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Public Reception & Behavior of Solid Waste Management

[1]Jayraj M Kakhandaki , [2]Dr. Chetan Marol

[1]Mtech Student, P.G. Department of civil Engineering, Secab Institute of Engineering & Technology, Vijayapura
[2]Assistant Professor, Department of Civil Engineering, Secab Institute of Engineering & Technology, Vijayapura

ABSTRACT:

Effective solid waste management (SWM) is essential for environmental sustainability and public health. However, its success heavily depends on public perception, behavior, and participation. This study explores the relationship between community awareness, attitudes, and behaviors toward solid waste management practices. It examines the influence of socio-economic factors, cultural norms, and education levels on waste segregation, recycling habits, and compliance with municipal regulations. Findings indicate that public engagement remains inconsistent due to a lack of awareness, inadequate infrastructure, and limited enforcement of waste policies. The paper highlights the need for inclusive strategies, community-based awareness programs, and behavioral interventions to foster responsible waste practices. Ultimately, improving public reception and modifying behavioral patterns are crucial for the long-term success and sustainability of solid waste management systems.

1.Introduction:

Solid waste management in emerging nations is severely hampered by issues including urbanization, poverty, and fast population increase. Disparities in the rates of garbage collection between rural low-middle-income countries (LMICs) and global assessment revealed their urban counterparts.. In particular, just 26% of the solid trash produced in rural low-income communities (LMICs) is collected, while 48% of waste in metropolitan areas is collected.

In India, it is estimated that people produce between 0.3 and 0.4 million metric tons of organic and recyclable solid waste daily. Indicate that urban India is expected to produce 276,342 tons per day (TPD) of municipal solid waste (MSW) by 2021. This figure is anticipated to increase to 450,132 TPD by 2031 and reach 1.2 million (10^6) TPD by 2050. This is a significant rise from the 143,449 TPD of MSW recorded in 2014 [3]. This issue has escalated into a global concern due to its significant environmental and health impacts. Improper waste disposal near water bodies and open spaces leads to water and soil pollution. Additionally, in developing countries, poor waste management in small towns and rural areas is linked to 80 percent of disease outbreaks within communities. Solid waste management also poses sanitation and cleanliness challenges; overloaded public bins not only generate unpleasant odors but also attract rodents and mosquitoes, which can spread diseases.

Even though India's economy is among the fastest expanding, the country still lags behind in important WASH (Water, Sanitation, and Hygiene) metrics. Exceeding more than 1.2 billion people on the planet, it is becoming very important to properly handle sanitation issues.

As waste evolves, public perceptions must also shift. The key is to treat waste as a valuable resource instead of something to be discarded. Successful approaches to solid waste management encompass:

- Minimizing waste production.
- Recycling as much as possible.
- Incinerating waste with proper environmental safeguards and energy recovery systems, or transforming it into compost.
- Continuing sanitary landfilling for specific waste items.

1.1 Solid wastes

Non-liquid materials generated by homes, companies, farms, industries, and government agencies are all included in the category of solid waste. It is sometimes called trash, refuse, garbage, or rubbish and is made up of a variety of abandoned objects. Daily, seasonal, and regional variables can cause variations in the amount and makeup of solid waste, especially municipal garbage.

1.2Solid Waste Classification

Based on its origin, treatability, and potential for risk, solid waste can be categorized.

□Sorting according to origin: Food waste comprises leftovers from the processing, preparing, and eating. Including vegetable, fruit and animal parts. These wastes break down quickly and biodegrade, frequently releasing disagreeable smells.

□Rubbish: This word refers to solid garbage produced by homes, businesses, and institutions that is both combustible and non-combustible; it does not include biodegradable items.

□Combustible Waste: This category encompasses items like furniture,paper, cardboard, components, leather,garden debris, rubber, wood, and textiles.

□Non-combustible Waste: This includes materials such as glass, broken ceramics, plastics, used cans, and both ferrous and non-ferrous metals.

□Byproducts from burning wood, coal, coke, and other fuels in residential, commercial, and industrial settings include ashes and residues. These typically consist of fine ash, cinders, clinkers, and partially burned materials.

□Demolished and construction waste: Waste from construction sites and demolished buildings is categorized as demolition and construction waste. Along with stones, concrete, bricks, plaster, and plumbing supplies, it also contains detritus from remodeling and repair projects.

□Municipal Waste: This group includes dead animals, abandoned cars, street sweepers, roadside litter, and garbage from municipal trash cans. It encompasses a variety of waste products, including trash and garbage.

