International Journal of Science and Research Archive
eISSN: 2582-8185
Cross Ref DOI: 10.30574/ijsra
Journal homepage: https://ijsra.net/

(RESEARCH ARTICLE)

Check for updates

Solid waste management in Narhe Village: A case study

Niteen Madhukar Survase *, Sakshi Sandip Thorat, Manas Ramchandra Wani, Shweta Raju Bhargude, Pratik Prakash Kalaskar and Suraj Umesh Jagtap

Department of Civil Engineering, Sinhgad Institute of Technology and Science, Narhe, Savitribai Phule Pune University Pune, Maharashtra, India.

International Journal of Science and Research Archive, 2025, 15(03), 494-499

Publication history: Received on 20 March 2025; revised on 05 June 2025; accepted on 07 June 2025

Article DOI: https://doi.org/10.30574/ijsra.2025.15.3.1251

Abstract

This case study examines the current state of solid waste management (SWM) in Narhe Village, a rapidly urbanizing area located in the Pune district of Maharashtra, India. The study focuses on the challenges, strategies, and solutions implemented by local authorities and communities to manage waste effectively. Narhe Village faces issues such as improper waste segregation, inadequate waste disposal infrastructure, and rising waste generation due to population growth. The research highlights the significance of community participation, public awareness programs, and government interventions in enhancing SWM practices. The study also delves into sustainable waste management practices, including composting, recycling, and waste-to-energy solutions, which have been gradually adopted in the village. It emphasizes the need for integrated approaches to improve waste management systems, promote environmental sustainability, and enhance the quality of life for residents. The findings offer valuable insights for other similar rural and semi-urban areas facing waste management challenges.

Keywords: Solid Waste Management; Waste Segregation; Recycling; Community Participation; Sustainable Solutions; Environmental Sustainability

1. Introduction

1.1. General

Solid Waste Management (SWM) is a critical aspect of urban and rural development, especially in rapidly growing regions. As rural areas like Narhe village in Maharashtra undergo significant transformations due to urbanization, population growth, and changing lifestyles, the need for an effective and sustainable waste management system becomes ever more pressing. In India, rural areas have traditionally been neglected in terms of waste management infrastructure, leading to environmental degradation, public health issues, and socio-economic challenges (Kumar & Kumar, 2017)

1.2. Solid Waste Management in Rural India

Solid waste in rural India is predominantly organic in nature, including agricultural waste, household waste, and food waste (Patel & Mulla, 2020). However, as urbanization spreads into rural areas, the waste composition is changing. Plastics, packaging materials, electronic waste, and construction debris are increasingly becoming common in rural waste streams, requiring new strategies and solutions (Sharma et al., 2018). Narhe village, situated on the outskirts of Pune, represents a unique case study of a rural area experiencing rapid urbanization. As the population increases and infrastructure develops, waste generation in the village has also escalated, putting a strain on the existing informal waste management systems.

* Corresponding author: Mr. Niteen M. Survase.

Inadequate infrastructure for solid waste management in rural areas is a persistent issue, contributing to unsanitary conditions and health hazards. The traditional methods of waste collection, such as open dumping and burning of waste, exacerbate environmental degradation and cause severe air, water, and soil pollution (Gurjar et al., 2018). Moreover, the lack of awareness among villagers about waste segregation and recycling makes it challenging to implement sustainable waste management practices (Chopra et al., 2017). Local authorities, while often equipped with limited resources, also struggle to establish and maintain comprehensive waste management systems in rural contexts (Srinivasan & Mishra, 2021).

1.3. The Importance of Solid Waste Management in Narhe

Narhe village, located on the southern edge of Pune, is undergoing rapid urbanization, with an increasing influx of migrants from nearby cities due to its proximity to Pune's IT hubs. This shift has significantly increased the volume and complexity of waste generated in the village. While urban areas in India have developed certain waste management systems, rural areas like Narhe often lack formal infrastructure, such as door-to-door waste collection, segregation at the source, or composting facilities (Saxena et al., 2019). In Narhe, like many other villages, waste collection is irregular, with waste sometimes being dumped in open spaces, creating unhygienic conditions and contributing to health hazards.

