

WASTE MANAGEMENT BASELINE SURVEY OF NEPAL 2020



Government of Nepal
National Planning Commission
Central Bureau of Statistics
Thapathali, Kathmandu Nepal

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Preface

Central Bureau of Statistics (CBS) is pleased to publish the Report on Waste Management Baseline Survey. Solid waste management is a crosscutting issue that affects and impacts various areas of sustainable development in each of the three sustainability domains: environment, economy and society. The quantity of solid waste is increasing every year in all the urban municipalities and in emerging rural municipalities mainly due to fast population growth and changing livelihood.

CBS conducted the waste management baseline survey in 2019/20. The major objective of the survey is to generate the baseline data and information on solid waste management including the quantity and composition of municipal solid waste and other vital information about the state of solid waste management in different urban municipalities of Nepal. Data obtained from the survey is expected to be a milestone for the planning, monitoring and evaluation of the national development plans and programs related to solid waste management.

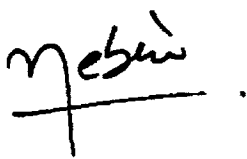
I would like to express my gratitude to all urban municipalities of Nepal for providing valuable data and supports to bring out this publication in its present form.

I am thankful to Mr. Hem Raj Regmi, Deputy Director General of the Bureau for his overall guidance in bringing out this publication. Mr. Pramod Raj Regmi and Mr. Sushil Kumar Sharma, Directors, Environment Statistics Section deserve special thanks for shouldering the responsibility to accomplish the whole tasks of the data compilation and bringing out this publication in time. Statistics Officer Mr. Tulasi Prasad Paudel and Statistics Assistant Mr. Bhim Bahadur Shakha also deserve thanks for their sincere involvement in data collection and management for the preparation of this report.

The Accelerating Implementation of the SDGs Nepal Project of UNDP/NPC deserves our special appreciation for providing technical support for the data management of this survey and publication. Similarly, I would like to express my sincere thanks to the data management and analysis team of TEAC Consultancy led by Mr. Binod Chandra Devkota and reviewer Dr. Ramesh Sapkota for their inputs in various stages of the survey and finalization of this report.

CBS always welcomes comments and suggestions from users, stakeholders and all well-wishers for the implementation of similar surveys and publication in the future.

February, 2021



Nebin Lal Shrestha
Director General
Central Bureau of Statistics

Executive Summary

The Central Bureau of Statistics (CBS) with the main objective of deriving systematic and comprehensive data and information on state of solid waste management (SWM), including the categorization of quantity and composition of the municipal solid waste (MSW) collected by the municipalities, executed this waste management baseline survey in the municipalities of Nepal. The survey was conducted in 2019/20 and has covered 271 municipalities of Nepal.

The survey found the overall average human resource available in the municipalities to be 114 per municipality, with the higher number (477) in the metropolitan cities and the lower (99) in the municipalities. The average number of human resources assigned for waste management was 118 per metropolitan city, followed by 59 and 12 in the sub-metropolitan cities and municipalities, respectively. The survey revealed very limited technical human resources in the municipalities.

The survey revealed three broad categories of wastes generated from the municipalities. These were: organic waste, inorganic waste and other waste. The organic waste mainly consists of paper, textile and agricultural waste; whereas inorganic waste comprised of plastic, glass, rubber, metals and minerals; and other wastes composed of waste that were not included in either of these two categories. The annual average total waste collected per municipality amounted to 2231.0 mt in 2073/74, 2164.4.0 mt in 2074/75 and 2232.7 mt in 2075/76. These figures convert to an average daily waste collection per municipality equals to 6.1 mt, 5.9 mt and 6.1 mt, respectively for the three years. By waste type, the organic waste accounted for higher share compared to the inorganic and other wastes. The organic waste composition was highest (54.0%) in 2075/76 compared to the inorganic waste (33.3%) and other wastes (12.7%). The municipal waste is generated from varied sources such as households, institutions, business/commercial

complex, hospitals, etc. Among the metropolitan cities, the quantity of daily waste collection was highest in the household (15900 kg/day), followed by business complex (7700 kg/day) and the educational institutes (4680 kg/day). Similarly, the households remained the major sources of waste generation in the sub-metropolitan cities (3300 kg/day) and municipalities (1440 kg/day).

The waste collection of the municipalities varied in terms of coverage. The highest coverage was made by the metropolitan cities in terms of wards, households and population coverage mainly because of their higher capacities in all respects. The sub-metropolitan cities and municipalities stood in second and third position, respectively in terms of coverage of wards, households and population. Considering coverage with respect to the ecological zones, municipalities of Terai region reported higher waste collection coverage, followed by the hill and mountain regions.

Among the municipalities, only 12 (4.4%) municipalities (1 metropolitan city, 1 sub-metropolitan city and 10 municipalities) were using transfer stations for processing of municipal solid waste. The size and capacity of the transfer stations varied considerably among the municipalities with the higher among the metropolitan cities and lower among the municipalities. The capacity of waste transfer stations was 10000 cu. m for the metropolitan city and lower for the sub-metropolitan cities and municipalities. Among the municipalities, only 5 municipalities (1 metropolitan city, 1 sub-metropolitan city and 3 municipalities) were having weighing machine for recording weight of waste at the transfer station. Out of the total, only 15 municipalities were using different facilities/methods for managing the waste in their transfer stations. Similarly, only 5 municipalities reported that they have measures to prevent the foul smell of the transfer stations.

A total of 232 (85.6%) municipalities reported at least one or other type of means of transportation for transporting waste. The higher number (70.7%) of the municipalities were having tractor/power tiller, 61.6% municipalities were having tippers/trucks and 23.7% of municipalities were having dozer for mobilization of the solid waste. Other waste means of transportation of the municipalities were mini trucks/pick up, loader, excavator, boomer, jet machine, rickshaw, etc. Among other, tractor/power tillers and tripper/trucks were the major transportation means used commonly by the municipalities. The municipalities, on average, were having more than 1 tractor/power tiller and most of them were having one tripper/truck.

The survey revealed different waste handling practices adopted by the municipalities. The three main methods of waste handling were, i) piling up in landfill site by 48.6%, ii) burning by 32.1%, and iii) piling up in the river side by 27.4%. Among the municipal categories, 60% each metropolitan cities and sub-metropolitan cities and 47.7% of municipalities were adopting piling up in the landfill sites. Out of the total municipalities surveyed, 212 (78.2%) municipalities reported one or other practices of handling waste. Out of them, 30 (14.2%) municipalities were recycling their waste, which included 2 metropolitan cities, 5 sub-metropolitan cities and 23 municipalities. The recycling of waste was higher among metropolitan cities (50%) and sub-metropolitan cities (40%) as compared to the municipalities accounting only 11.7%. Although the municipalities were involved in recycling of waste, the quantity used for recycling was low. The recycled quantity of waste averaged 4.1% of the total waste produced which indicates a large potential of reuse and resource recovery for the municipalities.

Among the total municipalities surveyed, 114 (42.1%) municipalities were using the landfill sites, whereas 117 (43.2%) municipalities were not using landfill sites. Remaining 14.8% municipalities did not respond their status about the landfill sites. Among the municipalities using the landfill sites, 85.1% reported to have their own sites and 14.9% were using others' landfill

sites. The average area of the landfill sites of the municipalities was 1.5 ha. However, the area varied considerably by the categories of the municipalities. The sub-metropolitan cities had the higher land area of landfill sites (3 ha per landfill site) in compared to 1.4 ha land area among the municipalities and 0.3 ha among the metropolitan cities. Out of the total 66 municipalities reported for the area of landfill sites, the average capacity of the landfill site for the municipalities was 29877 m³. The capacity, however, varied from 22516 m³ for the municipalities to 115000 m³ for the metropolitan cities, and 68293 m³ for the sub-metropolitan cities.

The survey revealed varied distances of landfill sites with different categories of the municipalities. The average distance of landfill sites was 4.3 km, with the higher average distance (17.5 km) among the metropolitan cities as compared to 4.4 km among the sub-metropolitan cities and 4.0 km among the municipalities. The average life span of the landfill sites was 16.3 years with the lowest (6.5 years) among the metropolitan cities. The low life span of the landfill sites in metropolitan cities is due to lower land area and capacity against relatively large volume of waste generation. The average life span of landfill sites of municipalities was nearly 3 times higher than that of the metropolitan cities. Out of the total 97 landfill sites under consideration, only 7 sites were having one or other type of treatment system. Very few landfill sites were having leachate treatment facilities among the municipalities suggesting need of activities of the municipalities for the leachate management for controlling further contamination of the surrounding environment. Only 6 sites had leachate control system, 5 had leachate drainage system and 3 had leachate treatment system.

Among the total (271) municipalities surveyed, 149 (55%) municipalities have prepared their plans which were the basis to implement the waste management activities. Among the municipalities, 109 municipalities had prepared annual plans, 37 municipalities prepared shorter plans for less than one-year period. Another 45 municipalities had periodic plans for the waste management. The surveyed municipalities dif-

ferred in terms of having their plans and strategies and their implementation. Out of the total, 99 (36.5%) municipalities reported for having their plans and strategies on waste management against 57.2% of the municipalities without having such plans and strategies. Among the 271 municipalities, only 54 (19.9%) reported to have prepared the procedures (guidelines) for waste management.

In the present governance structure, waste management is largely the responsibility of the local governments. For the solid waste management, the local governments require adequate resources like human and financial resources. The survey revealed that 257 (94.8%) municipalities were expecting funds from the federal and provincial governments indicating resource constraint with municipalities. The surveyed municipalities reported that they have considered waste manage-

ment as a major challenge. Out of the total, 247 municipalities reported solid waste management as the challenges. Among them, 147 (59.5%) municipalities reported the municipal waste management as a major challenge, 122 (49.4%) municipalities reported low awareness to be the major challenge, and 113 (45.8%) municipalities reported lack of the landfill sites as the major challenge of waste management.

It is expected that waste generation is likely to increase in the years to come and Nepal might face substantial challenge in managing these wastes with the existing waste management mechanisms. The government therefore needs to develop effective waste handling procedures and strengthen institutional mechanisms to respond solid waste management challenges. Moreover, there is also need to strengthen the capacity of the municipalities in waste data handling and management.

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Abbreviations

ADB	Asian Development Bank
BS	Bikram Sambat
CBS	Central Bureau of Statistics
CSPro	Census and Survey Processing System
EIA	Environmental Impact Assessment
e-waste	Electronic and Electrical Waste
FDES	Framework for the Development of Environment Statistics
FY	Fiscal Year
GoN	Government of Nepal
HHs	Households
ha	Hectare
IEE	Initial Environmental Examination
km	Kilometer
m	Meter
MSW	Municipal Solid Waste
mt	Metric Ton
NPC	National Planning Commission
NRs	Nepalese Rupees
SDGs	Sustainable Development Goals
SWM	Solid Waste Management
UNDP	United Nation Development Program

INTRODUCTION

1.1 BACKGROUND

Solid Waste Management (SWM) is a crosscutting issue that impacts various areas of sustainable development. The SWM strategies and approaches affect ecological, economic and societal sustainability domains of each country (Rodic & Wilson, 2017). The SWM may affect livelihood, sanitation, public health, freshwater and terrestrial ecosystems, access to decent jobs and sustainable use of natural resources which are intricately linked with societal wellbeing. Thus, Government of Nepal (GoN) has given high priority in SWM. Accordingly, GoN has taken various initiatives in devising appropriate policies, programmes, institutional and financial arrangements to accelerate implementation of the Sustainable Development Goals (SDGs) in Nepal. The National Planning Commission (NPC) is the focal institution for the SDG monitoring for achieving the set goals and targets. GoN has set number of goal and targets as well as key milestones and achievements for the 2015-2030 period. It is expected that the public, private and cooperative sectors will work together to enhance commitments to achieve social, economic and environmental goals and targets set by the SDGs in Nepal.

