Household Waste Management in Siddharthanagar Municipality: Practices, Challenges, and Solutions

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Abstract

This study analyzes household waste management practices in Siddharthanagar Municipality, Rupandehi District, Nepal. Using a mixed-method, cross-sectional design, data were collected from 174 households through questionnaires and analyzed using descriptive statistics and thematic analysis. The findings show challenges such as poor infrastructure, lack of equipment, and limited public awareness. The study emphasizes the need for collaboration between local governments and communities. It recommends awareness programs, improved waste collection systems, and community involvement to promote effective and sustainable waste management and reduce landfill waste in rural municipalities.

Keywords: household, waste management, municipality, practices

Introduction

Managing waste in municipal regions poses substantial difficulties for governments in developing countries (Han et al., 2018). Local municipalities often operate with restricted budgets, which are particularly constrained in rural and remote locations (Mihai&Taherzadeh, 2017). Waste collection efforts are hindered by insufficient equipment, infrastructure, and treatment facilities, along with limited access to waste processing centers (Hidalgo et al., 2017). Additionally, disparities in waste management infrastructure across Nepal arise from historical politico-socio-economic inequalities (NepalEconomicForum, 2024). These challenges contribute to issues like littering and illegal dumping, which differ in terms of waste volume and type—littering involves small items such as candy wrappers and plastic cups, while dumping entails large or bulky waste like old furniture and household items.

Waste includes any material that an owner wishes to discard, whether or not it can be reused, recycled, or recovered. Municipal Solid Waste (MSW) primarily consists of household waste, along with some commercial waste. Household waste is generated through activities such as cooking, cleaning, gardening, and product disposal, including items like old clothing, furniture, appliances, paper, and packaging materials (Viljoen et al., 2021). Managing MSW involves planning, financing, and implementing waste control programs that regulate waste generation, storage, collection, transportation, and environmentally responsible disposal (Viljoen et al., 2021).

A key objective in waste management is shifting from landfill-based disposal to resource recovery solutions, which prioritize waste reduction, reuse, recycling, and composting. Sustainable Development Goals (SDGs) were established as a result of the UN Conference on Sustainable Development in June 2012 and the UN General Assembly in September 2014. In the SDGs, 17 goals were set up for reducing poverty, enhancing social equality, decreasing pollution levels, and making cities more livable (UN, 2016). To achieve sustainability, the Global Waste Management Goals include ensuring affordable, secure, and accessible solid waste collection services; preventing open burning and dumping; and managing environmentally sound WM by 2030 (Ferronato& Torretta, 2019; Sharma et al., 2021). Nepal is committed to the current global initiative as a member of the UN (NPC, 2017).

Nepal's National Development Plan (NDP) aligns with the Sustainable Development Goals (SDGs), particularly Goal 3 (Good Health and Well-being) and Goal 11 (Sustainable Cities and Communities) (UN Nepal, n.d.). Progress in health initiatives, such as reducing the maternal mortality rate from 539 per 100,000 live births in 1996 to 151 per 100,000 live births in 2021, highlights the country's commitment to sustainability. Additionally, policies such as the Basic Health Service Package (BHSP) have enhanced healthcare accessibility and equity. Urban sustainability goals have been incorporated into Nepal's 15th Development Plan (2019/20–2023/24) and the 25-Year Long-Term Vision 2100, reflecting a commitment to public health and sustainable urban development.

Effective municipal waste management is closely linked to proper household waste handling (Birhanu&Berisa, 2015). Household waste management practices, such as reuse, recycling, and composting, are crucial for sustainability. However, in rural communities, separation-at-source programs are generally absent due to inadequate facilities (Wang et al., 2018). This underscores that waste management is not solely the responsibility of municipalities but also requires active household participation.

This study focuses on examining the unique context of Household waste management in Siddharthanagar municipality. It investigates household waste management practices, policies and challenges specific to the area. It identifies challenges such as inadequate garbage collection systems, a lack of public awareness, and financial limitations. In addition, it also provides valuable insights for policymakers,practitioners, and researchers by addressing these challenges and proposing recommendations and solutions to improve Household waste management in Siddharthanagar Municipality. The study aims to suggest sustainable and efficient household waste management strategies for the benefit of the municipality's residents and the environment. The study objectives include:

