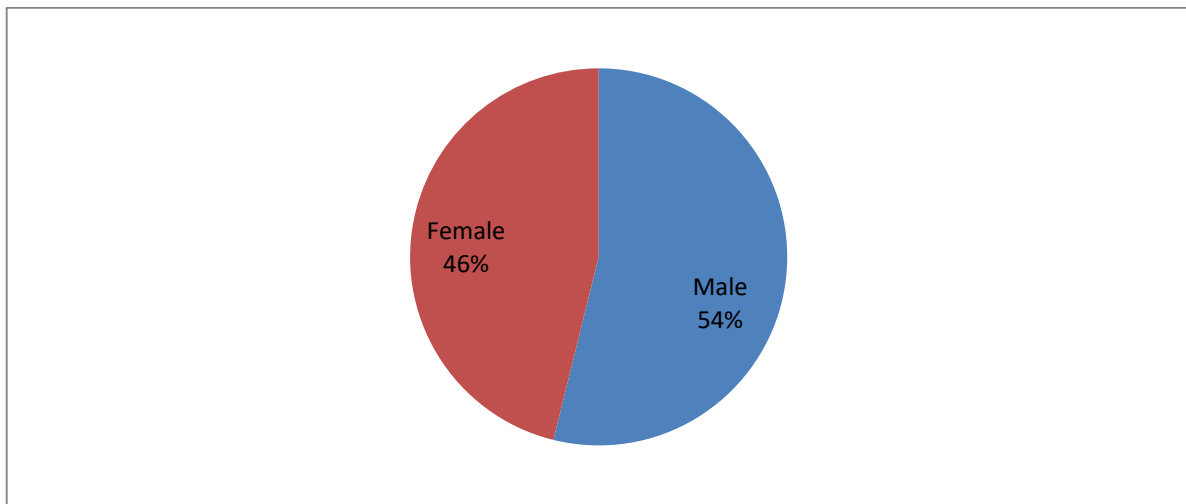


Figure 2 Sex of the respondents

The gender distribution of respondents is depicted in the graph above, with males accounting for 54 percent of all respondents and females accounting for 46 percent.

These findings are related to men's assumption that women are responsible for all aspects of community cleanliness. However, the study's findings were

gender balanced, with males accounting for 54% and females for 46%, and it should be remembered that men perform the majority of the manual labor, which includes hauling dust bins, containers, heavy forks, and cleaning floors. As a result, both men and women make important contributions to solid waste management practices in the Soroti municipality.

