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Gap analysis of the municipal solid waste management system in Ara City, Bihar

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Abstract---Ara city faces significant waste management issues due to its growing population and inadequate waste transportation system. The study aimed to identify gaps in current solid waste management practices and propose solutions. Results showed that waste segregation is absent in households in selected wards, and only 60% of each ward is under door-to-door collection services. Open dumping on roadsides, vacant places, sewers, and drains causes environmental and health hazards. The secondary waste collection system is inadequate, with poorly distributed and poorly designed bins not synchronized with the primary collection system. Ara generates a large proportion of organic waste, accounting for over 70% of total waste, which is directly disposed of in open dumping sites without processing or treatment. The existing dump site does not meet the criteria set by SWM Rules 2016, and integration between communities, the private sector, and urban authority could make current waste management practices feasible. Proper training and ethical awareness should be provided to driver staff, and further analysis, like the budgetary cost of every ton of waste from the waste generation site to a landfill site, is needed.

Keywords---Waste management, Open dumping, Organic waste, Secondary waste collection.

Introduction

One of the main concerns for urban planning and an integrated sustainable solid waste management system in Ara Municipal Corporation is the development and implementation of municipal solid waste management initiatives. Tanskanen (2000) asserts that the achievement of solid waste management's sustainable goals depends on the use of suitable techniques and management systems. However, failure to meet the integrated sustainable solid waste management objectives would result in a gap between the present and anticipated levels of sustainable solid waste management.

Gap analysis and strategy formulation is the process of developing a framework that helps identify the management situation as it is currently, the intended goals for the future, and the best course of action (measure to achieve such goals). The difference between the intended goals and the existing state is considered a gap, and the measure that would be changed to accomplish such goals is considered a strategy. Scientific disposal, recycling, environmental education, public involvement, substantial public awareness, financial help, and actual effect evaluation are some of the proposed solid waste management methods to enhance solid waste management, the environment, and human health. Sustainable solid waste management encompasses reusing, reducing, and recycling garbage and eco-friendly sorting, collecting, transportation, and disposal (Chen, 2010). Local governments establish favorable conditions, waste generators are in charge of producing garbage, and the federal government develops and prepares sustainable environmental laws and initiatives. This strategy ensures appropriate garbage disposal in eco-friendly manners (Aydin Temel et al., 2018).

However, when such anticipated planning fails due to various reasons, such as inadequate infrastructure, lack of community involvement, public ignorance, lack of coordination, lack of financial and technical efficiency, and failure to enforce regulations and guidelines, a gap in SMSW management occurs (Kumar et al., 2009). To control MSW management operations, Indian cities should adhere to the MSW Management Rules 2016.

There is an array of gaps in the storage, collection, transportation, and disposal of municipal solid waste as a result of the infrequent adherence to this solid waste management guideline. To meet the integrated MSW management goal, it is imperative to develop and apply sustainable waste management techniques in order to address any existing inadequacies. The main goal of this study is to find flaws in the solid waste management systems that Ara Municipal Corporation (AMC) currently has in place by using the SWOT analysis.

Objective

To find out the gaps in the current solid waste management practices in Ara city & as suggested by CPHEEO (S.W. M. Rules, 2016).

Study Area

Ara city is situated between 25°33'24"N and 84°40'9"E in the Bhojpur district of Bihar. It is the capital of Bhojpur and is located near the confluence of the

Ganges and Sone rivers. As of the 2011 Census, Ara Municipal Corporation has 261,430 residents, comprising 138,804 males and 122,626 women. Ara City, which is divided into 45 wards, has 39,274 households. Ara is the largest city in the Bhojpur district in the state of Bihar. A total of 110 tons of solid trash are produced daily from all 45 wards in Ara city, with dry, liquid, and hotel and food wastes accounting for 60, 40, and 10 percent of the average daily solid waste output of 0.450 kg per person. With the help of 1212 municipal personnel, Ara Municipal Corporation is handling the mentioned volume of solid trash collectively (AMC, 2024).