- Examining household waste management practices.
- Identifying challenges households face in waste disposal.
- Exploring ways in which municipalities can support effective waste management.
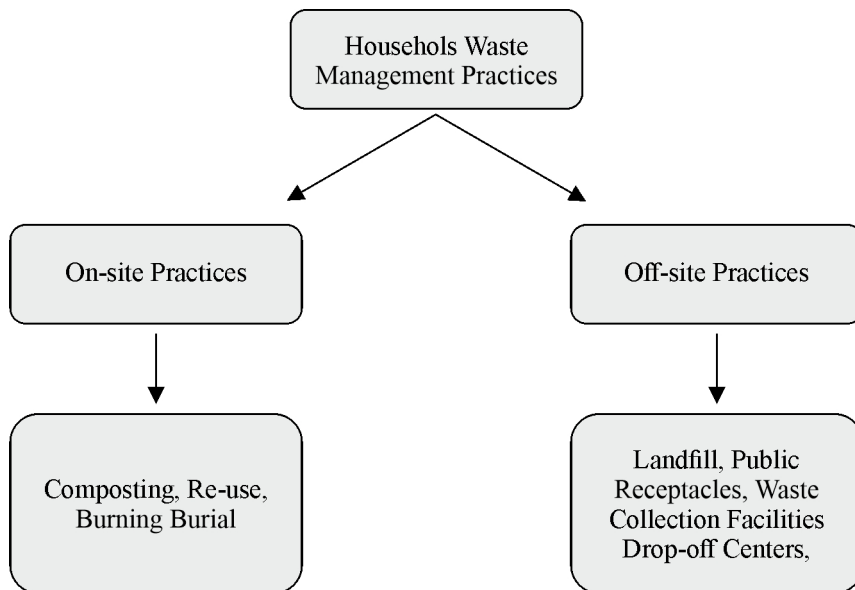- Providing policy recommendations for a more sustainable household waste management system.

Conceptual Framework and Literature Review

The conceptual framework and related concepts discussed are applied in the context of a rural, remote area where the management of waste is more challenging than in urban areas. The literature supporting the conceptual framework is summarised in two major categories, namely on-site and off-site household waste management practices.

Concept of Household Waste Management

The government's new waste management approach sees waste as a valuable resource and emphasises strategies, such as reducing, re-using, and recycling waste (Nepal et al., 2023). The types of solid waste generated by households vary according to economic circumstances, seasons, as well as the demographic landscape and location of the areas (Birhanu&Berisa, 2015). In higher- income areas, for example, more inorganic waste is generated whereas in low-income areas more organic waste is produced. The population density and socio-cultural, as well as seasonal, factors (e.g., fluctuations in garden waste) affect waste volumes (Birhanu & Berisa, 2015).

This study follows the conceptual framework of Ferrara (2008) in which the waste/recyclables disposal practices available to households are on-site, off-site, and curb- side waste disposal. These two categories of household waste management are depicted in Figure 1.

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        ┌─────────────────────┐
        │   Household Waste    │
        │ Management Practices │
        └─────────────────────┘
           ↙              ↘
┌──────────────────┐  ┌──────────────────┐
│ On-site Practices│  │ Off-site Practices│
└──────────────────┘  └──────────────────┘
        ↓                      ↓
┌──────────────────┐  ┌──────────────────┐
│ Composting, Re-use,│ │ Landfill, Public │
│  Burning Burial   │  │ Receptacles, Waste│
│                   │  │ Collection Facilities│
│                   │  │ Drop-off Centers, │
└──────────────────┘  └──────────────────┘
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On-site household waste management entails household composting, recycling, re- use, and burning or burying of waste in their own yards (Ferrara, 2008).Off-site household waste management refers to disposal at a landfill or in public receptacles, donations, or delivery ofseparatedrecyclablestodrop-offcentres (Ferrara, 2008).Off-sitewaste/recyclablesdisposalalso includes'conventional'environmentallyunfriendlywastedisposalpractices(wang et al., 2018; Abel, 2014; Comerford et al., 2018; Kawamoto&Urashima, 2006; Momoh et al., 2010; Sasao, 2016), such as open-burning and the dumping of waste in uncontrolled environments (for in- stance, on streets, in empty spaces, and on riverbanks).The latter practices pollute the environment,posecommunity healthrisks,andinvolvecostlyclean-upsofsuchsitesby the local government (Matsumoto&Takeuchi, 2011).

Literature Overview and Empirical Evidence

On-Site Household Waste Management

On-site household waste management refers to the practices households undertake to manage their waste within their own premises, aiming to reduce reliance on municipal waste services (Adhikari, Barrington, & Martinez, 2010). Organic waste can be composted at residential, community, and municipal levels. In developing countries, residential composting works well while high failure rates are reported for composting at municipal level (Birhanu & Berisa, 2015). Reasons provided for the failures at municipal level include high operational, management, and transportation costs, the poor quality of products received due to improper waste sorting, and poor understanding of the composting process. Evidence recorded by Ziraba et al. (2016) shows that waste sorting is rare or absent in most developing countries, making recycling or composting difficult. Hidalgo (2015) also found that the habits of rural populations to use biodegradable material as feed for animals

complicate centralised composting. Household and community level composting work best in isolated rural areas (Hidalgo et al., 2017; Sasao, 2016). Using organic materials as compost (plant nutrients) at the residential level can benefit households.

To reuse waste, it must be cleaned and used in its original form repeatedly for the same or a new purpose (e.g., bottles, clothes, and books) (Birhanu & Berisa, 2015). Rural households, especially in low- and middle-income countries, tend to re-use much waste, such as dung, crop residues, wood, sawdust, paper, and cardboard as an energy or heating source (Mihai&Taherzadeh, 2017). Food waste, such as meat and bones, is re-used for animal feed.