In Nepal, the local governments are facing serious challenges to manage solid waste generated in the cities, and keep cities clean. Among the 753 local governments, 293 are urban that include metropolitan and sub-metropolitan cities, and municipalities, and rest 460 are rural municipalities (CRISIL, 2020). Among other, the SWM is one of the most prioritized responsibilities of the local governments. The Solid Waste Management Act, 2068 of Nepal has made the local governments responsible for the operation and management of infrastructure for collection, treatment and final disposal of the Municipal Solid Waste (MSW). Yet, it has largely remained a socially complex and technically ever-challenging task for the municipal authorities due to limited information on sol-

id waste status, inadequate financial resources and insufficient well-trained human resources to address the issue. After state re-structuring, the most of the newly constituted municipalities are managing MSW on temporary basis due to lack of engineered, well planned SWM facilities to manage the wastes utilizing the sustainable management options. Many municipalities still lack integration of SWM issues in their periodic plan, strategic plan and action plans. The quantity of solid waste is increasing every year in all municipalities as well as newly emerging cities mainly due to rapid urban population growth, market development and changing lifestyles.

The Central Bureau of Statistics (CBS), the central authority for the collection, analysis, publication and dissemination of statistics in Nepal, has executed the waste management baseline survey in 293 municipalities (except rural municipalities) of Nepal in 2019/20. The survey was carried out with the major aim to derive systematic and comprehensive data and information on quantity and composition of collected solid wastes, and solicit other vital information on the state of SWM in the municipalities of Nepal. The baseline assessment is expected to provide support in finding appropriate low cost, locally appropriate, sustainable waste management solutions and to provide sustainable development benefits and ultimately create transformational change towards low carbon, resource efficient and climate resilient, sustainable cities. The present document briefly discusses the finding of the survey and also reviews the current policies and legal frames pertaining solid waste management.

1.2 POLICIES AND LEGISLATIVE FRAMEWORKS

The GoN is fully committed for the management of solid wastes in the country. The issue of waste disposal and management has been a major problem in most of the municipalities. Though the municipalities have placed waste disposal and management in high priority,

many of them have not been able to handle their waste effectively primarily due to inadequate resources and technologies. Nevertheless, the GoN has formulated several policies and legislative frameworks for waste disposal and management which are briefly discussed in the following sections.

Solid Waste Management National Policy, 2053 (1996)

The national policy on solid waste management provides broader framework for the government including local government to manage the solid waste at local level. The main objectives of the policy are:

- To make solid waste management simple and effective,
- To minimize environmental pollution caused by the solid wastes and adverse effect and thereof to the public health,
- To mobilize the solid wastes as resources,
- To privatize the solid waste management, and
- To obtain public support by increasing public awareness in sanitation works.

The national policy on solid waste management is directed towards making the then local bodies competent in wastes management and enhancement of their capacity to provide more skilled human resources and effective sanitation services.

Clause 5.1 of the policy clearly spells out the involvement of the local level institutions in solid waste management. The policy stipulates that there shall be a separate unit concerning sanitation works in each municipal corporation, sub-municipal corporations, municipalities, and town-oriented the then village development committees where the solid wastes management has become a problem. The local body shall operate its works in close co-ordination with the national level institutions concerning solid waste management maintained by the then His Majesty's Government (now named as Government of Nepal). The responsibilities of those institutions include collection, preservation, mobilization, site management, transportation and final disposal of solid wastes in collaboration with the private sector, if necessary.

Solid Waste Management Act, 2068 (2011)

The Solid Waste Management Act, 2068 is the governing legislative statute that provides regulatory guidance for the solid waste management in the country. The Act is explicit on various aspects of waste management with clearly outlined roles and responsibilities on the solid waste management from central to local level. Chapter 1, Clause 2 (aa) defines the "Local Body" as concerned municipality, sub-municipality, city and the then Village Development Committee whose roles are critical in solid waste management. Chapter 3 of the Act charts out the responsibilities of local bodies in the solid waste management as follows.

- The local body shall be responsible for the management of solid waste by construction and operation of infrastructure like transfer station, landfill site, processing plant, compost plant, biogas-plant and also collection of waste, final disposal and processing,
- The local body shall be responsible for the arrangement of the solid waste collected in the course of cleaning, throwing or placing solid waste at the collection centre, transfer station or processing site, or its use in other ways.

Local Government Operation Act, 2074 (2018)

The waste management activities at the local level are largely guided by the Local Government Operation Act, 2074. The functions, roles and responsibilities of local government have been clearly spelled out in Section 3 of the Act. Clause 1.1 of the Chapter specifies the roles and responsibilities of the local governments. Sub-clause "Jha" of the clause specifies fundamental health and sanitation with particular focus on the followings.

- Awareness raising on sanitation and waste management,
- Collection, re-use, re-cycle and disposal of waste and fixation of tariff and its regulation,
- Coordination, collaboration and partnership with private sector and non-government agencies for waste management.

Clause 12 (Sub-clause 11) of the Act outlines that the Ward Committee of the local government about the collection and management of household level wastes, sanitation of Chowks and Gallies, sewerage management, management of dead animals, drainage of surface water and conservation of water sources. Likewise, Clause 26 states about partnership and collaboration by the municipalities for the disposal of wastes or development and operation of waste management system.

National Climate Change Policy, 2076 (2019)

The government of Nepal has issued the National Climate Change Policy, 2076 with the objective of providing policy guidance to government bodies for reducing the impact of climate change and developing climate resilient society. The goal of this policy is to make contribution to socio-economic prosperity of the nation by building climate resilient society. Section 8.7 of the policy contains health, drinking water and sanitation under which strategies and working policies (C) specifies that emphasis will be given to the proper management of harmful and hazardous waste and the use of biodegradable waste for energy production by segregating the wastes generated by households, hotels and hospitals at their sources.

Environmental Protection Act, 2076 (2019)

Environmental Protection Act, 2076 came into force recently by amending and consolidating the prevailing laws on environmental protection. The Act envisages:

- To protect the fundamental right of each citizen to live in a clean and healthy environment,
- To provide the victim with compensation by the polluter for any damage resulting from environmental pollution or degradation,
- To maintain a proper balance between environment and development,
- To mitigate adverse environmental impacts on environment and biodiversity, and
- To face the challenges posed by climate change.

Chapter-2 of the Act has provisioned for an Environmental Study, including Initial Environmental Examination (IEE) report and/or

Environmental Impact Assessment (EIA) for a development project which shall be submitted and approved from the relevant authorities such as the Investment Board and/or by the Ministry of Forests and Environment of the GoN. Similarly, Chapter-3 refers about "Pollution Control" whereby the Government publishes notification in the Nepal Gazette, may determine necessary standards for the mitigation of the impacts of vehicular pollution, and pollution from equipment, industrial enterprises, hotels, restaurants or other places or from the disposal or emission of hazardous substances. According to sub-section-2, no person shall create pollution in such a manner as to cause significant adverse impacts on the public life, public health and environment or commit any act contrary to the standards determined by the Government of Nepal pursuant to sub-section-1.

Sustainable Development Goals (SDGs), 2016-2030

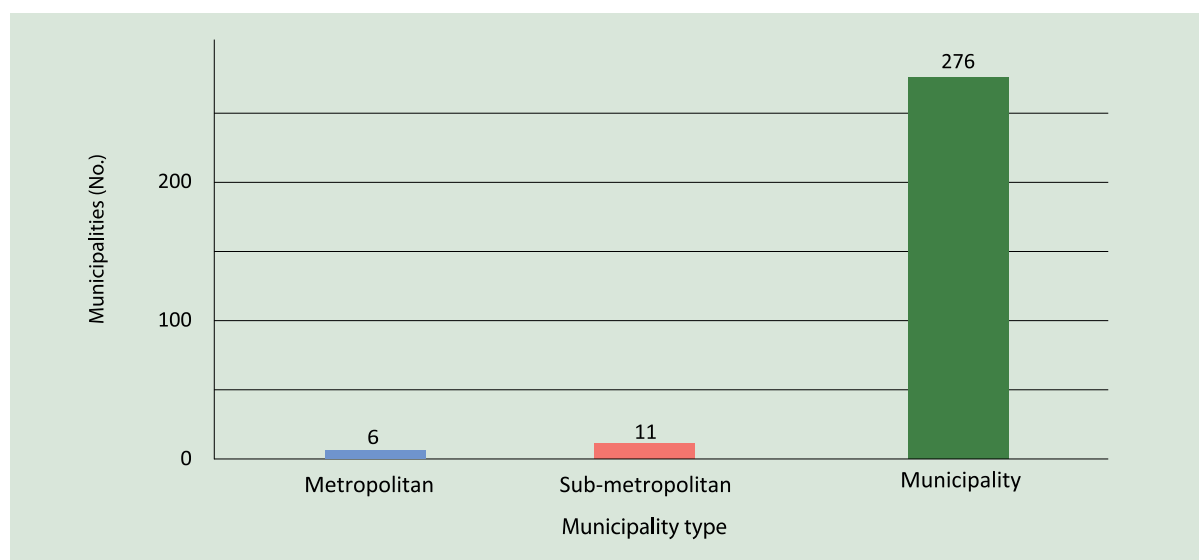
The SDG-11, target 6 stipulates to reduce the adverse per capita environmental impact of cities by paying special attention to air quality, and municipal and other waste management. In accordance with SDG-11, target 6, Nepal has set two targets and indicators in the municipal waste management. These targets include i) percentage of municipalities with sewerage services reaching 100% by 2020, and ii) private hospitals segregating waste attaining 100% by 2017.

1.3 SCOPE OF THE WORK

The present baseline survey of the solid waste management in the different municipalities of Nepal mainly consisted of two parts. The first part includes survey management for 293 municipalities and the second part includes data entry and analysis on MSW quantity and composition.

1.3.1 Survey Management

CBS conducted the waste management baseline survey in 2019/20 with the major aims of generating the baseline data and information on SWM including the quantity and composition of MSW, and other vital information about the state of SWM in different municipalities of

Fig 1.1: Distribution of the municipalities by their types**Table 1.1: Summary of Participating and Not Participating Municipalities**

Type of Municipalities	Participating (%)	Not Participating (%)	Municipalities (No.)
Metropolitan City	5 (83.3)	1 (16.7)	6 (100)
Sub-metropolitan City	11 (100.0)	0 (0.0)	11 (100)
Municipality	255 (92.4)	21 (7.6)	276 (100)
Overall	271 (92.5)	12 (7.5)	293 (100)

Note: Figures in parenthesis indicate percentage.