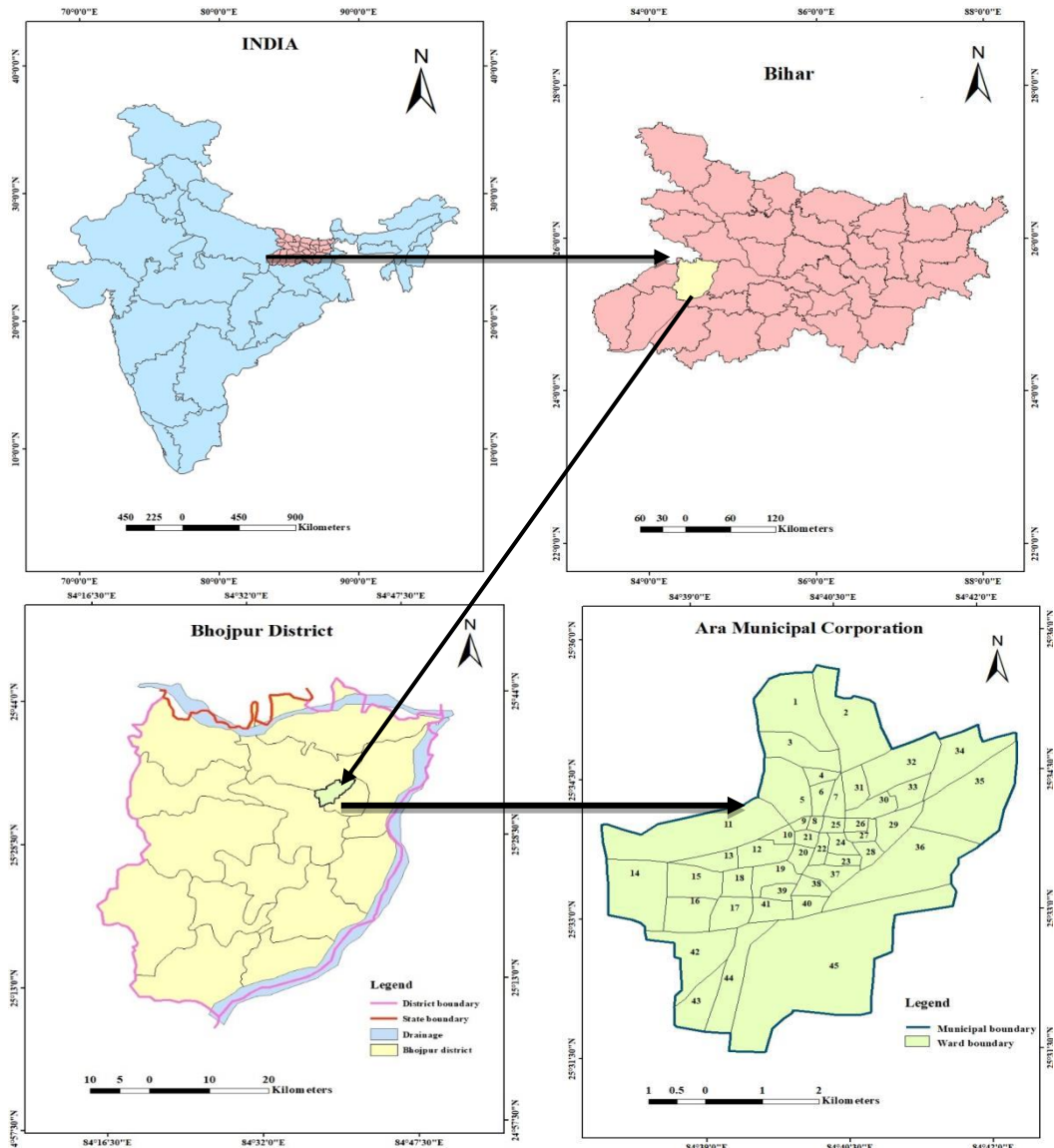


Fig.1: Study area

Source: Prepared by researcher based on Census of India, 2011

Database and Methodology

The present study is based on secondary and primary sources of data collected from different published and unpublished records from concerned departments and institutions such as the Ara Municipal Corporation development authority and the state pollution control board. Data related to the secondary waste collection system and solid waste disposal and transportation have been collected from the Ara Municipal Corporation. The status of household waste storage & waste segregation at the source of the partial primary collection system of waste at the doorstep regarding data has been collected from a field survey. SWOT analysis will be used for identifying the gap in solid waste management.