The re-use of recyclables is preferable over composting and recycling as it reduces pollution, decreases natural resource use, and saves the energy costs involved with producing new products from recyclables (Birhanu & Berisa, 2015). Re-using, re-distributing, and/or re-manufacturing strategies are the preferred approaches in a circular economy "as they are less costly in the long-run as repairing a product made to last is always less expensive than producing it from scratch' (Lemille, 2019).

Off-Site Household Waste Management

Off-site household waste management refers to the process where waste generated by households is collected and transported to locations outside the residential premises for treatment, recycling, or disposal. This typically involves municipal waste collection services and external facilities such as landfills, incinerators, or recycling plants (Adhikari, 2010). Serret and Ferrara (2008) also noted that access to drop-off recycling facilities increases the recycling efforts of households. However, according to Jenkins'(Jenkins et al., 2003) study in the United States of America, it does not hold for all types of recyclables.

Many other factors also play a role in the success of environmentally friendly off-site household waste management. Wang, Chen, Reisner, and Liu (2018), for example, stress the importance of multiple collection points close to residences to ensure proper waste disposal. These authors, as well as Abel (2014) and Niyobuhungiro and Schenck (2020), found that insufficient waste collection facilities in rural, remote and under- developed areas will increase the probability of dumping in open areas; they also point out that a lack of information is a concern. When people are not aware of the location of the nearest landfills or waste collection facilities the likelihood of dumping and littering increases. Both drop-off facilities (off-site waste management) and curb-side recycling programs (curb-side waste management) were found to reduce the time and storage costs of recycling. However, curb-side recycling programs increase recycling rates more due to their lower transport cost for the households (Fischer et al., 2013; Serret & Ferrara, 2008). Door-to-door collection of recyclables has been proven to achieve the best results in rural communities (Hidalgo et al., 2017).

Environmentally unfriendly off-site waste management practices of households, including burning practices, open-dumping, and littering, pose challenges to local authorities across countries, cultures, and languages as seen by studies in developed countries, such as Japan (Kawamoto&Urashima, 2006; Sasao, 2016) and Australia (Comerford et al., 2018), and developing countries, such as China (Wang et al., 2018), South Africa (Abel, 2014), and Nigeria (Momoh et al., 2010). In developing countries, agricultural, as well as household waste is often disposed of through open burning practices and open dumping (Mihai &Taherzadeh, 2017; UNEP, 2009). Rural residents in developing countries usually do not follow recommended waste collection practices out of habit or due to a lack of facilities and knowledge of these practices (Wang et al., 2018).

Poor waste management infrastructure and facilities, low quality of waste management services,

lack of funds, poor environmental awareness, limited markets for recycled materials, and the lack of separation of waste at source recycling programs contribute to the dumping of waste (Ichinose & Yamamoto, 2011). Remote and rural areas are often characterized by poorly managed domestic waste with inadequate waste management facilities and infrastructure (Apostel& Mihai, 2012). This, in turn, leads to higher levels of littering and the illegal dumping, burying, burning, storing, and uncontrolled abandoning of waste and unused resources (Lamasanu& Mihai, 2015).

In order to move towards a more holistic and community-driven waste management strategy at the municipal level, which emphasizes the importance of resource conservation, enhanced recycling initiatives, and the sustainable re-use of materials, it is crucial to first gain a thorough understanding of the existing waste management practices followed by households. Additionally, it is essential to identify and analyze the specific barriers and challenges that households face in effectively managing their waste. Understanding these dynamics is key to designing policies and interventions that encourage greater community involvement and ensure that waste management processes are more efficient, equitable, and environmentally sustainable for all stakeholders involved.

Materials and Methods

Research Context

The data for this study were collected in October 2024 in Siddharthanagar Municipality, using a sample of 174 households. During the data collection period, information was gathered on various aspects of waste management and disposal practices among different groups, including street traders, businesses, and households. However, this study specifically focuses on the waste disposal practices of households and the challenges they face in this context. Understanding household waste disposal behavior is crucial for developing effective and sustainable municipal solid waste management strategies, as households are one of the primary sources of urban waste. The findings of this research can provide valuable insights for local policymakers, municipal authorities, and environmental planners to design targeted interventions that address existing gaps, improve community awareness, and promote responsible waste management practices.

Research Design

A cross-sectional research design was used, and the data were collected at a given point in time. To estimate the prevalence of certain behaviours amongst a research population, a cross-sectional study is suitable (Mann, 2003; Sedgwick, 2014). Cross-sectional studies help to determine the prevalence of the aspects under investigation without the distinction between cause and effect, but rather to infer causation (Mann, 2003).

Research Population

The research population consists of the households in Siddharthanagar Municipality of Rupandehi district. The town has a total population of 9680 people (4634 males and 5046 females) and approximately 2509 households (Central Bureau of Statistics, n.d.). A sample of 174 households was interviewed. A non-probability sampling method was used in the form of convenience sampling (Etikan et al., 2016) to gather primary data from the representatives of all households. The findings also include researchers' observations and information gathered from key informants in the town.