Age of respondents

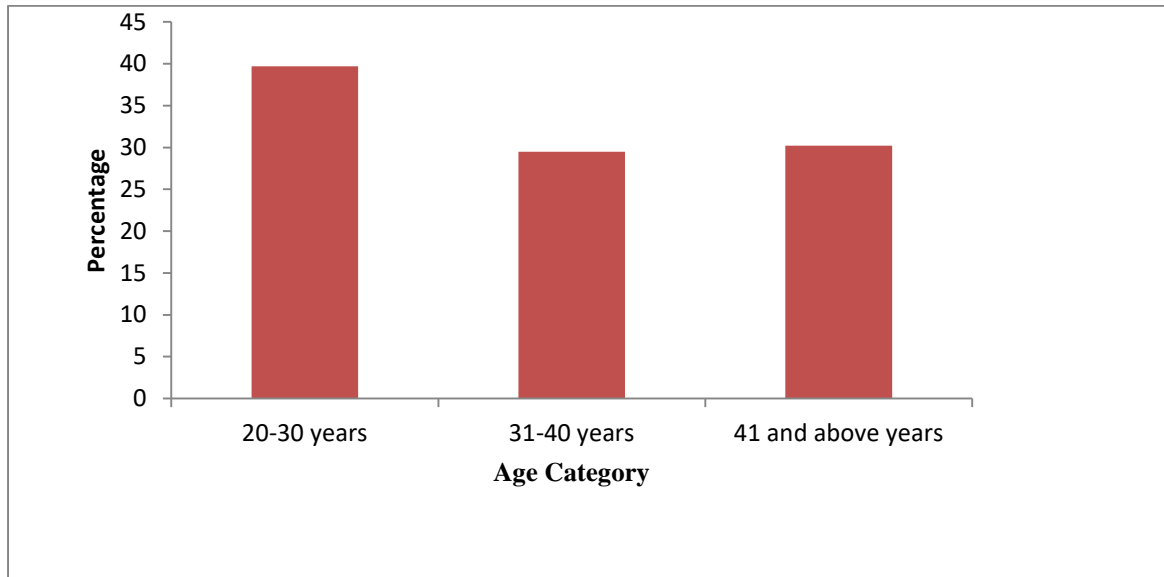


Figure 3 Shows Age category

Figure 3 shows that 39.9% of the respondents were between the ages of 20 and 30, 30.4 percent were between the ages of 41 and above, and 29.7% were between the ages of 31 and 40. This type of data shows that Soroti municipality's solid waste management practices are never discriminatory based on age, therefore the

municipality recruits people of various age groups to work and as a result, the age group of 20-30 years was high since these were mostly singles without family ties who were also energetic, thus they tended to be more active in solid waste management activities than other age groups such as 41 and above who had family ties.

Type of the respondent

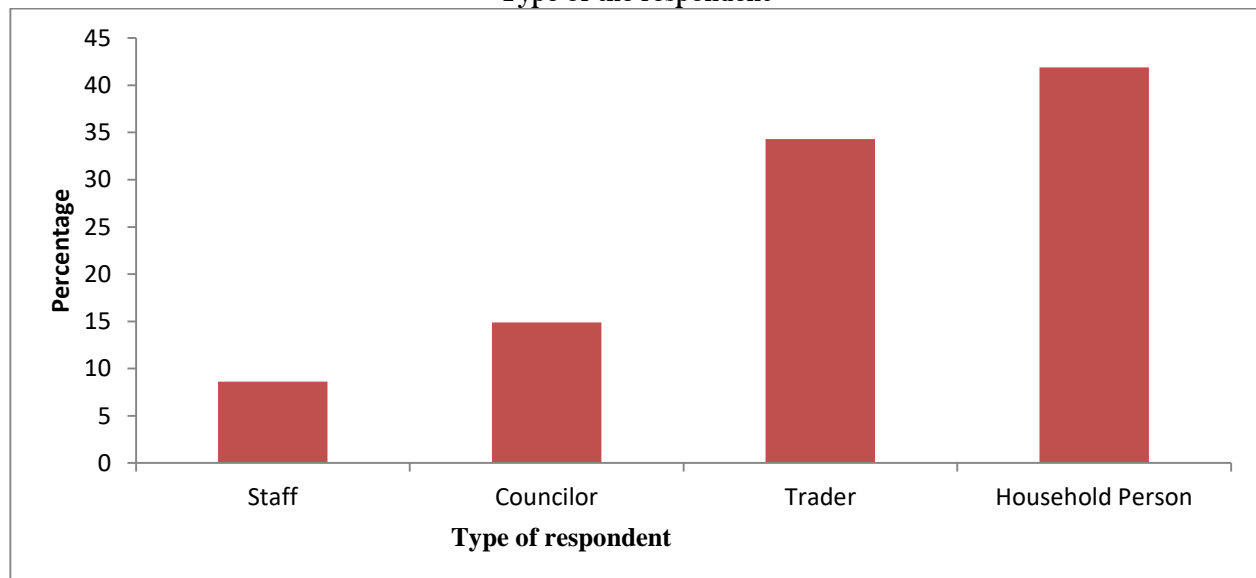


Figure 4 Shows type of respondents

The findings presented in figure 4 above reveal 41.9% were house hold persons who had the highest percentage, followed by 34.3% who were

traders, followed by 14.9% who were councilors and lastly 8.6% who were the staff.