One of the most critical challenges is the inadequate knowledge and awareness regarding waste segregation and recycling. Despite policies like the Swachh Bharat Abhiyan (Clean India Mission), which advocates for waste segregation at the source, rural areas such as Narhe face considerable difficulties in implementation (Bansal & Joshi, 2017). The lack of local-level awareness programs, limited involvement from the community, and absence of a comprehensive waste disposal system all contribute to a rising waste management crisis.

However, the rapid urbanization and the growing awareness of environmental issues offer a unique opportunity for the implementation of improved waste management practices. Implementing community-based solutions, promoting waste segregation at the source, and introducing sustainable disposal methods like composting could significantly alleviate the waste management problem in Narhe (Sharma & Raghavan, 2020).

1.4. Scope and Significance of the Study

This study focuses on solid waste management practices in Narhe village, exploring the current systems in place, identifying gaps and challenges, and proposing solutions. Through this detailed case study, the research aims to assess the effectiveness of existing waste management practices and evaluate the role of community involvement and local governance in managing solid waste. The study also aims to provide recommendations for a sustainable, community-driven waste management model that could be applied to other rural areas facing similar issues. The findings from this study will contribute to understanding the complexities of solid waste management in rural India, especially in rapidly urbanizing regions. By analyzing the effectiveness of current systems, identifying challenges, and exploring sustainable alternatives, this research will provide valuable insights for local authorities, environmental NGOs, and policymakers. Furthermore, the study aims to generate awareness about the importance of sustainable waste management in rural India, thereby encouraging community participation and fostering a cleaner, healthier environment (Pati & Behera, 2020).

2. Literature Review

2.1. Challenges in Rural Solid Waste Management

According to Kumar and Kumar (2017), the rural waste management sector is severely underdeveloped, with waste often disposed of through open dumping or burning. These methods not only pose a risk to environmental health but also contribute to the deterioration of soil quality, water sources, and air quality. Waste segregation, which is crucial for recycling and resource recovery, is often nonexistent in rural areas, and waste is treated as a homogeneous mass (Kumar & Kumar, 2017).

Patel and Mulla (2020) argue that rural communities, especially those undergoing rapid urbanization, are typically unprepared for the increased waste burden. With the increasing influx of plastics, packaging materials, and electronic waste in rural areas, the traditional waste management systems are unable to cope with the complexity of modern waste streams. In rural areas like Narhe, organic waste, such as agricultural residue, is a predominant component of the waste stream, but the introduction of non-biodegradable items complicates waste management further (Patel & Mulla, 2020).

The lack of waste management infrastructure is exacerbated by limited financial resources and manpower at the local level. Gurjar et al. (2018) highlight the role of rural municipalities in managing waste; however, these institutions often

lack the technical and financial capacity to implement effective waste management programs. This is compounded by low levels of awareness and the absence of waste segregation practices among the local population, as emphasized by Sharma et al. (2018). In many rural areas, the lack of training programs on waste management and sanitation limits the ability of local communities to adopt proper waste management practices.

2.2. The Role of Community Participation and Awareness

Srinivasan and Mishra (2021) suggest that rural waste management systems that integrate local knowledge, engage community leaders, and encourage collective action are more likely to succeed. They argue that rural populations are often unaware of the impacts of improper waste disposal on health and the environment, leading to a lack of participation in waste segregation, collection, and recycling efforts. Therefore, building awareness and encouraging local participation are essential components of any successful waste management initiative (Srinivasan & Mishra, 2021).