Nepal. The study also aims to contribute in developing the SDG indicator 11.6.1 “Proportion of municipal solid waste collected and managed in controlled facilities out of the total municipal waste generated by cities”, to develop the statistics on the solid waste sector in accordance with the Framework for the Development of Environment Statistics (FDES), and to provide recommendation for appropriate low cost and locally appropriate sustainable waste management solutions and ultimately create transformational change towards low carbon, resource efficient, climate resilient and sustainable cities.

During the course of survey, in the first phase, CBS organized a consultation workshop with the stakeholders for identifying the required information and availability of data in municipalities. Then the questionnaire was drafted in consultation with the experts working in the waste sector. The questionnaire was then tested in different places to collect the comments

and feedback for improvement. The major contents of the questionnaire include: land use information, organizational, managerial and financial information, composition and collection of solid waste, information about transfer station, landfill site and challenges/needs of the municipal waste management. After finalizing the questionnaire, training was organized for supervisors and enumerators for making them acquaint about survey protocols to be adapted during field data collection. The field survey was planned for 293 municipalities (6 were metropolitan city, 11 were sub-metropolitan city and 276 municipalities) of Nepal (Figure 1.1). But of total, responses were not obtained from 22 municipalities, therefore only 271 municipalities data were used to prepare this report (Table 1.1). In addition, though 271 municipalities participated in the survey process, for some of the questions, responses were not obtained from all the municipalities.

1.3.2 Data Entry

Data entry programme was developed in the Census and Survey Processing System (CSPRO). The data entry was based on double entry method. The CSPRO comparison facility was used to ensure that the forms are entered correctly. Any inconsistencies identified were verified with the questionnaire filled by the municipalities.

1.3.3 Data Analysis

The data was analyzed by integrating the Visual FoxPro and the Microsoft Excel to produce the summary tables in the Microsoft Excel in an automated method. The data was tabulated with disaggregated output data on the basis of ecological zones (mountain, hill and Terai) and types of municipality (Metropolitan City, Sub-Metropolitan City and Municipality). All the charts presented in the report were prepared in the R-software, version 3.5.1 (R Core Team, 2016).

1.3.4 Limitations of the Survey

The survey aimed to cover 293 municipalities of Nepal. However, responses were not obtained from some of the municipalities, therefore, during data analysis only 271 municipalities were considered. In addition, about 80% of the municipalities formed after state re-structuring in 2070 BS do not have enough physical infrastructure and mechanisms for waste handling, management and record keeping system. Thus, from those municipalities, responses for some key questions were not obtained. Moreover, there was large variation in information among municipalities; thus average values of waste collections might have been overestimated or underestimated when relating it to a particular municipality's data.

II. SURVEY FINDINGS

2.1 GEOGRAPHICAL CHARACTERISTICS

In the present federal structure, Nepal has a total of 753 local governments including metropolis, sub-metropolis, municipalities and rural municipalities. Among the total, the metropolis, sub-metropolis and municipalities account to be 293 with 6 metropolitan cities, 11 sub-metropolitan cities and 276 municipalities. The six metropolitan cities are Kathmandu, the federal capital of the country, Lalitpur, Pokhara, Bharatpur, Birgunj and Biratnagar.

2.1.1 Distribution of the Municipalities

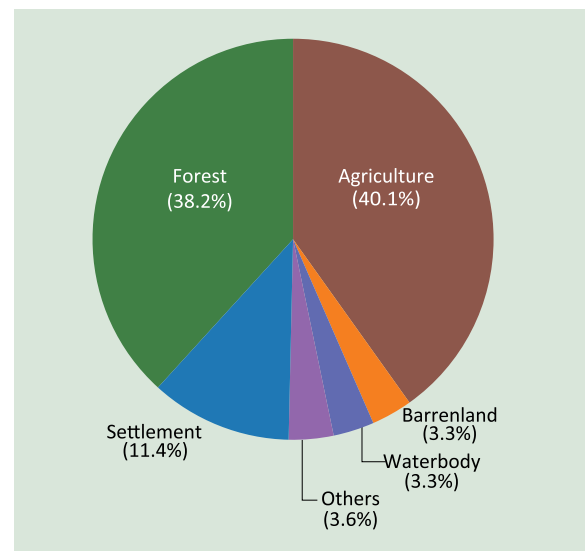
Geographically, the municipalities of Nepal are located in three different ecological zones, namely mountains, hills and Terai. Among the 271 municipalities considered in this study, the highest numbers (133) are located in Terai followed by hills (112) and mountains (26). Provincially, the Province-2 include the highest (60) number of municipalities followed by Province 1 (49) and Karnali Province (25).

In terms of area, the municipalities showed considerable variation in their size. The average area of 271 municipalities was 155.5 sq. km with higher (231.2 sq. km) average area for the metropolitan cities and lower average area (151.3 sq. km) for the municipalities. The average area for sub-metropolitan city was 219.7 sq. km. Among the 5 metropolitan cities considered for the present survey, 2 had land areas greater than 400 sq. km. Area wise, the large number (114) accounting 42.1% of municipalities fall under the area range of 200-300 sq. km and only 1 sub-metropolitan city and 4 municipalities were having area above 500 sq. km. Among the 271 municipalities considered, 28 were established before 2051 BS, 24 municipalities were established in between 2051 BS and 2070 BS, and 219 municipalities after 2070 BS.

2.1.2 Land Use and Natural Resources

In terms of the land use, the lands within municipalities were categorised under six different types, viz. settlement, agriculture, forest, water body, barren land, and others. The highest (38.2%) proportion of municipal land is covered by forest followed by agriculture (40.1%), settlement (11.4%), other uses (3.6%), and water bodies and barren land (3.3% each). Among sub-metropolitan cities, metropolitan cities and municipalities, the distribution of land under settlement were 21.1%, 14.8% and 11.1%, respectively. Agricultural land area is still higher in metropolitan cities (53.2%), while the forest coverage is higher among the municipalities (38.7%).

Fig 2.1: Land Use Pattern of the Municipalities



2.2 INSTITUTIONAL CAPACITY

The municipalities have important role in the waste management of the urban areas. However, the different municipalities have varying capabilities for waste handling and management in terms of institutional frameworks and settings. Among the surveyed municipali-

Table 2.2: Number of Total Municipal Human Resources of the Municipalities

Categories	Average Number of Human Resources		
	Male	Female	Total
Metropolitan City	316.0 (66.2)	161.3 (33.8)	477.3 (100.0)
Sub-Metropolitan City	223.8 (71.2)	90.5 (28.8)	314.3 (100.0)
Municipality	68.8(69.5)	30.2 (30.5)	98.9 (100.0)
Overall	79.1 (69.5)	34.7 (30.5)	113.8 (100.0)

Note: Figures in parenthesis indicate percentage.

ties, only 103 (38.0%) municipalities reported to have separate units/divisions to look after waste management. Among them, 129 (47.6%) municipalities reported lack of such units/divisions, whereas 39 (14.4%) municipalities did not report about institutional capacity for the waste management. Details of the institutional features and capacities are presented in the following sub-sections.

2.2.1 Human Resources

The survey revealed that the average human resources available with the municipalities were 114 (Table 2.2). The metropolitan cities hold higher number of human resources (averaging 477 persons) compared to the sub-metropolitan cities and the municipalities. In the municipalities, 69.5% of the human resources available represented males and the rest females. Out of the total human resources, working in the waste management sector was reported to be 16 per-

sons. The human resources working in waste management largely represented males accounting 76% (Table 2.3).

The average number of human resources assigned for waste management in the metropolitan cities was 118, followed by 59 and 12 in the sub-metropolitan cities and municipalities, respectively (Figure 2.2). Gender wise, males were higher than females in all the municipalities (Table 2.3). Among the females, share of females working in waste management was higher (38%) in the metropolitan cities compared to the sub-metropolitan cities and municipalities.

In the municipalities, the human resources having engineering background recruited were environmental, civil and mechanical engineers. The survey revealed limited technical human resources in the municipalities. The average numbers of environmental, civil and mechanical

Table 2.3: Human Resources Working in Waste Management

Categories	Average Number					
	Male		Female		Total	
	No.	%	No.	%	No.	%
Metropolitan City	74	62	45	38	118	100.0
Sub-Metropolitan City	47	80	12	20	59	100.0
Municipality	9	78	3	22	12	100.0
Overall	12	76	4	24	16	100.0

Table 2.4: Municipalities Reporting Human Resource Working on Waste Management by Positions

Positions	Number of Municipalities Reporting			Average Number of Human Resources		
	Male	Female	Total	Male	Female	Total
Environmental Engineer	11(73.3)	4(26.7)	15(5.5)	0.04 (73.3)	0.01 (26.7)	0.06 (100.0)
Civil Engineer	71 (100.0)	1 (1.4)	71(26.2)	0.42 (96.6)	0.01 (3.4)	0.44 (100.0)
Mechanical Engineer	5 (100.0)		5 (1.9)	0.03 (100.0)	-	0.03 (100.0)
Environmental Officer	43 (93.5)	4 (8.7)	46 (17.0)	0.17 (92.0)	0.01 (8.0)	0.18 (100.0)

Positions	Number of Municipalities Reporting			Average Number of Human Resources		
	Male	Female	Total	Male	Female	Total
Sub-engineer	59 (93.7)	13 (20.6)	63 (23.3)	0.48 (86.6)	0.07 (13.4)	0.55 (100.0)
Supervisor	70 (95.9)	5 (6.9)	73 (26.9)	0.60 (97.0)	0.02 (3.0)	0.62 (100.0)
Mechanics	12 (100.0)		12 (4.4)	0.07 (100.0)	-	0.07 (100.0)
Driver	197 (100.0)	1 (0.5)	197 (72.7)	2.29 (99.8)	0.00 (0.2)	2.30 (100.0)
Helper	135 (97.8)	31 (22.5)	138 (50.9)	2.06 (87.7)	0.29 (12.3)	2.34 (100.0)
Sweeper	134 (83.2)	103 (64.0)	161 (59.4)	4.55 (66.5)	2.29 (33.5)	6.85 (100.0)
Municipal (Nagar) Police	69 (98.6)	40 (57.1)	70 (25.8)	1.72 (83.7)	0.34(16.3)	2.06 (100.0)
Other	38 (88.4)	22 (51.2)	43 (15.9)	1.22(71.0)	0.50 (29.0)	1.72 (100.0)
Overall	228 (98.3)	144 (62.1)	232 (85.6)	13.66(79.4)	3.55 (20.7)	17.21 (100.0)

Note: Figures in parenthesis indicate percentage.

engineers available with the municipalities were very low. These numbers account about 1 engineer for 17 municipalities, less than 1 civil engineer for 2 municipalities and about 1 mechanical engineer for 34 municipalities. Similarly, each municipality lacks Environmental Officers which equates to about 1 environmental officer for 6 municipalities. The numbers of sub-engineer and supervisor were relatively high. Staffs like driver, helper, sweeper, etc. were relatively high in the municipalities. Among other, the sweepers accounted highest figure in all the municipalities with average ~ 7 per municipality or more than one third among the total human resources working in waste management sector

(Table 2.4). Female workers represented mostly the lower level staff mainly working in city sanitation such as sweeping and cleaning. Gender wise, males were higher than females in all the positions. In overall, female employees accounted for about 20% of the total human resources working in waste management.

