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Analysis of Institutional Governance and Policy Dimensions for Zero-Waste Initiatives in Bheemdatta Municipality, Kanchanpur, Nepal

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Abstract

Municipal waste management has become increasingly difficult due to rapid urbanization, internal migration, and unplanned settlements in municipalities. These challenges place a significant burden on municipal administrations to review and update their plans and strategies for effective waste management. This study analyzes the waste management practices and initiatives aimed at achieving zero waste in Bheemdatt Municipality by employing key informant interviews, field observations, and policy analysis methods. The findings indicate that the municipality has engaged a private waste management service provider to collect municipal waste from selected residential areas. Together, the municipality and the private company manage an average of six tons of solid waste daily. However, the final disposal of municipal waste is neither environmentally sustainable nor economically viable. A SWOT analysis reveals several strengths, including a decentralized government structure, endorsement of waste management policies, and strong community involvement. These factors support regional and participative approaches towards a zero-waste mechanism. Conversely, poor operational efficiency remains a major challenge due to inadequate infrastructure, lack of integrated solid waste management (ISWM) components, insufficiently skilled human resources, financial constraints, weak institutional capacity, and poor source segregation of waste. To manage municipal waste effectively and promote the zero-waste goal, opportunities exist to improve system efficiency, foster public-private partnerships, and enhance community awareness.

Keywords: waste management, zero-waste, SWOT analysis, policy, institution

Introduction

Emissions from waste contribute significantly to global climate change, extending beyond the local boundaries of waste generation (United Nations Environment Programme [UNEP], 2011). The annual production of 1.3 billion tons of solid waste, projected to increase to 2.2 billion tons by 2025 (Hoornweg & Bhada, 2012), underscores the growing challenges of waste management worldwide. In Nepal, the National Statistics Office

(2022) reports an annual generation of 1 million metric tons of solid waste, of which 38.99% is disposed of in landfills, 31.51% is openly dumped in riversides and public spaces, and 2.21% is incinerated, directly impacting environmental and public health.

According to the World Bank Group's "Assessment of Solid Waste Management Services and Systems" (Bharadwaj et al., 2020), Nepali metropolitan areas generate approximately 4,900 tons of solid waste daily, including 600 tons of plastic waste deposited in landfills. Furthermore, it is estimated that about 188,203 cubic meters of biogas and 12,976 kW of energy could be produced daily from organic waste in Nepal. The Accelerator Lab Nepal survey (Oh, 2024) indicates that Nepal's 285 urban municipalities produce roughly 350 tons of plastic waste each day, posing serious risks to human health and ecosystems. Variability in waste composition and inadequate disposal methods further exacerbate these challenges, leading to pollution, health hazards, and depletion of natural resources globally.

To meet Sustainable Development Goal (SDG) Target 11.6—which addresses the environmental impacts of urban waste generation—substantial improvements in solid waste management are required, particularly in many asian regions that are currently off track. Household awareness regarding the detrimental effects of growing landfill sites and open dumping is low, inhibiting shifts in consumption patterns and waste disposal behaviors. Mani et al. (2022) suggest that establishing separate collection and management systems for biodegradable and non-biodegradable waste could enhance at-source segregation—an essential condition for effective municipal solid waste management.

Integrated Solid Waste Management (ISWM) prioritizes waste prevention, recycling, and environmentally sound disposal, in alignment with circular economy principles. However, despite progressive legislation, effective implementation remains weak in Nepal (Khanal, 2023). Public perception of waste as a valuable resource could be improved through education campaigns, regulatory enforcement, and incentive programs. Successful municipal waste separation strategies depend on the collaborative participation of all stakeholders in decision-making processes (Hondo et al., 2020).

Historically, multiple Acts have assigned responsibilities for solid waste management, yet enforcement has been inadequate (Dangi et al., 2017). Under Nepal's new constitutional provisions and the Solid Waste Management Act 2068 (Nepal Law Commission, 2011), local governments are mandated to develop infrastructure for waste transfer stations, landfill sites, processing plants, composting, and biogas facilities, alongside responsibilities for waste collection, processing, and disposal. Local governments are also empowered to require organizations generating waste to engage in segregation, reduction, reuse, and recycling efforts while mobilizing communities and NGOs/INGOs to raise awareness. Additionally, local authorities have the power to determine service charges related to solid waste management.