Result and Discussion

Salient Features of Solid Waste Management Rules, 2016 Segregation of Waste and Door to Door Collection

The MSWM regulations of 2016 mandate all waste producers, including resident welfare organizations, market associations, institutions, hotels, restaurants, event planners, street vendors, and gated communities larger than 5000 square meters, to separate and sort their waste into three categories: dry or non-biodegradable waste, household hazardous waste, and biodegradable waste. They have a year to manage the garbage with the assistance of urban local bodies. Biodegradable waste must be processed through composting, recyclables must be given to approved recyclers, and segregated waste must be gathered in different bins. Urban municipal authorities or waste collectors must separate garbage before collection. Events with more than 100 attendees cannot be arranged without separating material at the source and turning it over to approved waste pickers. Waste producers must separate home waste from horticultural and garden waste and dispose of it on their own property. Door-to-door waste collection is the system for collecting solid garbage from residential and commercial properties, while municipal bodies are responsible for daily trash collection from vegetable, fruit, fish, flower, meat, and poultry markets.

Collecting and Disposing Off Sanitary Napkins

India's urban population is adopting more and more modern health and hygiene goods, which is increasing the amount of sanitary waste, such as diapers and pads. Manufacturers of sanitary napkins are now required by new regulations to supply pouches or wrappers for appropriate disposal in order to alleviate this problem. Additionally, waste producers are required to keep these wastes in non-biodegradable containers and dispose of them in the pouches or wrappers that the manufacturers provide.

User Charges and Spot Penalties

New waste management regulations are being implemented by Indian urban local authorities, which mandate that trash generators cover the costs of garbage collection, sorting, processing, and disposal. The amount may be determined by the authorities as "user fees." It is illegal for waste producers to bury, burn, or

leave trash in public areas, roadways, sewers, or bodies of water. 'Spot Fines' can also be applied for burying, burning, or littering created garbage. Additionally, local authorities are instructing street sweepers to keep tree leaves separate before delivering them to approved garbage collectors and to refrain from burning them.

Non-Biodegradable Packaging Waste Collection System and Bins for Street Vendors

Urban solid waste composition has shifted due to changing consumption patterns and lifestyle changes. Online shopping platforms like Zomato and Swiggy are delivering packaging for food, while retailers like Flipkart, Meesho, Amazon, Ajio, and Myntra provide daily product packaging. This leads to a significant volume of non-biodegradable and eco-friendly packaging materials. New regulations require brand owners to collect back these materials to prevent littering.

Urban street vendors are now required to store waste, including food and leftovers, in designated containers. Local bodies must ensure vendors dispose of their waste at designated locations. ULBs must also provide covered storage for temporary street sweepings and silt, aiming to improve trash management and reduce littering in metropolitan areas.

Rules for the Processing and Treatment of Waste

The new rules require waste producers to process, treat, and compost biodegradable trash on their land. On the recommendation of urban authorities, any leftover rubbish must be turned over to trash collectors or other organizations. Recycling and recovery facilities must occupy at least 5% of the area in parks, industrial estates, and Special Economic Zones (SEZs). In order to keep up with India's steep up population, which India's urban population is adopting more and more modern health and hygiene goods, which is increasing the amount of sanitary waste, such as diapers and pads. Manufacturers of sanitary napkins are now required by new regulations to supply pouches or wrappers for appropriate disposal in order to alleviate this problem. Additionally, waste producers are required to keep these wastes in non-biodegradable containers and dispose of them in the pouches or wrappers that the manufacturers provide.

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Secondary Storage Facilities Deposition Centers for Domestic Hazardous Waste

Local governments should establish secondary storage or material recovery facilities and encourage waste pickers and collectors to separate recyclables from waste producers. Different waste streams should have their own bins, with biodegradable garbage in green bins, recyclables in white bins, and other waste in black bins. Urban authorities should establish waste deposition centers for safe household hazardous waste disposal, notifying residents when generators should be delivered. Each center should cover twenty square kilometers. er to support the construction, operation, and maintenance of solid waste processing facilities and associated infrastructure, Urban Local Bodies (ULBs) must employ suitable technologies, such as waste-to-energy processes, microbial composting, vermicomposting, anaerobic digestion, and bio-methanation.