2.2.2 Annual Expenses

The annual average expenditures of the municipalities for three consecutive years amounted to Rs 363.1 million in 2074/75, which increased to Rs 691.8 million in 2075/76 and Rs 702.8 million in 2076/77 (Table 2.5). The information obtained regarding the annual expenditures made on en-

Table 2.5: Annual Expenditure of the Municipalities and Expenditure on Environment Sector

Categories	Average Annual Expenditure (Rs)		
	FY 2074/75	FY 2075/76	FY 2076/77 (Provisional)
Metropolitan City	3,541,894,360	5,535,409,971	5,494,277,346
Sub-Metropolitan City	500,320,043	1,237,202,831	1,379,133,620
Municipality	294,875,694	573,292,802	579,770,661
Overall	363,122,857	691,793,157	702,890,683
Average Annual Expenditure on Environment Sector (Rs)			
Metropolitan City	249,123,000	309,275,700	256,641,000
Sub-Metropolitan City	5,783,008	14,053,747	18,682,944
Municipality	1,658,411	4,732,922	4,803,750
Overall	6,426,788	10,774,717	10,052,290
Budget on Environment as % of Total Municipal Budget			
Metropolitan City	7.03	5.59	4.67
Sub-Metropolitan City	1.16	1.14	1.35
Municipality	0.56	0.83	0.83
Overall	1.77	1.56	1.43

Table 2.6: No. and Percentage of Municipalities Collecting Waste Collection Charge from the Waste Producers

Categories	Households	Office/ Institutions	Hotel/ Restaurant	Business house/ Commercial complex	Health Institutions/ Hospitals	Other specify	Total Reporting (N)
Metropolitan City	80.0	60.0	80.0	60.0	60.0	20.0	5
Sub-Metropolitan City	87.5	87.5	100.0	87.5	75.0	25.0	8
Municipality	94.3	70.0	91.4	82.9	65.7	24.3	70
Total/ Overall	92.8	71.1	91.6	81.9	66.3	24.1	83

vironmental sector were from 187, 239 and 252 municipalities for the year 2074/75, 2075/76 and 2076/77, respectively. The annual expenditures of the municipalities increased considerably over three years. The substantial increment in the expenditure in 2075/76 and 2076/77 reflect increased budgetary allocations after the execution of federal system under which local governments (municipalities) have increased roles in resource generation, budget allocation and utilization from their own sources.

The municipality's expenditure on the environment sector as percentage of the total expenditure varied markedly across the three types of municipalities. The expenditures of metropolitan cities on environmental sector were in the range of 4.7% to 7.0% of the total budget during the last three years. The corresponding values for sub-metropolitan cities were in the range of 1.1% to 1.4%, while that of municipalities was less than 1% for the years.

2.2.3 Sources of Revenue

In order to manage their wastes, the municipalities generated their resources through different sources. The large share of the municipalities' resources was obtained from the federal government, while

limited revenue was generated from other sources. Out of the total, only 83 (30.6%) municipalities collected fees locally for waste management (Table 2.6). These included 5 metropolitan cities, 8 sub-metropolitan cities and 70 municipalities. The survey revealed that 112 (41.3%) municipalities were not collecting any fees, whereas 152 (56.1%) municipalities did not report about fee collection. The information indicates the possibility of revenue generation at local level by the municipalities for waste management.

The municipalities collected fees or charges against waste collection from various sources such as households, office/institutions, hotel/restaurants, business/commercial entities, health institutions, etc. Among the municipalities surveyed, all metropolitan cities (100%) collected fees from one or other sources, whereas 72.7% sub-metropolitan cities and only 27.5% municipalities collected fees from the above mentioned sources.

The monthly waste collection charges or service charges varied among three categories of the municipalities and also by sources. In general, the waste collection charges ranged from NRs 30/month per household to NRs 317/month for health institution. The waste collection charges

Table 2.7: Average Amount of Service Charge Collected

Categories	Households (Rs/Month)	Office/ Institutions (Rs/Month)	Hotel/ Restaurant (Rs/Month)	Business house/ Commercial complex (Rs/Month)	Health Institutions/ Hospitals (Rs/Month)	Other (Rs/ Month)
Metropolitan City	138	200	780	180	1128	300
Sub-Metropolitan City	106	764	986	2,500	909	91
Municipality	25	35	84	49	275	97
Overall	30	68	134	151	317	100

Table 2.8: Annual Revenue from Waste Collection Charge

Categories	Number of Municipalities Reporting		
	FY 2074/75	FY 2075/76	FY 2076/77
Metropolitan City	2 (40.0)	2 (40.0)	2 (40.0)
Sub-Metropolitan City	3 (27.3)	4 (36.4)	4 (36.4)
Municipality	31 (12.2)	55 (21.6)	59 (23.1)
Total	36 (13.3)	61 (22.5)	65 (24.0)
Average Annual Revenue (Rs)			
Metropolitan City	1,075,088	9,478,181	7,661,095
Sub-Metropolitan City	2,443,548	1,815,419	1,929,227
Municipality	835,488	930,273	940,071
Overall	964,394	1,360,198	1,335,481

Note: Figures in parenthesis indicate percentage.

in the metropolitan cities were higher (NRs 138) for households, NRs 1128 for health institutions/hospitals and NRs 300 for others; whereas sub-metropolitan cities charged higher (NRs 764) fees for the office/institutions, NRs 986 for hotels/restaurants, and NRs 151 for business/commercial complex (Table 2.7). In compared to the metropolis and sub-metropolis, the municipalities were charging less for all the sectors.

The overall annual revenue generated by the municipalities from waste collection amounted to NRs 0.96 million in 2074/75 which rose to NRs 1.36 million in 2075/76 (Table 2.8). However, this (provisional) amount decreased marginally to NRs 1.34 million in 2076/77. By the type of the municipalities, the annual revenues generated were higher among the metropolitan cities followed by the sub-metropolitan cities and the municipalities, including the provisional amount estimated for 2076/77.

The municipalities, although very small, also generated some revenue from fines and penalties

charged against violation of the waste collection and management practices. The overall revenue collected under the fine and penalty was NRs 10362 in 2074/75 which increased marginally to over NRs 11000 in 2075/76 and fell down again to an estimated NRs 9582 in 2076/77 (Table 2.9). The amounts were higher for metropolitan cities for all the three years as compared to the sub-metropolitan cities and the municipalities.

At present, for the municipalities, grants from the federal and provincial governments are the major sources of revenue. However, there is limited information about the budget/revenue that municipalities have received from the federal and provincial governments. The survey showed information not available on the grants received by the metropolitan cities; whereas the provisional grant amount to a sub-metropolitan city was NRs 2.58 million for the year 2076/77 (Table 2.10). The average grant provided to the municipalities ranged from NRs 0.3 million to nearly NRs 0.6 million.

Table 2.9: Annual Revenue from Fine and Penalty

Categories	Number of Municipalities Reporting			Average Annual Revenue (NRs)		
	FY 2074/75	FY 2075/76	FY 2076/77	FY 2074/75 Actual	FY 2075/76 Actual	FY 2076/77 Provisional
Metropolitan City	2 (40.0)	2 (40.0)	2 (40.0)	91,200	124,613	132,875
Sub-Metropolitan City		2 (18.2)	1 (9.1)	-	35,833	16,667
Municipality	4 (1.6)	7(2.8)	7 (2.8)	4,648	3,286	2,244
Overall	6(2.2)	11(4.1)	10(3.7)	10,362	11,054	9,582

Note: Figures in parenthesis indicate percentage

Table 2.10: Annual Revenue from Federal/Provincial Grant

Categories	Number of Municipalities Reporting			Average Annual Revenue (NRs)		
	FY 2074/75	FY 2075/76	FY 2076/77	FY 2074/75 Actual	FY 2075/76 Actual	FY 2076/77 Provisional
Metropolitan City				-	-	-
Sub-Metropolitan City			1 (9.1)	-	-	2,577,415
Municipality	6 (2.4)	8 (3.1)	9 (3.5)	354,852	443,984	430,137
Overall	6 (2.2)	8 (3.0)	10 (3.7)	305,338	388,486	564,632

Note: Figures in parenthesis indicate percentage.

In addition to the federal and provincial government's support, foreign grant was also reported as a source of revenue for the municipalities. The survey showed that only one metropolitan city received grant amounting NRs 10.9 million in 2076/77 (Table 2.11). In case of the municipalities, very few have received the grant averaging NRs 0.26 million in 2074/75, Rs 0.05 million in 2075/76 and Rs 0.22 million (provisional) in 2076/77 (Figure 2.3). The average revenue equivalent to NRs 1.7 million in the year 2074/75, increased marginally to Rs 1.97 million in 2075/76 which substantially increased to 2.79 million (provisional) in 2076/77.

During the survey, the overall average revenues showed marginal increment over the last 3 years. However, these figures showed fluctuations among

different types of municipalities. The metropolitan cities reported much higher share of revenue, compared to other two categories, with significant rise over 3 years which jumped from NRs 1.17 million in 2074/75 to NRs 18.7 million (provisional) in 2076/77 (Table 2.12). In case of sub-metropolitan cities, the revenues decreased in the second year and again rose in the third year, though by a much lower proportion. Similarly, the municipalities also reported increment in their revenue during the three years period, by lower growth rate in compared to the metropolitan cities.

2.3 TYPE OF WASTE

The wastes generated by the municipalities were broadly categorized in to three types, namely the organic waste, inorganic waste and other waste. Although different categories of solid

Table 2.11: Annual Revenue from Foreign Grant

Categories	Number of Municipalities Reporting			Average Annual Revenue (NRs)		
	FY 2074/75	FY 2075/76	FY 2076/77	FY 2074/75 Actual	FY 2075/76 Actual	FY 2076/77 Provisional
Metropolitan City			1 (20.0)	-	-	10,915,313
Sub-Metropolitan City				-	-	-
Municipality	4 (1.6)	4 (1.6)	5 (2.0)	255,960	49,063	219,014
Overall	4 (1.5)	4 (1.5)	6(2.2)	220,244	42,930	718,666

Note: Figures in parenthesis indicate percentage.

Table 2.12: Annual Revenue from Waste Related Activities - Combined of all the Sources

Categories	Number of Municipalities Reporting			Average Annual Revenue (Rs)		
	FY 2074/75	FY 2075/76	FY 2076/77	FY 2074/75 Actual	FY 2075/76 Actual	FY 2076/77 Provisional
Metropolitan City	3 (60.0)	3 (60.0)	4 (80.0)	1,166,288	9,602,794	18,709,283
Sub-Metropolitan City	3 (27.3)	6 (54.6)	6 (54.6)	3,643,548	2,451,253	5,123,308
Municipality	37 (14.5)	63 (24.7)	73 (28.6)	1,657,362	1,562,848	1,731,638
Overall	43 (15.9)	72 (26.6)	83 (30.6)	1,761,672	1,971,880	2,795,018

Note: Figures in parenthesis indicate percentage.