Similarly, the Local Government Operation Act 2017 (Article 2, Sub-section 1) mandates that municipalities ensure proper management of municipal waste and landfill sites. Responsibilities extend to safe healthcare waste management—including segregation at source, collection, treatment, transportation, recycling/reuse, safe disposal, tariff setting, and regulation. Effective policies and legislation are necessary to control municipal solid waste (MSW) and health-related waste management at the municipal level, with strategic MSW planning being a core municipal responsibility.

The body of research by Sharma et al. (2022) on minimizing material waste using Lean Construction offers valuable insights into waste reduction strategies that could be adapted beyond the construction sector, including municipal solid waste management. Lean Construction principles

that emphasize efficiency, waste minimization, and resource optimization—concepts highly relevant to the development of integrated waste management systems in municipalities like Bheemdatta.

Similarly, Mishra and Aithal (2022) provide a quantitative assessment of waste magnitude supports informed policymaking by quantifying waste flows, which can guide prioritization in municipal waste management frameworks.

Mishra (2024) expands the discourse to entrepreneurial success factors in Nepal, suggesting that innovative leadership and governance play a critical role in tackling challenges such as waste management. This complements the institutional governance focus needed for successful zero-waste initiatives in Bheemdatt Municipality.

Mishra's earlier work (2019) on the development of building bye-laws in Nepal provides a critical perspective on regulatory frameworks that influence urban infrastructure and waste management. Effective bye-laws and policy instruments are essential for enforcing source segregation and ensuring compliance with the Solid Waste Management Act, 2011, which remains a challenge in Bheemdatta.

Furthermore, Mishra et al. (2022) study on Industry 4.0 concepts for Nepal highlights the potential of integrating advanced technologies and innovative industrial models such as virtual farming—to enhance sustainability. This perspective encourages the adoption of modern technologies and smart systems in waste management to address issues like e-waste, which is an emerging concern in Bheemdatt Municipality.

The critical issues identified in Bheemdatta such as the lack of land for establishing an Integrated Solid Waste Management (ISWM) center, absence of systematic source segregation, and inefficiencies in waste processing reflect systemic governance and operational gaps underscored in these studies. Collectively, these works advocate for a comprehensive waste management framework that incorporates policy enforcement, advanced technology adoption, skilled human resources, and stakeholder engagement to achieve sustainable zero-waste outcomes. Addressing these multidimensional challenges will be essential for enhancing environmental quality and public health, reducing landfill dependency, and optimizing resource recovery in Bheemdatt Municipality.

Problem Statement

Municipal solid waste management in Bheemdatta Municipality, Kanchanpur, faces significant institutional and governance challenges that hinder the effective implementation of zero-waste initiatives. Despite households generating the largest share of waste (23.3%) followed by commercial and institutional sectors (Joshi & Joshi, 2018), only 15% of recyclable waste is collected from households nationally (Cataldo et al., 2024). Key issues identified include outdated waste management technology, limited involvement and capacity of municipal authorities, and the growing proportion of electronic waste (Pant, 2024). These problems reflect gaps in existing policies and institutional frameworks, resulting in inefficient waste segregation, collection, and disposal systems. Furthermore, the lack of coordinated governance mechanisms and inadequate policy enforcement constrains progress toward sustainable and environmentally sound waste management practices essential for achieving zero-waste goals. Addressing these governance and policy dimensions is crucial to overcoming operational barriers and advancing effective, participatory waste management strategies in Bheemdatta Municipality.

Research Objective

The primary objective of this study is to analyze the existing policies, institutional frameworks, and management practices related to municipal waste management in Bhimdatta Municipality, with a particular focus on zero-waste initiatives, including an assessment of the opportunities and challenges faced by the local government.

