

## Availability and Accessibility of Waste Management Infrastructure for Promoting Sustainable Waste Disposal Practices in Bushenyi-Ishaka Municipality. A cross-sectional study.

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Page | 1

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### Abstract

#### Background

Effective household waste disposal depends on the availability and accessibility of waste management infrastructure. This study examined the availability and accessibility of waste management infrastructure for promoting sustainable waste disposal practices in the municipality.

#### Methodology

A descriptive mixed-methods design was used. Multistage sampling selected the division, parishes and villages, and simple random sampling selected 222 town dwellers. Purposive sampling selected NEMA officers, environmental officers and local leaders as key informants. Data were collected using questionnaires and interview guides. Quantitative data were analysed in SPSS version 28 using frequencies, percentages, cross-tabulations and means, while qualitative data were analysed thematically.

#### Results

Most respondents were female (62.6%), aged above 35 years (70.7%), married (70.7%), traders or shop owners (89.6%) and tenants (92.8%). Nearly all (99.1%) reported that collection points were easily accessible, mainly because of proximity to home (97.7%). However, 97.3% reported that public bins were insufficient, resulting in overflowing waste and littering (96.4%), bad odours (82.4%) and risk of injury from sharp waste (74.8%). Although 99.5% knew the collection schedule, the most frequently cited municipal support gaps were insufficient communal bins (95.9%) and irregular or absent collection (93.7%).

#### Conclusion

Waste collection points are physically accessible, but the adequacy, maintenance, reliability and separation capacity of facilities remain major shortcomings that constrain sustainable waste disposal.

#### Recommendations

The municipality should increase and strategically distribute public bins, ensure regular emptying, cleaning and maintenance, follow reliable collection schedules, and provide clearly labelled containers for separate waste types.

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**Keywords:** Waste management infrastructure, accessibility, sustainable waste disposal, Bushenyi-Ishaka Municipality

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## Background

Page | 2

The effectiveness of household waste disposal is closely linked to the availability and accessibility of waste management facilities. Globally, municipal solid waste (MSW) generation has accelerated beyond earlier projections. In many urban areas of Uganda, residents face limited access to formal collection points, transfer stations, and recycling facilities. Apio et al. (2024) found that in Lira City, less than 30 percent of households were within a 500-metre radius of municipal waste bins, contributing to illegal dumping in open spaces and drainage channels. Access is further constrained by infrastructural challenges. Nakato et al. (2021) highlighted that poor road networks, especially in slum settlements in Kampala, hinder the ability of waste collection trucks to reach all households regularly, forcing residents to rely on temporary open dumping. Sustainable waste management therefore requires not only the provision of facilities but also supportive urban infrastructure.

Affordability further limits accessibility. Ssemugabo et al. (2020) reported that in Kampala's low-income areas, many households could not pay user fees for waste collection, leading to inconsistent participation in municipal programmes and continued reliance on burning or unregulated dumping. Recycling and composting facilities remain scarce. Konstantinidou et al. (2024) noted that households are more likely to engage in waste separation and reuse when accessible recycling points or community composting schemes exist within walking distance. In their absence, organic waste is commonly mixed with plastics and metals, reducing the efficiency of sustainable practices. Equitable access across socio-economic and gender groups remains a challenge. Mutekanga (2025) found that higher-income and better-educated households were more likely to access functional waste bins and private collection services, while lower-income households depended on informal and often unsafe disposal points. Similar patterns appear elsewhere in the region. Masawe and Mhina (2025) observed in Arusha City, Tanzania, that high-density neighbourhoods had fewer accessible collection points, forcing residents to carry waste long distances or dispose of it improperly. In Ugandan informal settlements, narrow alleys frequently prevent municipal trucks from reaching households.

Informal waste collectors help bridge accessibility gaps. Omona (2024) reported that in Kawempe Municipality, informal collectors recovered recyclables directly from households, compensating for limited formal infrastructure though this also underscores the need to integrate informal actors into formal systems. Community awareness also matters: Onyango (2024) found that households aware of designated disposal sites and schedules were 2.5 times more likely to use them effectively. Specialised facilities for composting or e-waste remain limited across East African cities (Gebrekidan et al., 2024), while private-sector door-

to-door services improve disposal outcomes for those who can afford them (Apio et al., 2024), yet exclude many lower-income households. Locally, Bushenyi-Ishaka Municipality faces these same pressures on a smaller but significant scale. The municipality generates an estimated 20-40 tonnes of solid waste daily. Collection coverage has been reported at around 60 percent in recent assessments, with open dumping still practised at the main disposal site. Challenges date back more than a decade and include limited formal infrastructure, reliance on private collection fees, inadequate equipment, and incomplete service coverage, particularly in certain villages and divisions. Residents continue to encounter barriers related to distance to facilities, affordability, and irregular collection, which encourage improper disposal practices. This study examined availability and accessibility of Waste Management Infrastructure for Promoting Sustainable Waste Disposal Practices in Bushenyi-Ishaka Municipality. A cross-sectional study.