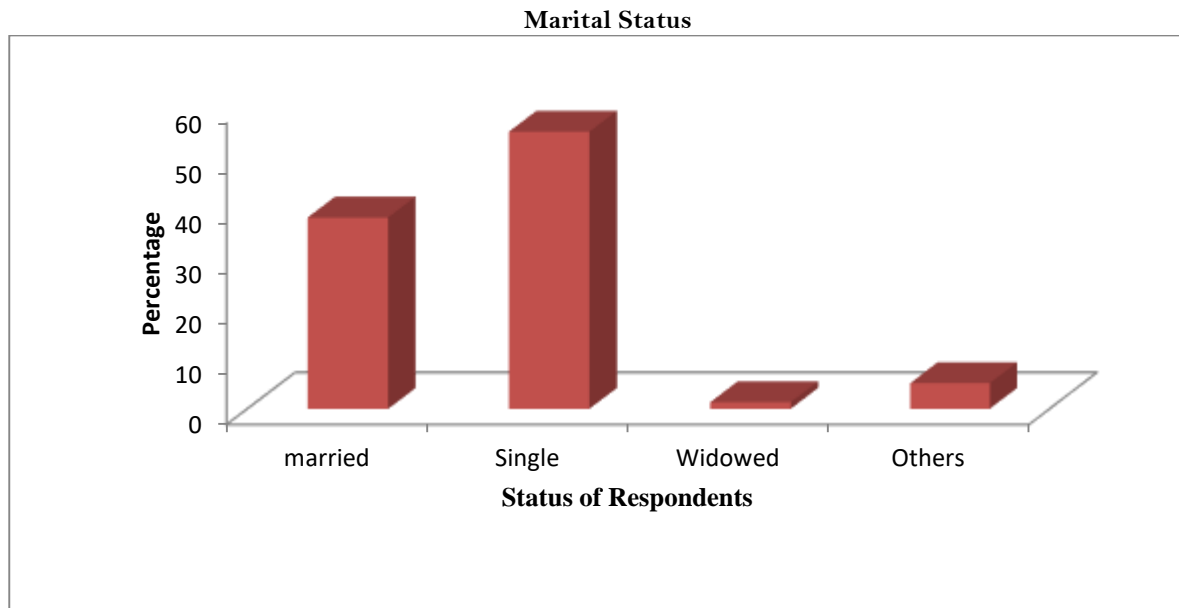


Figure 5 Shows status of respondents

The findings presented in figure 5 above reveal that the highest percentage was 55.2% of the respondents who were single, followed by 38.1%

who were married then lastly followed by 5.1% who belonged to others and 1.3% who were widows as seen from the above figure.

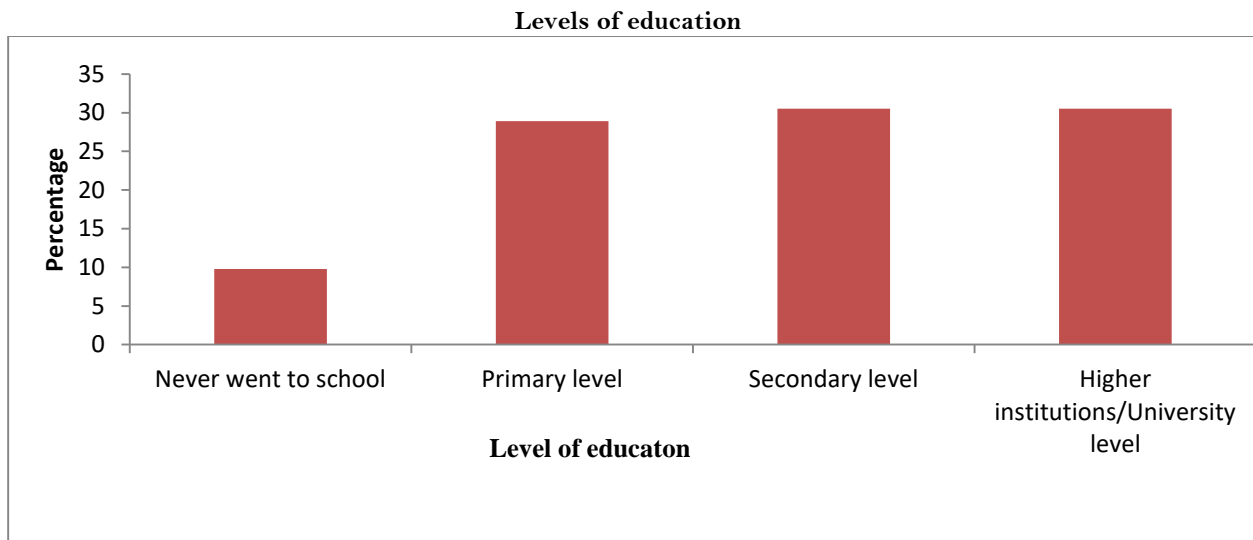


Figure 6 Shows Education Level

Figure 6 reveals that 30.5 percent of respondents have both secondary and post-level education, 28.9% had primary level education, and 9.8% had never attended school; this was due to the fact that some

