Situational Analysis Report

Waste Management Practices in Lalitpur Metropolitan City and Opportunities for Green Jobs

BERLIN
Senate Department for Economics, Energy and Public Enterprises
State Office for Development Cooperation

GEMS-L

Clean up Nepal

BGZ

Green Empowerment through Vocational Training for Solid Waste Management in Lalitpur (GEMS-L) Project

Acknowledgement

I would like to extend my heartfelt gratitude to Mr. Rabindra Lamichhane (Executive Director), Ms. Binita Pandey (Project Officer), and whole Clean Up Nepal Team for entrusting me with the opportunity to conduct this Situational Analysis study. I am deeply thankful to the officials of Lalitpur Metropolitan City, including ward officials, environmental engineers, waste management officers, and enterprise development facilitators, for their unwavering support throughout this study. Their provision of crucial information during the interviews was invaluable. I also wish to express my appreciation to the representatives of Nepsemyak, Nepco Nepal, Doko Recyclers, Khaalisisi Management, and GD Labs and Research for sharing their insights during the key informant interviews. My sincere thanks go to the community leaders and community-based organizations, including women's groups, who actively participated in the study and shared their experiences and perspectives during the focused group discussions. Without their voluntary contributions, this study would not have been possible. Thank you all for your invaluable contributions.

Amber Thapa
2nd September, 2024

Contents

List of Tables, Figures and Photographs

Abbreviations

ADB	:	Asian Development Bank
AI	:	Artificial Intelligence
BGZ	:	Berliner Gesellschaft für internationale Zusammenarbeit mbH
CBO	:	Community Based Organization
CCTV	:	Closed Circuit Television
CBS	:	Central Bureau of Statistics
CSR	:	Corporate Social Responsibility
DIY	:	Do It Yourself
ESMP	:	Environmental and Social Management Plan
EU	:	European Union
FGD	:	Focused Group Discussion
GEMS-L	:	Green Empowering through Vocational Training for Solid Waste Management in Lalitpur (GEMS-L) Project
ILO	:	International Labour Organization
INGO	:	International Non-Governmental Organization
JICA	:	Japan International Cooperation Agency
KII	:	Key Informant Interview
KMC	:	Kathmandu Metropolitan City
LMC	:	Lalitpur Metropolitan City
MRF	:	Material Recovery Facility
NGO	:	Non-Governmental Organization
NPHC	:	National Population and Housing Census
NSO	:	National Statistics Office
PPE	:	Personal Protective Equipment
PPP	:	Public Private Partnership
Q&A	:	Question and Answer
RDF	:	Refuse Derived Fuel
SEA	:	South East Asia
SWM	:	Solid Waste Management
SWMRMC	:	Solid Waste Management and Resource Mobilization Center
TVET	:	Technical and Vocational Education and Training
VET	:	Vocational Education and Training
WB	:	World Bank

Executive Summary

Nepal faces significant challenges in waste management and youth unemployment, exacerbated by rapid urbanization and population growth. Addressing these problems requires comprehensive policies and active participation from both the government and the community. The waste management sector presents promising opportunities for youth employment, particularly in recycling and resource upscaling, which can promote environmentally friendly practices while creating job opportunities.

In this context, Clean Up Nepal and BGZ (Berliner Gesellschaft für internationale Zusammenarbeit mbH) have partnered on a project targeting youths and waste management to address the gap that arises due to enormous accumulation of waste and the high youth unemployment problem in Lalitpur Metropolitan City (LMC). This situational analysis conducted for this project identified gaps in current waste management practices, such as inadequate waste segregation, insufficient recycling facilities, and limited public awareness. The study also explored opportunities for green jobs and formulated strategic recommendations for improving waste management practices.

Key findings indicate that while Lalitpur Metropolitan's waste management system is improving, challenges remain, including the need for integrated transfer stations and material recovery facilities, consistent public participation, and effective waste disposal infrastructure. The primary disposal method is dumping at the Banchare Danda landfill site, which faces issues like festering, leachate contamination, and community protests. There is significant potential for green jobs in the sector, particularly in waste segregation, composting, and recycling. Enhancing public-private partnerships, improving coordination, and implementing long-term plans for recovery and treatment plants are crucial for sustainable waste management.

This situational analysis study recommends implementing a comprehensive vocational training program for youths in waste management. The program should cover waste characterization, segregation, recycling, composting, health and safety, and environmental regulations. Additionally, suggested is also incorporating entrepreneurial skills and VET 4.0 concepts to prepare youths for advanced roles in the sector. The study also advises making the age limit for vocational training more flexible to include a diverse group, such as housewives and long-term residents of LMC. This will ensure broader participation and engagement in green jobs and waste management initiatives.

Chapter I: Introduction

1.1. Background

Nepal faces significant challenges in waste management and youth unemployment. The rapid urbanization and population growth have led to increased waste generation, with many municipalities struggling to manage it effectively. Improper waste disposal practices, such as open dumping and burning, contribute to environmental pollution and health risks (ADB, 2013). On the other hand, according to Macrotrends, youth unemployment remains a pressing issue, with the unemployment rate for individuals aged 15-24 hovering around 20.52% in 2022. This high rate of unemployment among the youth is not only hampering economic growth but also leads to social issues such as increased migration and underemployment. Addressing these problems requires comprehensive policies and active participation from both the government and the community to create sustainable solutions and job opportunities for the younger generation.

Waste management is an escalating issue in both urban and rural areas of Nepal. Additionally, the country grapples with a high youth unemployment rate, posing a significant socio-economic challenge. Many young people in urban regions face uncertain and unstable future prospects. According to the latest report of international labour organization (ILO), youth employment quality is low in terms of productivity, earnings, and working conditions. However, the waste management sector presents promising opportunities for youth, including roles in recycling and resource upscaling. By integrating solid waste management (SWM) into the green jobs sector, Nepal can promote environmentally friendly practices while creating employment opportunities. Training programs in waste management can equip young people with the necessary skills for these roles.

In this context, Clean Up Nepal and BGZ (Berliner Gesellschaft für internationale Zusammenarbeit mbH) have partnered on a project targeting youths and waste management to address the gap that arises due to enormous accumulation of waste and the high youth unemployment problem in Lalitpur Metropolitan City (LMC).

1.2. About the Project

Green Empowering through Vocational Training for Solid Waste Management in Lalitpur (GEMS-L) Project is a pilot project focused in Lalitpur Metropolitan City, the third largest city in the country. The funding partner of the project is BGZ. The project is being implemented in four wards - 2, 9, 7, and 11 of the City. The GEMS-L project aims to address the gap that arises due to enormous accumulation of waste in the city and the

high youth unemployment problem. These gaps will be addressed by implementing a vocational training program focused on the field of solid waste management for young people of LMC. The project will focus on youth of the age group i.e., between the ages of 16 and 40.

The LMC located in the Bagmati Province encompassing 29 wards, comprises 77,159 households and a total population of 294,098 with a male-to-female ratio of 99.57 males per 100 females according to the national population and housing census (NPHC) 2021. The adult literacy rate stands at 90%, with 94.6% for males and 85.4% for females. Additionally, 1.3% of the population is reported to be living with various forms of disabilities (NSO, 2022).

1.3. Rationale, Objectives and Scope of the Study

The overall objective of this situational analysis is to conduct a comprehensive situation analysis of waste management practices in Lalitpur Metropolitan, identifying gaps (waste generation rates, disposal methods, existing infrastructure, and regulatory frameworks) and opportunities for green jobs in Lalitpur Metropolitan City.

Given the importance of situation analysis, the study was conducted to compressively analyze the situation of waste management practices and the opportunities for green jobs in LMC. The scope of the study includes the aspects as listed in Figure 1.