Methodology

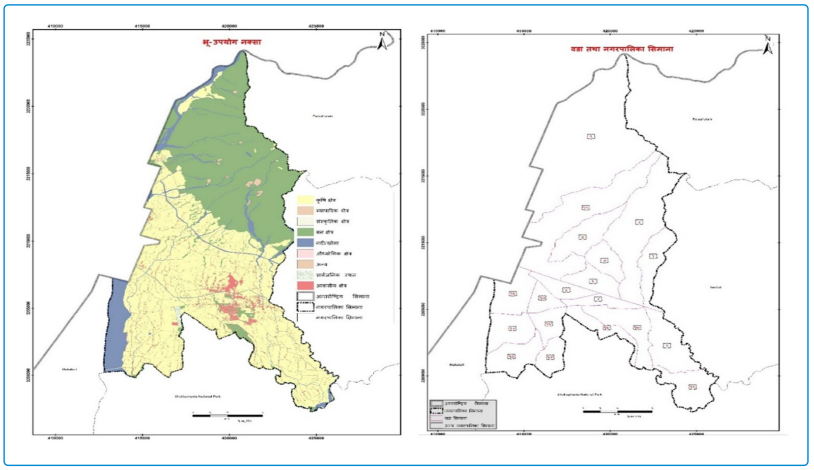
This study investigated the governance and institutional mechanisms of municipal solid waste management in Bheemdatta Municipality, focusing on identifying strengths, weaknesses, opportunities, and threats (SWOT) related to waste management. A mixed-methods approach was employed for data collection and analysis, incorporating key informant interviews, site observations, and policy analysis. Thematic analysis and SWOT analysis were applied to interpret the findings.

Study area

Bheemdatta Municipality, formerly known as Mahendranagar Municipality, is located in Kanchanpur district of Sudurpaschim Province, Nepal. It covers an area of 171.34 square kilometers and lies approximately 750 kilometers west of Kathmandu. Geographically, it is positioned at latitude 37.0902°N and longitude 95.7219°W. The Mahakali River borders the municipality to the west, Bedkot Municipality to the east, Parshuram Municipality of Dadeldhura district to the north, and Shuklaphanta National Park to the south. Administratively, Bheemdatta is divided into 19 wards: 10 rural, 6 semi-urban, and 3 urban wards. According to the Central Bureau of Statistics (2021), the population is 122,320.

Figure 1

Map of Bheemdatt Municipality



Data Collections Methods

Primary Data Collection

Key informants Interview. Twelve semi-structured key informant interviews (KIIs) were conducted with stakeholders from different sectors of the local government, including representatives from municipal offices, sanitary departments, waste management focal persons, ward personnel, private waste management companies, informal waste workers, and other relevant local government officials. These interviews aimed to gather comprehensive insights into the waste management system, policies, operational practices, challenges, and recommendations. Ward personnel provided localized information on waste generation and management within their areas. Private sector representatives contributed perspectives on challenges and potential improvements, while informal workers shared their practical experiences and constraints.

Site Observation. Field observations focused primarily on open dumping sites within the municipality. The study also examined waste conditions in market areas, roadsides, public

spaces, ponds, and riverbanks. Working conditions of landfill and scrap center workers were closely observed, noting occupational challenges. Additionally, municipal waste collection, transportation, and disposal systems were assessed in terms of infrastructure, operational efficiency, and disposal mechanisms.

Secondary Data Collection

Demographic data were obtained from the national census website to establish population context. Information on waste management practices was reviewed from academic journals, news articles, and previous studies relevant to the region. Policies and guidelines of local governments were collected and analyzed from official websites. All secondary data supplemented the primary findings and supported a comprehensive understanding of the waste management framework.

Data Analysis

The collected data were analyzed using thematic analysis to identify major patterns and themes related to governance and institutional mechanisms. SWOT analysis was employed as a strategic tool to assess internal strengths and weaknesses along with external opportunities and threats affecting municipal solid waste management in Bheemdatta Municipality. Results are presented narratively with detailed descriptions.

Results and Discussion

Results shows that waste management is one of the major challenge for municipality. Forl long time waste management is one of the expensive activities of municipality. It shows that on average 6 ton of waste collecting from commercial, institutional and residential areas per day and dumped in the river bank are and open low land area where filling is required. In many case it showed that municipality used solid waste to fill the pits in any land area either private or public place. The findings of KIIs and policy analysis presented in tabular form for each component which clearly pointed the detailed about the strengths, weakness, opportunities and challenges for municipal waste management.