respondents had varying educational backgrounds, which the researcher requested they indicate by ticking. According to the study's findings, nearly all respondents could read and write, which can be

attributed to the fact that the majority of respondents were literate, which means they had received a basic education that enabled them to fully comprehend that poor solid waste management practices are a threat to the local community and the environment as a whole. As a result, the varied academic degrees suggested a wide range of respondents who contributed data to this study, and the study's conclusions are instructional primarily because they captured the opinions of respondents of various intellectual calibers.

Occupation of Respondents

In addition, responses on respondents' jobs were obtained, and quantitative findings are presented in figure 7 below.

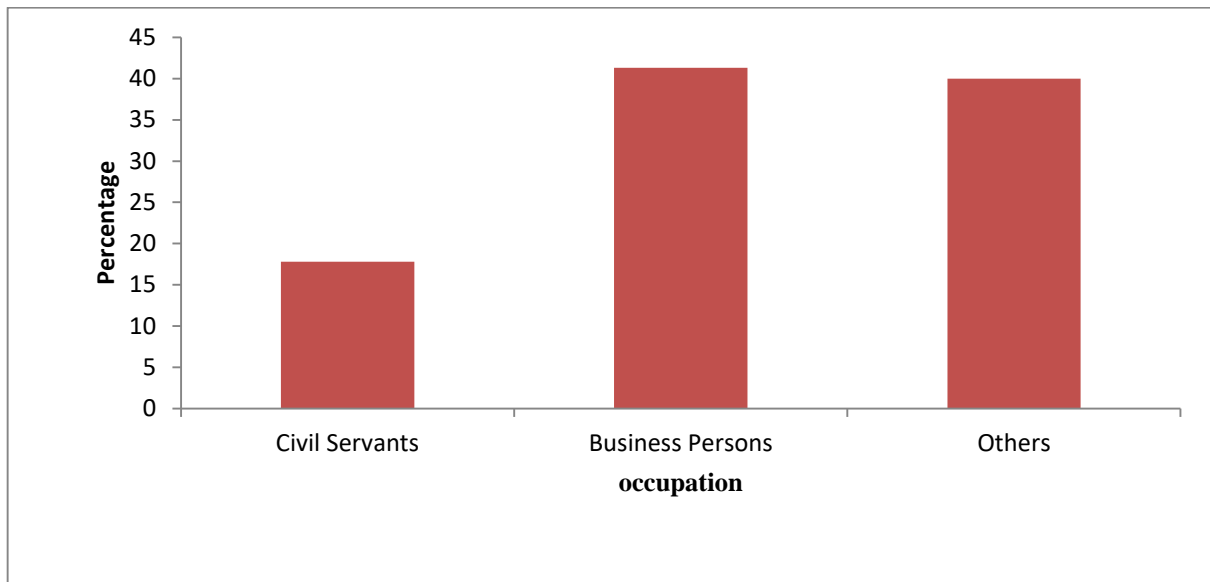


Figure 7 Shows Types of Occupation

The respondents had various occupations, according to the primary data in the above figure. 41.3 percent of the respondents were businesspeople, 40.0 percent were community leaders, and 17.8 percent were civil servants, but while in the field, the researcher asked respondents to indicate their occupation in order to collect a diverse range of perspectives on solid waste management practices in Soroti municipality, as shown above.

The results from the above figure show that the community and other people have a variety of occupations because the results show that business people dominated the study with 41.3 percent, indicating that business people are the ones who contribute the most to solid waste generation in the municipality in terms of plastics, paper, and food peels, among other things. Civil servants made up

17.8% of the total, but they were included because they make frequent trips to town for work and then return home in the evenings or on weekends, and because most of them did not live-in town. They were also included because they make a significant contribution and have a stake in the municipality's solid waste management.

The State of Solid Waste Management in the Municipality of Soroti

The study's objective was to establish the existing state of solid waste collection, transportation, and disposal in the Soroti municipality.

Solid waste transportation

Table 3 presents solid waste transportation approaches in Soroti Municipality.