Table 2.13: Number of Municipalities Reporting Different Types of Organic Waste Collected

Categories	Textile	Leather	Paper	Agricultural/Garden Management	Other	Total Reporting
Metropolitan City	2 (100.0)	2 (100.0)	2 (100.0)	2 (100.0)	2 (100.0)	2 (40.0)
Sub-Metropolitan City	5 (71.4)	4 (57.1)	5 (71.4)	4 (57.1)	4 (57.1)	7 (63.6)
Municipality	98 (64.5)	68 (44.7)	96 (63.2)	85 (55.9)	77 (50.7)	152 (59.6)
Overall	105 (65.2)	74 (46.0)	103 (64.0)	91 (56.5)	83 (51.6)	161 (59.4)

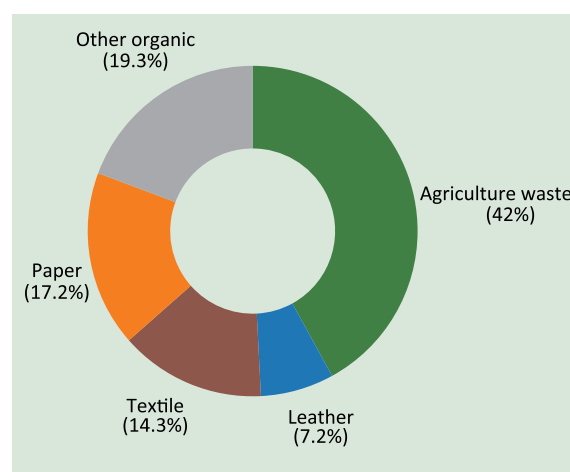
Note: Figures in parenthesis indicate percentage.

waste could be created, municipal solid wastes have been categorized in these three groups due to readily identifiable fractions, and ease of making consistent with categories cited in most researches and applications (Tchobanoglous et al., 1993). A total of 161, 164 and 140 municipalities reported organic waste, inorganic waste and other waste, respectively.

2.3.1 Organic Waste

The survey revealed organic waste as one of the major categories of waste generated from the municipalities. These categories include agricultural/garden waste, paper, textile, leather and other organic wastes (Figure 2.2). Among the 161 municipalities who reported qualitative information about the organic waste, 105 (65.2%) municipalities reported textile waste, 103 (64.0%) municipalities reported paper waste, 91 (56.5%) municipalities reported agricultural/garden waste, 74 (44.7%) municipalities reported leather waste and 83 (51.6%) municipalities reported other categories (Table 2.13).

Among the different municipalities, some differences were noted on the organic waste collection. The overall annual collection of textile waste among the municipality and sub-metropolitan city averaged in the range of 106 mt to about 162 mt from 2073/74 to 2075/76 (Table 2.14). However, the average figures were con-

Fig 2.2: Overall Composition of Organic Waste in the Municipalities (2075/76)

siderably higher among the metropolitan cities in compared to the sub-metropolitan cities and municipalities. For instance, the average quantity of textile waste collection in the metropolitan cities stood at 2,514.5 mt in 2075/76 against 146.8 mt in the sub-metropolitan cities and only 124.2 mt among the municipalities.

Similarly, the average quantity of leather waste collection per municipality ranged from 114.2 mt in 2073/74 to 86.3 mt in 2075/76 (Table 2.15). The average quantity was higher among the metropolitan cities and lower among the sub-metropolitan cities during the three years period.

Table 2.14: Annual Organic Waste Collection – Textile

Categories	Number of Municipalities Reporting			Average Annual Collection of Textile (mt)		
	FY 2073/74	FY 2074/75	FY 2075/76	FY 2073/74	FY 2074/75	FY 2075/76
Metropolitan City	1 (20.0)	1 (20.0)	2 (40.0)	3,811.0	4,034.0	2,514.5
Sub-Metropolitan City	3 (27.3)	3 (27.3)	5 (45.5)	141.3	162.0	146.8
Municipality	53 (20.8)	73 (28.6)	93 (36.5)	117.0	106.3	124.2
Overall	57 (21.0)	77 (28.4)	100 (36.9)	183.1	159.5	173.1

Note: Figures in parenthesis indicate percentage.

Table 2.15: Annual Organic Waste Collection – Leather

Categories	Number of Municipalities Reporting			Average Annual Collection of Leather (mt)		
	FY 2073/74	FY 2074/75	FY 2075/76	FY 2073/74	FY 2074/75	FY 2075/76
Metropolitan City	1 (20.0)	1 (20.0)	2(40.0)	2,018.0	2,136.0	1,342.0
Sub-Metropolitan City	3 (27.3)	3 (27.3)	4 (36.4)	16.3	20.3	19.8
Municipality	31 (12.2)	44 (17.3)	62 (24.3)	62.3	55.3	50.0
Overall	35 (12.9)	48 (17.7)	68 (25.1)	114.2	96.5	86.3

The survey revealed paper waste as one of the major constituents of waste material reported by the municipalities. The quantity of paper waste collected by the municipalities was increasing for the last 3 years (Table 2.16). The quantity of paper waste in the metropolitan cities was higher than that of the sub-metropolitan cities and municipalities. The survey revealed the agricultural/garden waste comprised an important fraction of waste with an average of 472.8 mt per municipality in 2073/74 which increased to 558.8 mt in 2074/75 and 506.3

mt in 2075/76 (Table 2.17). Agricultural/garden waste in this survey includes all the food related wastes from kitchen, vegetable wastes generated from vegetable markets and also the fraction of garden wastes collected from the households.

The organic waste other than paper, textile waste, agricultural waste and leather has been categorized as the other organic waste. The survey revealed that the quantity of other organic waste was higher in the range from 1243.5mt to

Table 2.16: Annual Organic Waste Collection - Paper

Categories	Number of Municipalities Reporting			Average Annual Collection of Paper (mt)		
	FY 2073/74	FY 2074/75	FY 2075/76	FY 2073/74	FY 2074/75	FY 2075/76
Metropolitan City	1 (20.0)	1 (20.0)	2 (40.0)	4,708.0	4,983.0	3,494.0
Sub-Metropolitan City	3 (27.3)	3 (27.3)	5 (45.5)	169.0	202.3	735.4
Municipality	48 (18.8)	69 (27.1)	92 (36.1)	131.7	137.9	107.1
Overall	52 (19.2)	73 (26.9)	99 (36.5)	221.8	207.0	207.3

Note: Figures in parenthesis indicate percentage.

Table 2.17: Annual Organic Waste Collection - Agricultural/Garden Management

Categories	Number of Municipalities Reporting			Average Annual Collection of Agricultural/Garden Waste (mt)		
	FY 2073/74	FY 2074/75	FY 2075/76	FY 2073/74	FY 2074/75	FY 2075/76
Metropolitan City	1 (20.0)	1 (20.0)	2 (40.0)	1,076.0	1,139.0	2,343.0
Sub-Metropolitan City	3 (27.3)	3 (27.3)	4 (36.4)	699.7	836.0	1,808.0
Municipality	45 (17.7)	63 (24.7)	79 (31.0)	444.2	536.4	393.9
Overall	49 (18.1)	67 (24.7)	85 (31.4)	472.8	558.8	506.3

Note: Figures in parenthesis indicate percentage.

Table 2.18: Annual Organic Waste Collection - Other Organic Waste

Categories	Number of Municipalities Reporting			Average Annual Collection of Other Organic Waste (mt)		
	FY 2073/74	FY 2074/75	FY 2075/76	FY 2073/74	FY 2074/75	FY 2075/76
Metropolitan City	1 (20.0)	1 (20.0)	2 (40.0)	1,121.0	1,186.0	976.0
Sub-Metropolitan City	2 (18.2)	2 (18.2)	4 (36.4)	1,243.5	1,823.5	1,378.3
Municipality	36 (14.1)	54 (21.2)	72 (28.2)	74.7	114.0	148.9
Overall	39 (14.4)	57 (21.0)	78 (28.8)	161.5	192.8	233.2

Note: Figures in parenthesis indicate percentage.

Table 2.19: Annual Average Organic Waste Collection per Municipality by Years

S.N.	Waste Type	FY	Metropolitan City	Sub-Metropolitan City	Municipality	Average
1	Textile (mt)	FY 2073/74	3,811.0	141.3	117.0	183.1
		FY 2074/75	4,034.0	162.0	106.3	159.5
		FY 2075/76	2,514.5	146.8	124.2	173.1
2	Leather (mt)	FY 2073/74	2,018.0	16.3	62.3	114.2
		FY 2074/75	2,136.0	20.3	55.3	96.5
		FY 2075/76	1,342.0	19.8	50.0	86.3
3	Paper (mt)	FY 2073/74	4,708.0	169.0	131.7	221.8
		FY 2074/75	4,983.0	202.3	137.9	207.0
		FY 2075/76	3,494.0	735.4	107.1	207.3
4	Agricultural/Garden management (mt)	FY 2073/74	1,076.0	699.7	444.2	472.8
		FY 2074/75	1,139.0	836.0	536.4	558.8
		FY 2075/76	2,343.0	1,808.0	393.9	506.3
5	Other Organic (mt)	FY 2073/74	1,121.0	1,243.5	74.7	161.5
		FY 2074/75	1,186.0	1,823.5	114.0	192.8
		FY 2075/76	976.0	1,378.3	148.9	233.2
6	Total of Organic Waste (mt)	FY 2073/74	12,734.0	2,269.8	829.8	1,153.3
		FY 2074/75	13,478.0	3,044.2	950.0	1,214.6
		FY 2075/76	10,669.5	4,088.2	824.2	1,206.1

1823.5 mt per sub-metropolitan cities in compared to the metropolitan cities (Table 2.18). The average quantity of other organic waste in the municipalities was in between 74.7 mt and 148.9 mt for the last 3 years.

The aggregated data pertaining different types of organic waste collected by the municipalities for the last 3 years revealed that the organic waste was increasing consistently over the last 3 years with higher quantity among the metropolitan cities in compared to the sub-metropolitan

cities and the municipalities (Table 2.19). Among the five categories of wastes, paper, textile waste and agricultural/garden wastes were prominent in the metropolitan cities. For instance, paper and textile wastes were the major two organic wastes in the metropolitan cities amounting 3494 mt and 2515 mt, respectively in 2075/76. In sub-metropolitan cities and municipalities, agricultural/garden waste was the major waste that accounted 1808 mt and 394 mt, respectively in 2075/76. These data indicate difference in organic waste composition in different categories of the urban areas (Figure 2.3).