Table 1

WOT Analysis of Municipal Solid Waste Management

Strengths: Strengths are the internal attributes that they are positive aspects that are within the control of the organization or situation.	**Weaknesses:** Internal limitations or areas where the organization or system is lacking and hinder progress or create disadvantages relative to competitors or goals.
• Decentralized Governance and legislation • Community Involvement and Community Engagement. • Waste Management in majority of the urban wards and cities. • Service Charge on waste management determined and revised. • Private organizations involved in waste management as private party of local government. However, it covers small area. • Informal sectors and scrap dealers collecting and recycling PET, metals and paper waste which supports the revenue of municipalities too. • Regular collection of waste from HHs and commercial area.	• Limited Financial Resources to municipality. • Weak Institutional Capacity where technical expertise is not available. • Shortage of household database and updated data collection, record keeping and key performance indicators of solid waste. • Inconsistent Waste Collection Systems. • Lack of Public Awareness for waste segregation and management. • Limited Infrastructure due to which there is difficulties to proper shorting and disposal of collected waste. • Municipality is involved in “collect and dump” but not following other operational components of ISWM. • Inconsistent Policy enforcement however the solid waste management act and related act for solid waste.

• Local Resources and Indigenous Knowledge are applied in rural area for waste management. • Natural Resources conservation and resource recovery initiatives. • Support from NGOs and INGOs: Growing Awareness and skills in communities	• Lack of reward and punishment for the encouragement of public participation in SWM activities, including source segregation, adopting 3R practices, • Disposal of the waste at the bank of different river and recently at Khanya Khola at Bichpuri, which is impacting land and ground water through percolation.
Opportunities: External factors or trends that the organization or system can capitalize on to improve performance or gain a competitive edge for municipal waste. These are possibilities for growth or progress. The major opportunities in municipalities area;	**Threats/Challenges:** Threats are external factors or obstacles that could negatively impact the organization or system. These are often outside the organization's control and can cause problems or risks.
• Growing Support for Circular Economy by promoting source segregation. • External Funding and Partnerships with development agencies and private sectors. • Formation of ISWM committee in local level • Establish large scale infrastructures for the management of waste singlehandedly or in partnership with other municipalities in Tarai area. • Develop different MIS tools for the collection, payment, treatment and disposal of waste. • Value adding to increase recycling of recyclables, including plastics and impose policy to make responsible to manufactures of the use of single use plastic and low grade plastic like MLP and others resources. • Capacity Building through Training and Education for staffs and communities. • Innovation and Technology for integrated waste management. • There is a need for drafting separate regulations for each category of waste— that is, hazardous (hazardous industrial, bio-medical and electronic waste) and non-hazardous waste—considering their differential impacts on environmental and public health. • Public-Private Partnerships (PPP) in different sectors of waste management. Circular Economy Models which include 3R principle. • Government Support, Tourism Promotion and Job Creation in the green development sectors.	• Geographical Barriers and connectivity in all areas of municipality. • Rapid Urbanization and Population Growth. • Climate Change and disaster. • Political Instability and Bureaucratic Challenges. • Cultural and Behavioral Barriers. • Environmental and Health Risks. • Limited Market for Recyclables. • Insufficient attention to promote environmental research and research collaborations with universities and research centers. • Insufficient funding in establishment of large-scale technology. • Difficulty in behavioral change after the training and awareness program • Difficulty to identify and allocate sufficient and appropriate land for the development of ISWM facilities, including landfill site due to public's NIMBY syndrome. • There is a need for drafting separate regulations for each category of waste— that is, hazardous (hazardous industrial, bio-medical and electronic waste) and non-hazardous waste—considering their differential impacts on environmental and public health.

The discussion highlights that waste management remains a significant and costly challenge for Bheemdatta Municipality. On average, six tons of waste are collected daily from commercial, institutional, and residential areas but are often disposed of inefficiently, such as dumping in riverbanks or low-lying open areas, sometimes used to fill pits on both private and public land. This reflects a common practice that raises serious environmental and health concerns.