Table 3. Solid waste transportation (=314)

	Percent
Solid waste transportation with reliable trucks and carts	8.9
Solid waste reduction and disposal	28.0
Solid waste recycling	34.1
Resource recovery through solid waste disposal	29.0
Total	100.0

The findings presented in the above table show that 8.9 percent of the respondents with frequency of 28 agreed that there was little transportation of solid waste by the municipality authorities and part of the transportation was done by private individuals and clubs and the ordinary people themselves like the traders in the municipality who had different motives. Furthermore, the municipal authorities have a limited number of vehicles that are utilized in the

transportation of solid trash in the municipality, therefore rubbish was collected and transported on a weekly basis by the various divisions in the municipality. Figure 9 shows the effects of not collecting and transporting solid waste in Soroti municipality regularly where most of the wastes are scattered everywhere in the environment.



Figure 8. Shows some wastes being littered in southern Division of Soroti Municipality
Effect of implementation of solid waste management plans on solid waste management practices

Table 4 Municipality disposes wastes in a good manner

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SD	32	10.1	10.2	10.2
	D	63	19.8	20.1	30.4
	N	0.0	0.0	0.0	30.4
	A	124	39.0	39.6	70.0
	SA	94	29.6	30.0	100.0
	Total	313	98.4	100.0	
Missing	System	5	1.6		
Total		318	100.0		



Figure: 9 Shows wastes being dumped along the market street of Soroti municipality

The findings of the study are summarized and discussed

The management of solid waste is not a novel endeavor Soroti municipality, even if it's a pretty recent municipality in Eastern Uganda but It is rather a process that requires public engagement rather than a one-day event.

Despite the fact that the municipality of Soroti is a relatively new to the region, man has been cleaning and disposing of solid wastes since the dawn of time, and his efforts have contributed to the town's cleanliness. However, the findings of this study show that solid waste collection and disposal are not solely the responsibility of municipal authorities, council divisions, individual persons, private companies, associations such as the Lions Club, individual households, and so on; the Ugandan government must also be involved in solid waste management in Soroti municipality, as these will necessitate.

The current state of solid waste collection, transportation, and disposal

According to the study's findings, in the municipality of Soroti solid waste collection and transportation were discovered not to be done and collected on a regular basis as they should have been because they were done manually by men and women travelling from place to place, street to street, using sacks that were not intended for that purpose. As a result, the findings of this study are consistent with those of Bello et al. [15], who discovered that solid waste accumulation in most African cities and urban centers, including Soroti

municipality, is estimated to be 0.5 kg per capita/day and is collected by either males or females and delivered to collection centers. They also discovered that hotels and families in metropolitan regions generate enormous volumes of solid garbage, which must be regularly collected and transported to disposal facilities.

The most common sources of solid waste generation in Africa are households, commercial centres, institutions, hotels, and health facilities [15, 16]. Hazardous solid waste is usually generated from these sources and needs to be addressed right away by municipal councils, divisions, the government, and other authorities. For frequent collection systems like door-to-door, curbside, set out, the block collection system, and street sweeping, different locations within cities usually have varied locations. This is similar to the research carried out by Yadav et al. [18], in urban municipality. This research also found that the majority of solid waste transportation in Soroti municipality was done by private individuals and companies, such as business people and private companies, who were employed by the municipality officials, who gave them bids to keep the municipality clean and neat. It was also discovered that the transportation was not carried out by garbage-carrying and transporting trucks. Several cities in developing countries, such as Uganda, still have too much garbage [50-54]. This creates a transportation hurdle. As a result, solid garbage is thrown beside roads and behind buildings, posing major collection and transportation challenges.

Despite the fact that rubbish is frequently dumped along the roadside or on the streets, this investigation discovered fewer roadblocks. Despite the many methods utilized in solid waste

transportation, cities in low-income nations such as Uganda and Soroti usually lack adequate vehicles and equipment to collect waste, according to the World Bank [51-54].

CONCLUSION

This study report has attempted to analyze the current status of the existing solid waste collection, transportation disposal and treatment practices in Soroti district, Uganda. The investigation was addressed by employing questionnaires, field observation, semi-structured and structured interview given to various people in the Municipality and reviewing published and unpublished documents.

The effects that the municipality's growth and expansion will have on the environment and its citizens are evident, and it is the responsibility of the state, the municipality, the division, and the general

public to make sure that solid waste is collected and disposed of properly at all times.