Figure 1: Scope of the study

1.4. Study Framework and Methods

The situation analysis was conducted through a cross sectional study utilizing both qualitative and quantitative data collection approach. The study was a combination of literature review, interviews with key stakeholders, field observations, and data analysis as framed in Figure 2 below.

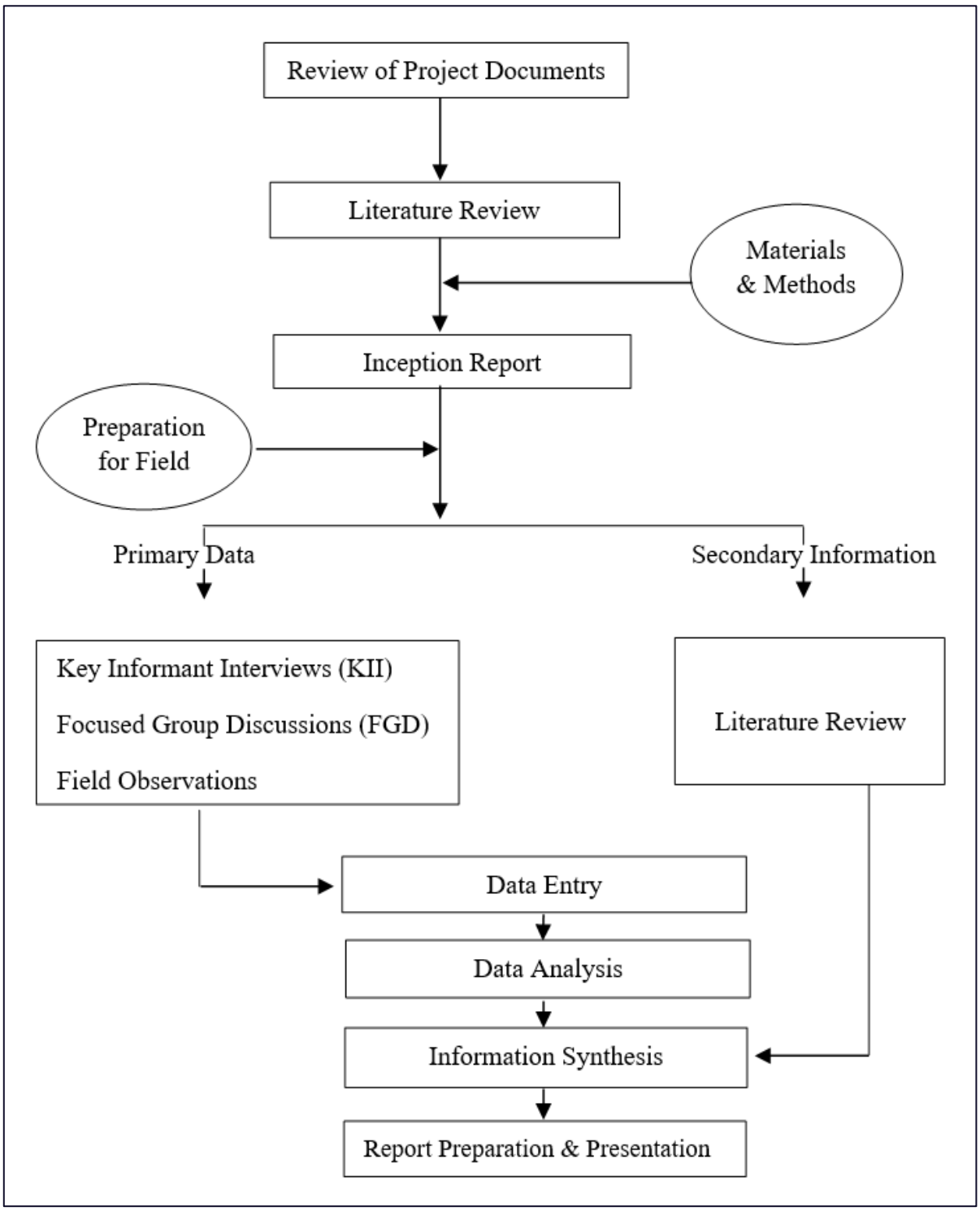

Figure 2: Study framework

1.4.1. Primary Data

For primary information, a total of thirteen semi structure interviews including eleven key informant interview (KII), and two focused group discussion (FGD) were conducted with respondents from reverent stakeholders as listed in the Table 1 below. Relevant stakeholders from waste management sector and LMC participated in the project's working conference (i.e. the inception/planning workshop). The respondents for the KII and FGD of the study were selected among the participants of the working conference of the project.

Table 1: Stakeholders and number of KII and FGD

Interview	Affiliation	Respondents	Number
Key Informant Interviews (KII)	Lalitpur Metropolitan City	Environmental Engineer	2
		Waste Management Officer	2
		Enterprise Development Facilitator	2
	Private Companies	Nepsemyak	1
		GD Labs & Research	1
		Khaalisisi Management	1
		Nepco Nepal	1
		Doko Recyclers	1
Focused Group Discussions (FGD)	LMC Ward	Ward no. 11	1
	Community Groups	Dathulan Women Group	1
		Ikhachhen Women Group	
		Talachhen Women Group	
		Total	**13**

In addition to the interviews, areas including municipal waste transfer station at Balkumari, a few designated waste collection points, etc. were also observed to get insights.

1.4.2. Secondary Information

A systematic review of the existing reports, documents and studies including LMC's annual municipal development plan, waste management related policies and scientific articles was done to collect secondary information for the study. The reviewed literatures are listed below:

- Lalitpur Metropolitan City's Annual Municipal Development Plan 2078/80
- Reviews on participatory approach of solid waste management with special focus on Lalitpur Metropolitan City, Nepal - 2019
- Governance and women's group participation in solid waste management in Nepal: A case of Lalitpur Sub-Metropolitan City - 2017

- Environmental and social management plan (ESMP): OBA for municipal waste management in Lalitpur Sub-Metropolitan City - 2015
- Solid waste management in Lalitpur Sub-Metropolitan City - 2004
- Waste management baseline survey of Nepal - 2020
- Solid waste management: Challenges and practices in Nepalese context - 2019
- Solid waste management in Nepal: Current status and Policy recommendations - 2013
- Best practices on solid waste management of Nepalese cities - 2008

1.4.3. Ethical Considerations and Quality Assurance

The fundamental ethical principles, including informed consent, anonymity, no harm, participant autonomy, and fair presentation of empirical data were strictly followed during the study. Given the sensitivity of data related to waste management and youth unemployment, ethical standards were maintained during the data collection. This included ensuring confidentiality, voluntary participation, and informed consent. All sources of information have been specifically acknowledged by referencing to the author(s) or institution(s). During the primary data collection verbal informed consent from participants was obtained before starting data collection for each component, ensuring ethical compliance throughout the study.

To ensure the richness and quality of the data, brief discussions on data collection aspects were held each morning before data collection began, and brief reflections were conducted each evening after data collection ended. Daily updates on data collection and lessons learned were compiled and documented from field observations. Quality assurance mechanisms were implemented to ensure the accuracy, reliability, and validity of the data and information in the reports.

1.4.4. Data Collection, Management, Analysis, and Report Writing

Primary data were collected using questionnaires, audio recordings and google forms, while secondary information was gathered through literature review. The collected data were then organized into a database using Microsoft Excel. With the collected data and information, scenario analysis was conducted to provide a clearer picture of waste management practices in LMC and to identify the opportunities for green jobs.

Following the desk review, a short robust inception report was prepared and submitted to Clean Up Nepal. Subsequently, surveys were conducted to gather primary data. By combining primary and secondary information, a draft narrative report was created in alignment with the study objectives and shared with Clean Up Nepal for valuable feedback and suggestions. After incorporating the comments and suggestions, the narrative report was finalized and submitted.