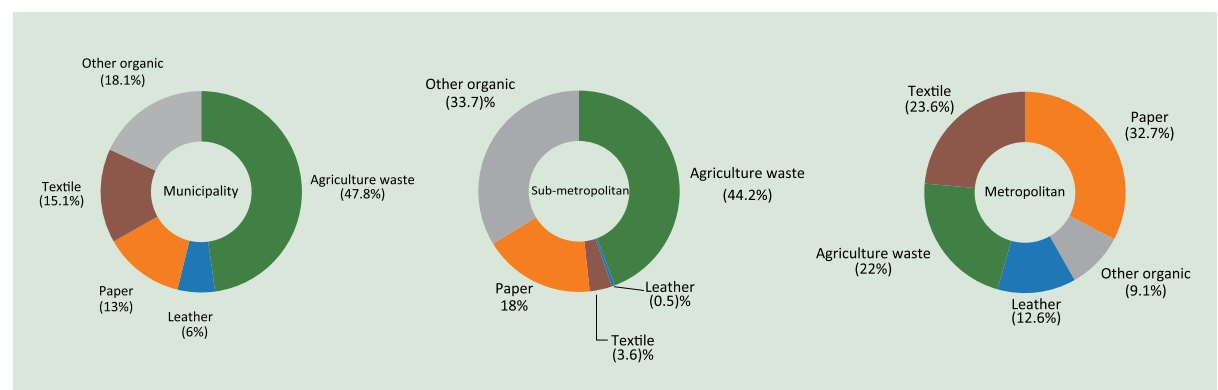
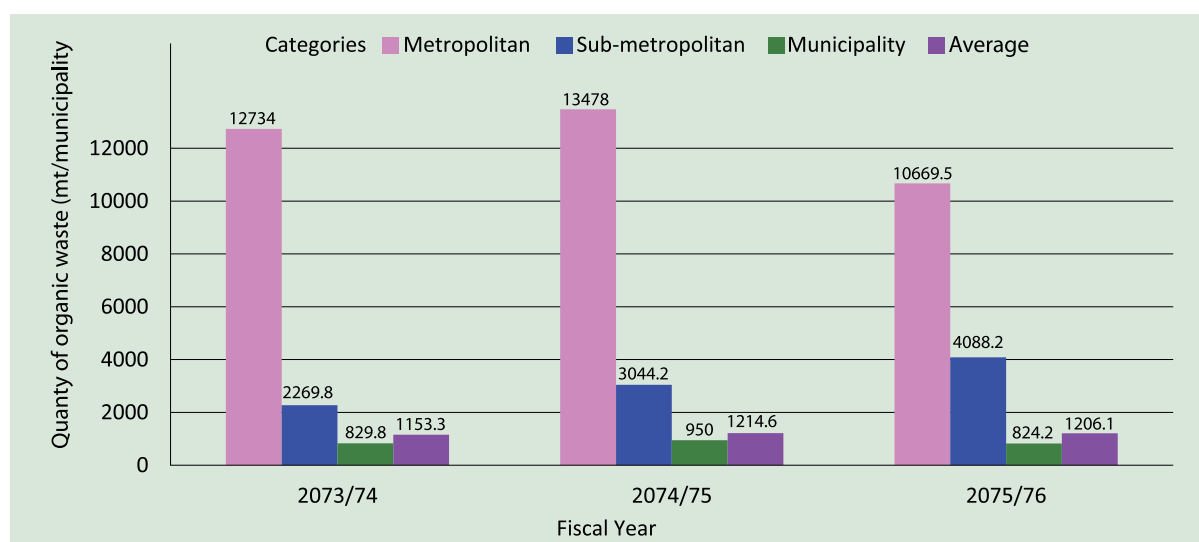
Fig 2.3: Composition of Organic Waste in the Municipalities (2075/76)

Fig 2.4: Average Annual Quantity of Organic Waste Collected by the Municipalities

The combined average quantity of organic waste varied considerably with the municipalities accounting higher share of the metropolitan cities in compared to the sub-metropolis and municipalities. The average quantity of organic waste per municipality amounted to 1153 mt in 2073/74 which increased to 1215 mt in 2074/75 and 1206 mt in 2075/76 (Figure 2.4).

2.3.2 Inorganic Waste

The survey revealed inorganic waste collected by the municipalities include plastic, glass, rubber, metals and minerals, and other inorganic waste. Among the surveyed municipalities,

164 municipalities reported about inorganic waste and these include 2 metropolitan cities, 7 sub-metropolitan cities and 155 municipalities (Table 2.20).

Among other, plastic was one of the major inorganic wastes in all the municipalities (Table 2.21). The average quantity of plastic waste was higher among the metropolitan cities as compared to the municipalities.

Like other waste components, the average quantity of glass was higher for the metropolitan cities in compared to the municipalities (Table 2.22).

Table 2.20: Number of Municipalities Reporting Different Types of Inorganic Wastes

Categories	Plastic	Glass	Rubber	Mineral	Other	Total Reporting
Metropolitan City	2 (100.0)	2 (100.0)	2 (100.0)	2 (100.0)	2 (100.0)	2 (40.0)
Sub-Metropolitan City	5 (71.4)	5 (71.4)	5 (71.4)	4 (57.1)	4 (57.1)	7 (63.6)
Municipality	104 (67.1)	101 (65.2)	88 (56.8)	87 (56.1)	68 (43.9)	155 (60.8)
Overall	111 (67.7)	108 (65.9)	95 (57.9)	93 (56.7)	74 (45.1)	164 (60.5)

Note: Figures in parenthesis indicate percentage.

Table 2.21: Annual Inorganic Waste Collection - Plastic

Categories	Number of Municipalities Reporting			Average Annual Collection of Plastic (mt)		
	FY 2073/74	FY 2074/75	FY 2075/76	FY 2073/74	FY 2074/75	FY 2075/76
Metropolitan City	1 (20.0)	1 (20.0)	2 (40.0)	3,950.0	4,182.0	3,172.0
Sub-Metropolitan City	3 (27.3)	3 (27.3)	5 (45.5)	716.0	930.0	803.2
Municipality	55 (21.6)	76 (29.8)	97 (38.0)	194.0	201.5	270.7
Overall	59 (21.8)	80 (29.5)	104 (38.4)	284.2	278.6	352.1

Note: Figures in parenthesis indicate percentage.

Table 2.22: Annual Inorganic Waste Collection - Glass

Categories	Number of Municipalities Reporting			Average Annual Collection of Glass (mt)		
	FY 2073/74	FY 2074/75	FY 2075/76	FY 2073/74	FY 2074/75	FY 2075/76
Metropolitan City	1 (20.0)	1 (20.0)	2 (40.0)	2,205.0	2,334.0	1,551.0
Sub-Metropolitan City	3 (27.3)	3 (27.3)	5 (45.5)	110.3	162.3	135.6
Municipality	53 (20.8)	73 (28.6)	93 (36.5)	98.4	97.4	90.4
Overall	57 (21.0)	77 (28.4)	100 (36.9)	136.0	129.0	121.8

Note: Figures in parenthesis indicate percentage.

Table 2.23: Annual Inorganic Waste Collection - Rubber

Categories	Number of Municipalities Reporting			Average Annual Collection of Rubber (mt)		
	FY 2073/74	FY 2074/75	FY 2075/76	FY 2073/74	FY 2074/75	FY 2075/76
Metropolitan City	1 (20.0)	1 (20.0)	2 (40.0)	1,746.0	1,848.0	1,281.0
Sub-Metropolitan City	3 (27.3)	3 (27.3)	5 (45.5)	54.7	75.7	67.8
Municipality	42 (16.5)	58 (22.8)	77 (30.2)	46.8	47.9	62.2
Overall	46 (17.0)	62 (22.9)	84 (31.0)	84.2	78.3	91.5

Note: Figures in parenthesis indicate percentage.

The municipalities also reported rubber as one of the major inorganic wastes. The average quantity of rubber waste was higher for the metropolitan cities ranging from 1746 mt/year in 2073/74 to 1848 mt/year in 2074/75 with a substantial fall to 1281 mt/year (Table 2.23). The amount of rubber waste was lower among the sub-metropolitan cities and municipalities as compared to the metropolitan cities.

Like other, the metals and minerals are other type of waste reported by the municipalities.

The higher quantity of metals and minerals waste was collected by the metropolitan cities in compared to the sub-metropolitan cities and municipalities (Table 2.24).

The municipalities also reported other inorganic wastes. The average quantity of this waste ranged from 96.8 mt/day in 2073/74 to 90.5 mt/day in 2075/76 (Table 2.25). Like other types of wastes, this type of wastes was higher among the metropolitan cities in compared to the municipalities.

Table 2.24: Annual Inorganic Waste Collection –Metals and Minerals

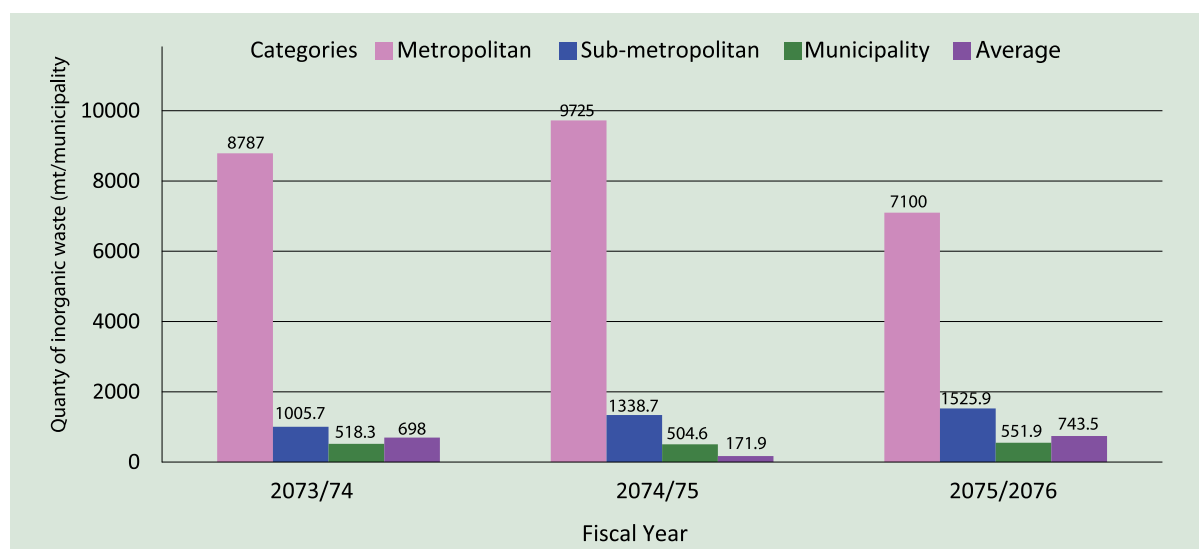
Categories	Number of Municipalities Reporting			Average Annual Collection (mt)		
	FY 2073/74	FY 2074/75	FY 2075/76	FY 2073/74	FY 2074/75	FY 2075/76
Metropolitan City	1 (20.0)	1 (20.0)	2 (40.0)	427.0	875.0	656.0
Sub-Metropolitan City	3 (27.3)	3 (27.3)	4 (36.4)	61.0	82.7	102.0
Municipality	39 (15.3)	54 (21.2)	75 (29.4)	91.1	78.7	71.6
Overall	43 (15.9)	58 (21.4)	81 (29.9)	96.8	92.6	87.6

Note: Figures in parenthesis indicate percentage.

Table 2.25: Annual Inorganic Waste Collection - Other Inorganic Waste

Categories	Number of Municipalities Reporting			Average Annual Collection of Other Inorganic Waste (mt)		
	FY 2073/74	FY 2074/75	FY 2075/76	FY 2073/74	FY 2074/75	FY 2075/76
Metropolitan City	1(20.0)	1 (20.0)	2 (40.0)	459.0	486.0	440.0
Sub-Metropolitan City	3 (27.3)	3 (27.3)	4 (36.4)	63.7	88.0	417.3
Municipality	30 (11.8)	43 (16.9)	60 (23.5)	88.0	79.1	57.1
Overall	34 (12.6)	47 (17.3)	66 (24.4)	96.8	88.4	90.5

Note: Figures in parenthesis indicate percentage.

Fig 2.5: Average Annual Quantity of Inorganic Waste Collected by the Municipalities

The combined quantity of inorganic waste averaged to 698 mt in 2073/74 which was 666.8 mt in 2074/75 and about 743.5 mt in 2075/76 (Figure 2.5; Table 2.26). The figures showed higher growth rate among the metropolitan cities.