The findings from key informant interviews and policy analysis, summarized in a SWOT framework, reveal several critical internal and external factors affecting municipal waste management:

Strengths include decentralized governance and supportive legislation, active community involvement, waste management services in most urban wards, regular waste collection from households and commercial zones, involvement of private organizations albeit in limited areas, and the contribution of informal sectors and scrap dealers to recycling efforts. Additionally, indigenous knowledge and local resource use in rural areas, alongside support from NGOs and INGOs, enhance awareness and skills in waste management.

Weaknesses identified are limited financial resources, weak institutional capacity, lack of technical expertise, and poor data management systems including incomplete household databases and performance indicators. Inconsistent waste collection and policy enforcement, lack of public awareness on waste segregation, insufficient infrastructure for sorting and disposal, and a predominant "collect and dump" practice rather than integrated solid waste management (ISWM) are substantial barriers. Importantly, improper disposal in riverbanks, such as at Khanya Khola, threatens land and groundwater quality.

Opportunities arise from growing support towards circular economy principles emphasizing source segregation, availability of external funding and partnerships, formation of ISWM committees, and potential to develop large-scale infrastructure either independently or in collaboration with neighboring municipalities. The development of management information systems (MIS) for waste collection and payment, policies incentivizing recycling and manufacturer responsibility for single-use plastics, capacity building through training, and technological innovations present avenues for improvement. Public-private partnerships and government support aligned with tourism and job creation can further strengthen waste management.

Threats and challenges include rapid urbanization and population growth, geographical and connectivity barriers within the municipality, climate change impacts, political instability, and bureaucratic hurdles. Cultural and behavioral resistance, limited markets for recyclables, inadequate promotion of environmental research collaborations, insufficient funding for advanced technologies, and difficulties in changing public behavior after awareness programs impede progress. Moreover, the "Not In My Backyard" (NIMBY) syndrome complicates land allocation for ISWM facilities, especially landfill sites. There is also a regulatory gap regarding the separate management of hazardous and non-hazardous waste categories, requiring urgent attention to mitigate environmental and health risks.

These findings resonate with research by Sharma et al. (2022) and Mishra & Aithal (2022), who emphasize minimizing material waste through lean principles and careful assessment of waste magnitude, respectively. Mishra's (2024) work underscores the importance of entrepreneurial and governance factors in managing waste challenges in Nepal. The need for strong regulatory frameworks highlighted by Mishra (2019) and the potential of Industry 4.0 technologies for sustainable development as noted by Mishra et al. (2022) further bolster the argument for integrated, technologically advanced, and policy-supported waste management systems.

In summary, addressing Bheemdatt Municipality's waste management challenges requires a multi-pronged strategy. This includes

enhancing institutional capacity, enforcing policies consistently, expanding infrastructure with modern technology, fostering public-private collaborations, and implementing educational programs to change community behavior. Such comprehensive efforts are critical to transitioning toward sustainable, zero-waste municipal waste management that protects environmental and public health.

Conclusion

In Bheemdatta Municipality Kanchanpur, Nepal, municipal waste management is a crucial issue to address the needs of current urbanization and population expansion. The daily collection and management practice is not environmentally sustainable and economically viable. Results of SWOT analysis points out a number of ways to improve waste management systems, including utilizing public-private partnerships (PPP), putting integrated solid waste management (ISWM) systems into place, embracing circular economy concepts, promoting community awareness and encouraging innovation in waste management sectors. These actions, when backed by thorough planning and calculated interventions, have the potential to completely change the region's waste management situation while guaranteeing sustainability, environmental preservation, and financial effectiveness with the help of circular economic development.

However, there have severely stretched local government capacity, this study shows the complex opportunities and problems in municipal waste management. The SWOT analysis emphasizes how systemic flaws, such as poor infrastructure, a lack of funding, and institutional inefficiencies, impede operational efficiency even though decentralized governance and active community involvement serve as a basis for regional and participatory solutions. The difficulties are made worse by outside variables such geographic isolation, climate change, and fast urbanization.

The results highlight how communities, private organizations, and local governments must work together to address the structural and external issues. Municipality can create comprehensive waste management plan with a robust and sustainable waste management framework that supports more general environmental and developmental objectives by giving priority to resource efficiency, capacity creation, and policy enforcement in all level of it.

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