Chapter II: Findings

2.1. Current Waste Management Practices

Based on key informant interviews conducted during the study, the waste management system in Lalitpur Metropolitan City is improving, with door-to-door collection and designated waste collection points. Compared to neighboring municipalities in the Kathmandu Valley, LMC has cleaner streets and a visible presence of sweepers and recyclable waste collectors. However, challenges remain, including the need for more transfer stations and material recovery facilities (MRF), consistent public participation, and effective waste disposal infrastructure. While waste collection, transportation, and disposal are well-established, other crucial steps like waste segregation, recovery, and treatment are practiced only in limited areas and to a limited extent.

Figure 3: A general waste management cycle

As per the KII respondents, municipal solid waste in LMC includes residential, institutional, commercial, construction and demolition, and agricultural and animal wastes. Industrial and hazardous wastes are managed by their respective owners/emitters. Used batteries and engine oils are collected by informal waste workers and dealers, then returned to the respective companies for recovery. As per the findings of KII (Figure 4), LMC generates about 250 tons of waste daily, on average. Of this, around 220 tons are collected, with approximately 20 tons being segregated, composted, or recycled by some private companies. The remaining 200 tons are disposed of each day. There is seasonal variation in the amount and nature of waste generation, with roughly 20 tons less in winter compared to summer. During festive seasons, significant amounts of fruit and flower waste are generated.

According to the municipal environmental engineer, waste is collected daily on main streets and twice a week from peripheral and inner settlements from a total of 192 designated waste collection points. Some streets are one-way, and waste collection vehicles face challenges due to traffic jams. Not all generated waste is collected, and only a small portion of the collected waste is segregated and recovered.

According to the report of the Solid Waste Management and Resource Mobilization Center (SWMRMC), besides the municipality, several I/NGOs and companies are involved in waste management in the city. A few private companies, including Nepsemyak, Nepco Nepal, Shreejansil, and Fulbari play crucial role in waste management in specific areas of LMC and the Kathmandu Valley. As per the respective KII respondents, the companies collect, segregate, reuse, recycle, and compost waste, manage it at their dedicated facilities before transferring it to landfills, conduct awareness programs, and promote waste reduction methods. These organizations collaborate with communities, businesses, and local governments to promote sustainable practices and reduce landfill waste. Some digitally connect waste producers with waste entrepreneurs, operate collection centers and material recovery facilities, and advocate for the inclusion of women in the sector. Some also provide training in waste segregation and management and specialize in upcycling refused polypropylene plastics into insulation materials. However, the absence of a central waste treatment and disposal facility hampers effective waste management. While LMC and private companies coordinate in some respects, LMC can create a more favorable environment for these companies in the waste management process. Coordination in waste collection is generally effective, but challenges such as inconsistent segregation, lack of community awareness, and insufficient advocacy persist. Syndicates and political influences further complicate the process, hindering the adoption of scientific waste management practices. To improve the system, greater collaboration, transparency, and public engagement are essential.

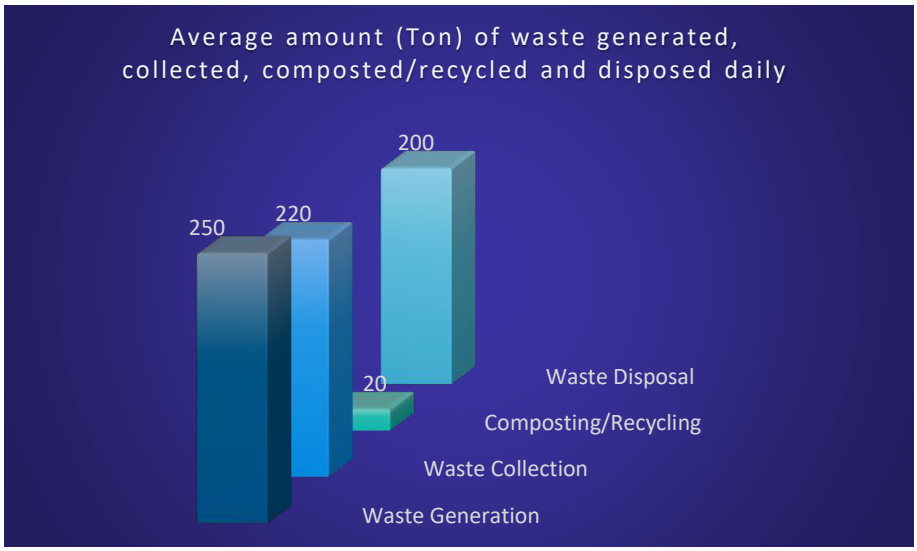

Figure 4: Average amount (Ton) of waste generated, collected, composted/ recycled and disposed daily

According to the findings of KII and FGD, the efficiency and coverage of waste collection services in LMC are improving but still face challenges. While central areas receive regular collection, peripheral and densely populated areas experience less consistent services. Issues such as irregular schedules, inadequate resources, and limited public participation in waste segregation hamper effectiveness. Enhanced planning, better resource allocation, and increased community involvement are essential to improve overall efficiency and coverage.

According to the waste management officer, the primary waste disposal method of LMC is dumping at the Banchare Danda landfill site, approximately 30 km from Kathmandu. The landfill, owned by Kathmandu Metropolitan City (KMC), receives waste from all 18 municipalities in the valley. The landfill is covered daily with a layer of soil, and LMC is responsible for this. The Banchare Danda landfill site faces challenges such as festering, leachate contamination, and protests from local communities due to the rapid filling of the site against its projected capacity. A significant protest occurred on July 17, 2023, when locals and political representatives obstructed waste disposal due to unmet demands. During the protest, holding waste was challenging, leading to incidences of uncontrolled dumping and open burning. In normal times, open dumping is monitored, including through CCTVs, and is rare. However, open burning is common in winter as shopkeepers burn waste on the streets for heating. In summer, waste decays faster, causing festering, for which pesticides are used to control pests and smell. According to the municipal environmental engineer, LMC has a long-term vision of establishing recovery and treatment plants, including waste-to-energy, refuse-derived fuel (RDF), and sanitary landfill sites. New landfill sites are being explored, including in Bungmati and Mahankal.
Based on the findings from KII and FGD, the community participation in waste management is active and cooperative, but waste is collected unsegregated. There is a significant opportunity for waste segregation at the source through community awareness and engagement, creating green jobs in recovery and treatment, and ultimately minimizing waste for disposal. As per the municipal environmental engineer, LMC conducts regular training and awareness programs related to waste management through community-based organizations (CBO), including around 450 women groups. There is also a feedback mechanism for residents on waste management services through the mobile application - LMC Alert, handled by municipal police.

2.2. Existing Infrastructures

According to the municipal waste management officer, 181 staff from Lalitpur Metropolitan City and around five hundred staff from private companies are dedicated for municipal waste management. Additionally, there are approximately seven thousand informal waste management workers in the Kathmandu Valley. The city uses two broomer machines, each cleaning eight kilometers of streets daily. However, the number of street cleaners has decreased from 194 to 46 over the years due to various issues, including occupational health concerns.
Similarly, as per the officer, LMC operates a fleet of 17 vehicles, including 15 dedicated to waste collection, transfer, and transport, one compactor stationed at Lagankhel bus park, and one water sprinkler. Some additional vehicles are currently not in operation due to

financial constraints. The waste management vehicles are supported by the federal government and international agencies such as the World Bank (WB), the European Union (EU), and the Japan International Cooperation Agency (JICA). Private companies also have vehicles for waste management activities.