Data Collection

A mixed method research methodology was used. A questionnaire with qualitative (open-ended) and quantitative (closed) questions was used as the data collection tool. Open-ended questions were used to yield in-depth and additional data and information to complement the quantitative data. The qualitative information can also be used to explain the quantitative data. The data collection was managed by the researchers who also participated in the collection of data, assisted by a team of well-trained field workers who have previous experience in data collection of this nature. Ethical clearance for the project was obtained and adhered to in the study, and the municipality's permission was granted for the project.

Data Analysis

The data were captured and analysed in Excel and STATA version 15. The analyses include descriptive results with frequencies, percentages, means, and medians, as well as thematic tables and qualitative responses from the respondents. The thematic analysis was used to identify the challenges that households experience with their waste management activities and ways in which the municipality can encourage households to keep the town clean. The validity of the data was assured by restricting the household representatives' age to 18 and older and byusing well-trained field workers to ensure an accurate representation of the households' responses by the persons interviewed.

Findings

The findings of the study were presented according to the objectives of the study. The first section presents the personal background of the respondents and household characteristics. The second section provides the waste management and waste disposal practices of the households according to the conceptual framework followed by the challenges experienced by households regarding their waste management. The environmentally unfriendly waste disposal practices will be outlined. The paper will end with a discussion of the results, as well as policy recommendations towards a more sustainable household waste management system in the area.

Respondents' Personal Background and Household Characteristics

The demographic background of the respondents and the characteristics of their households are summarised in Table 1.

Table 1:

Respondents' Personal Background and Household Characteristics (N = 174)

Category	Sub-category	Frequency (N)	Percentage (%)
Gender	Male	98	56.3%
	Female	74	42.5%
Age Category	18 to 24 years	25	14.4%
	25 to 34 years	58	33.3%
	35 to 44 years	42	24.1%
	45 to 54 years	28	16.1%

	55+ years	21	12.1%
Family Size	1 to 2 members	39	22.4%
	3 to 5 members	94	54.0%
	More than 5 members	41	23.6%
Occupation	Government employee	30	17.24%
	Private sector employee	45	25.86%
	Self-employed/Business	35	20.11%
	Student	25	14.37%
	Retired	10	5.75%
	Unemployed	29	16.67%
Income Range (Monthly)	Below Rs.15000	60	34.48%
	Rs.15000-Rs.25000	50	28.74%
	Rs.25000-Rs.35000	40	22.99%
	Rs.35000-Rs.45000	15	8.62%
	Above Rs.45000	9	5.17%
Educational Qualification	Primary education	23	13.2%
	Secondary education	47	27.0%
	Bachelor's degree	62	35.6%
	Master's degree or higher	32	18.4%
Housing Status	Owned	118	67.8%
	Rented	56	32.2%
Dwelling Type	Single-family house	91	52.3%
	Multi-family house	30	17.2%
	Other (Shared, informal)	7	4.0%

The table presents the personal and household characteristics of 174 respondents. A majority of respondents are male (56.3%), with 42.5% being female. The age distribution shows that 33.3% are aged 25 to 34 years, followed by 24.1% in the 35 to 44 age group. Most respondents (54.0%) live in families with 3 to 5 members, and 22.4% live in smaller households with 1 to 2 members. In terms of occupation, private sector employees make up the largest group (26.4%), followed by government employees (19.5%) and self-employed individuals (21.3%). The majority (52.9%) of respondents earn between Rs. 15,000 to Rs. 25,000 monthly, while 27.6% earn below Rs. 15,000. Educationally, most respondents hold a Bachelor's degree (35.6%), with 27.0% having completed secondary education. The majority of respondents own their homes (67.8%), with 32.2% renting. Most live in single-family houses (52.3%), followed by 17.2% in multi-family houses.

Types of Waste

Waste is any material that is discarded after primary use or is no longer useful. It can be classified

into different categories based on its origin, composition, and environmental impact. The major types of waste include solid waste, liquid waste, organic waste, inorganic waste, hazardous waste, e-waste, biomedical waste, construction and demolition waste, radioactive waste, industrial waste and agricultural waste.

Table 2:

Types of Waste

Waste Type	Number of Respondents (N)	Percentage (%)
Food waste	140	80.5%
Plastic waste	160	91.9%
Paper waste	120	69.0%
Glass waste	80	46.0%
Textile waste	95	54.6%
Electronics	65	37.4%
Metal waste	55	31.6%
Hazardous waste	30	17.2%
Yard waste	100	57.5%

The survey indicates the most common types of waste generated by households. Plastic waste is the most prevalent, with 91.9% of respondents reporting its occurrence. Food waste follows closely at 80.5%, reflecting its significant presence in households. Paper waste is also common, with 69.0% of respondents disposing of it. Other types include textile waste (54.6%), yard waste (57.5%), and glass waste (46.0%). Electronics waste is reported by 37.4% of respondents, while metal waste is less common at 31.6%. Hazardous waste is the least reported, with only 17.2% of respondents indicating its disposal. This highlights that plastic and food waste are the dominant waste types, while hazardous and metal waste are less frequently encountered.