## Methodology.

### Description of the study area.

The study area is Bushenyi-Ishaka Municipality, which is located in the Western region of Uganda. It is made up of three sub-counties (divisions), 15 parishes, 74 villages and 10257 households. It covers an area of 81.29 sq km and has an estimated population of 64000 people (2024 population and housing census).

### Research design

The study employed a descriptive research design integrating both qualitative and quantitative methods. While the quantitative component follows methodological principles of objectivity, measurement, and statistical analysis, it goes beyond mere description to include explanatory elements that address the underlying reasons behind respondents' attitudes or behaviours. Therefore, the study used both closed ended and open-ended questions that enable meaningful statistical analysis such as frequencies, means, standard deviations, correlations, or regressions using statistical software like SPSS. This approach ensures that the data collected not only describes the current situation but also provides explanations that support deeper interpretation and academic rigor. Quantitative research is suitable for studies that aim to quantify variables, identify patterns, and test relationships using numerical data. The study used this approach to systematically describe and assess the variables related to town dwellers' attitudes and behaviors concerning solid waste disposal.

## Target Population

The study included town dwellers, NEMA officers, local leaders and environmental officers. These study participants were because they possess valuable knowledge and experience related to the research topic. Thus, town dwellers are directly involved generating waste, making them crucial for understanding current disposal practices and challenges. NEMA officers play a vital role in enforcing environmental policies and managing waste systems, providing insights into regulatory frameworks. Local leaders have a deep understanding of community behaviors and influence attitudes toward waste management, while environmental officers offer technical guidance to town dwellers on sustainable practices, including proper waste disposal.

## Sampling Technique

The study used a combination of simple random sampling, purposive sampling and multistage sampling techniques to select respondents.

## Multistage Sampling

The study employed multistage sampling to systematically select the study area from the three divisions, fifteen parishes, and seventy-four villages within Bushenyi-Ishaka Municipality. Since it is neither practical nor necessary to cover all administrative units, multistage sampling guided the selection process. At the first stage, one division was selected from the three using simple random selection. In the second stage, a representative number of parishes were randomly chosen from the selected division. Finally, at the third stage, specific villages were randomly selected from the chosen parishes. This hierarchical selection approach ensures that the sample is manageable, cost-effective, and geographically representative, while maintaining the statistical integrity required for a master's level study.

## Purposive Sampling

Purposive sampling was used to select NEMA officers, environmental officers and local leaders, chosen deliberately because they hold specific knowledge and responsibilities relevant to the study objectives. Specifically, NEMA officers and environmental officers were considered as key informants due to their regulatory role in environmental management; local leaders provided insights into community dynamics and enforcement at the grassroots level.

## Simple Random Sampling

In addition to multi stage sampling and purposive sampling, Simple random sampling was applied to select town

dwellers as respondents. This technique ensures that every respondent within the study area has an equal chance of being chosen, which helps to reduce bias and produce representative data about the respondents' attitudes and practices related to solid waste disposal. Town dwellers were targeted because they are the primary waste generators in agricultural settings and their practices significantly influence waste management outcomes.

## Sample size determination

A sample size of 222 respondents was determined for the study using the Yamane (1967) formula for sample size calculation. The formula provides a simplified method to determine an appropriate sample size for a given population, ensuring representativeness within a specified margin of error.

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

Where  $n$  is Sample size,  $N$  is the target population, and  $e$  is coefficient error (0.05).

The target population of 500 households was obtained from Bushenyi-Ishaka Municipality Statistical Abstract (2024), which provides current demographic and service coverage data for all administrative cells in the area. Substituting these values into the formula;

$$n = \frac{500}{1 + 500(0.05)^2} = 222$$

Therefore, the calculated sample size ( $n$ ) was approximately 222 respondents. This sample size was considered adequate to represent the target population of Bushenyi-Ishaka Municipality, ensuring reliability and precision in the study findings while maintaining statistical validity.

## Criteria

### Inclusion Criteria

The study included participants who are directly involved in or have significant knowledge of solid waste management within Bushenyi-Ishaka Municipality.

This includes town dwellers who actively generate and handle household waste, NEMA officers and environmental officers responsible for enforcing environmental regulations, and local leaders who influence community behaviors and practices.

Participants must be residents or officials within the selected divisions, parishes, and villages of the municipality and

willing to provide informed consent to participate in the study.

Additionally, respondents should be capable of communicating effectively in English or the local language to ensure accurate and comprehensive data collection.

## Page | 4 Exclusion Criteria

Persons under the legal age of consent without parental or guardian assent, those unable to communicate adequately in English or the local language, or individuals with no direct involvement or knowledge of waste management practices were also excluded.