2.3.3 Other Waste

The waste like hospital waste, electronic and electrical waste (e-waste), toxic waste, other chemical waste and other wastes which are not included on the above two categories were considered as the other waste. In this survey, 140 (51.7%) municipalities reported one or other types of such wastes.

The hospital waste was reported by 56% and toxic waste by 35% of the municipalities (Table 2.27).

The average quantity of wastes comprising hospital waste, e-waste, toxic and others wastes collection amounted to 380 mt in 2073/74, 283 mt in 2074/75 and 283 mt in 2075/76 (Figure 2.6). The quantity of waste collected by metropolitan cities was more than 20 times higher than the quantity collected by the municipalities. Managing these wastes poses further challenge to the respective municipalities as these wastes are riskier and more hazardous for people and the environment.

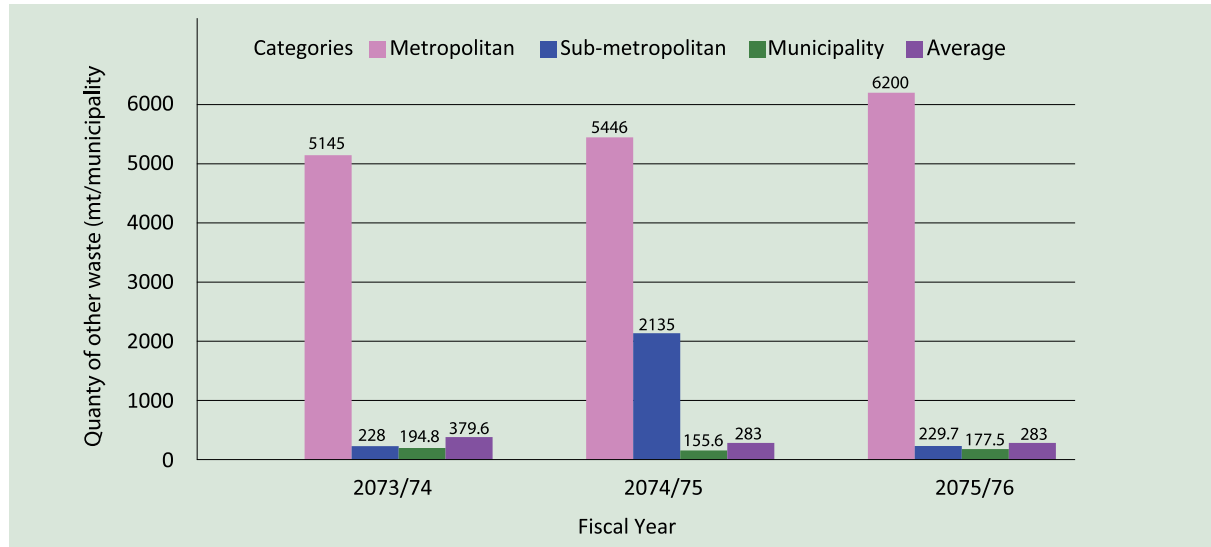
Table 2.26: Annual Inorganic Waste Collection of All Types

Categories	Average Annual Collection of Inorganic Waste (mt)		
	FY 2073/74	FY 2074/75	FY 2075/76
Metropolitan City	8,787.0	9,725.0	7,100.0
Sub-Metropolitan City	1,005.7	1,338.7	1,525.9
Municipality	518.3	504.6	551.9
Overall	698.0	666.8	743.5

Table 2.27: Number of Municipalities Reporting Different Types of Other Waste Collected

Categories	Toxic	Hospital Waste	Electronic and Electrical Waste	Other Chemical Waste	Other	Total Reporting
Metropolitan City	1 (33.3)	1 (33.3)	1 (33.3)	2 (66.7)	2 (66.7)	3 (60.0)
Sub-Metropolitan City	2 (33.3)	2 (33.3)	3 (50.0)	2 (33.3)	5 (83.3)	6 (54.6)
Municipality	46 (35.1)	75 (57.3)	63 (48.1)	52 (39.7)	119 (90.8)	131 (51.4)
Overall	49 (35.0)	78 (55.7)	67 (47.9)	56 (40.0)	126 (90.0)	140 (51.7)

Note: Figures in parenthesis indicate percentage.

Fig 2.6: Other Wastes Collection by the Municipalities

2.3.4 Total Annual Waste Collection

Table 2.28, and Figures 2.7, 2.8 and 2.9 presents comprehensive picture on waste collection by their type in the municipalities for the last three years. The data indicate that for all municipalities organic waste was higher than inorganic and other types of waste. The annual average total waste collected per municipality amounted to 2231.0 mt in 2073/74, 2164.4.0 mt in 2074/75 and 2232.7 mt in 2075/76. These figures convert to an average daily waste collection per municipality equals to 6.1 mt, 5.9 mt and 6.1 mt, respectively

for the three years. By waste type, organic waste accounted higher share as compared to inorganic and other type of waste. For instance, organic waste constitutes 54.0% in 2075/76 against 33.3% inorganic waste and 12.7% other waste. ADB (2012) reported the percentage of organic waste to be 56% (excluding agriculture waste).

In terms of per capita waste generation, the Asian Development Bank reported 317 g/capita/day solid waste generation in 2012. Based on this per capita waste and the population data

Table 2.28: Annual Average Waste Collection per Municipality by Waste Types and Categories

S.N.	Waste Type	FY	Metropolitan City (mt/Year)	Sub-Metropolitan City (mt/Year)	Municipality (mt/Year)	Annual Average of Municipalities (mt/Year/Municipality)	Daily Average of Municipalities (mt/Day/Municipality)
1.	Organic	FY 2073/74	12,734.0	2,269.8	829.8	1,153.3	3.2
		FY 2074/75	13,478.0	3,044.2	950.0	1,214.6	3.3
		FY 2075/76	10,669.5	4,088.2	824.2	1,206.1	3.3
2.	Inorganic	FY 2073/74	8,787.0	1,005.7	518.3	698.0	1.9
		FY 2074/75	9,725.0	1,338.7	504.6	666.8	1.8
		FY 2075/76	7,100.0	1,525.9	551.9	743.5	2.0
3.	Other	FY 2073/74	5,145.0	228.0	194.8	379.6	1.0
		FY 2074/75	5,446.0	213.5	155.6	283.0	0.8
		FY 2075/76	6,200.0	229.7	177.5	283.0	0.8
4.	Total	FY 2073/74	26,666.0	3,503.5	1,543.0	2,231.0	6.1
		FY 2074/75	28,649.0	4,596.3	1,610.2	2,164.4	5.9
		FY 2075/76	23,969.5	5,843.7	1,553.6	2,232.7	6.1

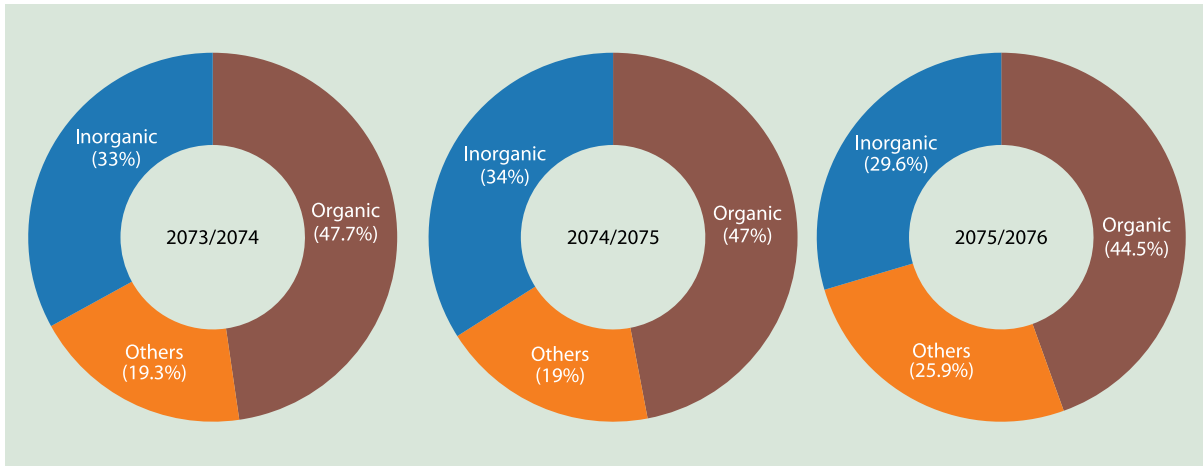
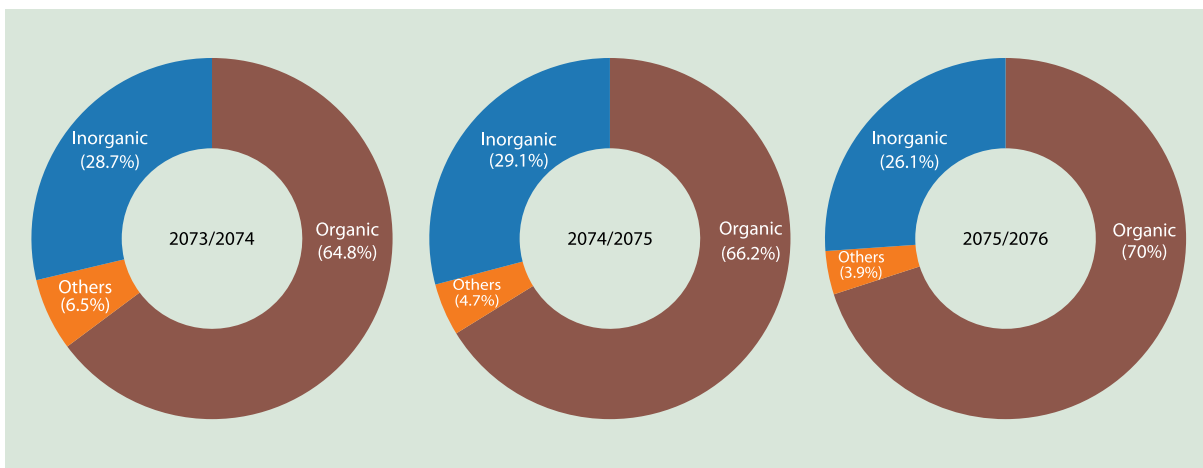
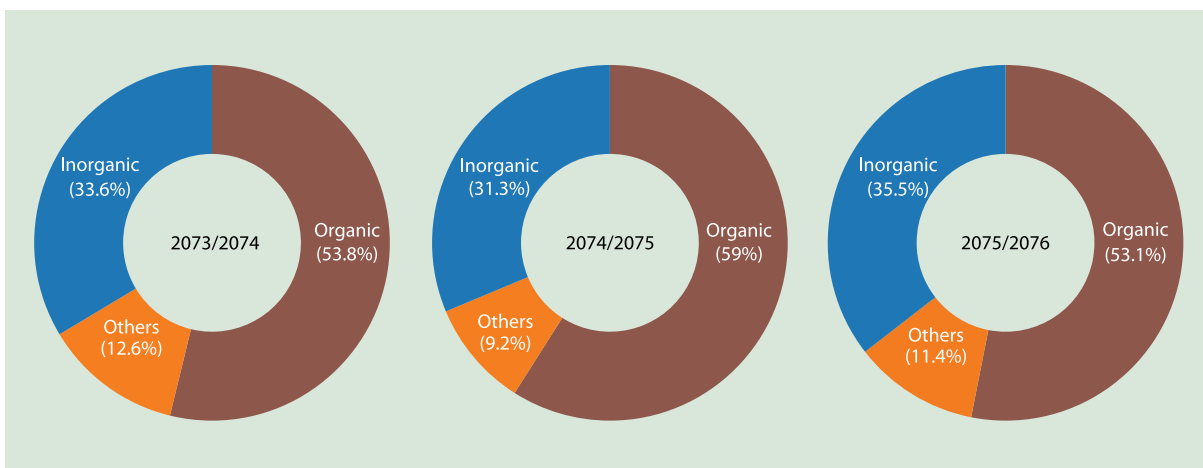
Fig 2.7: Composition of Collected Waste for the Metropolitan Cities with Years**Fig 2.8: Composition of Collected Waste for the Sub-metropolitan City with Years****Fig 2.9: Composition of Collected Waste for the Municipality with Years**