Figure 5: Existing infrastructure and system for waste management in LMC

In addition, based on KII and field observation, the municipal waste transfer station at Balkumari, expanding over almost 7 ropani (0.35 ha), faces challenges due to its proximity to settlements and community infrastructures, leading to demands for its relocation. Segregation, sorting, compaction, and odor control are partially managed at this station. Private companies also have similar stations in Balkhu, Harisiddhi, and Hattiban.

A team of environmental engineers at the LMC City Pride Project Office in Pulchowk is responsible for long-term strategic planning of municipal waste management. The municipal waste management center at Balkumari oversees the operation and management of waste services, while ward offices and community-based organizations raise awareness and monitor waste management practices at the community level.

As per the annual municipal development plan for the fiscal year 2079/80, LMC allocated NPR 1.86 crore for waste management and NPR 53.5 lakhs for enterprise development, including training and technology support. According to the municipal enterprise development facilitator, youths can also access the fund for entrepreneurship in the waste management sector.

The municipal environmental officer stated that the service charge for waste management is included in annual property tax, and a tipping fee of NPR. 250 per trip is charged to private companies disposing of waste at the landfill site. According to the Environmental Statistics of Nepal, the average waste disposal cost for LMC is NPR. 277,260 per day (CBS, 2019).

Table 2: LMC's program and budget for waste management and enterprise development in fiscal year 2079/80

S.N.	Budget Heading	Amount (NPR)
Waste Management		
1	Landfill site development/construction	3,500,000
2	Park and greenery development/construction	1,500,000
3	Pesticide (Phenyl, etc.)	3,000,000
4	Sanitation materials	2,750,000
5	Cleanliness of touristic places	1,500,000
6	Dead body management	500,000
7	Festival waste management	500,000
8	Allowances for waste management workers	200,000
9	PPE for waste management workers	700,000
10	Waste management center maintenance	2,000,000
11	Waste management vehicle parking/workshop construction	2,500,000
	Total	18,650,000
Enterprise Development		
1	Demand based training	2,000,000
2	Technology support	2,000,000
3	Market linkage support	550,000
4	Follow-up support	600,000
5	Best entrepreneurship award	200,000
	Total	5,350,000

2.3. Regulatory Framework

According to the Waste management baseline survey of Nepal (CBS, 2020), the national waste management policies and regulatory frameworks in Nepal (Figure 6) aim to address the growing challenges of waste. The Solid Waste Management Act, 2011 provide a comprehensive legal framework for managing solid waste, emphasizing segregation, recycling, and proper disposal. The Local Government Operation Act, 2017 empowers local bodies to manage waste within their jurisdictions. The Environment Protection Act, 2019 focuses on minimizing environmental impacts through sustainable practices. The National Urban Development Strategy, 2017 outlines strategic urban planning, including waste management. The Industrial Enterprises Act, 2017 regulates industrial waste, promoting

eco-friendly practices. The Solid Waste Management Regulation 2013 and the Solid Waste Management Policy 2014 provide technical guidelines for effective waste management.

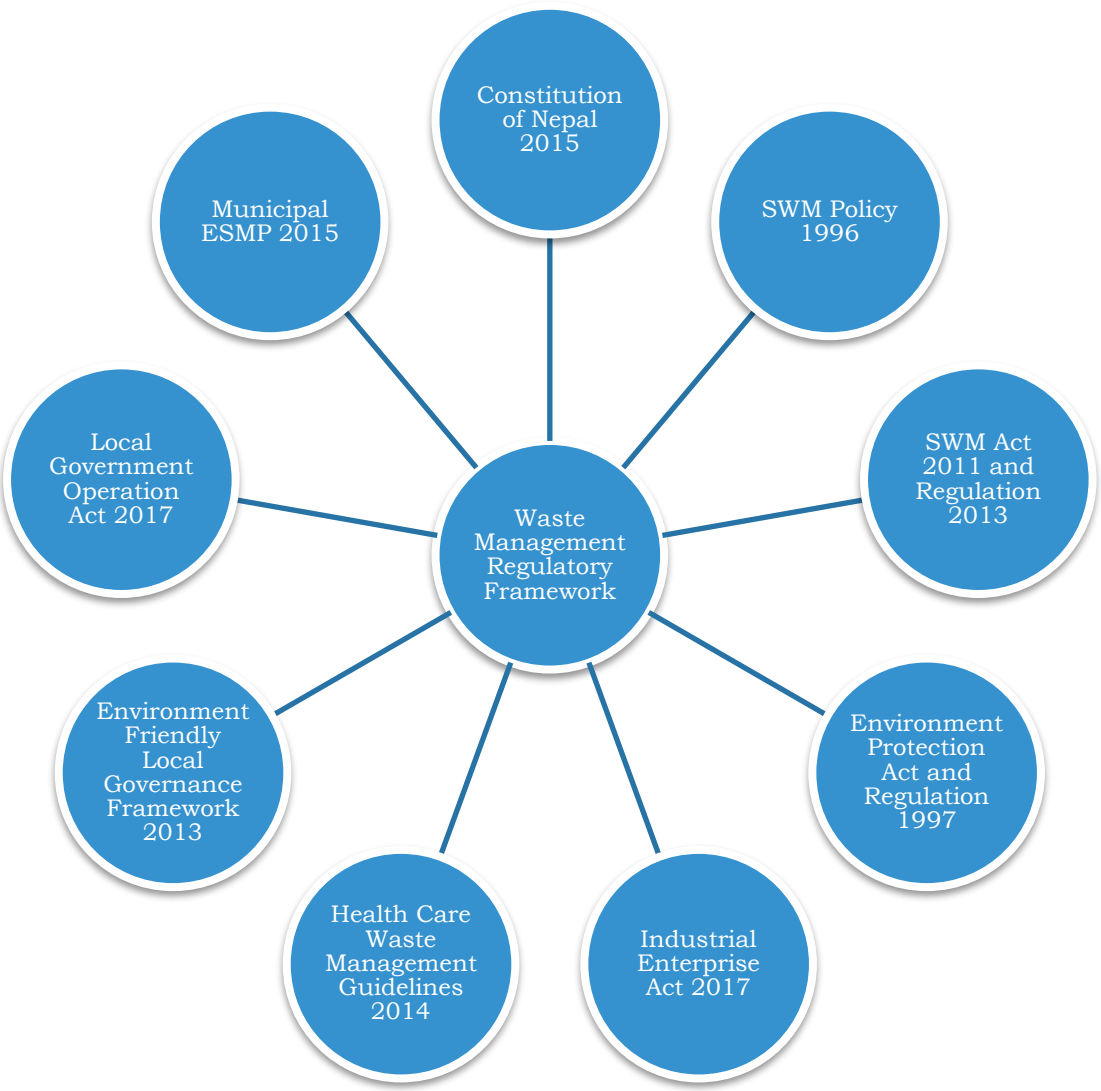

Figure 6: Waste management regulatory framework

In Lalitpur, the regulatory framework includes policies on waste collection, segregation, and treatment, such as the Environmental and Social Management Plan (ESMP) 2015. The ESMP has set ambitious targets for the recovery of organic and recyclable waste and reducing landfill waste:

- Increase recovery of organic waste to 90% by 2028.
- Increase recovery of recyclable waste to 100% by 2028.
- Decrease waste sent to landfills to 12% by 2028.

The long-term strategic objectives of the ESMP align with the National SWM policy. The municipal council has adopted policies for the gradual introduction of tariffs in core areas and regulation of private operators in non-core areas to improve waste management. As per the municipal environmental engineer, LMC has a monitoring and evaluation mechanism, reported yearly, and an enforcement mechanism with penalties for non-compliance. For example, an institution was fined NPR. 100,000 for disposing of expired

fire extinguisher powder in the river, as captured by CCTV footage. However, there is a need for stricter enforcement of regulations and better coordination among stakeholders to effectively implement these frameworks.