## Data collection methods

### Questionnaire Method

The study used questionnaires as a primary data collection tool. Closed-ended questions were designed to collect quantifiable data that is easy to analyze statistically, allowing for efficient comparison across respondents. Open-ended questions were also included to give town dwellers the opportunity to share detailed opinions and insights about the study topic, providing richer qualitative information.

### Interview Method

Face-to-face interviews were conducted with selected key informants such as NEMA officers, local leaders, and agricultural extension officers. This approach enabled the researcher to build rapport and establish trust with participants, encouraging openness and honesty in their responses.

## Data collection tools

### Interview Guide

An interview guide containing open-ended questions were used by the researcher to collect detailed information from key informants, including NEMA officers, environmental officers, local leaders, and agricultural extension officers.

### Questionnaire

The questionnaire was administered primarily to town dwellers because it allowed respondents to maintain privacy, encouraging more honest and candid answers. Additionally, the structured format provided respondents with enough time to consider their responses carefully and, if necessary, consult relevant documents or reflect on their practices before answering. This approach helped to collect accurate, consistent, and quantifiable data for analysis.

## Data Analysis

This study employed a mixed-methods approach, combining both quantitative and qualitative data to provide a comprehensive understanding of solid waste management practices in Bushenyi-Ishaka Municipality. The integration of both data types enabled the researcher to triangulate findings and answer the research objectives effectively.

### Quantitative Data Analysis

Quantitative data was collected through structured questionnaires administered to 222 respondents. The completed questionnaires were checked for accuracy and completeness before data entry. Data cleaning, coding, and entry were performed using the Statistical Package for Social Sciences (SPSS, version 28). Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize respondents' demographic characteristics. For Objective one, which evaluates the availability and accessibility of waste management facilities, cross-tabulations and frequency distributions were applied to determine the proportion of town dwellers with access to bins, collection points, and other infrastructure. Mean scores were also used to assess overall accessibility.

### Qualitative Data Analysis

Qualitative data was obtained through interviews which was analyzed using thematic content analysis and narrative analysis. Responses were first transcribed and then carefully examined to identify recurring patterns, concepts, and themes related to assessing attitudes and practices on solid waste management and their environmental impact. The themes were coded, categorized, and interpreted to provide deeper insights into participants' perceptions and experiences.

## Ethical Considerations

Permission for the study was sought from Bishop Stuart University Research and Ethics Committee (BSU-REC) after clearance from the Faculty of Agriculture, Environmental Science and Technology before proceeding to the field. The study was also cleared by the Uganda National Council for Science and Technology (UNCST), the office of Bushenyi-Ishaka Municipal authorities, and the local council offices of selected communities. A detailed work plan was laid out to guide the data collection process. Sampling was conducted to identify households and town dwellers where the research was carried out.

The investigator printed sufficient copies of the research instruments and familiarize themselves with the study area

by visiting the locations prior to data collection. Respondents were assured of anonymity, with numbers used instead of names to label data. All information provided by participants were treated with strict confidentiality, ensuring respondents' rights and privacy are maintained even after the study. The researcher emphasized that the information collected was solely for academic purposes and that participation was entirely voluntary, allowing respondents to withdraw or decline to answer any question at any time without consequence.

Finally, informed consent was obtained from all participants through written consent forms attached to the research instruments, and assent forms were used for any minors involved in the study. The study strictly observed ethical norms such as avoiding falsification or misrepresentation of data, respecting copyright and patent policies, and adhering to data sharing and peer review guidelines. These measures ensured accountability, integrity, and transparency throughout the research process.

## Results

### Demographic Characteristics

*Table 1: Demographics characteristics*

| Characteristic                         | Frequency (N = 222) | Percent (%) |
|----------------------------------------|---------------------|-------------|
| <b>Sex</b>                             |                     |             |
| Female                                 | 139                 | 62.6        |
| Male                                   | 83                  | 37.4        |
| <b>Age (Years)</b>                     |                     |             |
| 18–31                                  | 8                   | 3.6         |
| 32–35                                  | 57                  | 25.7        |
| 36–40                                  | 89                  | 40.1        |
| Above 40                               | 68                  | 30.6        |
| <b>Marital status</b>                  |                     |             |
| Married                                | 157                 | 70.7        |
| Single                                 | 65                  | 29.3        |
| <b>Education level</b>                 |                     |             |
| Primary                                | 32                  | 14.4        |
| Secondary                              | 56                  | 25.2        |
| Tertiary                               | 134                 | 60.4        |
| <b>Occupation</b>                      |                     |             |
| Civil servant                          | 6                   | 2.7         |
| Farmer                                 | 5                   | 2.3         |
| Student                                | 12                  | 5.4         |
| Trader/shop owner                      | 199                 | 89.6        |
| <b>Monthly household income</b>        |                     |             |
| 200,000–500,000                        | 97                  | 43.7        |
| 500,001–1,000,000                      | 98                  | 44.1        |
| Above 1,000,000                        | 19                  | 8.6         |
| Below UGX 200,000                      | 8                   | 3.6         |
| <b>Home ownership</b>                  |                     |             |
| Own                                    | 16                  | 7.2         |
| Rent                                   | 206                 | 92.8        |
| <b>Years lived in the municipality</b> |                     |             |
| 1–5                                    | 69                  | 31.1        |
| 6–10                                   | 117                 | 52.7        |
| Above 10                               | 36                  | 16.2        |