Sharma and Raghavan (2020) also underscore the importance of community education in waste management, particularly in rural areas. Their study in rural areas of Kerala showed that introducing localized waste segregation systems, combined with awareness campaigns and training sessions, significantly improved community participation. This participatory approach not only fostered waste segregation but also promoted composting and the recycling of organic waste, leading to a cleaner environment and reduced waste volume. The success of such initiatives has been observed in other rural areas across India, where grassroots organizations, local panchayats (village councils), and NGOs have played a crucial role in raising awareness and ensuring community involvement (Sharma & Raghavan, 2020).

2.3. Innovative Waste Management Solutions in Rural Areas

Bansal and Joshi (2017) highlight the role of decentralized waste management systems, particularly composting and biogas plants, in reducing the volume of waste in rural areas. In areas like Tamil Nadu, composting organic waste and converting it into organic fertilizers has not only reduced waste accumulation but also provided an alternative source of income for local farmers (Bansal & Joshi, 2017). Additionally, biogas plants, which convert organic waste into biogas for cooking, have been successfully implemented in rural settings, particularly where agricultural residues are abundant.

Rani et al. (2021) argue that while the mission has brought about significant changes in urban areas, its implementation in rural India has faced challenges. Rural communities often lack the infrastructure and incentives to implement waste management practices, and the focus has primarily been on the construction of toilets rather than comprehensive waste management systems (Rani et al., 2021).

Chopra et al. (2017) point out that rural waste management systems that incorporate a combination of government policies, local initiatives, and innovative technologies are more likely to achieve sustainability. For instance, the introduction of plastic waste collection systems and mobile collection units in rural Maharashtra has led to a reduction in plastic litter, which is one of the fastest-growing waste components in rural areas (Chopra et al., 2017).

2.4. Health and Environmental Impacts of Poor Waste Management

Gurjar et al. (2018) emphasize that open dumping and burning of waste in rural areas contribute to air pollution, water contamination, and the spread of disease. Open burning of waste releases harmful chemicals, including particulate matter, carbon monoxide, and heavy metals, which pose significant health risks to residents, especially in rural villages where people often live-in close proximity to waste disposal sites. The impact of this pollution is particularly severe in rural India, where access to healthcare may be limited, and people often lack knowledge about the dangers of poor waste management practices.

Sharma et al. (2018) report that improper waste disposal also contaminates water sources, which are vital for rural communities. With many villages relying on wells, rivers, or ponds for drinking water, the leaching of chemicals and pathogens from improperly disposed waste can lead to waterborne diseases, particularly during the monsoon season. This is a significant public health concern in rural areas where sanitation infrastructure is often inadequate.

Environmental degradation due to poor waste management further exacerbates challenges related to agriculture. Saxena et al. (2019) suggest that waste disposal practices, such as dumping waste in open fields, reduce soil fertility and harm local ecosystems. The accumulation of waste in agricultural lands can prevent proper drainage, reduce soil quality, and even introduce toxic substances into the food chain.