□Industrial Process Waste: Depending on the manufacturing processes involved, these solid and semi-solid wastes are created by industrial activities.

Their characteristics change.

□Agricultural waste: It refers to the leftovers from raising animals and farming, such as feedlot waste and agricultural byproducts.

Categorization according to Features

□Biodegradable Waste: This refers to any carbonaceous waste that microbes and creatures such as insects and annelids can convert into products that are either beneficial or less harmful.

□Non-biodegradable Waste: This group consists of inorganic wastes and organic polymeric materials that do not break down, such some kinds of plastics.

Categorization Considering the Potential for Risk

Hazardous wastes are defined as materials that represent a significant risk to human, plant, or animal life, either immediately or over time. These wastes have properties including toxicity, reactivity, flammability, or corrosiveness. They are divided up even further into:

□Wastes that include radioactive materials are known as radioactive substances.

□Chemicals: Toxic, reactive, or corrosive wastes.

□Hazardous waste produced by healthcare facilities and biological research centers is referred to as biological waste.

□Easily ignited wastes are referred to as flammable wastes.

□Explosives: Trash that, in certain circumstances, has the potential to blow up.

1.3 Solid Waste Sources

□Residential Areas: Domestic trash, sometimes referred to as waste from residential areas, differs according to socioeconomic and cultural reasons. High-income communities that cook with gas or electricity produce less waste than those that use charcoal or wood. Paper, cardboard, tin, and bottle production is frequently higher in affluent and commercial zones.

□Stores & Business Establishments: A lot of waste comes from stores and business places that can be recycled. Vegetable markets and stores produce a lot of biodegradable garbage, including dried plantain leaves that are used to wrap items.

□Shops and Commercial Establishments: Waste from hotels, restaurants, and food stands is a mixture of non-biodegradable and biodegradable materials. Due to the large volume of waste generated, it is recommended to use separate bins and arrange for daily collection.

□Slaughterhouses and Fish Markets: Fish markets and slaughterhouses produce extremely putrescible waste that decomposes quickly and emits foul aromas. There is frequently a lack of proper collection and clearance, which causes waste to build up on the site.

□Street Hawkers: The food waste produced by street food sellers, along with throwaway products like paper and plastic plates, is significant.

1.4 Solid Waste Characteristics

Physical Properties: Socioeconomic, cultural, and climatic factors greatly influence the physical properties of solid waste, such as bulk density and moisture content. These attributes are crucial for selecting the appropriate methods for processing, recycling, and disposal.

Chemical characteristics: Evaluating processing and recovery alternatives necessitates a thorough understanding of the chemical composition of solid waste. Important chemical properties include carbon content, pH, and vital elements like potassium, phosphorus, and nitrogen. The chemical makeup might differ greatly, which makes standardization difficult. In general, the percentages of non- combustibles, carbon, hydrogen, and nitrogen are calculated. High concentrations of organic carbon can accelerate the decomposition process. The selection of final waste disposal methods is influenced by both physical and chemical characteristics.

2. Literature Review

Ali Akbar Babaei et al. (2015):

In their study, survey conducted with 2,400 households in Abadan aimed to evaluate residents' knowledge, attitudes, and practices (KAP) concerning solid waste (SW) reduction, source separation, recycling, collection, and their willingness to pay (WTP) for waste services. A positive attitude towards participating in solid waste source separation and recycling initiatives, participants exhibited a lack of knowledge about the various steps in solid waste management and demonstrated a lack of active involvement in these practices. Demographic elements such as age, education level, gender, and occupation were found to influence KAP related to SW source separation and recycling. Notably, education level and occupation had a significant effect on residents' WTP. The study highlighted the importance of establishing public infrastructure for SW management and increasing awareness to foster recycling programs. It highlighted the necessity for focused educational campaigns, particularly for women, and stressed the importance of aligning municipal requirements with intervention strategies. This underlined the necessity for tailored training programs to address gaps in public knowledge and behavior regarding SW management, particularly in source separation and recycling.

M.Purcel et al. (2010):

The research hypothesized that attitudes towards managing biodegradable municipal waste (BMW) would vary spatially, even within a city with a relatively modest population of 1.2 million. In Dublin, Ireland, residents from several representative electoral districts were surveyed about their general waste management attitudes and specific BMW management. A total of 850 survey responses were gathered, with 688 collected through door-to-door interviews in residential areas and an additional 162 through a web-based survey.