2.4. Major Challenges in SWM and Opportunities for Green Jobs

The major challenges within the existing solid waste management system in LMC have been identified through the municipal Environmental and Social Management Plan and key informant interviews during this study, listed in Figure 7.

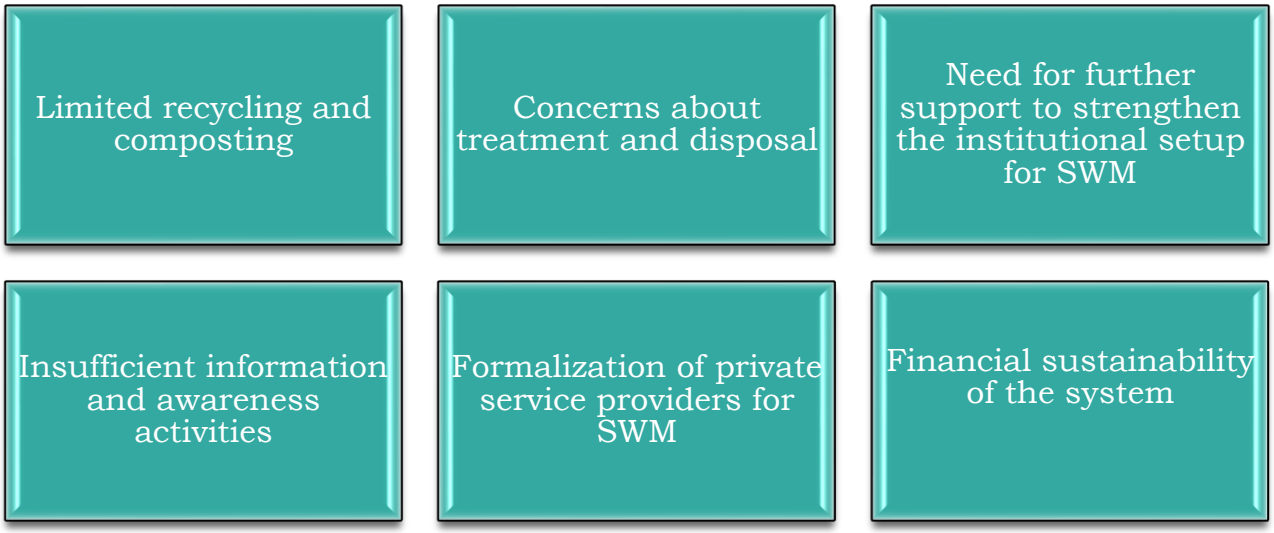

Figure 7: Major challenges in solid waste management of LMC

Based on the findings of the KII, the increasing volume and complexity of waste indicate that the current staff in LMC and private waste management companies are insufficient. Additionally, the number of waste management workers, such as street cleaners and informal waste management workers, is gradually decreasing due to occupational health issues. In this context, there are several promising opportunities for creating green jobs in the waste management sector in Lalitpur Metropolitan City, considering the importance of occupational health and safety.

According to the KII respondents, enhanced processes in SWM in the city could generate an estimated five hundred to seven hundred new jobs, supporting better waste management and environmental sustainability. However, the potential for green jobs depends on establishing a systematic and formalized waste management sector with proper infrastructure and training.

- **Waste Collection and Segregation:** Improving waste collection systems and encouraging waste segregation at the source can create more jobs for waste collectors, sorters, and drivers. Effective segregation can identify reusable or recyclable items, creating numerous green jobs in sorting, management, and processing.

- **Recycling and Upcycling:** The potential for green jobs in recycling within LMC is substantial, encompassing areas like landfill gas extraction, plastic recycling, acid battery recycling, paper recycling, and glass and aluminum recycling. Organizations like Doko Recyclers, Khaalisisi Management, and Blue Waste to Value, along with informal waste workers, play crucial roles in this ecosystem. Formalizing roles for waste management staff and integrating informal workers can improve job security and working conditions. Establishing more recycling centers and upcycling initiatives can create jobs in sorting, processing, and transforming waste materials into new products.
- **Composting:** Composting in LMC presents significant green job opportunities, with organizations like Blue Waste to Value and Praramva Biotech actively involved. Given the large portion of organic waste, there is ample material for composting. Expanding composting facilities and promoting household composting can generate employment in the production and sale of compost bins, as well as in the operation of larger composting sites.
- **Public Awareness and Education:** Initiatives to educate the public about waste reduction, recycling, and composting can employ educators, community organizers, and campaign managers.
- **Infrastructure Development:** Building and maintaining waste management infrastructure, such as sanitary landfills and recycling plants, can create numerous construction and maintenance jobs.
- **Partnership, Innovation, and Entrepreneurship:** Projects like GEMS-L focus on promoting entrepreneurship and self-employment in areas such as waste segregation, recycling, and innovative business practices within the green economy. Private companies are actively partnering with city governments, believing that public-private partnerships (PPP) are the most effective approach to waste management. Their efforts include establishing hubs for managing dry waste, which involve collection and segregation. Each new hub can generate jobs for multiple staff members, with this number increasing over time as operations expand and waste collection improves.

As per the municipal enterprise development facilitator, the department offers various provisions, including demand-based training, business planning, technology support, and entrepreneurship promotion. This year, the enterprise development department plans to offer training and technology support for making bags from plastic waste. The city office also facilitates exchange visits for waste management workers and provides space (e.g., shutters) for startups during their initial six months.

According to the results of KII, beyond the city, there are training and funding opportunities from federal and provincial governments, private companies, corporate social responsibility (CSR) initiatives, and I/NGO projects. Companies like Nepsemyak, Nepco Nepal, Doko Recyclers, Khaalisisi Management, and GD Labs and Research offer

internships and volunteering opportunities. However, there has been limited coordination between the municipal waste management center, the enterprise development department, private companies, and projects, despite the sector's significant potential.

The waste management sector holds significant potential for green jobs. However, as per the representatives of the waste management companies, challenges such as syndicates, monopolies, and the need for proper policies and guidelines from local bodies create obstacles in the process. Despite these issues, there are ample opportunities for green jobs. Government support is crucial to foster these opportunities, and entrepreneurs should aim to make their businesses self-sustaining while ensuring affordability for the public. By focusing on these areas, LMC can not only improve its waste management practices but also create sustainable employment opportunities for its youths and residents.

Chapter III: Conclusion and Recommendations

3.1. Conclusion

Based on the findings of the KII and FGD, LMC's waste management system is improving with initiatives like door-to-door collection and designated waste collection points. However, challenges remain, such as the need for integrated transfer stations and material recovery facilities, consistent public participation, and effective waste disposal infrastructure. Private companies play crucial role in waste management, focusing on collection, segregation, recycling, and composting. Despite generally effective coordination between LMC and private companies, issues like inconsistent segregation, lack of community awareness, and political influences persist.

According to the municipal waste management officer, the primary disposal method of municipal waste of LMC is dumping at the Banchare Danda landfill site, which faces challenges like festering, leachate contamination, and community protests. Active community participation exists, but unsegregated waste collection remains a problem. 181 staff from LMC and around five hundred staff from private companies work for municipal waste management, with approximately seven thousand informal waste workers in the Kathmandu Valley.

As per the Waste management baseline survey of Nepal (CBS, 2020), the Solid Waste Management Act 2011, Solid Waste Management Regulation 2013, and the Environmental and Social Management Plan 2015 provide a comprehensive legal framework, but stricter enforcement and better coordination are needed.

And from the study, it can be concluded that there is significant potential for green jobs in the sector, especially with proper training, support, and public-private partnerships.