Person(s) primarily responsible for waste management

Table 3 provides a summary of the person(s) primarily responsible for the waste management of their household.

Table 3:

Person(s) primarily responsible for the waste management

Disposer	Responses (N, %)
a. Mother/Wife	78 (44.8%)
b. Father/Husband	52 (29.9%)
c. Child/Children	28 (16.1%)
d. Grandparents	12 (6.9%)
e. Servant	4 (2.3%)

The survey reveals that waste disposal in households is primarily handled by the mother or wife, with 44.8% of respondents reporting that they are responsible. The father or husband follows closely

at 29.9%, while children contribute to waste disposal in 16.1% of cases. A smaller percentage of respondents (6.9%) mentioned that grandparents take on the task. Only 2.3% of households employ servants for waste disposal, highlighting that the responsibility is largely managed by family members rather than external help. This distribution suggests that waste disposal is predominantly seen as a household duty, with the mother or wife taking on the largest share of this responsibility.

Household Solid Waste Management Practices

As illustrated in Table 4, most of the household very few households make use of on-site (composting and re-use) waste management and disposal practices whereas. Food waste is the most common waste product that is re-used as animal feed (in this case, dogs) by 32.4% of households, 6% re-use their paper, whereas only one household re-uses plastic products and another separates its food waste for making compost.

Table 4:

Household Solid Waste Management Practices (N = 174)

Waste Type	Compost (N, %)	Re-use (N, %)	Burn (N, %)	Bury (N, %)	Landfills (N, %)	Public Receptacles (N, %)	Road-side area (N, %)	Door-to-Door Collectors (N, %)
Food Waste	50 (29%)	30 (17%)	40 (23%)	20 (11%)	15 (9%)	10 (6%)	5 (3%)	14 (8%)
Textile (Clothes)	10 (6%)	70 (40%)	5 (3%)	15 (9%)	10 (6%)	20 (11%)	5 (3%)	9 (5%)
Glass Waste	8 (5%)	15 (9%)	2 (1%)	4 (2%)	20 (12%)	25 (14%)	8 (5%)	15 (9%)
Plastic Waste	30 (17%)	25 (14%)	50 (29%)	10 (6%)	5 (3%)	10 (6%)	40 (23%)	25 (14%)
Paper Waste	20 (11%)	40 (23%)	10 (6%)	5 (3%)	5 (3%)	25 (14%)	10 (6%)	9 (5%)
Electronics	0 (0%)	15 (9%)	3 (2%)	10 (6%)	50 (29%)	5 (3%)	0 (0%)	5 (3%)
Batteries	2 (1%)	5 (3%)	8 (5%)	0 (0%)	50 (29%)	0 (0%)	0 (0%)	0 (0%)

The table reveals diverse waste management practices across different types of waste. For food waste, the majority of respondents (29%) compost, but a significant number still burn (23%) or bury (11%) it, indicating room for improvement in sustainable practices. Textile waste is mainly reused by 40% of respondents, suggesting a shift toward more sustainable disposal, while 11% place it in public receptacles and a smaller percentage bury or compost it. In the case of glass waste, 14% discard it in public receptacles, and 12% use landfills, with only small percentages composting or reusing it. Plastic waste is a major concern, with 29% burning it, which poses environmental risks, and 23% discard it in roadside areas, highlighting the need for better management. Paper waste is largely

reused (23%) and disposed of in public receptacles (14%), though composting is also common. Electronics waste predominantly ends up in landfills (29%), with minimal reusing or composting, reflecting the challenges of managing e-waste. Similarly, battery disposal is problematic, with 29% opting for landfills, underscoring the need for more responsible disposal options. Overall, while some respondents engage in eco-friendly practices, landfilling and burning remain widespread, indicating a pressing need for improved waste management strategies and public awareness.

Table 5:

"How do you perceive the waste management system in your community?" with corresponding numbers of respondents and percentages:

Response	Number of Respondents (N)	Percentage (%)
Very effective	45	25.9%
Somewhat effective	80	46.0%
Not effective	30	17.2%
I am unsure	19	10.9%

The data presents respondents' perceptions of the effectiveness of a particular waste management initiative or program. A significant portion (46.0%) of respondents felt that the program was somewhat effective, indicating moderate satisfaction with its outcomes or impact. 25.9% viewed the program as very effective, suggesting that a quarter of respondents were strongly supportive of its success. However, 17.2% felt the program was not effective, reflecting concerns or dissatisfaction with its implementation or outcomes. Lastly, 10.9% were unsure, indicating a lack of clarity or familiarity with the program's effectiveness. This distribution suggests a mixed response, with most respondents recognizing some level of effectiveness, but also indicating room for improvement.