The results showed that the dominant portion of households utilized waste collection services provided by local authorities instead of private entities, though both options were available. Contentment with waste management services was generally high across different local authorities. The issue of ―reducing the quantity of waste generated‖ was identified as the most important future concern by 28% of residential respondents. Statistical analysis revealed that the local authority in which respondents lived significantly impacted various aspects of their responses, such as the type of waste collection service used, satisfaction with waste services, and involvement in backyard composting. Additionally, personal characteristics of respondents, such as education level, type of accommodation, and age, were found to significantly influence their responses regarding waste service satisfaction and management influences. These findings supported the hypothesis and indicated that waste management strategies tailored to specific areas within the city, rather than a one-size-fits-all approach, could better address local needs and improve BMW diversion rates from landfills, as mandated by the Landfill Directive.

Pradeep Rathore et al. (2021):

The theoretical framework was evaluated using an empirical study involving urban Indian residents aged 18-60, with the factors on source separation intention (SSI) analyzed using partial least squares structural equation modeling. The findings indicated that eleven out of the fifteen factors significantly influenced source separation intention, with residents generally willing to separate their waste. Notably, perceived benefit, source separation facilities, market characteristics, and social awareness were identified as the top four factors most affecting source separation intention among urban Indian residents. Furthermore, the study found that the impact of attitude as a mediator was also significant for these factors.

Kaveri kala et al. (2020):

This paper outlines a framework for developing a Waste Management Communication Policy (WMCP) aimed at improving citizen awareness of municipal solid waste management. The study employs econometrics-based Multinomial Logistic Regression (MLR) models to determine the most effective communication channels tailored to different socio-economic groups. These offer valuable insights for crafting targeted outreach campaigns to improve awareness of municipal solid waste management (MSWM).

Globally, waste management (WM) is a pressing issue, with India generating 62 million tons of municipal solid waste annually. However, only 25% of this waste is processed effectively, leading to health problems and respiratory diseases among waste disposal workers. The situation is exacerbated in developing countries due to limited capabilities for cost-effective waste collection, processing, recycling, and disposal. While government policy formulation can play a role, effective waste management requires well-defined guidelines and rigorous monitoring. Policies that involve all stakeholders, particularly citizens, are essential for successful waste management. Encouraging public participation in decision-making can foster partnership, ownership, and responsibility. Nonetheless, citizens often refrain from participating due to concerns that their opinions will not be heard. Addressing this issue through welfare and social policy modeling could provide a viable solution.

Issam A. Al-Khatib et al. (2015):

The accumulation of municipal solid waste (MSW) is a significant issue in developing countries due to uneven waste collection and treatment. Understanding citizens' views and involving them in MSW planning is crucial, as is assessing their perception of hazardous waste to improve waste management strategies. A case study in Palestine's West Bank and Gaza Strip, informed by previous research, highlighted that factors such as a lack of skilled workers, irregular collection, inadequate equipment, and insufficient legal provisions challenge waste management. The study emphasized the educational gap, the findings show that increased levels of education are associated with greater awareness of hazardous waste. Addressing these issues through national policies and specialized training programs is important for improving waste management and reducing hazards.

Asmawati Desa et al. (2011):

In this study, a survey conducted through a questionnaire with 589 first-year students to assess their knowledge, attitudes, awareness, and behaviors related to solid waste management. The findings indicated that the students' knowledge, attitudes, awareness, and behavior concerning solid waste management were moderate. The research indicates that initiatives should be made to enhance education and awareness on waste management on campus, and to implement programs that foster attitude changes and promote sustainable environmental practices. In Malaysia, the government allocates 40-70% of taxpayer money yeraly for solid waste management, yet less than 5% of the waste is recycled, despite up to 70% being potentially recyclable or reusable.

3. Methodology

STUDY AREA

The study focuses on Ward No. 26 of Vijayapura District is geographically positioned at approximately 16.8302° N latitude and 75.7061° E longitude. This area is situated within the urban landscape of Vijayapura as show in a figure 3.1, contributing to its diverse demographic and economic makeup. Vijayapura district in the state of Karnataka is a key economic hub.

Ward No. 26 of Vijayapura District covers an area of 0.49 square kilometers. It comprises 1,806 houses with a population of 10,059, split between 5,005 males and 5,054 females. The ward is characterized by its well-developed infrastructure, including main roads and essential facilities. The ward benefits from excellent connectivity, with nearly 1 kilometer of the NH-13 highway running through it. This highway connects the area to other significant parts of the region. Additionally, the ward is conveniently located about 0.5 kilometers from both the Station Road and the Bus Stand, making it easily accessible for commuters and residents alike.

