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Swot analysis for sustainable municipal solid waste management in Gurugram city, Haryana (India).

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ABSTRACT

In developing countries, solid waste is typically disposed of inappropriately, which has a negative impact on the environment and healthcare. One of the most serious environmental issues is the management of municipal solid waste because of the huge increase in waste generation brought on by industrialization, economic development, urbanization, and the exponential growth of Gurugram City's population. Municipal Corporation Gurugram (MCG) handles solid waste collection, transportation, and disposal. The city generates over 1100 tons of solid waste per day. In consideration of this, the current study employed the strengths, weaknesses, opportunities, and threats framework called SWOT analysis to critically examine the city's current methods for the management of municipal solid waste to provide more effective policy solutions. For conducting the analysis, the questionnaires and other interviews were conducted to gather information from households and officials in the city, and the observation made during field visits were recorded. The analysis shows that the waste management issue is getting worse for a variety of causes, including a lack of regulatory enforcement, insufficient technical and financial resources, insufficient people's participation, inadequate execution of policies, a lack of political priorities, and poor coordination between authorities.

Keywords: Solid Waste, Sustainable, SWOT, Urbanization

RESUMEN

In developing countries, solid waste is typically disposed of inappropriately, which has a negative impact on the environment and healthcare. One of the most serious environmental issues is the management of municipal solid waste because of the huge increase in waste generation brought on by industrialization, economic development, urbanization, and the exponential growth of Gurugram City's population. Municipal Corporation Gurugram (MCG)

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INTRODUCTION

Municipal solid waste management primarily entails the generation, segregation, collection, transfer, and disposal of MSW. It is carried out with the help of the central government, city municipalities, and households (Chen, 2010). Sorting MSW into recyclables and other categories at home is the responsibility of households. Additionally, households should separately and at a specific time throw recyclables and other waste into the containers. Local administrations oversee the waste bins, transferring waste generated on-site, processing bio-degradable waste, and disposing of other waste. The design and planning of suitable environmental policies and initiatives are under the purview of the central government. However, MSW management is becoming more problematic owing to several factors, including inadequate financial and technical capability, insufficient infrastructure, unsustainable land use, inadequate policy, and a lack of regulatory enforcement (Kumar et al., 2009).

Increased living standards, industrialization, and urbanization all contribute to an increase in the complexity and volume of municipal solid waste generation (Gupta et al., 2015). MSW typically consists of biodegradable waste (food crumbs, paper, textiles, cardboard, and yard waste), partially biodegradable waste (Disposable cutlery, sludge, and wood), and non-biodegradable waste (Electronic waste, plastics, dust, leather, ash, rubber, glass, and metals). As per government agency reports, about 420 lakh tons of municipal solid waste, or 1.15 lakh tons per day (TPD), are generated annually in urban India, with 423 Class-I cities contributing 83,378 TPD of that total. Many researchers have changed in recent years and now use decision support methods to develop MSW management systems. One of the tools created to be utilized in the first stages of decision-making and as a predecessor to strategic management planning on the other is a SWOT (Strength, Weakness, Opportunity, Threat) analysis. It is a technique for analysis designed to find opportunities and strategies for successfully implementing MSW management. To identify variables that contribute to poor management, the study's purpose is to assess the current MSW management methods in Gurugram City.

MATERIAL AND METHODS

Study area: Gurugram is located in the Haryana state. It is most well-known for being India's millennium city. It is one of the major cities in the National Capital Region. It is situated at 77° 02' E longitude and 28°45' N latitude. The city is divided into 35 wards with a total size of 314 sq. km. From a population of 0.8 million in 2011 to more than 1.8 million in 2021, the city has seen phenomenal development (MCG Reports). Due to the city's enormous urban growth during the past 20 years, factors include population increase, immigration, and unplanned urbanization. Gurugram is administratively divided into four zones: Gurugram south, Gurugram north, Gurugram west, and Gurugram east (Fig. 1). 1936 sanitation employees, both permanent and contract, oversee managing the solid waste (Table 1).