Table 6:

Reasons for Improper Waste Disposal (Multiple Responses Allowed)

Causes of Improper Waste Disposal	Responses (N, %)
(a) No dustbin nearby, so waste is disposed of anywhere	110 (63.2%)
(b) Waste is not collected regularly	95 (54.6%)
(c) Waste is left around the dustbin instead of inside it	85 (48.9%)
(d) Waste is left in drains	72 (41.4%)
(e) Waste is left on roads	78 (44.8%)

Challenges experienced by Households regarding Waste Management

The majority of households experience challenges with the waste management services provided by the municipality. A thematic analysis of these challenges, as captured in Table 5, shows that the dominant challenge is linked to the municipal waste pick-up services (37.5%): the municipality does not collect dumped waste, does not clean the streets, is not always on time, does not communicate pick-up arrangements during holidays, and does not enforce the law against people who add their waste to uncontrolled dumps. The second ranked challenge was the behaviour of the community and the cleanliness of the neighbourhood. Some of the respondents are concerned about health issues,

such as dog carcasses that are left to rot anywhere, especially as children are playing in the dumps. Another challenge highlighted was the parents' lack of responsibility to keep their children off the dumps. Moreover, respondents were also concerned about the fact that households often lack the transport to 'clean up,' especially yard waste that is not removed by the municipality.

Table 7:

Thematic analysis of challenges with waste management

Theme	Challenge Description	N	%
Municipal Waste Pick-Up	Not always on time/not sure when truck will come/does not always come weekly	16	9.2%
	Skips houses if the truck is too full	4	2.3%
	Does not fetch/remove/collect dumped waste/clean streets	4	2.3%
	Municipality does not give notice to/punish dumpsters	1	0.6%
	Weak management/weak communication during holidays/municipality neglects area	5	2.9%
Community Behaviour and Cleanliness	People pile dirt/are dirty	3	1.7%
	All streets are very dirty—especially over the weekend	4	2.3%
	Illegal dumping hotspots are a concern	3	1.7%
	Uncollected waste and yard dirt is dumped close to homes/in ditches/in others' yards	6	3.4%
	The wind blows waste against the wire fences	3	1.7%
	Dogs tear open bags not collected by the municipality	1	0.6%
Health Concerns	Enough space is needed to bury dead animals	1	0.6%
	Waste dumps and landfill are health risks/dangerous for children playing in the dumps	4	2.3%
	Burning of waste and medical waste causes smoke	2	1.1%
Outside Town	Landfill not managed/big problem at dumping site/disgusting	3	1.7%
	Dirt outside town	1	0.6%
	Plastic bags are a concern	1	0.6%
No Infrastructure	Bins and black bags needed	10	5.7%
	Provide recycling services	1	0.6%
Provide Jobs/ EPWP Jobs	Employ more people to clean more thoroughly	5	2.9%
Educate People	Teach people about composting and recycling	2	1.1%

The researcher observed parents dumping discarded items in front of the school and saw children playing on uncontrolled dumps. Some respondents also mentioned problems at the landfill site and plastic bags that are blown all over the area. Five respondents asked that more people be employed

to clean the town, and two respondents asked for more information on composting and recycling.

Table 7:

Ways to Improve

Themes	N (174 respodents)	%
More education on environmental clean-ups/recycling programs and awareness campaigns	129	74.1%
Provide empty bags	131	75.3%
Incentives as encouragement, such as giving food parcels	111	63.8%
Launch competitions to keep the community clean	102	58.6%
Create jobs (use the unemployed to pick up waste so they can earn an income)	21	12.1%
Provide bins (to households/along the streets)	20	11.5%
Drop-off sites	3	1.7%
The community must all take responsibility for cleaning their areas	9	5.2%
Fine people for dumping	5	2.9%
School projects	7	4.0%
Better waste management and communication from the municipality	10	5.7%

The data presents a range of suggestions for improving waste management practices in the community, highlighting the varied approaches that respondents consider important. The most commonly suggested interventions include education on environmental clean-ups and recycling programs (74.1%) and providing empty bags (75.3%). These responses emphasize the importance of raising awareness and encouraging community participation in sustainable waste disposal practices. Such suggestions align with findings from previous research, where education is frequently identified as a crucial element in promoting pro-environmental behavior (Oosterveer&Spaargaren, 2010). Awareness campaigns can help bridge the gap between knowledge and behavior, potentially leading to more consistent waste segregation, recycling, and responsible disposal.

The suggestion to provide incentives like food parcels (63.8%) and launch competitions (58.6%) reflects a community-driven approach to motivate action. These measures are commonly used in behavioral change programs to foster positive engagement, though their long-term effectiveness may depend on the sustainability of the incentives and the integration of incentives with more structural, systemic changes in waste management. Financial or material incentives can stimulate short-term improvements but may need to be accompanied by deeper societal shifts in attitudes and practices for long-lasting effects (Aldrich, 2009).

Interestingly, job creation through waste collection (12.1%) has relatively low support. While providing employment opportunities can serve a dual purpose of addressing unemployment and improving waste management, respondents might not see this as an immediate priority compared to

awareness programs or incentives. Nevertheless, this approach aligns with the idea of creating green jobs, which has been advocated in environmental policies as a way to address both environmental and social issues (UNEP, 2016). The relatively low percentage of support might indicate a preference for direct solutions rather than structural changes.