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Rules Regarding Landfills

Landfill sites must be 500 meters from important infrastructure, rivers, ponds, and airports, according to new guidelines outlining the procedure. Landfills should only be used for non-recyclable, non-biodegradable, non-combustible, non-reactive inert garbage and leftovers from waste processing plants. They should also be located in plain regions. Thermal power plants and cement should employ high-calorie wastes. In addition to building, running, and maintaining landfills, Urban Landfills (ULLs) are required to look into possible bio-mining and bio-remediation.

Incorporating Ragpickers and Waste-Pickers and Creating Self-Help Organizations

Urban local governments must develop a mechanism to identify informal waste-pickers and trash collectors and promote their involvement in SWM, including door-to-door garbage collection, according to the new recommendations. Urban local governments also need to encourage the formation of self-help groups and foster collaboration in solid waste management, which includes door-to-door garbage collection.

Guidelines for Urban Local Bodies and Establishment of Monitoring Committee

The MSW Rules, 2016, recommend that urban local bodies establish bylaws for proper waste management and segregation, involve communities in waste management, and promote home composting through educational campaigns. The Department of Fertilizers and the Ministry of Chemicals should provide market development assistance on city compost and promote co-marketing with chemical fertilizers. Public awareness should be created through information, education, and communication campaigns, educating waste generators on litter prevention, waste reuse, waste segregation, storage, handover, home composting, and paying monthly fees to waste collectors. A central monitoring committee will ensure the effective application of regulations.

The Gap in Present Status of Solid Waste Management in Ara City

The current study attempts to analyze the gaps between the level of management that is advised by the Government of India's CPHEEO and the current state of the municipal solid waste management systems in the study area by conducting a field survey and empirical observation of the current solid waste management systems in the study area. Based on the opinions of respondents and municipal workers collected through field surveys and SWOT analysis, the methodological principles used for this analysis aim to identify important gaps in solid waste management and develop strategies to fill them in order to incorporate municipal solid waste management in the study area.

Status of Household Waste Storage & Waste Segregation at Source

For effective solid waste management, household garbage storage is essential. However, the majority of homes, companies, and enterprises discard their trash on roads, sewers, and water bodies rather than storing it at the source. Diseases are brought on by rats and stray animals drawn to this trash. Littering behaviors, public awareness, motivation, and unwillingness to change are all blamed for the absence of home garbage storage. Due to distance, people frequently refuse to dispose of their garbage in community bins, and they are not adequately dispersed. Furthermore, there are no stringent municipal regulations or penalties, which leads to inefficient trash management. Because people are unaware of the negative effects solid waste segregation has on the environment, barely 15% to 20% of people in Ara City participate in this practice. There was very little segregation in the selected wards, according to a survey. The city offers ten dumper placers and fifty containers for the storage of waste, and several kinds of vehicles are utilized for delivery. However, there aren't enough vehicles accessible for collection, transportation, and disposal because of the city's population, which suggests that future demand criteria are necessary.

Partial Primary Collection System of Waste at the Doorstep

Primary trash collection is the most important component of SWM services that is significantly underused in the research region. The city has an outdated and inefficient rubbish collecting system. According to the MSW Rules of 2016, AMC must pick up the segregated waste from door to door. Because there aren't enough municipal workers to satisfy the demands of the city's population, Ara Municipal Corporation's primary solid waste collection system is incredibly unorganized. Only 50 to 60 percent of the city's areas—32 of the 45 wards—use door-to-door collection. Only high-income homes and a tiny percentage of middle-class families have access to it; the primary collecting method mainly ignores low-income family regions and slum pockets. In several wards, including 07, 08, 09, 10, 21, 22, 23, 25, 26, 27, 31, 37, and 38, door-to-door garbage collection services are either nonexistent or inadequate. The construction of a primary rubbish collection system for commercial enterprises, as well as for the markets for fruits, vegetables, meat, and fish, has not been undertaken by the local administration. The mandatory rules and penalties that significantly alter the principal waste collection method are not well enforced. The street bins provided by AMC are often used by the public to dispose of their trash. People often toss trash into the streets, while sanitary workers periodically sweep the streets to pick up waste.