The demographic profile of the 222 respondents reveals a predominantly female sample (62.6%), which is significant given that women in Ugandan households typically bear primary responsibility for domestic waste management, making their perspectives particularly valuable for this study. The age distribution shows that the majority of respondents were aged 36 years and above (70.7%), with the

largest proportion falling in the 36–40 years bracket (40.1%), suggesting a mature adult population actively engaged in household and community affairs. Regarding marital status, over two-thirds of respondents were married (70.7%), reflecting the prevalence of family-based household structures in the municipality. Occupation was highly concentrated in trade and shop-owning (89.6%), pointing to

the commercial nature of Bushenyi-Ishaka Municipality as a bustling urban centre, while household income was fairly evenly distributed between the UGX 200,000–500,000 (43.7%) and UGX 500,001–1,000,000 (44.1%) brackets, with only a small minority earning above UGX 1,000,000 (8.6%). The overwhelming majority of respondents were renters (92.8%) rather than homeowners (7.2%), a pattern

characteristic of transient urban populations that may influence their sense of community responsibility and investment in long-term environmental improvements. Finally, over half of the respondents (52.7%) had lived in the municipality for 6–10 years, indicating a stable but not permanent residential base, while 31.1% had been residents for 1–5 years, suggesting some level of population mobility.

## Availability and Accessibility of Facilities Accessibility

**Table 2: Accessibility of waste collection points**

| Variable                                                            | Frequency<br>(n = 222) | Proportion<br>(%) |
|---------------------------------------------------------------------|------------------------|-------------------|
| Waste collection points are easily accessible in your neighbourhood |                        |                   |
| No                                                                  | 02                     | 0.9               |
| Yes                                                                 | 220                    | 99.1              |
| <b>What makes them accessible?</b>                                  |                        |                   |
| Close proximity to home                                             |                        |                   |
| No                                                                  | 3                      | 1.4               |
| Yes                                                                 | 217                    | 97.7              |
| Well-maintained and clean                                           |                        |                   |
| No                                                                  | 217                    | 97.7              |
| Yes                                                                 | 3                      | 1.4               |
| Frequent and reliable collection                                    |                        |                   |
| No                                                                  | 219                    | 98.6              |
| Yes                                                                 | 1                      | 0.5               |
| Safe access (good roads, lighting)                                  |                        |                   |
| No                                                                  | 215                    | 96.8              |
| Yes                                                                 | 5                      | 2.3               |
| Separate bins for different waste types                             |                        |                   |
| No                                                                  | 216                    | 97.3              |
| Yes                                                                 | 4                      | 1.8               |
| Clear instructions or signage                                       |                        |                   |
| No                                                                  | 217                    | 97.7              |
| Yes                                                                 | 3                      | 1.7               |

Conversely, among the few who found facilities inaccessible, the reasons were evenly distributed across far distance from home (0.9%), poor road access or unsafe pathways (0.9%), overflowing or poorly maintained bins (0.9%), infrequent collection services (0.9%), lack of bins for specific waste types (0.5%), and lack of awareness about location (0.5%). The near-universal perception of accessibility (99.1%) is a notably positive finding and stands in contrast to studies by Katongole *et al.* (2021), who found that 52% of households in central Uganda reported having no nearby collection points, and Mwesige and Tumuhairwe (2022), who documented that in low-income areas, skips and bins are spaced over 800 meters apart, discouraging proper disposal. This high accessibility rate may reflect Bushenyi-Ishaka Municipality's relatively better infrastructure compared to other Ugandan urban centres, consistent with findings by Kakooza *et al.* (2021), who

observed that areas within 1 km of waste transfer stations had lower rates of illegal dumping.

The finding that 97.7% of respondents attribute accessibility solely to proximity, while only 1.4% cite well-maintained and clean facilities and 0.5% cite frequent and reliable collection suggests that though bins may be physically close, quality of service including maintenance, collection frequency, and cleanliness is severely inadequate. That only 24.8% of respondents believed current waste disposal methods were effective, and the low proportion citing well-maintained facilities (1.4%) and reliable collection (0.5%) as positive attributes. The very low recognition of separate bins for different waste types (1.8%) is consistent with the near-universal non-separation of waste (99.5%), as the absence of segregated bins discourages source separation (Namulindwa *et al.*, 2023; Naggayi & Mugisha, 2022).