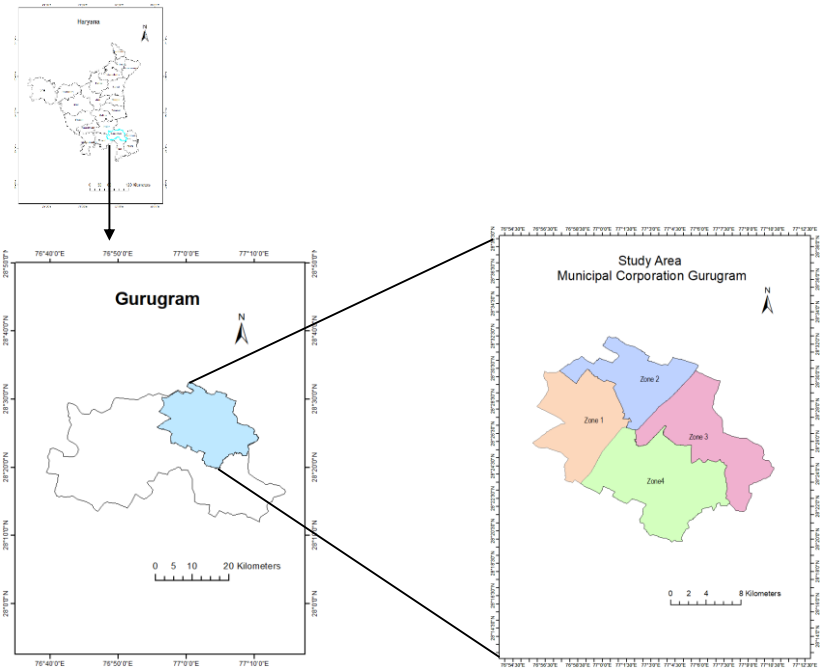

Fig 1: Study Area

Objective: The study's main objective is to make a SWOT analysis for sustainable municipal solid waste management in Gurugram city.

Database and methodology: To determine the desired strategies for managing MSW in Gurugram City, a SWOT analysis is conducted. It evaluated which internal and external components are crucial for reaching the goal. The factors are:

Internal factors: The management is informed of the internal factors' strengths and weaknesses.

External factors - The threats and opportunities posed by the external environment.

Proposing policy recommendations based on the SWOT analysis.

SWOT Analysis: An important approach given by the United States Environmental protection Agency regarding waste management practices of an area is the SWOT model. This model helps to identify the positive and negative factors that could help to identify the effect on the management practice of an area (Srivastva et al., 2005). This method was used to assess the advantages and disadvantages of solid waste management techniques in Gurugram City. In the SWOT technique, various factors are used for identifying their impacts like strengths, weaknesses, opportunities, and threats of the program or other associated activity. For conducting a SWOT analysis, the questionnaires and other interviews were conducted to gather information from households and officials (Municipal Corporation Gurugram) on waste management practices in the study area, and the observation made during field visits were recorded.

RESULTS AND DISCUSSION

Table 1. Current Worker's Availability of SWM in Gurugram City

Sr. No.	Activity	No. of Workers
1.	Door to Door Collection	1206
2.	Transportation	200
3.	Processing	460
4.	Disposal	70
	Total	1936

Source: Report of Municipal Corporation Gurugram, 2021

Status of MSWM in Gurugram City: The primary causes of waste generation in Gurugram are urban expansion, rapid population growth, and changes in consumer patterns. According to MCG, municipal solid waste generated in the city was 525 tons/day (2011) and 1100 tons per day in 2021. In 2021, the daily average generation rate of solid waste was 0.58 kg/person.

Fig. 2: Unsegregated waste near landfill site

Fig. 3: Garbage Mountain and collection vehicles moving

Table 2: Zone-wise Waste Generation in Gurugram City

Sr. No.	Area	Waste quantity (tons/day)
1.	Zone I	370
2.	Zone II	230
3.	Zone III	310
4.	Zone IV	190
	Total	1100

Source: Municipal Corporation Gurugram, 2021

Municipal solid waste (MSW) has different qualities that vary by place. MSW was collected from households door to door and in containers at designated locations. MSW is transported to the disposal site after being collected. Sanitary landfilling is the predominant way of managing MSW in Gurugram.