3. Methodology

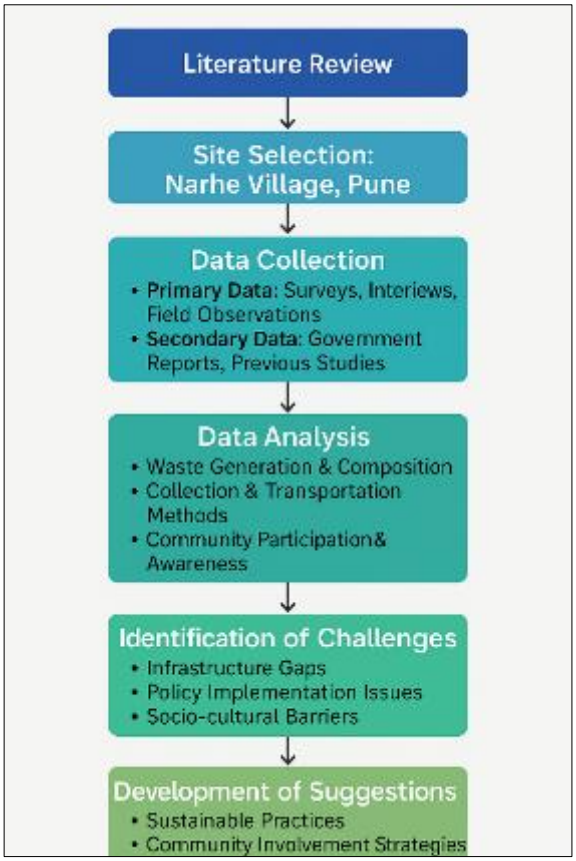

Figure 1 Methodology

4. Result and Discussion

The analysis of solid waste management practices in Narhe Village reveals a complex interplay of infrastructural, behavioral, and administrative challenges. The village generates an estimated 1.2 to 1.5 kilograms of waste per household per day, with organic waste comprising approximately 65%**,** followed by plastics (18%), paper (10%), and inert materials (7%). However, only 12% of households practice source segregation, indicating a significant gap in waste sorting awareness and implementation. Waste collection services are irregular operating on a 3 to 4-day schedule per week and cover just 60% of the total generated waste, leaving the remaining 40% to accumulate in open plots, drains, or along roadsides. The absence of a scientific disposal mechanism results in widespread open dumping, as the village lacks a designated landfill or composting facility. Field observations confirmed that while a few households engage in informal composting, these efforts are uncoordinated and unsupervised. Additionally, community participation remains low, with over 70% of residents unaware of the Solid Waste Management Rules (2016). Interviews revealed that villagers often consider waste disposal the sole responsibility of the local governing body, reflecting a lack of ownership and awareness. Institutional challenges such as lack of financial resources, insufficient staff training, and absence of monitoring tools like route mapping or performance tracking were also identified. Notably, comparisons with more progressive models from Indore and Jajankhedi show that decentralization and active community participation can lead to more sustainable outcomes. These findings underline the importance of a holistic strategy that combines infrastructure development, community education, decentralized waste processing, and stronger policy enforcement to improve waste management in Narhe Village.

5. Conclusion

the case study of Narhe Village underscores the pressing need for a comprehensive and sustainable approach to solid waste management in rural and semi-urban settings. The study revealed that while waste generation rates are moderate, systemic issues such as inadequate infrastructure, poor waste segregation practices, irregular collection, and unscientific disposal methods significantly undermine environmental and public health. The lack of awareness and

community participation, compounded by weak policy enforcement and resource limitations, further exacerbates the problem. Despite being included under national programs like the Swachh Bharat Mission, Narhe has yet to fully implement recommended practices such as source segregation, decentralized composting, and effective monitoring. However, the village also presents an opportunity for transformation by adopting successful models from other regions, integrating local participation, and leveraging low-cost, community-driven solutions. Strengthening local governance, building capacity among sanitation workers, and fostering behavioral change through education are critical to achieving long-term improvements. Ultimately, sustainable waste management in Narhe requires coordinated action among government agencies, the community, and civil society to build a cleaner, healthier environment.

Future scope of study

- Waste Segregation and Recycling: Investigate community-based waste segregation programs and explore affordable recycling technologies for better waste management.
- Waste-to-Energy Solutions: Assess the feasibility of small-scale waste-to-energy projects (e.g., biogas plants) to address both waste disposal and energy needs.
- Environmental Impact Studies: Examine the long-term effects of waste on local soil and water quality, and explore sustainable waste disposal practices.
- Community Engagement and Behavior Change: Research strategies to improve community participation and incentivize proper waste disposal practices.
- Policy and Governance Frameworks: Explore how local government policies and public-private partnerships can enhance solid waste management systems in rural areas.