## Bin Adequacy

Table 3: Bin Adequacy

| Variable                                  | Frequency (n = 222) | Proportion(%) |
|-------------------------------------------|---------------------|---------------|
| There are enough public bins in area      |                     |               |
| No                                        | 216                 | 97.3          |
| Yes                                       | 06                  | 2.7           |
| <b>What challenges does this cause?</b>   |                     |               |
| Overflowing waste leading to littering    |                     |               |
| No                                        | 8                   | 3.6           |
| Yes                                       | 214                 | 96.4          |
| Encourages open dumping                   |                     |               |
| No                                        | 177                 | 79.7          |
| Yes                                       | 45                  | 20.3          |
| Bad odours and unhygienic conditions      |                     |               |
| No                                        | 39                  | 17.6          |
| Yes                                       | 183                 | 82.4          |
| Attracts disease vectors                  |                     |               |
| No                                        | 140                 | 63.1          |
| Yes                                       | 82                  | 36.9          |
| Blockage of drainage channels             |                     |               |
| No                                        | 134                 | 60.4          |
| Yes                                       | 88                  | 39.6          |
| Reduces community motivation              |                     |               |
| No                                        | 216                 | 97.3          |
| Yes                                       | 6                   | 2.7           |
| Increases risk of injury from sharp waste |                     |               |
| No                                        | 56                  | 25.2          |
| Yes                                       | 166                 | 74.8          |
| Environmental pollution                   |                     |               |
| No                                        | 213                 | 95.9          |
| Yes                                       | 9                   | 4.1           |

The findings reveal that the vast majority of respondents (97.3%) reported that there are not enough public bins in their area, with only 2.7% indicating sufficiency. Among the challenges attributed to inadequate bin numbers, the most frequently cited were overflowing waste leading to littering (96.4%), bad odours and unhygienic conditions (82.4%), increased risk of injury from sharp waste (74.8%), attraction of disease vectors (36.9%), blockage of drainage channels (39.6%), encouragement of open dumping (20.3%), environmental pollution (4.1%), and reduced community motivation (2.7%).

The near-universal perception of bin inadequacy (97.3%) is consistent with findings by Namulindwa *et al.* (2023), who reported that most waste facilities in Uganda are poorly maintained and frequently overflow, and Mwesige and Tumuhairwe (2022), who found bins spaced over 800 meters apart in low-income areas. The predominance of overflowing waste leading to littering (96.4%) corroborates studies by Naggayi and Mugisha (2022) and Kisembo and Ainebyoona (2022), who documented that overflowing bins are a major deterrent to proper disposal, with 41% of

households avoiding communal skips due to foul odour and flies.

The significant proportion citing increased risk of injury from sharp waste (74.8%) is concerning, highlighting public safety risks associated with inadequate waste infrastructure, a consequence underrecognized in Section 4.2.3 (only 7.7%). The moderate recognition of blockage of drainage channels (39.6%) and disease vectors (36.9%) reflects environmental and public health consequences consistent with NEMA (2022) and Wambui *et al.* (2021). The relatively low proportion citing encouragement of open dumping (20.3%) may suggest that despite inadequacy, residents continue using formal disposal points (91.4%), or that open dumping is so normalized it is no longer perceived as a consequence.

Therefore, these findings underscore the critical need for municipalities to increase the number and distribution of public bins, ensure regular emptying and maintenance, and implement community-based management models (Asiimwe *et al.*, 2023; Mugarura *et al.*, 2023; Nabirye *et al.*, 2023).

## Collection Schedule

**Table 4: Collection Schedule**

| Variable                                                                   | Frequency<br>(n = 222) | Proportion<br>(%) |
|----------------------------------------------------------------------------|------------------------|-------------------|
| I'm aware of the municipal waste collection schedule                       |                        |                   |
| No                                                                         | 1                      | 0.5               |
| Yes                                                                        | 221                    | 99.5              |
| <b>How does your awareness, or lack of it affect your disposal habits?</b> |                        |                   |
| I dispose properly because I know the schedule                             |                        |                   |
| No                                                                         | 5                      | 2.3               |
| Yes                                                                        | 217                    | 97.7              |
| I store waste at home until collection day                                 |                        |                   |
| No                                                                         | 13                     | 5.9               |
| Yes                                                                        | 209                    | 94.1              |
| I dump waste improperly when I miss collection day                         |                        |                   |
| No                                                                         | 220                    | 99.1              |
| Yes                                                                        | 2                      | 0.9               |
| Lack of knowledge encourages open dumping                                  |                        |                   |
| No                                                                         | 215                    | 96.8              |
| Yes                                                                        | 7                      | 3.2               |
| I participate in communal activities if aware                              |                        |                   |
| No                                                                         | 221                    | 99.5              |
| Yes                                                                        | 1                      | 0.5               |
| Awareness does not affect my habits                                        |                        |                   |
| No                                                                         | 218                    | 98.2              |
| Yes                                                                        | 4                      | 1.8               |