Collection and Disposal of Sanitary Napkins

Since sanitary napkins are made of plastic, which is not biodegradable and endangers both human health and the environment, disposing of sanitary waste has become a major problem in the city. The damage is exacerbated by the city's chaotic municipal solid waste management procedures and inadequate community collection, disposal, and transportation systems. Except in a few rare cases, solid waste management is not carried out in Ara in compliance with the stipulations of the SWM Rules, 2016. It is impossible to gather sanitary napkins

from households or other places using any method. Sanitary napkins and infant diapers are dangerously disposed of by the people of Ara city, who toss them unwrapped into fields, sewers, roads, or near to dustbins and other abandoned locations.

Secondary Waste Collection System

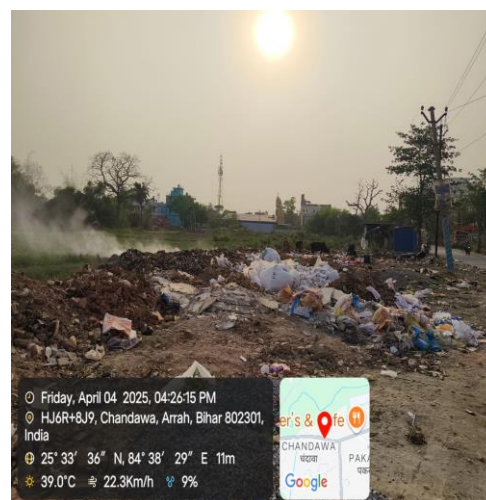
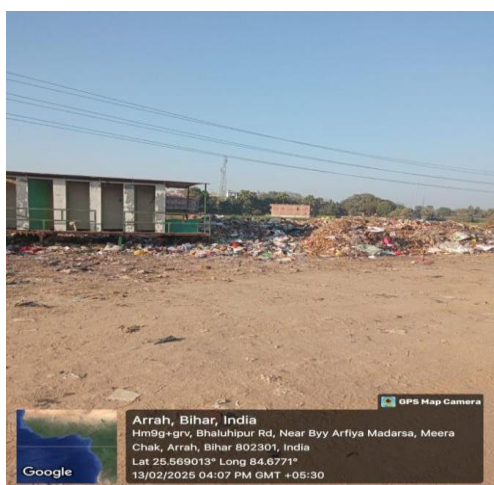
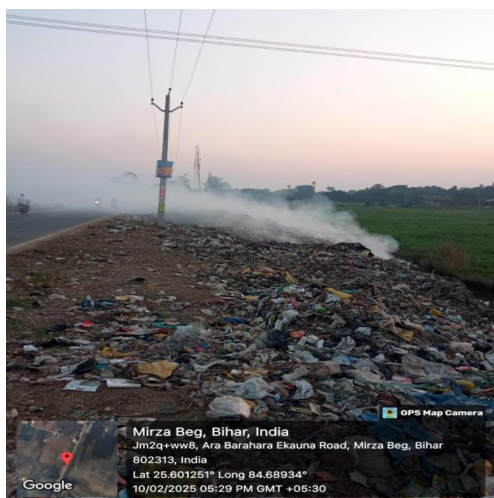
Trucks, tractors, and dumpers are used in the secondary garbage collection system in the AMC region to collect solid waste from homes and businesses. After that, the garbage is sent to secondary collection locations, which are spread over 45 city wards. There are several open dumps that are positioned at random intervals and just 48 iron containers. Waste is collected from these locations by municipal trucks, which then deliver it to unapproved disposal locations. Containers are spaced 1.5–2 km apart on average. Rubbish collection from these locations is not always efficient; occasionally, rubbish is removed after a week. During festival seasons, garbage from containers is collected once or twice daily. Many wards have overflowing dustbins, which causes rubbish to spread and become an annoyance.

Existing Problems of Transportation of Waste

Ara city is grappling with an inefficient and unhygienic waste transportation system, using dumpers, tractors, and open trucks. The city's survey reveals uneven waste collection points and bin shortages. The Ara Municipal Corporation faces challenges in setting up new collection points due to pressure to shift or abolish existing ones. Temporary collection points are established at the ward level. Vehicles are poorly maintained, leading to frequent breakdowns and long-term outages. Fuel distribution is based on assumed trips, with fewer regular operators than required. A cumbersome procurement system makes spare parts unavailable. Municipal transport vehicles are not frequently covered from the upside, violating Supreme Court guidelines. Improper loading often leads to garbage overflows. The waste transport vehicles travel on crowded roads, causing storage of solid waste to remain for three to four days, causing bad odors.