On the lower end of the spectrum, providing bins (11.5%), drop-off sites (1.7%), and school projects (4.0%) indicate limited enthusiasm for infrastructural improvements or educational projects within schools. This suggests that respondents prioritize action-oriented measures (like awareness campaigns and incentives) rather than long-term, infrastructure-heavy solutions. It also implies that respondents may see the lack of waste management infrastructure as aconsequence of broader systemic failures, rather than as a straightforward issue that can be solved with more bins or drop-off sites.

The notion that the community must take responsibility (5.2%) and fines for dumping (2.9%) reflects a grassroots approach to waste management. These responses suggest a desire for more accountability at the community level. However, the relatively low support for fines suggests a possible reluctance to impose punitive measures, which may be viewed as too harsh or ineffective without a comprehensive strategy that includes support, education, and infrastructure improvements. Similarly, the low demand for better communication from the municipality (5.7%) may indicate frustration with local authorities but also reflects a possible underestimation of the importance of clear and transparent communication between local governments and the public.

In summary, the results point to a strong preference for educational and incentive-based approaches, with a marked focus on community engagement. However, there is less enthusiasm for structural changes, such as the provision of bins or drop-off sites, and even less for punitive measures like fines. This suggests that successful waste management interventions in the community will likely require a combination of education, motivation through rewards, and increased community responsibility, rather than relying solely on infrastructural improvements or enforcement.

Ways to Improve the Cleanliness of the Municipality

To improve cleanliness in the municipality, a multi-faceted approach is required, involving residents, local authorities, and various stakeholders. Here are several ways to enhance cleanliness:

1. Improve Waste Collection and Management

- Regular and Timely Collection: Ensure that waste collection is consistent, frequent, and timely, especially in densely populated or high-traffic areas. Establishing clear schedules and ensuring that waste collection vehicles are properly maintained will reduce littering and waste build-up.

- Expand Door-to-Door Collection Services: Offer waste collection services that directly collect from residential homes. This reduces the likelihood of waste being dumped in public areas.

- Introduce Segregated Waste Collection: Separate waste into recyclable, organic, and non-recyclable categories to facilitate more efficient management and recycling. Provide residents with appropriate bins and clear guidelines on sorting waste.

2. Enhance Public Awareness and Education

- **Launch Educational Campaigns:** Run campaigns to raise awareness about the importance of cleanliness and proper waste disposal. Use media, schools, and community centers to

spread the message.

- **Promote Zero Waste Lifestyle:** Encourage residents to adopt zero-waste habits by reducing consumption, reusing materials, and recycling. Educate the public on the environmental and health impacts of littering and improper waste disposal.

- **Community Workshops and Cleanliness Programs:** Organize workshops, school programs, and neighborhood meetings to educate people about the importance of waste segregation, responsible disposal, and the dangers of littering.

3. Install Proper Infrastructure

- **More Waste Bins in Public Spaces:** Ensure that there are enough waste bins placed strategically throughout the municipality, especially in parks, markets, streets, and public transport areas. Label the bins to make it clear which materials should go in each one.

- **Develop Recycling Stations:** Set up designated recycling stations where residents can dispose of recyclable materials separately. This reduces contamination of recyclable waste and increases recycling rates.

- **Litter Traps and Collection Points:** Install litter traps in gutters, drains, and near water bodies to prevent waste from being carried into the environment, especially in rainy seasons.

4. Foster Community Involvement

- **Organize Community Clean-up Drives:** Host regular neighborhood or community-wide clean-up events where residents come together to clean streets, parks, and public areas. This fosters a sense of community responsibility for cleanliness.

- **Create "Cleanliness Ambassadors":** Encourage local leaders or passionate individuals to serve as cleanliness ambassadors, who can motivate others to keep their neighborhoods clean and lead by example.

- **Incentivize Cleanliness:** Offer rewards or recognition for individuals, families, or neighborhoods that consistently maintain cleanliness. Incentives can include discounts on municipal services, food vouchers, or community recognition.

5. Enforce Strict Laws and Regulations

- **Implement Fines for Littering:** Enforce fines for littering in public spaces. Publicize the penalties for illegal dumping or improper waste disposal to deter such actions.

- **Establish and Enforce Sanitation Laws:** Strengthen sanitation laws that mandate regular cleaning of private properties, commercial establishments, and public areas. Conduct regular inspections to ensure compliance.

- **Create a Waste Management Task Force:** Set up a team to monitor and address sanitation issues. This team would respond to complaints, inspect businesses and residential areas, and enforce cleanliness standards.

6. Promote Waste-to-Energy and Composting Initiatives

- **Develop Composting Facilities:** Promote community-based composting programs for organic waste. Educate residents about how to compost at home or at designated facilities,

reducing the amount of waste sent to landfills.

- **Waste-to-Energy Projects:** Explore waste-to-energy technologies that convert municipal waste into usable energy, thus reducing waste volume while providing an additional source of energy for the community.

- **Encourage Biodegradable Alternatives:** Promote the use of biodegradable bags and products to reduce plastic waste in the municipality. Distribute reusable bags or offer incentives for using them.