Recommendations

The municipality of Soroti should prioritise raising community awareness and developing capacity for effective solid waste management. To improve social and economic conditions, the town should research composting and the 4Rs. To target the wealthy and impoverished, further strategies like integrated waste management must to be used. For effective disposal, resource recovery facilities ought to be constructed.

REFERENCES

1. Akiyode, O. O., & Tech, B. (2005). Solid Waste Management practices in a developing economy Mega city, A case study of Lagos, Nigeria. *Journal of Solid Waste Management & Technology*. 20th International Conference on Solid Waste Technology and Management, Philadelphia, PA USA April 3-6, pp 343-358.
2. Tukahirwa, J. T., & Lukooya, N. B. (2015). The role of policy and institutional reforms in enhancing technical efficiency of urban authorities: Reference to solid waste management in Kampala city, Uganda. *Future Directions of Municipal Solid Waste Management in Africa. Africa Institute of South Africa*, 136-154.
3. Okot-Okumu, J., & Nyenje, R. (2011). Municipal solid waste management under decentralisation in Uganda. *Habitat International*, 35, 537-543. <https://doi.org/10.1016/J.HABITATINT.2011.03.003>.
4. Akiyode, O. O., Hadijjah, K., & Tumushabe, A. (2018). Sustainable Environmental Education Is a Panacea for Community's Sustainability in Uganda. *American Journal of Environmental Policy and Management*, 4(1), 1-8.
5. Voukkali, I., Papamichael, I., Loizia, P., & Zorpas, A. A. (2023). Urbanization and solid waste production: prospects and challenges. *Environmental Science and Pollution Research*, 31(12), 17678-17689. <https://doi.org/10.1007/s11356-023-27670-2>
6. Ahmed, S., & Ali, M. (2004). Partnerships for solid waste management in developing countries: linking theories to realities. *Habitat International*, 28, 467-479.
7. Mungure, J. M. (2008). *Governance and Community Participation in Municipal Solid Waste Management, Case of Arusha and Dar es Salaam Tanzania* (Doctoral dissertation, Aalborg University).
8. Scott, W. R. (2005). Institutional theory: Contributing to a theoretical research program. *Great minds in management: The process of theory development*, 37(2), 460-484.
9. Marshall, R., & Farahbakhsh, K. (2013). Systems approaches to integrated solid waste management in developing countries. *Waste management*, 33(4), 988-1003. <https://doi.org/10.1016/j.wasman.2012.12.023>.
10. Gupta, S. K. (2001) Rethinking waste management in India. *Humanscape Magazine*. In UNEP (2007) *Global Environment Outlook-4. Environment for Development, United Nations Environmental Programme*
11. Gbekor, A. (2003). Domestic waste management. *Ghana Environmental Protection Agency (EPA) Newsletter*, 47(5), 12-17.
12. Rogers, A., & Williamson, J. G. (1982). Migration, urbanization, and third world development: an overview. *Economic Development and Cultural Change*, 30(3), 463-482.
13. Mukwaya, P., Bamutaze, Y., Mugarura, S., & Benson, T. (2012). Rural-urban transformation in Uganda. *Journal of African Development*. <https://doi.org/10.5325/jafrideve.14.2.0169>.