Disposal of Solid Waste

The last phase of solid waste management is disposal, when all garbage is gathered and taken to landfills outside of Ara City that are neither approved nor scientific. Solid and semi-solid wastes, such as drainage materials and sludges from municipal garbage, require proper disposal strategies. For garbage that cannot be reduced, recycled, composted, burned, or subjected to additional processing, an effective solid waste management system must offer ecologically friendly disposal choices (Ali et al., 1999). Dustbins, open dumping sites, drains, and roadways are just a few of the locations from which solid waste is collected and moved, both manually and automatically. The inability to properly dispose of the city's trash has resulted in the establishment of temporary, non-scientific dumping sites in outlying regions such as Buxar-Bihiya Road, Majhauan Bandh, Laxmanpur Mathwalia Road, Chandwa Bandh, Dhanupara Bypass Road, and Mirachak near the Gangi River Band.



Source: Shot by the researcher, 2025Photo Plate 1: Unscientific waste disposal along the roads in Ara city

SWOT Analysis for Identifying the Gap in Solid Waste Management Practices in Ara

Using a SWOT analysis, the study examines Ara Municipal Corporation's solid waste management procedures. In order to pinpoint areas that require development, the study focuses on strengths, weaknesses, opportunities, and threats. According to the report, Ara's waste management has a number of flaws, such as inconsistent collection, delayed clearing, a lack of personnel, a lack of funding, unequal dustbin distribution, individuals becoming unconscious, waterlogging, open dumping, and uncontrolled incineration.

The installation of compactors, compost plants, trash segregation at the source, night collection, and nearly 100% collection efficiency, on the other hand, are the advantages of Ara's current waste management programs. The SWOT analysis has been modified to emphasize Ara Municipal Corporation's advantages, the shortcomings of the current waste management system, the risks associated with improper waste management, the main obstacles to Ara's waste management, and areas for development (table 1). According to the study, attaining Ara's sustainable waste management objectives is a difficult task, but it is achievable with the right strategy.

Table 1: SWOT Analysis for Solid Waste Management in Ara city

INTERNAL FACTORS	
STRENGTHS	WEAKNESSES
❖ Local administrations are aware of their obligations on waste management. ❖ Local administrations have established environmental units headed by a local executive committee member ❖ Local administrations have designated waste disposal sites ❖ Local administrations are increasingly investing in waste management systems and equipment ❖ Local administrations are aware of the existing environmental laws ❖ Adequate number of active employees ❖ Regularity of Sweeping services ❖ Regular waste collection ❖ Financial Availability	❖ Lack of segregation of waste at source ❖ Low priority to waste management ❖ leading to low budgetary allocations ❖ Inadequate trained personnel ❖ Poorly managed disposal sites ❖ Inadequate/ poor maintenance of machinery and equipment ❖ Inappropriate location of disposal sites ❖ Poor public perceptions/ attitude on individual responsibility towards waste management ❖ Tolerant towards dirty environment ❖ Intolerance to the establishment of new waste management facilities by potential host communities ❖ Poor infrastructure in informal sector ❖ Settlements hindering waste collection ❖ Land grabbing of land set aside for dump sites ❖ No modern waste management facility developed to date e.g. Sanitary landfill ❖ More than 50% of the waste fraction

	are organic and being dumped unscientifically without segregating them which increases the unwanted loads and nuisance. ❖ Absence of active sanitary landfill and recycling units. ❖ Lack of participation of public in waste segregation. ❖ Lack of latest tools & technology for waste collection and transportation. ❖ Low quantity of recyclable and compostable products available to consumers (product and packaging alternatives controlled by producers and manufacturers)
EXTERNAL FACTORS	
OPPORTUNITIES	THREATS
❖ Increase involvement of the private sector ❖ Employment opportunities in waste management through diverse waste-based enterprises (waste as a resource by recovery) ❖ External financial resources from development partners and investors ❖ Investment opportunities in recycling, energy recovery, composting, incineration ❖ Adoption of emerging technologies in waste management ❖ Increased public awareness on waste management and related opportunities ❖ Opportunity to implement the existing environmental regulations	❖ Dealing with the environmental issues and human health due to existing unscientific dumpsites. ❖ Conservative/Municipal Workers are prone to number of health risks. ❖ Water Logging issues. ❖ Uncovered Vats and Drains. ❖ Unawareness. ❖ Complex waste composition. ❖ Over burdening of unauthorized disposal grounds. ❖ Open Burning. ❖ Incorrect disposal of wastes.