3.2. Recommendations

3.2.1. Recommendation for Waste Management Practices and Green Jobs

To further improve waste management in LMC, several key actions are recommended based on the study. First, increasing infrastructure by establishing integrated transfer stations and material recovery facilities is essential for better waste segregation and recovery. Enhancing public participation through increased community awareness and engagement in waste segregation at the source can create green jobs and minimize waste for disposal. Improving coordination between LMC and private companies is crucial, fostering greater collaboration, transparency, and public engagement to enhance waste management practices. Additionally, implementing long-term plans for recovery and treatment plants, including waste-to-energy and refuse-derived fuel facilities, is necessary for sustainable waste management.

Implementing stricter enforcement of existing regulations to ensure compliance are recommended. Enhancing the workforce by increasing the number of waste management workers and addressing occupational health issues can help retain and attract workers. Promoting green jobs by focusing on occupational health and safety, and expanding provisions for training, business planning, technology support, and entrepreneurship promotion are vital for sectoral growth.

Improving waste collection and segregation processes to identify reusable or recyclable items and boost composting efforts is crucial. Developing more recycling and processing centers can fully realize the potential for green jobs in recycling. Strengthening public-private partnerships to create green jobs and improve waste management. Government support is crucial to foster these opportunities and ensure the sustainability and affordability of waste management efforts.

A road map, as in Figure 8, is recommended for further improving the waste management practices. In addition, this roadmap and action plan outline the steps required to create green jobs in waste management, along with the necessary support required from various stakeholders. Implementing these actions can help improve waste management practices, create sustainable employment opportunities, and support environmental sustainability.

	Objectives	Steps	Necessary Support
Infrastructure Development	Establish integrated transfer stations and material recovery facilities to improve waste segregation and recovery.	1. Assessment and Planning: • Conduct a needs assessment to identify suitable locations for transfer stations and recovery facilities. • Develop a detailed plan and budget for infrastructure development. 2. Stakeholder Engagement: • Engage with local government, private companies, and community organizations to secure support and funding. • Organize public consultations to gather input and ensure community buy-in. 3. Construction and Setup: • Initiate construction of transfer stations and recovery facilities. • Equip facilities with necessary tools and technologies for efficient waste processing. 4. Operationalization: • Hire and train staff to manage and operate the facilities. • Implement standard operating procedures for waste segregation and recovery.	• Local government for land allocation and permits. • Private companies for funding and technical expertise. • Community organizations for awareness and participation.
Public Participation & Awareness	Enhance public participation in waste segregation at the source to create green jobs and minimize waste for disposal.	1. Awareness Campaigns: • Develop and launch awareness campaigns on the importance of waste segregation. • Use various media channels (social media, local radio, community meetings) to reach a wide audience. 2. Educational Programs: • Implement educational programs in schools and communities to teach waste segregation practices. • Distribute educational materials and conduct workshops. 3. Incentive Programs: • Introduce incentive programs to encourage households and businesses to segregate waste. • Provide rewards or discounts for consistent participation. 4. Monitoring and Feedback: • Establish a monitoring system to track participation rates and gather feedback. • Adjust strategies based on feedback to improve participation.	• Local government for campaign funding and policy support. • Schools and community organizations for program implementation. • Media partners for campaign dissemination.
Workforce Enhancement	Increase the number of waste management	1. Recruitment Drives: • Conduct recruitment drives to hire additional waste management workers. • Partner with local employment agencies and vocational training centers. 2. Training Programs:	• Local government for funding and policy support.

	workers and address occupational health issues to retain and attract workers.	• Develop and implement training programs focused on occupational health and safety. • Provide specialized training for different roles (e.g., street cleaners, waste sorters). 3. Health and Safety Measures: • Introduce health and safety protocols to protect workers. • Provide personal protective equipment (PPE) and regular health check-ups. 4. Career Development: • Create career development pathways to retain workers and provide growth opportunities. • Offer continuous learning and upskilling programs.	• Vocational training centers for training program development. • Health organizations for health and safety measures.
Promoting Green Jobs in Composting and Recycling	Boost job creation in composting and recycling by improving waste segregation and developing processing centers.	1. Composting Initiatives: • Scale up composting programs by providing training and resources to youths and communities. • Establish composting centers and promote urban gardening and organic farming. 2. Recycling Programs: • Develop recycling programs for various materials (plastic, paper, metal, etc.). • Set up recycling centers and provide training for sorting and processing recyclable materials. 3. Market Development: • Promote the market for compost and recycled products through marketing campaigns. • Collaborate with businesses to create demand for recycled materials. 4. Integration of Informal Workers: • Formalize roles for informal waste management workers and provide training and support. • Ensure fair wages and safe working conditions.	• Local government for funding and policy support. • Private companies for market development and partnerships. • NGOs and community organizations for training and awareness.
Strengthening PPP	Enhance collaboration between public and private sectors to create green jobs and improve waste management.	1. Partnership Agreements: • Develop and sign partnership agreements between local government and private companies. • Define roles, responsibilities, and benefits for each party. 2. Joint Projects: • Initiate joint projects for waste collection, segregation, and processing. • Establish hubs for managing dry waste and other initiatives. 3. Funding and Resources: • Secure funding and resources from both public and private sectors. • Leverage CSR initiatives and grants for project implementation. 4. Monitoring and Evaluation: • Set up a monitoring and evaluation framework to track progress and outcomes. • Conduct regular reviews and make necessary adjustments.	• Local government for policy support & coordination. • Private companies for funding and technical expertise. • NGOs for monitoring and evaluation.

Figure 8: Recommended roadmap and action plan steps for further improving the waste management practices and for realizing the identified opportunities for green jobs in waste management

3.2.2. Recommendation for Vocational Training

There is significant potential for green jobs in the waste management sector, especially with proper training. A vocational training is recommended for equipping young people with the practical skills and knowledge necessary to pursue careers in the waste management sector. It should cover waste characterization, segregation, recycling, composting, health and safety, and environmental regulations. The hands-on training should reinforce both theoretical and practical knowledge. Additionally, entrepreneurial skills should be taught to help youth innovate, seize opportunities, manage risks, and create sustainable businesses. The module should also introduce VET 4.0[1] concepts, including automation, global internetworking, and artificial intelligence (AI) systems, to prepare youth for advanced roles in the waste management sector. This training should aim to contribute to environmental conservation and socio-economic development. A comprehensive five days training is recommended as follows.

Table 3: Recommended 5-days vocational training

Day 1: Introduction to Solid Waste Management and Waste Characterization	
Objectives:	• Understand the basic concepts of SWM and its importance. • Learn how to identify and classify different types of waste.
Welcome session:	• Welcome and Introduction. • Overview of the training program. • Objectives and expected outcomes.
Morning Session:	**1.1 Introduction to SWM:** • Definition and types of solid waste. • Overview of the waste management hierarchy: reduce, reuse, recycle. • Importance of SWM for environmental and public health. • Introduction to global and local waste management challenges and solutions.
Afternoon Session:	**1.2 Waste Characterization:** • Types of waste: organic, inorganic, hazardous, etc. • Importance of waste characterization in waste management. • Methods for waste characterization and analysis.