The presence of the Jamiya Masjid within the ward underscores the cultural and social cohesion of the community. The diverse areas such as Sardeshpande Colony and Jain area reflect the rich cultural fabric and the inclusive nature of the ward.

Fig 1&2 showing ward no 26 of Vijayapura

STUDY AREA FOR INSTALLING PIPE COMPOST

The study area for the pipe composting system is located at Government Primary & High School in Ward No. 26, Vijayapura, specifically (RPFG+79J, Gopalpur Galli). This site includes both an Anganwadi and a Primary School for girls and boys, and the composting system is implemented to manage the organic waste generated from the school's mid-day meal program.

COLLECTION OF SAMPLES

In Ward No. 26 of Vijayapur, samples of household waste were gathered from an auto tipper through a door-to-door waste collection system. Each day, 25 kg of waste was taken from the tipper, ensuring the sample represented the ward's overall waste generation. This process was conducted consecutively for five days, from June 15, 2024, to June 19, 2024, to account for daily variations in waste composition.

The samples collected were subjected to physicochemical analysis, focusing on both physical components (such as paper, plastics, metal waste, glass waste and organic matter) and chemical properties (including C: N, , pH, organic carbon, nitrogen, total volatile solids, total potassium, total phosphorus

C:N, moisture content, etc.). This approach provided a comprehensive and accurate assessment of the waste characteristics in the ward over the sampling period.

METHDOLOGY

Materials

The study employed a structured paper-based questionnaire along with face-to-face interviews to assess public perception and behavior of solid waste management in Ward No. 26, Vijayapura. The questionnaire was designed to collect data on demographics, awareness, attitudes, and practices related to waste management. The face-to-face interviews, conducted using the standardized questionnaires The survey was conducted over a two-week duration in June, during the early monsoon season.

Sampling Technique and Sample Size Calculation

The sample size for assessing public perception and behavior regarding management of solid waste in Ward No. 26, Vijayapura, was determined using the Taro Yamane method, a scientific approach widely used in survey research. The formula used for this calculation is:

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

Where, n represents the total sample size, N is the total population size (10,059 for Ward No. 26), and e signifies the accuracy of precision. In this study, the accuracy of precision was set at ±9% with a 2% risk level, which translates to a margin of error of 0.09. Applying the formula, the required sample size for the study was determined to be approximately 150 respondents, reflecting a representative cross-section of the ward's population.

To ensure a comprehensive survey, a sample size of 150 respondents was targeted. Data was gathered using a structured questionnaire designed to gather detailed insights on residents' perceptions and behaviors related to solid waste management. The questionnaire covered aspects such as waste segregation practices, recycling habits, awareness of waste management policies, and general attitudes towards waste management.

Following the survey, the data were sourced from reliable sources to supplement the primary data collected. Individual interviews were conducted to elicit residents' views and understanding of the waste management systems in their locality. The collected information was assessed using Microsoft Excel 2013 to assess the efficiency of the waste management practices and to identify trends in public perception. Statistical analysis was used to examine the influence of parameters such as age, gender, literacy, and economic status on individual perceptions and attitudes towards solid waste management.

Physicochemical Analysis of Household Waste

In Ward No. 26 of Vijayapura, household waste samples were gathered from an auto tipper through a door-to-door collection system. Each day, 25 kg of waste was extracted from the tipper, ensuring that the sample was reflected of the ward's overall waste generation. The collection procedure was conducted out continuously over a period of five days, from June 22, 2024, to June 26, 2024, to account for daily variations in waste composition.

Fig 3 Solid waste sample

Fig 4 Segregation of waste

Fig 5 Weighing of segregated waste

In Ward No. 26 of Vijayapura, household waste samples were gathered from an auto tipper through a door-to-door collection system. Each day, 25 kg of waste was extracted from the tipper, ensuring that the sample was reflected of the ward's overall waste generation. The collection procedure was conducted out continuously over a period of five days, from June 22, 2024, to June 26, 2024, to account for daily variations in waste composition .

The collected samples underwent physicochemical analysis, which evaluated both physical components (such as paper, plastics, metal, glass, and organic matter) and chemical properties (including organic carbon, pH, moisture content, nitrogen, total potassium, total volatile solids, total phosphorus, and the carbon-to-nitrogen ratio (C:N). This comprehensive analysis provided a detailed assessment of the waste characteristics in the ward during the sampling period.