14. Akiyode, O. O., & Sojinu, O. S. (2006). Integrating Cart Pushers and Scavengers in Lagos (Nigeria) Solid Waste Management. *Journal of Solid Waste Technology and Management, January*, 349-353.
15. Ismail, M., & Kabbashi, N. (2016). Solid Waste Management in Africa: A Review. *International Journal of Waste Resources*, 6. <https://doi.org/10.4172/2252-5211.1000216>
16. Renner, M. (2016). *Source Reduction and Recycling of Waste*. 217-229. https://doi.org/10.5822/978-1-61091-756-8_18
17. Okot-Okumu, J. (2012). Solid waste management in African cities—East Africa. *Waste Management—An Integrated Vision*, 1-20.
18. Yadav, V., & Karmakar, S. (2020). Sustainable collection and transportation of municipal solid waste in urban centers. *Sustainable Cities and Society*, 53, 101937. <https://doi.org/10.1016/j.scs.2019.101937>
19. Rogerson, C. M. (2001). The waste sector and informal entrepreneurship in developing world cities. *Urban Forum*, 12(2), 247-259. <https://doi.org/10.1007/s12132-001-0018-2>
20. Haimi, Y. (2009). The Trash Collecting System Related to Cleaners in Urban Logistics. *Journal of Guizhou University for Ethnic Minorities*.
21. Ramachandra, T. V., & Bachamanda, S. (2007). Environmental audit of municipal solid waste management. *International Journal of Environmental Technology and Management*, Vol 7(3-4), pp. 369-391.
22. Shivashankara G.P., & Rekha H.B (2005). Solid waste management in suburban areas of Bangalore, *Journal of Nature Environment and Pollution Technology*, Vol. 4(4); 495-500.
23. Guerrero M. H., (2013). Study on Solid Waste Management Options for Africa, Abidjan: African Development Bank.
24. Okot-Okumu, J., & Nyenje, R. (2011). Municipal solid waste management under decentralisation in Uganda. *Habitat International*, 35, 537-543. <https://doi.org/10.1016/J.HABITATINT.2011.03.003>.
25. UNDP Annual Report 2004. (n.d.). UNDP. <https://www.undp.org/publications/undp-annual-report-2004>
26. Rathana, K. (2009). Solid Waste Management in Cambodia". *Cambodia Institute for Cooperation and Peace*, Working Paper No. 27 May 2009.
27. Medina, M. (2002). Globalization, development, and municipal solid waste management in third world cities. *Institute of Advance Studies, Mexico*, 1-23.
28. Ssegujja, K. (2015). The influence of urban population behavior on solid waste management in Jinja Town.
29. Roberts, C., Watkin, G., Ezeah, C., Phillips, P., & Odunfa, A. (2010). Seasonal Variation And Municipal Solid Waste Composition—Issues for Development of New Waste Management Strategies in Abuja, Nigeria. *The Journal of Solid Waste Technology and Management*, 36, 210-219. <https://doi.org/10.5276/JSWTM.2010.210>.
30. Jerumeh, T., Igbinadolor, J., & Akinbinu, T. (2020). Public health implications of solid waste management in Akure, Nigeria. *GeoJournal*, 87, 1121-1131. <https://doi.org/10.1007/S10708-020-10300-6>.
31. Abubakar, I., Maniruzzaman, K., Dano, U., Alshihri, F., Alshammari, M., Ahmed, S., Al-Gehlani, W., & Alrawaf, T. (2022). Environmental Sustainability Impacts of Solid Waste Management Practices in the Global South. *International Journal of Environmental Research and Public Health*, 19. <https://doi.org/10.3390/ijerph191912717>.
32. El-Salam, M., & Abu-Zuid, G. (2014). Impact of landfill leachate on the groundwater quality: A case study in Egypt. *Journal of Advanced Research*, 6, 579 - 586. <https://doi.org/10.1016/j.jare.2014.02.003>.
33. Ferronato, N., & Torretta, V. (2019). Waste Mismanagement in Developing Countries: A Review of Global Issues. *International Journal of Environmental Research and Public Health*, 16. <https://doi.org/10.3390/ijerph16061060>.
34. Al-Salem, S., Lettieri, P., & Baeyens, J. (2009). Recycling and recovery routes of plastic solid waste (PSW): a review. *Waste management*, 29 10, 2625-43. <https://doi.org/10.1016/j.wasman.2009.06.004>.
35. Hayal, D., Hailu, W., & Aramde, F. (2014). Assessment of the contemporary Municipal Solid Waste Management in urban environment: the case of Addis Ababa, Ethiopia. *Journal of environmental science and technology*, 7(2), 107-122.
36. The World Bank. *Trends in solid waste management*. (n.d.). <https://datatopics.worldbank.org/what-a->