[1] ***VET 4.0, or Vocational Education and Training 4.0, refers to the integration of advanced technologies and digitalization into vocational education and training systems. It aligns with the principles of Industry 4.0, emphasizing automation, cyber-physical systems, the Internet of Things (IoT), and artificial intelligence (AI). The goal is to prepare the workforce for the evolving demands of modern industries by incorporating these technologies into training programs (CEDEFOP, European Center or the Development of Vocational Training). This approach ensures that vocational training remains relevant and equips learners with the skills needed to thrive in a technologically advanced and interconnected world. It also promotes lifelong learning and adaptability to rapidly changing job requirements (SEA-VET, TVET Platform for SEA).***

	• Tools and techniques of waste auditing.
Activities	• Case studies on waste composition of LMC. • Group activities to identify and classify different types of waste. • Group discussions on local waste challenges and recommend solutions. • Conducting a sample waste audit.
Day 2: Segregation Techniques and Recycling Methods	
Objectives:	• Master techniques for effective waste segregation. • Understand various recycling methods and their applications.
Morning Session:	**2.1 Segregation Techniques:** • Importance of waste segregation for recycling and disposal. • Techniques for effective segregation at source. • Tools and equipment used in waste segregation. • Challenges and solutions in waste segregation
Afternoon Session:	**2.2 Recycling Methods:** • Overview of recycling processes. • Methods and technologies for recycling different types of waste (e.g. paper, plastic, metal, etc.) • The role of recycling in waste reduction and resource conservation. • Value generation from low-grade plastic and multi-layer plastic.
Activities	• Case studies / demonstration of successful recycling / upcycling initiatives • Practical exercises on waste segregation and material recovery. • Making DIY upcycled high value products by participants.
Day 3: Composting and Health & Safety Protocols	
Objectives:	• Learn the principles and methods of composting organic waste. • Ensure safety and health in waste management operations.
Morning Session:	**3.1 Composting Techniques:** • Benefits of composting for waste reduction and agriculture. • Types of composting: aerobic, anaerobic, vermicomposting. • Methods for composting organic waste. • Steps involved in setting up a composting system and troubleshooting common composting issues.
Afternoon Session:	**3.2 Health and Safety Protocols:** • Identification of health risk associated with waste management. • Safety protocols in waste management.

	• Safe handling and disposal of hazardous waste. • Personal protective equipment (PPE) and its usage.
Activities	• Video presentation and hands-on composting demonstration (bin composting). • Safety drills and proper use of PPE while handling waste and video presentation on safety in the respective work environment.
Day 4: Environmental Regulations, Entrepreneurial Skills, and Sustainable Business Models	
Objectives:	• Understand the regulatory framework governing SWM. • Explore local SWM practices and potential opportunities. • Develop entrepreneurial skills to promote innovation in SWM. • Understand sustainable business models in waste management.
Morning Session:	**4.1 Environmental Regulations:** • Overview of global, national and municipal waste management regulations. • Compliance and enforcement. • Role of government and NGOs in sustainable waste management. **4.2 Local SWM practices and Opportunities** • Traditional and modern waste management practices in Nepal. • Community-based waste management initiatives. • Integration of SWM with other sectors (e.g., agriculture, energy, etc.)
Afternoon Session:	**4.3 Entrepreneurial Skills:** • Innovative technologies and practices in SWM. • Identifying business opportunities in waste management sector. • Business planning and market research for waste management enterprises including risk management. • Funding and support mechanisms for waste-related startups. **4.4 Sustainable Business Models in Waste Management:** • Introduction to sustainable business models. • Case studies of successful sustainable waste management businesses. • Strategies for integrating sustainability into business practices. • Financial and environmental benefits of sustainable business models.
Activities	• Case studies on successful waste management businesses. • Group activities to develop a potential business model and group presentation.

Day 5: VET 4.0 and Practical Applications	
Objectives:	• Introduction of VET 4.0 and its applications. • Evaluation of understanding and applications of SWM concepts.
Morning Session:	**5.1 VET 4.0:** • Introduction of VET 4.0 including automation and globalized internetworking in waste management processes. • Cyber-physical systems and AI in waste management. • Discussion on the use of VET 4.0 in recycling and composting *(highlighting case studies where international collaborations have led to successful recycling and composting initiatives).* • Discussion on use of VET 4.0 for business development and networking *(highlighting how digital tools can assist in market research, customer engagement, and accessing funding opportunities).*
Afternoon Session:	**5.2 Practical Applications:** • Visit to waste management company/plant like Nepsemyak or Biocomp Nepal Pvt Ltd, etc.
Activities	• Reflections and learning sharing.
Closing Session:	• Summary of the training program. • Review, Feedforward and Q&A. • Certification and closing remarks.

3.3.3. Recommendation for Flexibility in Age bar and Nativeness

Based on focused group discussion with women groups during the study, a recommendation for GEMS-L project is to make the age limit for vocational training more flexible. This adjustment is necessary because many young people are either studying, employed elsewhere, or planning to go abroad, which limits their availability for training. Additionally, some youths may not be interested in waste management jobs, potentially affecting the project's goals. Similarly, as in Table 4 below, according to the National Population and Housing Census (NPHC) 2021, 45% of the prime working age population of the city falls between the age of 40 to 54, which is technically not the youth age; relaxing the age limit would allow the inclusion of this prime working population in the training. Furthermore, many long-term residents of the city who are not originally from LMC should also be considered for participation in the training. By easing age and nativeness restrictions, the training could include a diverse group, both young people and housewives. Housewives, who are generally free during the day, could dedicate sufficient time to vocational training and potentially engage in green jobs or start their own green businesses in waste management.

Table 4: Population composition of LMC

S.N.	Age Group	Population	Percentage
1	Children (0-14)	52,932	18%
2	Early working age (15-24)	54,009	18%
3	Prime working age (25-54)	141,480	48%
4	Mature working age (55-64)	23,477	8%
5	Elderly (65+)	22,200	8%
6	Total	294,098	100%
Youth and Prime working age Population			
1	Youth (16-40)	132,381	45% *(of total pop)*
2	Other prime working age (40-54)	63,108	45% *(of the prime working age pop)*
			Source: NPHC, 2021

References

Annual Municipal Development Plan 2079/80, Lalitpur Metropolitan City, Municipal Office, Pulchowk, Lalitpur, Nepal

Best practices on solid waste management of Nepalese cities, Practical Action, 2008.

Environmental and social management plan (ESMP): OBA for municipal waste management in Lalitpur Sub-Metropolitan City. Lalitpur Sub-Metropolitan City, 2015.

Governance and women's group participation in solid waste management in Nepal: A case of Lalitpur Sub-Metropolitan City. Nikita Sharma, 2017.

National Population and Housing Census 2021, National Statistics Office (NSO), 2022.

Nepal Youth Unemployment Rate 1960-2024, Macrotrends (accessed from https://www.macrotrends.net/global-metrics/countries/NPL/nepal/youth-unemployment-rate on 21.08.2024)

Reviews on participatory approach of solid waste management with special focus on Lalitpur Metropolitan City, Nepal. Global Scientific Journals, 2019.

Solid waste management in Lalitpur Sub-Metropolitan City, His Majesty's Government of Nepal, 2004.

Solid Waste Management in Nepal: Current Status and Policy Recommendations, Asian Development Bank (ADB), 2013.

Solid waste management: Challenges and practices in Nepalese context, Himalayan Biodiversity, 2019.

Waste management baseline survey of Nepal, Central Bureau of Statistics (CBS), 2020.

World Employment and Social Outlook: Trends 2023, International Labour Organization (ILO), 2023.