Source: Computed by researcher based on primary survey, 2025 and Ara Municipal Corporation, 2024

It is difficult but not impossible to find an expedient alternative to Ara's reliance on unlawful and improper dumping sites for garbage disposal. Sustainable waste management is actually a dynamic process that, once completed, doesn't require any more modifications. Rather, it is completely adaptable and may change according to the needs of space, time, and location. The goal is to modernize the policies pertaining to waste management. Nonetheless, every consideration must be given to the current situation, and a strategy must be created to accommodate

it. Establishing a sustainable waste management plan is partially the responsibility of the municipality, but citizens should take an active role in the process as well. Only community engagement at each level of the hierarchy will be highly beneficial for sustainable waste management. There should be mutual understanding between the government and the citizens.

Conclusion

The study finds that households in particular wards do not practice waste segregation because of a lack of motivation, public awareness, and understanding of the need to use separate bins for recyclables, as well as negative attitudes toward waste segregation and a lack of strict regulations and legal recourse from the municipality. As a result, recyclable items end up piling up in bins and landfills. Strict legislation to enhance garbage collection is not being implemented, nor is there enough oversight. 60% of each ward is now covered by door-to-door collection services, despite AMC being required by the MSW Rules 2016 to conduct door-to-door collection of segregated trash. Serious environmental and health risks, such as odor and sight pollution and the spread of illnesses including malaria, dengue, and filariasis, are brought on by open dumping on roadsides, vacant lots, sewers, and drains. The city's secondary garbage collection system is insufficient, with poorly constructed and dispersed containers that are not in sync with the primary collection system. The city's garbage transportation infrastructure is currently insufficient, unclean, and inefficient. Approximately 70% of the garbage generated in Ara city is organic waste, which is dumped in open areas without any kind of processing or treatment. Because the current dump site is low-lying and covered in sandy clay loam to loam soil, it does not satisfy the requirements outlined in the SWM Rules of 2016. Current trash management techniques may become viable with community, private sector, and urban authority integration.

References

- Ali et al. (1999). Public sector delivery of waste management services: cases from the Indian Sub-Continent. *Habitat International*, 23 (4), 495-510, [https://doi.org/10.1016/S0197-3975\(99\)00023-5](https://doi.org/10.1016/S0197-3975(99)00023-5). (<https://www.sciencedirect.com/science/article/pii/S0197397599000235>)
- A M C (2024). Arrah Municipal Corporation, Arrah, Bhojpur.
- Aydin Temel et al. (2018). The SWOT analysis for sustainable MSWM and minimization practices in Turkey. *Global NEST Journal*, 20 (1), 83-87.
- Census of India (2011). Primary Census Abstract, Census of India, 2011.
- Chen, C., C. (2010). Spatial inequality in municipal solid waste disposal across regions in developing countries. *Int. J. Environ. Sci. Technol.*, 7, 447-456. <https://doi.org/10.1007/BF03326154>.
- CPHEEO (2016). Swachh Bharat mission municipal solid waste management manual- part I: the manual, ministry of urban development.
- Kumar et al. (2009). Assessment of the status of municipal solid waste management in metro cities, state capitals, class I cities, and class II towns in India: An insight. *Waste Management*, 29 (2), 883-895, <https://doi.org/10.1016/j.wasman.2008.04.011>. (<https://www.sciencedirect.com/science/article/pii/S0956053X08001529>).

Tanskanen, J. H. (2000). Strategic Planning of Municipal Solid Waste Management. *Resources, Conservation and Recycling*, 30, 111-133.
[https://doi.org/10.1016/S0921-3449\(00\)00056-2](https://doi.org/10.1016/S0921-3449(00)00056-2)