Table 3: Composition of Urban Solid Waste at Gurugram

Sr. No.	Category of Material	Old Gurugram	New Gurugram	Overall Gurugram
1.	Paper	7.505 ± 1.612	6.857 ± 2.545	7.246 ± 1.355
2.	Plastics	13.730 ± 1.142	10.872 ± 2.127	12.587 ± 1.095
3.	Metal	1.223 ± 0.331	0.674 ± 0.327	1.003 ± 0.242
4.	Glass	1.074 ± 0.304	0.872 ± 0.489	0.993 ± 0.258
5.	Organics	28.747 ± 3.866	38.618 ± 8.989	32.695 ± 4.210
6.	Others	47.722 ± 4.691	42.108 ± 7.048	45.476 ± 3.900

Source: The Energy and Research Institute (TERI) Report 2019

SWOT analysis of municipal solid waste management practices: An action plan for the management of municipal solid waste in Gurugram city was developed using the SWOT analysis. It sought to pinpoint both internal and external factors that would affect the planned MSWM program. Since their conclusions were applied to subsequent strategic planning initiatives, the factors are precise and evaluative (Srivastava et al., 2005). It can include some SWOT implementation advantages and disadvantages as well as the requirements that motivate the process. Some potential actions should be considered while considering SWOT factors:

Ecological actions: Increasing environmental education and consciousness, making consumers and citizens more aware, developing legislation to conserve natural resources, and reducing environmental contamination such as water, air, and soil pollution.

Social actions: Establishing public participation for effective MSW management, creating policies to increase public awareness, enhancing effective communication, and making connections between the government and the community for MSW management.

Economic measures: Establishing guidelines for material recycling, reducing costs using recycled materials, creating advertising campaigns, and setting up recycling waste collection stations.

Strategical actions: Enforcement of the SWM Rules, 2016; qualification of businesses (producers, distributors, importers, and retailers) to meet community demands; collaborations between the government and businesses aforementioned above that permit the collecting of recyclable waste at an appropriate price and efficiency; and promotion of incentives for businesses.

The Municipal Corporation of Gurugram (MCG) is the principal organization in charge of managing the area's municipal solid waste, which includes the storage, collection, and transfer of waste to the landfill site and processing facility. In Bandhwari village, Gurugram city has a 30.5 acre landfill that was built in 2018. Fig. 4 depicts the solid waste management system of the city as it now exists. The study used SWOT analysis to find flaws in the current municipal solid waste management procedures and suggest improvements.

Strength: M/s Ecogreen Energy Gurgaon Pvt. Ltd. provides door-to-door waste collection and transportation services. From three transfer stations and 36 secondary collection points at the Bandhwari dump site, this agency transfers all MSW in the city.

Waste is collected door-to-door, and residents (4.21 lakh households) pay fixed user fees; this reduces the financial load on MCG for door-to-door collection. In addition to MCG, several other groups, including Resident Welfare Association (RWA) and Haryana Urban Development Authority (HUDA), are involved in the management of MSW. This public-private partnership helped to relieve some of the landfill's congestion.

Weaknesses: Lack of source segregation has implications on MSW's composition. According to the MSW's physical nature, more than 30% of the waste fraction was organic and could be converted into compost to improve soil fertility. For season-specific leaf waste (urban forestry), there wasn't any unique arrangement or treatment option available. Lack of a distinctive monsoon management strategy to stop the addition of moisture to waste at the Bandhwari dump. The miscellaneous portion of municipal solid waste (40 tons per day), which mostly consisted of household hazardous waste and E-waste, received little attention.