Compliance with ethical standards

Acknowledgments

The successful completion of this case study would not have been possible without the valuable support and cooperation of several individuals and institutions. We extend our thank the local Panchayat and municipal authorities for providing essential data and logistical support throughout the fieldwork. Our appreciation goes to our Head of Department and guide for their continuous encouragement, critical feedback, and guidance during every phase of this study.

Disclosure of conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this case study. This research was conducted independently, and no financial or personal relationships influenced the findings, interpretations, or conclusions presented in this report.

References

[1] Bansal, R., & Joshi, A. (2017). Swachh Bharat Abhiyan: Challenges and implementation issues in rural areas. Environmental Management Review, 8(3), 112-119.

[2] Bharti, O., Singh, A., Singh, D. P., & Sood, V. (2014). Effective municipal solid waste management practices: A case study of Shimla, Himachal Pradesh. Waste Management & Resource Utilization, 173-182.

[3] Chopra, P., Sharma, R., & Yadav, S. (2017). Community-based waste management strategies for rural India. Journal of Rural Environmental Studies, 11(2), 56-63.

[4] Gurjar, B. R., Kumar, P., & Nagpure, A. S. (2018). Air pollution and waste management in rural India. Environmental Science and Pollution Research, 25(9), 8772-8784.

[5] Gour, D., & Saraswat, S. (2022). A case study of village Jajankhedi, District Sehore (M.P.). International Research Journal of Engineering and Technology, 9(12), 547-552.

[6] Kumar, S., Sharma, S., & Jaluthriya, S. (2016). Solid waste management of Jaipur city. International Journal of Engineering Research & Technology, 4(23).

[7] Kumar, A., & Kumar, M. (2017). Solid waste management in rural India: A review of practices and challenges. Waste Management & Research, 35(5), 440-447.

[8] Mishra, A. R., Mishra, S. A., & Tiwari, A. V. (2014). Solid waste management: A case study. International Journal of Research in Advent Technology, 2(1), 396-399.

[9] Patel, N., & Mulla, S. (2020). Challenges and opportunities in rural waste management in India. Environmental Sustainability Journal, 10(4), 28-35.

[10] Rani, M., Mishra, S., & Gupta, N. (2021). Waste segregation and recycling practices in rural India. Sustainable Development and Environmental Management, 12(3), 88-97.

[11] Saxena, P., Singh, R., & Gupta, R. (2019). Waste management in rural areas: A case study of emerging practices in India. Indian Journal of Rural Development, 40(1), 105-110.

[12] Sharma, P., & Raghavan, M. (2020). Solid waste management in rural India: A community-centered approach. Global Environmental Change, 13(3), 67-78.

[13] Sharma, R., Yadav, V., & Kumar, S. (2018). The changing waste composition in rural India: A study of emerging trends. Journal of Environmental Sciences, 29(2), 15-22.

[14] Singh, R. (2021). Municipal solid waste management in the city of Indore: A case study. Civil Engineering and Environmental Sciences, 7(1), 8-17.

[15] Srinivasan, R., & Mishra, S. (2021). Governance in rural waste management: A case study of Maharashtra. Environmental Policy and Governance, 31(5), 377-387.

[16] Yukalang, N., Clarke, B., & Ross, K. (2018). Solid waste management solutions for a rapidly urbanizing area in Thailand: Recommendations based on stakeholder input. International Journal of Environmental Research and Public Health, 15(7).

[17] Solid Waste Management - A Case Study of Delhi.

[18] Central Pollution Control Board (CPCB). (2016). Report on assessment of plastic waste management in India.

[19] Ministry of Housing and Urban Affairs (MoHUA). (2020). Swachh Bharat Mission - Urban: Solid Waste Management Guidelines.

[20] Solid Waste Management Rules (2016), Government of India.

[21] National Green Tribunal (NGT). (2019). Status report on solid waste management rules compliance.

[22] Ministry of Environment, Forest and Climate Change (MoEFCC), India. (2016). Municipal solid waste management manual.