- [waste/trends in solid waste management.html](https://doi.org/10.1177/0145482x1711100511)
37. Mohammed, A., & Elias, E. (2017). Domestic solid waste management and its environmental impacts in Addis Ababa city. *Journal of Environment and Waste management*, 4(1), 194-203.
 38. Rindfleisch, A., Malter, A., Ganesan, S., & Moorman, C. (2008). Cross-Sectional versus Longitudinal Survey Research: Concepts, Findings, and Guidelines. *Journal of Marketing Research*, 45, 261 - 279. <https://doi.org/10.1509/jmkr.45.3.261>.
 39. Spector, P. (2019). Do Not Cross Me: Optimizing the Use of Cross-Sectional Designs. *Journal of Business and Psychology*, 34, 125-137. <https://doi.org/10.1007/S10869-018-09613-8>.
 40. Bryman, A. (2006). Integrating quantitative and qualitative research: how is it done? *Qualitative Research*, 6, 113 - 97. <https://doi.org/10.1177/1468794106058877>.
 41. Morse, J. (2000). Determining Sample Size. *Qualitative Health Research*, 10, 3 - 5. <https://doi.org/10.1177/104973200129118183>.
 42. Mazhar, S. (2021). Methods of Data Collection: A Fundamental Tool of Research. *Journal of Integrated Community Health*. <https://doi.org/10.24321/2319.9113.202101>.
 43. Pederson, L., Vingilis, E., Wickens, C., Koval, J., & Mann, R. (2020). Use of secondary data analyses in research: Pros and Cons., 6, 058-060. <https://doi.org/10.17352/2455-3484.000039>.
 44. DiCicco-Bloom, B., & Crabtree, B. (2006). The qualitative research interview. *Medical Education*, 40. <https://doi.org/10.1111/j.1365-2929.2006.02418.x>.
 45. Reid, A. (1988). Questionnaires. *Medical Journal of Australia*, 148. <https://doi.org/10.5694/j.1326-5377.1988.tb99485.x>.
 46. Goroff, D. (2015). Balancing privacy versus accuracy in research protocols. *Science*, 347, 479 - 480. <https://doi.org/10.1126/science.aaa3483>.
 47. Emerson, R. (2017). Likert Scales. *Journal of Visual Impairment & Blindness*, 111, 488 - 488. <https://doi.org/10.1177/0145482x1711100511>.
 48. Renninger, K., & Bachrach, J. (2015). Studying Triggers for Interest and Engagement Using Observational Methods. *Educational Psychologist*, 50, 58 - 69. <https://doi.org/10.1080/00461520.2014.999920>.
 49. Kimberlin, C., & Winterstein, A. (2008). Validity and reliability of measurement instruments used in research. *American journal of health-system pharmacy: AJHP: official journal of the American Society of Health-System Pharmacists*, 65, 23, 2276-84. <https://doi.org/10.2146/ajhp070364>.
 50. Komakech, A., Banadda, N., Kinobe, J., Kasisira, L., Sundberg, C., Gebresenbet, G., & Vinnerås, B. (2014). Characterization of municipal waste in Kampala, Uganda. *Journal of the Air & Waste Management Association*, 64, 340 - 348. <https://doi.org/10.1080/10962247.2013.861373>.
 51. *Solid Waste Management*. (2022). World Bank. Retrieved March 20, 2024, from <https://www.worldbank.org/en/topic/urbandevelopment/brief/solid-waste-management>
 52. Mundu, M. M., Nnamchi, S. N., Ssempevo, J. I. and Umi O. B. (2024). Exploring Solar Energy Integration in Ugandan Health Centers: Evaluating the Implementation of Heliophotovoltaic Solutions for Rural Healthcare. *INOSR Scientific Research* 11(1):72-81 <https://doi.org/10.59298/INOSRSR/2024/1.1.17281>
 53. Mutungirehi Faisal, Mustafa M. Mundu and Stephen N. Nnamchi (2023). Analysis and Characterization of the Solid Waste from Kabagarama Dumping site in Bushenyi District, Uganda. *IDOSR Journal of Applied Sciences*, 8(2)87-107. <https://doi.org/10.59298/IDOSR/2023/10.1.7007>
 54. Mundu, M.M.; Nnamchi, S.N.; Muhaise, H. Sustainable Energy Transitions in Uganda: Influential Determinants of the Renewable Energy Landscape. *IAA J. Appl. Sci.* 2024, 11, 57-72, <https://doi.org/10.59298/iaajas/2024/6.68.40>.

CITE AS: Omoding Jacob and Suzan Luyiga (2024). Assessment of the Status of the Existing Solid Waste Collection, Transportation Disposal and Treatment Practices in Soroti District, Uganda. *IAA Journal of Applied Sciences* 11(2):35-49. <https://doi.org/10.59298/IAAJAS/2024/112.35.49>