The solid waste sample are gathered directly from the auto tipper that serves the households in Ward No. 26. As shown in Figure 3 approximately 25 kg of solid waste was collected each day. The auto tipper is responsible for daily waste collection, ensuring a representative sample from the area. This 25 kg sample was chosen as the standard weight for consistency across all five days of data collection

Segregation of Waste

Once the waste Once the samples are collected, they were manually segregated by municipal laborers into different waste categories, as depicted in Figure 4 The segregation process divided the waste into four distinct categories:

•Organic Waste: Food scraps, garden waste, and other biodegradable materials.

•Plastic Waste: Polythene bags, plastic bottles, and other non-biodegradable plastic products.

•Paper Waste: Newspapers, packaging materials, and other paper products.

•Other Waste: Miscellaneous waste found not suitable for the primary categories.

Each category was segregated carefully to ensure accuracy in waste classification. The manual segregation process enabled detailed analysis by focusing on specific waste streams.

Weighing and Recording

After the segregation, the weight of each waste category was measured individually as show in figure 5. This step enabled accurate data gathering on the constituents of the municipal solid waste. The total weight of the segregated categories (organic, plastic, paper, and other waste) was logged each day for comparison and analysis. The weights were carefully logged for five consecutive days, ensuring consistency and repeatability in the data collection process.

Data Collection Over Five Days

The waste characterization process was conducted out daily for five days to gather comprehensive data on the waste composition in Ward No. 26. By analyzing waste over multiple days, the study aimed to capture variations in waste generation patterns and provide a more accurate representation of the overall waste composition. The daily readings were compiled and used for further analysis.

Analysis of Waste Composition

The obtained data through the weighing method was employed to known the proportions of different waste categories. This analysis helped identify trends in waste generation, highlighting the prevalence of organic waste and the proportions of recyclable materials such as paper and plastic. The results also offered insights into the configuration of waste patterns, helping to inform waste management strategies in the area.

Due to limitations in chemical analysis facilities at the college, a composite sample of the solid waste was sent to Anna Lab in Solapur, an ISO 9001 certified laboratory. This lab conducted the chemical analysis, which included measuring parameters such as pH, C: N, Organic Carbon, moisture content, C:N, total Nitrogen, total potassium, total phosphorus, and the total volatile solids.

Evaluation of Compost Quality in Pipe Composters.

The pipe composting system has been installed at the Government Primary & High School of Ward No. 26 in Vijayapura. This system is designed to manage the organic waste generated by the mid-day meal scheme at the school. On average, the school produces about 1 to 1.5 kg of organic waste daily, which is then processed into compost through an aerobic decomposition process.

The composting setup consists of two PVC pipes, each used as a composter. Cow dung and Eisenia foetida (red wigglers) are utilized to enhance the decomposition process, resulting in nutrient-rich compost. Organic waste is added daily to the pipe composters, and the standard of the compost is analyzed on the 15th and 30th days.

Because of the insufficient testing facilities in the college, the compost samples were sent to Ana laboratory certified by IS9005 for detailed chemical analysis. The tests conducted included measuring pH, moisture level, organic carbon content, total volatile solids, total phosphorous, total potassium, total nitrogen, and the carbon-to-nitrogen (C:N) ratio.

The study methodology outlined in the flowchart involves several key components for assessing and enhancing solid waste management in Ward No. 26 of Vijayapura. Initially, a preliminary survey conducted and a comprehensive questionnaire is designed, divided into four parts. The first part collects personal details to collect fundamental demographic details from respondents. Part A explores respondents' perceptions of solid waste management, while Part B examines their waste disposal behaviors. And Part C includes open-ended questions to obtain qualitative insights.

Data collection follows, with respondents providing information through interviews or surveys. This data is then analyzed using MS Excel, allowing for the identification of trends, correlations, and patterns related to public perceptions and behaviors concerning waste management. The analysis results are summarized to derive insights into community attitudes and practices.

Subsequently, household waste samples are collected for physical and chemical analysis to understand their composition and compared with CPHEEO standards. The study also involves selecting a site for installing a composting system, likely at the Government Primary & High School in Ward No. 26, to manage organic waste effectively. This system uses organic waste from households or mid-day meal programs, combined with cow dung and red wigglers (worms), to produce compost.

The composting process is monitored by analyzing the compost quality on the 15th and 30th days, focusing on parameters such as pH, organic carbon, nitrogen, and phosphorus. Overall, this methodology integrates public perception surveys with waste characterization and composting experiments, combining social and environmental aspects to enhance solid waste management in the community. Additionally, the compost quality is evaluated against the standards set by the CPHEEO standards to confirm adherence to established guidelines and to ensure that the compost produced meets high- quality standards.