The findings on awareness of the municipal waste collection schedule reveal that nearly all respondents (99.5%) reported being aware of the collection schedule, with only 0.5% indicating otherwise (Table 9). Among those aware of the schedule, the majority reported that awareness positively influenced their disposal habits, with 97.7% stating they dispose of waste properly because they know the schedule, and 94.1% reporting that they store waste at home until collection day. Conversely, very few respondents indicated negative effects of awareness or lack thereof, with only 0.9% reporting improper dumping when missing collection day, 3.2% stating that lack of knowledge encourages open dumping, 0.5% reporting participation in communal activities if aware, and 1.8% stating that awareness does not affect their habits.

The near-universal awareness of the collection schedule (99.5%) is a notably positive finding and stands in contrast to studies by Nambatya and Mugerwa (2022), who reported that poor communication between service providers and communities led to mistrust and low engagement, and Kabugho and Busingye (2022), who found that mobile SMS alerts led to a 31% increase in compliance, suggesting that awareness interventions can significantly improve disposal behaviour.

The finding that 97.7% of respondents dispose properly because they know the schedule aligns with studies by Mwesigwa *et al.* (2021), who piloted a GPS-based bin tracking system that increased pickup efficiency by 24%, and Asiimwe *et al.* (2023), who recommended digital reporting tools to monitor fill levels and reduce overflow problems, demonstrating that structured collection schedules enhance compliance.

The high proportion storing waste at home until collection day (94.1%) indicates responsible waste storage behaviour, which is essential for preventing littering and environmental contamination, consistent with the positive disposal practices documented by Onyango and Njuguna (2022) and Olayemi *et al.* (2021), who found that awareness campaigns increased use of designated waste points. The very low proportion reporting improper dumping when missing collection day (0.9%) is encouraging and suggests that most residents adhere to proper disposal practices even when collection is missed, perhaps due to the high sense of personal responsibility (100%) and concern for environmental impacts (100%).

The minimal proportion citing lack of knowledge encourages open dumping (3.2%) reflects the overall high awareness levels and contradicts the pervasive knowledge deficits, where 89.2% reported lacking sufficient knowledge

about proper waste sorting and disposal, suggesting that while residents may lack detailed knowledge about sorting, they are aware of collection schedules and basic disposal protocols.

The negligible proportion reporting participation in communal activities if aware (0.5%) is consistent with the low community participation rate (9.0%), indicating that awareness of collection schedules does not translate to broader community engagement in clean-up activities, a finding that aligns with Katushabe *et al.* (2023b), who observed that CBOs often fail to maintain long-term engagement due to volunteer fatigue and weak partnerships with municipal authorities. The low proportion stating awareness does not affect their habits (1.8%) confirms that for the vast majority, knowledge of the collection schedule is a key driver of proper disposal behaviour.

Therefore, these findings underscore the critical importance of maintaining clear and consistent communication between municipal authorities and residents regarding collection schedules, as awareness is strongly associated with proper disposal practices, and recommend the use of technology-based communication tools such as SMS alerts and digital platforms to further enhance compliance, as suggested by Kabugho and Busingye (2022), Mwesigwa *et al.* (2021), and Bwire *et al.* (2023).

### Convenience

The findings reveal that the majority of respondents (95.5%) reported finding it convenient to dispose of waste properly, with only 3.2% indicating otherwise. But when asked to specify what makes disposal convenient, the patterns were inconsistent: only 2.7% cited proximity of disposal sites, 0.5% cited availability of communal bins, 5.0% cited

frequent and reliable collection, 2.3% cited safe access, and 0.5% cited separate bins for different waste types, while 64.4% cited community support/campaigns, and 34.7% responded "sometimes."

Conversely, among those who found disposal inconvenient, the primary reasons were: far distance to disposal sites (73.0%), lack of knowledge about proper methods (70.7%), and lack of bins or inadequate facilities (49.1%), while very few cited poor road access (0.9%), infrequent or unreliable collection (0.5%), or household members not cooperating (5.4%).