Annexes

Annex I: Photographs

KIIs with LMC's Environmental Engineer and Solid Waste Management Officer at Pulchowk and Balkumari respectively

FGDs with Women group and Ward representatives at Dathulan and Emukhel respectively

A glimpse of Municipal Waste Transfer Station at Balkumari

KII with the representative of Nepsemyak at Chabahill

Annex II: KII and FGD Contact List

S.N.	Name	Affiliation	Contact	KII/FGD
1	Pradeep Amatya	Environmental Engineer, LMC Pride Project Office	9851084083	KII
2	Awanish Adhikari	Environmental Engineer, LMC Pride Project Office	9863471813	KII
3	Surendra Raj Awale	Senior Officer, LMC Waste Management Department	9851248443	KII
4	Richa Maharjan	Officer, LMC Waste Management Department	9841468480	KII
5	Sarita Adhikari	LMC Enterprise Development Facilitator	9841924455	KII
6	Laxmi Chaulagain	LMC Enterprise Development Facilitator	9860195302	KII
7	Mitra Prasad Ghimire	Nepsemyak	9851079865	KII
8	Dibya Rai	GD Labs & Research	9767818200	KII
9	Rubina Thapaliya	Khaalisisi Management	9863426226	KII
10	Sagar Aryal	Nepco Nepal	9851183250	KII
11	Nabin Bhandari	Doko Recyclers	9849347489	KII
12	Indraman Maharjan	LMC Ward-11 Chairperson	9841493543	FGD
13	Aapulu Shakya	LMC Ward-11 Member	9841027787	FGD
14	Krishna Maharjan	LMC Ward-11 Member	9841398997	FGD
15	Sanjit Shrestha	LMC Ward-11 Member	9851159908	FGD
16	Ramita Maharjan	Dathulan Women Group, Vice-Chairperson	9849875582	FGD
17	Amulya Devi Shakya	Dathulan Women Group, Chairperson	9851002961	FGD
18	Kul Shova Shakya	Dathulan Women Group, Former Chairperson	9841286839	FGD
19	Sangita Bajracharya	Ikhanchhen Women Group, Chairperson	9841858873	FGD
20	Sumitra Maharjan	Talachhen Women Group, Treasurer	9841711346	FGD
21	Ratna Maharjan	Talachhen Women Group, Secretary	9841733936	FGD
22	Bishnu Maharjan	Talachhen Women Group, Chairperson	9818384752	FGD

Annex III: Questionnaire

Questionnaire: Situational Analysis of Waste Management Practices of Lalitpur Metropolitan City (LMC) & Opportunities for Green Jobs

Name:	Date:
Affiliation:	Contact:

1. What is the current status of SWM in LMC?	
2. What is your role in waste management within the municipality?	
3. How long have you been involved in waste management?	

Waste Generation

4. Sources of Municipal solid waste (MSW):	Residential	Institutional	Commercial	Industrial	Construction	Agricultural	Hazardous	Electronic	Other?

5. Average quantity of waste generated per capita per day (in kg):

6. Types of waste generated and their system for collection and management	Collection	Management
• Paper and cardboard		
• Plastics and rubber		
• Metals and glass		
• Organic waste		
• Market, slaughter and animal wastes		

7. What percent of the generated waste is collected by the municipality (%):	
8. Are there any designated waste collection points?	
9. How frequently is waste collected?	
10. Seasonal variations in waste generation:	

Waste Collection and Disposal

11. Who is responsible for waste collection in LMC?				
12. Is there a good cooperation between the organizations managing the waste?				
13. Methods of waste collection:	Door-To-Door	Curbside	Community Bins	Others:
14. Efficiency and coverage of waste collection services:				
15. What are the key challenges faced by the municipality in waste collection?				
16. Who is responsible for disposal?				

17. Primary disposal methods:	Landfill	Incineration	Composting	Recycling	Dumping
18. Where is waste taken and how it is disposed?					
19. How much waste is transferred to dumping site daily (Ton):					
20. Are there any locations with uncontrolled dumping of wastes?					
21. Is there evidences of any open burning of wastes? How can it be prevented?					
22. Are there any problems of festering wastes? How can it be prevented?					
23. What are the key challenges faced by LMC in waste disposal?					

Existing Infrastructure for Waste Management

24. What resources exist for SWM in LMC?	Staffs	Program	Budget	Rikshaw	Tractors	Pickup	Truck	Loader	Dozer	Excavator	Broomer	Others?

25. Availability and condition of waste collection vehicles:							
26. Who is responsible for cleaning public spaces, roads? How often they are cleaned?							
27. Do you feel there are enough street cleaners?							
28. Do you feel the waste collection staff have the correct/enough tools, cleaning equipment, and personal protective equipment?	Yes/No						
29. Training and skill development programs for waste management workers?							
30. Facilities for waste segregation?							
31. Does the municipality have transfer station?	Yes/No	Area (m^2):					
32. Are the following steps done at Transfer station?	Compaction	Segregation	Sorting	Control of smell	Others:		
33. How is the collected waste managed (%)?	Composting	Recycling	Incineration	Landfill dumping	Riverside dumping	Open dumping	Others:

34. How are the following hazardous waste managed?

• Used batteries	
• Used engine oils	
• Paints, solvents, and varnishes	
• Broken electrical equipment	
• Medical waste	

35. Where is the landfill site? Who owns the landfill site?	
36. Tipping fee? *(paid for disposing of waste in the landfill)*	

37. Leachate: control and treatment systems

• Are there any problems of leachates from waste dumps or landfills contaminating local water supplies or the local environment?	
• Are groundwater supplies effectively protected from waste dumps?	
• When it rains, are landfills protected from surface waters with diversion canals?	

38. Disease vector control					
• Is solid waste creating problems with disease vectors *(such as vermin, bats, birds, mosquitoes, flies, ants, cats, or dogs)*?					
• Are landfills covered daily with at least 20cm soil cover?					
• Is solid waste creating problems of stagnant water, or, blocked ditches?					
• Do you have any suggestions how vector populations can be reduced?					
39. Is there a new landfill site planned?	Yes/No	Slope of terrain:	Groundwater table:	Suitable geological condition?: Yes/No	
40. Are there specific waste segregation or recycling initiatives?					
41. What activities are being undertaken to reduce, recycle or reuse solid wastes?					
42. How many recycling companies are there?					
43. Facilities for recycling:					
44. Does the municipality have treatment plant?					
45. Waste processing centers:	Composting	Biogas Production			
46. Has the municipality established Waste to Energy Technology?	Yes/No	Electricity (Watt):	Biogas (m^3):	Others:	
47. How effective are the existing waste management practices?					

Regulatory Framework

48. Does the municipality have its own solid waste management plan/law/working procedure?	Yes/No	Short (<1 year)	Annual	Periodic	
49. Does the municipality have the monitoring and evaluation mechanism on solid waste management?	Yes/No, if Yes:	Regular update on the waste management work done by municipality?	Regular inspection of the involved in waste management?	Performance inspection of private sector?	Regular inspection of the vehicles carrying solid waste?
50. Enforcement mechanisms and penalties for non-compliance?					

Community Involvement

51. Does the municipality conduct regular training and awareness program related to waste management?	
52. Feedback mechanisms for residents on waste management services?	
53. Community participation in waste management programs?	
54. Role of CBOs in waste management?	

Waste management Finance

55. Municipal budget allocated for waste management:						
56. Revenue generated from waste management services:	**Household**	**Office/ Organization**	**Hotel/ Restaurant**	**Trade Establishment**	**Health institution/ Hospital**	**Others:**
Service charges						
Fines						
57. Funding:	Government grants:		International aid:		Private sector:	
58. Cost recovery mechanisms for waste management services:						

Opportunity for Green Jobs

59. Current employment in the waste management sector?	
60. Potential for job creation in:	
• Waste collection:	
• Waste segregation:	
• Recycling:	
• Composting:	
• Other:	
61. Initiatives for promoting green jobs and sustainable practices:	
62. Has the municipality allocated any budget/program for promoting Green Jobs for Youths in SWM? Or is there any possibility in the planned budget/program for this?	
63. Partnerships with NGOs and private sector for green job creation:	

64. Is there anything else you would like to share about waste management practices of LMC?	
65. Is there anything else you would like to share about green jobs in SWM of LMC?	