7. Improve Drainage and Sewage Systems

- **Regularly Clean Drains and Sewers:** Make it a priority to maintain and clean public drains, sewers, and waterways to prevent garbage buildup and blockages. This will prevent flooding and ensure that waste is properly managed.

- **Install Stormwater Management Systems:** In areas prone to flooding, develop stormwater management systems that can handle large amounts of water without carrying waste into public spaces.

8. Enhance Waste Management Technology

- **Implement Smart Waste Management:** Use technology such as smart bins, which are equipped with sensors to detect when they are full, to optimize waste collection schedules and avoid overflow.

- **Waste Management Apps:** Develop or promote apps that allow residents to track waste collection times, report issues with waste management services, or request additional collection services.

- **Use Drones for Inspection:** Deploy drones for monitoring areas prone to illegal dumping or areas where waste piles up unnoticed.

9. Involve the Private Sector

- **Partnerships with Waste Management Companies:** Collaborate with private waste management firms to improve efficiency in waste collection, recycling programs, and public education campaigns.

- **Corporate Social Responsibility (CSR) Programs:** Encourage businesses to contribute to maintaining cleanliness by supporting community clean-ups, providing bins, and participating in sustainability initiatives.

10. Improve Public Health and Sanitation

- **Regular Street Sweeping:** Implement or enhance street sweeping programs to clean up dust, debris, and litter from public streets. Ensure that streets, particularly those near markets and public transit stations, are swept regularly.

- **Public Health Campaigns:** Address the health risks associated with poor cleanliness by highlighting the links between sanitation and public health. Educate citizens on diseases caused by unsanitary conditions and improper waste disposal.

By employing these strategies, municipalities can significantly improve cleanliness, reduce waste

accumulation, and promote sustainable waste management practices, ultimately leading to a cleaner, healthier environment for all residents.

Conclusion

To move towards a more sustainable household waste management system, the commitment of the municipality, households (community), businesses, shop-owners, as well as producers, is essential. Although the removal of waste in Siddharthanagar Municipality is the legal responsibility of municipalities, the participation of communities in waste management is becoming more relevant, and even critical, in keeping most towns clean.

To move towards a more sustainable household waste management system, not only recycling, but also the re-use of recyclables and the composting of organic waste, should be encouraged. To achieve these, the commitment of the municipality, households, and the community, as well as the producers of products that generate recyclable products, are essential.

The challenges, as experienced by the households, ask for the commitment of the municipality to:

Efficient and timely waste collection from all designated points is crucial in managing household waste effectively and preventing illegal dumping and littering. Regular and structured waste collection services play a significant role in maintaining cleanliness and environmental sustainability.

Recommendation

To discourage uncontrolled dumping, the municipality should identify, map, and monitor illegal waste disposal sites while enforcing stricter regulations and penalties. Involving the community in monitoring and reporting illegal dumping activities can further strengthen enforcement efforts.

Public awareness and education are essential for improving waste management practices. The municipality should:

- Provide residents with knowledge about composting at both the household and community levels.
- Encourage the re-use of recyclable materials by inviting industry experts to demonstrate innovative ways to extend the life cycle of recyclable products.
- Establish drop-off points where community members can return empty containers for reuse by others, possibly as part of a funded initiative.

To ensure effective waste disposal, the municipality should provide:

•	Bins, skips, drop-off points, and receptacles for mixed waste, garden waste, and recyclables at convenient locations. These collection sites should be well-maintained and regularly emptied, as unclean surroundings often encourage further littering.

- A curbside recycling collection program to motivate households to separate recyclable materials from general waste.

Households and the broader community should actively engage in waste management by:

- Attending information sessions and discussions on best practices for waste disposal, composting, and recycling. Experts and community members can share innovative recycling ideas and techniques.

- Participating in community-led recycling initiatives and supporting individuals who can benefit from reusable items.

- Using designated waste disposal facilities responsibly, keeping them clean, and reporting any misuse.

- Avoiding environmentally harmful waste disposal practices such as littering and uncontrolled dumping, while reporting violations.

- Utilizing biodegradable organic waste for composting at home.

- Increasing the re-use of household waste and separating recyclable materials from general waste.

Manufacturers and producers of recyclable goods should also extend their reach to rural and remote communities by establishing sponsored recycling facilities, conducting awareness programs, and educating residents on creative ways to repurpose waste materials, including transforming recyclables into valuable tourist souvenirs.

It is recognized that financial limitations, common in many rural and remote areas, may hinder municipal efforts in providing the necessary infrastructure and services for sustainable waste management. To overcome these challenges, additional funding and investment are needed. Given the town's geographic remoteness from recycling markets, the municipality should explore alternative waste management solutions at the local level and collaborate with neighboring regions.

Ultimately, effective waste management requires a collaborative approach between the municipality and local households. A participatory system of discussions and actions can help develop practical waste solutions that align with the needs of both the community and the local government. By fostering responsible waste behavior and establishing well-structured waste management systems, Siddharthanagar Municipality can move towards a cleaner and more sustainable environment.

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