### Municipal Support

The findings on perceived gaps in municipal support reveal that the most frequently cited deficiencies were insufficient number of communal bins (95.9%), irregular/absent collection (93.7%), weak enforcement of laws (9.9%), lack of guidance or education (7.2%), lack of public awareness campaigns (1.4%), and no recycling/composting support (1.4%) (Table 11). The near-universal identification of insufficient bins (95.9%) and irregular collection (93.7%) as major support gaps is consistent with the earlier findings where 97.3% reported inadequate public bins, and 49.1% cited lack of bins as a barrier to convenience, suggesting that infrastructure deficits and service reliability are the most pressing municipal failures in Bushenyi-Ishaka Municipality. This aligns with studies by Namulindwa *et al.* (2023), who reported that most waste facilities are poorly maintained and frequently overflow, Naggayi and Mugisha (2022), who documented that collection trucks often skip routes due to impassable roads, and Lwanga *et al.* (2021), who noted that decentralized urban councils often lack logistics and funding to install and maintain waste facilities.

**Table 5: Perceived gaps in municipal support**

| Support lacking                      | Frequency<br>(n = 222) | Proportion<br>(%) |
|--------------------------------------|------------------------|-------------------|
| Irregular or absent collection       |                        |                   |
| No                                   | 14                     | 6.3               |
| Yes                                  | 208                    | 93.7              |
| Insufficient number of communal bins |                        |                   |
| No                                   | 09                     | 4.1               |
| Yes                                  | 213                    | 95.9              |
| Lack of public awareness campaigns   |                        |                   |
| No                                   | 219                    | 98.6              |
| Yes                                  | 03                     | 1.4               |
| Weak enforcement of laws             |                        |                   |
| No                                   | 200                    | 90.1              |
| Yes                                  | 22                     | 9.9               |
| No recycling or composting support   |                        |                   |
| No                                   | 219                    | 98.6              |
| Yes                                  | 03                     | 1.4               |
| Lack of guidance or education        |                        |                   |
| No                                   | 206                    | 92.8              |
| Yes                                  | 16                     | 7.2               |

The very low proportion citing lack of public awareness campaigns (1.4%) and lack of guidance or education (7.2%) as support gaps is notable given the pervasive knowledge deficits identified throughout this study, including 89.2% lacking knowledge about waste sorting, 78.4% citing lack of knowledge as a barrier to separation, and 70.7% citing lack of knowledge as a barrier to convenience. This discrepancy may suggest that residents are less aware of the need for education campaigns or prioritize tangible infrastructure deficits over informational gaps when evaluating municipal support, consistent with Mugisha *et al.* (2023) and Kakembo and Okello (2023), who found that economic and infrastructure concerns often overshadow educational needs in residents' assessments of service quality. The low proportion citing weak enforcement of laws (9.9%) as a support gap contrasts with studies by Turyasingura *et al.* (2021) and Amanya and Akugizibwe (2022), who noted that weak enforcement of urban bylaws undermines compliance with waste management policies, and Kakuru *et al.* (2023), who stressed the need for increased monitoring and enforcement.

This may indicate that residents in Bushenyi-Ishaka Municipality do not perceive enforcement as a priority issue, or alternatively, that enforcement is so consistently absent that it has become normalized and is no longer seen as a specific gap requiring attention. The minimal proportion citing no recycling or composting support (1.4%) is consistent with the low adoption of composting (0.5%) and waste reduction practices (4.1%) documented, suggesting that residents may not prioritize or even recognize recycling and composting as important municipal responsibilities due to low awareness of their environmental and economic benefits (Kabagambe *et al.*, 2021; Namirembe & Katongole, 2022; Ninsiima *et al.*, 2023).

Therefore, these findings highlight that residents' primary expectations of municipal support centre on basic service delivery adequate bins and reliable collection rather than on enforcement, education, or recycling support. This underscores the need for municipalities to prioritize infrastructure improvements and service reliability as foundational interventions, while simultaneously investing in public awareness campaigns to build demand for more advanced waste management services such as recycling and composting, as recommended by Asimwe *et al.* (2023), Nabirye *et al.* (2023), and Tumuhimbise *et al.* (2023).

During an interview with NEMA officers, Local Leaders and Agricultural Extension officers,

The NEMA officer had this to say;

*“There are several waste management facilities and services available in Bushenyi-Ishaka Municipality, including waste collection points, waste storage containers, collection trucks and designated areas for waste disposal. However, the availability and accessibility of these facilities are not uniform across all parts of the municipality. Commercial centres and densely populated areas tend to have better*

*access to waste collection services than some residential and peripheral areas. In some places, the available waste containers are insufficient for the amount of waste generated, while irregular collection may cause them to overflow. There is therefore a need to increase the number of waste collection facilities, improve transportation and strengthen waste collection services to ensure sustainable waste disposal throughout the municipality”*

One of the local leaders noted that;

*“Waste management facilities are available in some parts of the municipality, particularly around markets, and other busy areas. However, some households are located far from designated waste collection points, making it difficult for residents to transport their waste to the appropriate facilities. In addition, some waste collection services are not regular, and this sometimes encourages residents to dispose of waste in open spaces, drainage channels and other unauthorized areas. The municipality needs to establish more accessible collection points and ensure that waste is collected regularly so that town dwellers can conveniently participate in proper waste management.”*