Experimental Set Up of Pipe Compost

The Government Primary & High School in Gopalpur galli of Ward No. 26 of Vijayapura has been selected as the site for implementing a pipe composting system. This decision was based on the substantial amount of organic waste generated daily by the mid-day meal scheme, which ranges from 1 to 1.5 kg. To effectively manage this waste, a pipe composting system consisting of two PVC pipes was installed at the school.

In this study involves a PVC pipe composter designed to handle 1 to 1.5 kg of waste per day. This system aims to efficiently process organic waste using a pipe of specific dimensions, enhanced by the addition of cow dung and Eisenia foetida (red wigglers), to create high-quality compost.

As show in fig 3.5, the PVC pipe was cut to a height of 91 cm, ensuring precise measurements for consistent experimental conditions. The pipe's diameter was fixed at 21 cm to accommodate the required volume of compostable material and to facilitate adequate aeration. A hole was excavated to accommodate the pipe, with 9 cm of the pipe's base buried in the ground. This partial burial was essential for stability and to allow for effective leachate drainage. The pipe was carefully positioned vertically in the hole and secured to prevent tipping.

The composting process began with a layer of bedding material, such as straw or dried leaves, placed at the base of the pipe. This initial layer, approximately 2-3 inches thick, helps with drainage and airflow. Organic waste, including kitchen scraps and garden trimmings, was added to the pipe. The system was designed to handle 1 to 1.5 kg of waste per day. The waste was layered with additional brown materials (e.g., dry leaves, paper) to balance the carbon-to-nitrogen ratio, essential for effective composting.

Cow dung was added to the compost to introduce beneficial microbes and enhance decomposition. Additionally, Eisenia foetida (red wigglers) are added to the system to accelerate the breakdown of organic material. These worms are effective at processing waste and composting process.

Regular monitoring ensured the compost remained moist but not waterlogged. Adequate moisture levels are important for the activity of both microbes and worms. Periodic turning of the compost was performed to promote aeration and uniform decomposition. A long stick was used to mix the contents, ensuring consistent breakdown of materials. The internal temperature of the compost was monitored to ensure it remained within the optimal range for microbial activity.

Fig 6 Pipe composter

The samples collected from the pipe composting system were analyzed at two different intervals: 15 days and 30 days. The following parameters were assessed to evaluate the composting process: Moisture Level, pH, Total Organic Carbon (TOC), Total Volatile Solids (TVS), Total Nitrogen, Total P_2O_5 (Phosphorus Pentoxide), Total K_2O (Potassium Oxide), Carbon-to-Nitrogen Ratio to know the maturity level of compost.

4. Expected Project Outcomes

1.Assessment of Public Awareness and Attitude:

•Detailed understanding of the current level of public awareness, perception, and attitudes toward solid waste management (SWM).

•Identification of knowledge gaps and misinformation regarding waste segregation, disposal, and recycling.

2.Behavioral Insights:

•Analysis of behavioral patterns related to waste generation, segregation, and disposal at the household and community levels.

•Identification of common practices and resistance points to sustainable waste behavior.

3.Community Participation Trends:

•Evaluation of the level and type of public participation in SWM initiatives (e.g., recycling programs, cleanup drives, composting).

•Mapping of engagement based on demographics like age, education, and income.

4.Factors Influencing Public Behavior:

•Identification of key motivators and barriers (social, cultural, economic, and infrastructural) that affect public behavior in waste management.

•Recommendations for behavior change strategies (e.g., incentives, penalties, education).

5.Impact of Public Awareness Campaigns.

•Evaluation of the effectiveness of past or ongoing awareness programs or policies.

•Suggestions for improvement in communication strategies.

6.Policy and Program Recommendations:

•Evidence-based recommendations for local authorities or NGOs to improve public cooperation and behavioral compliance in SWM.

•Framework for community-based waste management strategies.

7.Design of Targeted Interventions:

•Development of tailored programs (like workshops, media campaigns, or school activities) to enhance public involvement and environmentally responsible behavior.

8.Improved Waste Management Efficiency:

•Better alignment between public behavior and municipal SWM efforts, potentially leading to improved efficiency in collection, segregation, recycling, and disposal systems.

9.Data for Future Research:

•Collection of valuable primary data on public behavior toward SWM, useful for future academic, policy, or urban planning studies.

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