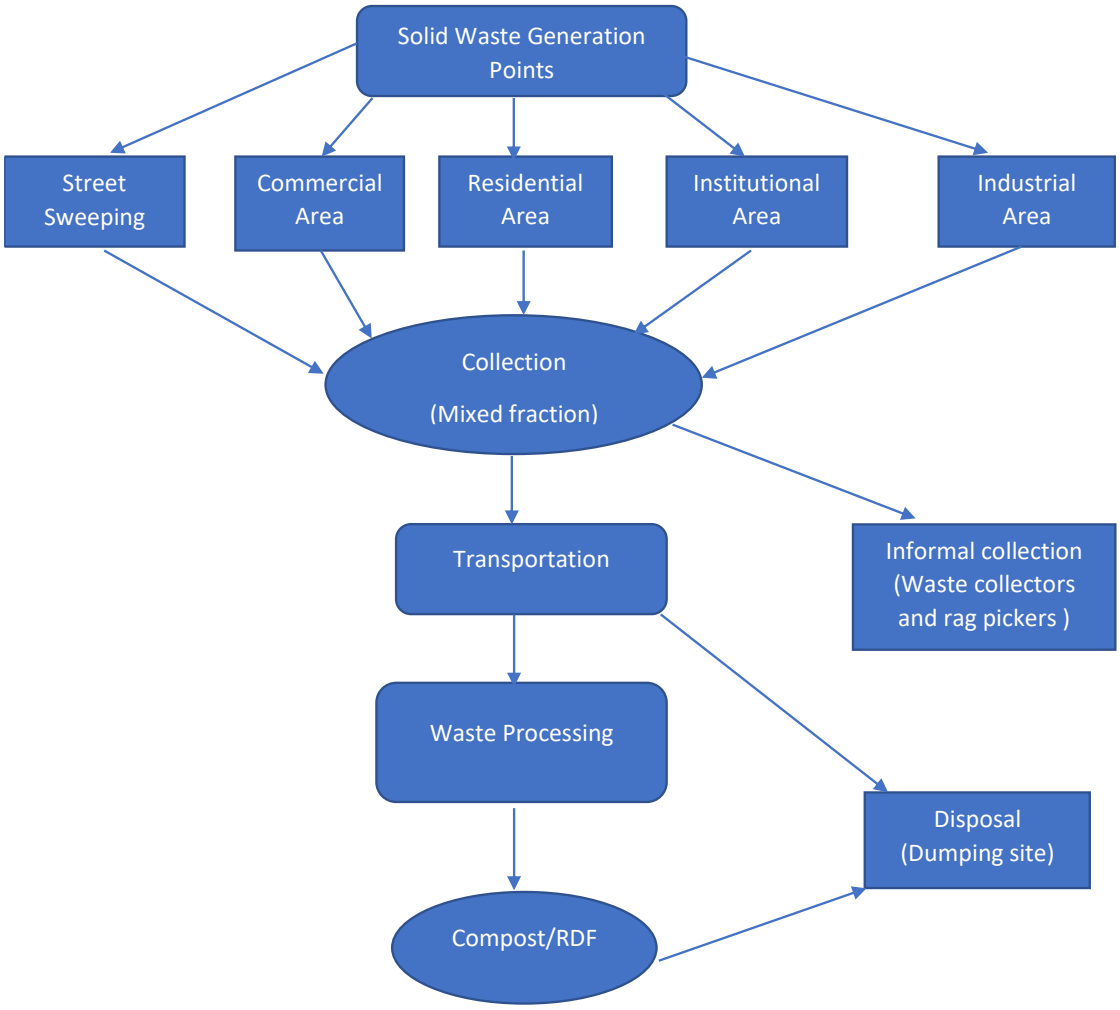

Fig. 4: Existing Municipal Solid Waste Practices in Gurugram

Opportunity: The Indian city Gurugram is referred to as the "Millennium City." The city can serve as an example of complete adherence to India's MSW Management Rules, 2016. The analysis concluded that the processing area and landfill site's waste-to-energy capacity should be expanded based on the classification of MSW. The capacity might be determined based on various economic group sectors, and families should be encouraged to establish in-house composting facilities. Municipal solid waste that has been separated at the source may be easier to manage and treat in less expensive. It could be possible to establish a recycling center, especially for waste. A key role might be played by the media, residents' welfare associations, NGOs, and educational institutions.

Threats: One of the main threats that decreased the total energy content of solid waste is the mixed fraction of waste and various waste-related laws and policies are not being implemented effectively. Numerous waste-related legislation and programs are poorly implemented. Waste handlers are unaware of the risks to their health at work. Leachate, landfill gases, and odors from the open dumping site all cause environmental contamination.

CONCLUSION

Economic development, unplanned urbanization patterns, and material consumption considerably enhance the MSW generation rate in any city. The poor waste management strategies and unscientific disposal system were responsible for the increased open dumping of MSW in Gurugram city. It could lead to the perpetual degradation of soil and overall environmental quality.

The SWOT analysis is a useful tool for identifying the potential solutions and strategies for putting MSW management into practice. All activities that have an impact on the management of MSW are evaluated systematically as part of the SWOT analysis.

The SWOT analysis in this study included both the positive and negative issues of MSW management. Some potential measures, such as those related to the environment, society, economy, and strategy, were determined after considering all the variables of weaknesses, opportunities, and threats, as well as strengths.

Specific strategies, new management methods, and policies for public participation and awareness are some of the suggested courses of action.

According to the study's findings, even if Gurugram's current solid waste management strategy is functional, it might not eventually prove to be effective from the perspective of a sustainable city. To reduce the load of solid waste generated in the city and, to a lesser extent, to lessen the mounting strain on natural resources, solid waste might be used in the production of compost and energy. As a result, the PPP mode should be more actively involved in strategic decisions about the successful execution of MSW management rules, 2016 and according to the Environment Protection Act 1986.

Only if the community gets involved with the government can alternatives to the existing procedures be feasible.

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