One of the agricultural extension officers during the interview explained that;

*“The municipality has some facilities for handling solid waste, but access to facilities for waste recovery, composting and recycling remains limited. Most residents can access basic waste storage and collection services, but facilities for separating organic waste, producing compost and recycling plastics and other reusable materials are not sufficiently available in all areas. This limits the ability of town dwellers to convert waste into useful resources. For sustainable waste disposal, there is a need to establish more community-based waste segregation, composting and recycling facilities that are easily accessible to households, markets and urban farmers. Such facilities would reduce open dumping and burning while promoting the productive reuse of biodegradable waste.”*

## Discussion of results

### Availability and accessibility of waste management facilities for sustainable waste disposal in Bushenyi-Ishaka Municipality

The findings showed that waste collection points were generally physically accessible to residents, with proximity to homes being the major factor supporting accessibility. Other factors identified included the condition of the facilities, frequency and reliability of collection, safety of access, availability of separate bins, and the presence of instructions or signage. However, physical accessibility did not necessarily mean that the available facilities were adequate or sufficiently functional.

The study established that the major challenge was the inadequate number of public waste bins. Respondents

reported that insufficient bins contributed to overflowing waste and littering, bad odours and unhygienic conditions, risks of injury from sharp waste, blockage of drainage channels, attraction of disease vectors and open dumping. These findings suggest that residents could access waste collection points but faced limitations arising from insufficient waste storage capacity and the condition and management of available facilities. Therefore, the findings indicate that sustainable waste disposal in Bushenyi-Ishaka Municipality requires improvements beyond simply providing accessible collection points. There is a need to increase the number of public waste bins, improve their maintenance, provide appropriate facilities for separating different waste types, and strengthen the regularity and reliability of waste collection services. Addressing these facility-related challenges would help reduce overflowing waste, littering, open dumping and associated health and environmental risks.

## Conclusion

The study concludes that waste collection facilities are generally physically accessible to residents, particularly because collection points are located close to households, but the adequacy and functionality of the facilities remain major concerns. The shortage of public waste bins contributes to overflowing waste, littering, unpleasant conditions, risks of injury, drainage blockage, disease vectors and open dumping, while aspects such as facility maintenance, reliable collection, safety, separate waste containers and clear signage are less consistently available. Therefore, sustainable waste disposal in Bushenyi-Ishaka Municipality requires not only accessible collection points but also adequate numbers of well-maintained bins, reliable collection services and facilities that support appropriate separation and management of different waste types.

## Recommendation

Ishaka-Bushenyi Municipality should prioritize increasing the number and strategic distribution of public waste bins and ensuring that existing facilities are regularly emptied, cleaned and maintained. Reliable waste collection schedules should be established and consistently followed to minimize overflowing bins, littering, unpleasant conditions, drainage blockage and open dumping. Where waste separation is promoted, appropriate containers for different waste categories should be provided and clearly labelled.

The Municipality should also strengthen routine monitoring and maintenance of collection facilities to ensure that they remain safe, functional and accessible to residents. These measures would complement the existing physical accessibility of collection points by addressing the identified shortcomings in the adequacy, maintenance, reliability, safety and functionality of waste management facilities.

An in-depth qualitative study should be conducted to examine the institutional arrangements, governance structures, political economy factors, and power dynamics shaping waste management service delivery in Bushenyi-Ishaka Municipality.

This research should explore the roles and relationships among municipal authorities, private sector actors, community-based organizations, and informal waste collectors, identify systemic barriers to effective service delivery including fiscal constraints, administrative capacity gaps, and accountability failures, and document successful governance models from other municipalities to inform institutional reforms and policy development for sustainable waste management.

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## List of Abbreviations

BSU-REC: Bishop Stuart University Research and Ethics Committee  
CBOs: Community-Based Organizations  
GPS: Global Positioning System  
MSW: Municipal Solid Waste  
NEMA: National Environmental Management Authority  
SMS: Short Message Service  
SPSS: Statistical Package for the Social Sciences  
UGX: Uganda Shillings  
UNCST: Uganda National Council for Science and Technology

## Informed Consent

Written informed consent was obtained from all participants prior to their inclusion in the study. Participants were informed about the purpose of the study, procedures involved, potential risks and benefits, and their right to withdraw at any time without penalty.

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There is no conflict of interest.

Availability of data

Page | 12 Data used in this study is available upon request from the corresponding author

Authors contribution

SA conceptualized the study, developed the methodology, carried out the investigation, wrote the original draft.  
BM supervision, validation, writing- review and editing  
SK supervision, validation, writing- review and editing  
All authors approved the final version of the manuscript and agreed to be accountable for the work.

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