Table 2.29: Number of Municipalities Categorizing Waste

Categories	Household waste	Business house/ Commercial Complex waste	Industrial House waste	Educational Institutes waste	Health institutions/ Hospitals waste	Other	Total Reporting
Metropolitan City	3 (100.0)	3 (100.0)	3 (100.0)	3 (100.0)	3 (100.0)		3 (60.0)
Sub-Metropolitan City	7 (87.5)	8 (100.0)	5 (62.5)	8 (100.0)	6 (75.0)	6 (75.0)	8 (72.7)
Municipality	131 (94.2)	132 (95.0)	67 (48.2)	99 (71.2)	107 (77.0)	49 (35.3)	139 (54.5)
Overall	141 (94.0)	143 (95.3)	75 (50.0)	110 (73.3)	116 (77.3)	55 (36.7)	150 (55.4)

Note: Figures in parenthesis indicate percentage.

of 2011 census, the total municipal solid waste generation of the 58 municipalities was estimated to be 1,435 tons/day which equals to 24.7 mt per day per municipality or 9030 mt per year per municipality (ADB, 2013).

2.4 SOURCES OF WASTE

The municipal wastes are generated from different sources. Out of the surveyed municipalities, 3 (60%) metropolitan cities, 8 (72.7%) sub-metropolitan cities and 139 (54.5%) municipalities categorized the municipal wastes into six different categories based on the waste sources (Table 2.29). These categories include household waste, business/commercial waste, industrial waste, waste produced from educational institutions

and waste from health institutions and from other sources.

The waste collected from the different municipalities varied considerably. The quantity of waste collected was higher among the metropolitan cities accounting 37300 kg/day per metropolitan city (Table 2.30). The corresponding figures were lower that account 11000 kg/day for sub-metropolitan cities and 3700 kg/day for the municipalities. Among the metropolitan cities, the quantity of daily waste collection was higher in the household (15920 kg/day), followed by business complex (7720 kg/day) and the educational institutes (4680 kg/day). Similarly, the households were the major sources of waste generation in the

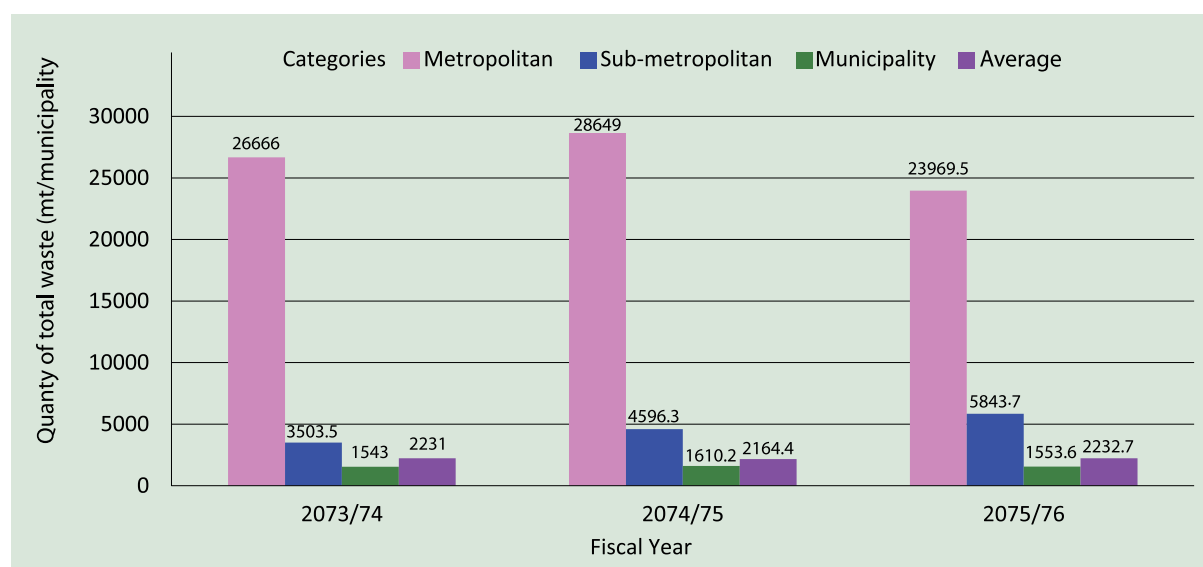
Fig 2.10: Average Total Waste Collection by the Municipalities

Table 2.30: Average Quantity of Waste Collected from Different Sources and Municipal Categories

Categories	Household waste (kg/day)	Business House/Commercial Complex waste (kg/day)	Industrial House/ District waste (kg/day)	Educational Institutes waste (kg/day)	Health Institutions/ Hospitals waste (kg/day)	Other(kg/day)	Total Quantity (kg/day)
Metropolitan City	15920 (42.6)	7720 (20.7)	4460 (11.9)	4680 (12.5)	4560 (12.2)	-	37340 (100.0)
Sub-Metropolitan City	3316 (30.2)	3025 (27.6)	1544 (14.1)	1322 (12.1)	594 (5.4)	1171 (10.7)	10973 (100.0)
Municipality	1441 (38.9)	932 (25.2)	310 (8.4)	358 (9.7)	381 (10.3)	282 (7.6)	3704 (100.0)
Overall	1784 (38.6)	1142 (24.7)	436 (9.5)	477 (10.3)	467 (10.1)	313 (6.8)	4619 (100.0)

Note: Figures in parenthesis indicate percentage.

sub-metropolitan cities (3316 kg/day) and the municipalities (1441 kg/day).

The quantity of daily waste collected from all sources was higher for the metropolitan cities, and the higher amount waste was originated from the households. From all sources, the daily waste collection was higher for metropolitan cities in compared to the sub-metropolitan cities and municipalities.

In terms of ecological zones, the municipalities of the Terai region were collecting the larger quantity of daily waste (5267 kg/day) followed by the hill region municipalities (4424 kg/day) and the mountain region municipalities (2147 kg/day) (Table 2.31). It is notable that municipalities in the Terai region collected more waste

from the sources like business complex, industrial areas and health institutions. Among the hill region municipalities, the first and second major sources of waste were reported to be come from households (1775 kg/day) and from business house/commercial complex (1203 kg/day), respectively.

The survey findings indicate households as the first major source of waste generation which accounting 38.6% (Table 2.31). This figure however varied with the ecological regions. According to ADB (2012), the household wastes in general contribute 50% to 75% of the total MSW.

2.5 CLEANING PRACTICES

In connection to cleaning the public areas within the municipalities, 175 (64.6%) of the municipal-

Table 2.31: Average Quantity of Different Waste by Sources in Different Ecological Belts

Categories	Household waste (kg/day)	Business House/ Commercial Complex waste (kg/day)	Industrial House/ District Produced(kg/day)	Educational Institutes waste (kg/day)	Health Institutions/ Hospitals waste (kg/day)	Other(kg/day)	Total (kg/day)
Mountain	884 (41.2)	825 (38.4)	028 (1.3)	109 (5.1)	132 (6.2)	170 (7.9)	2147 (100.0)
Hill	1775 (40.1)	1203 (27.2)	419 (9.5)	264 (6.0)	370 (8.4)	393 (8.9)	4424 (100.0)
Terai	1967 (37.4)	1153 (21.9)	531 (10.1)	729 (13.8)	613 (11.6)	274 (5.2)	5267 (100.0)
Overall	1784 (38.6)	1142 (24.7)	436 (9.5)	477 (10.3)	467 (10.1)	313 (6.8)	4619 (100.0)

Note: Figures in parenthesis indicate percentage.

Table 2.32: Number of Municipalities Cleaning Roads and Public Places

Categories	Yes	No	Not Reported	Total Municipalities	% Coverage
Metropolitan City	5 (100.0)			5 (100.0)	33.6
Sub-Metropolitan City	11 (100.0)			11 (100.0)	36.9
Municipality	159 (62.4)	60 (23.5)	36 (14.1)	255 (100.0)	22.9
Overall	175 (64.6)	60 (22.1)	36 (13.3)	271 (100.0)	24.0

Note: Figures in parenthesis indicate percentage.

Table 2.33: Number of Municipalities Reporting the Coverage (Wards and Population)

Categories	Ward Coverage		Household Coverage		Population Coverage	
	Number Reporting	Number of Wards Covered	Number Reporting	Number HHs Covered	Number Reporting	Population Covered
Ecological Zones						
Mountain	22 (84.6)	2.8	21 (80.8)	1,399.5	20 (76.9)	9,864
Hill	91 (81.3)	5.9	85 (75.9)	4,592.4	80 (71.4)	25,703
Terai	112 (84.2)	8.0	89 (66.9)	7,047.1	91 (68.4)	33,375
Overall	225 (83.0)	6.6	195 (72.0)	5,368.9	191 (70.5)	27,700
Type of Municipalities						
Metropolitan City	5 (100.0)	29.0	2 (40.0)	40,517.5	3 (60.0)	275,867
Sub-Metropolitan City	11 (100.0)	15.6	9 (81.8)	18,673.8	9 (81.8)	86,374
Municipality	209 (82.0)	5.6	184 (72.2)	4,336.0	179 (70.2)	20,590
Overall	225 (83.0)	6.6	195 (72.0)	5,368.9	191 (70.5)	27,700

Note: Figures in parenthesis indicate percentage.

ities were cleaning their roads and public places, which is an important indicator revealing the practices of cleanliness of the cities (Table 2.32). Among the municipalities which were involved in cleaning the roads and public places, only 24% municipalities were cleaning, leaving the large percentage of the municipal areas uncleaned, reflecting poor level cleanliness.

Regarding the scope of waste collection, 225 (83%) municipalities reported ward level collection, 195 (72%) municipalities reported household level coverage and 191 (70.5%) municipality reported population level coverage (Table 2.33). The higher coverage was made by the metropolitan cities in terms of wards, households and population mainly because of their better capacities in all the aspects. The sub-metropolitan cities and municipalities stood in second and third position, respectively in terms of wards, households and population level coverage. By ecological regions, municipalities of Terai region reported higher waste collection coverage followed by hill and mountain regions municipalities.

In terms of waste collection by the municipality categories, higher number (60%) of the metropolitan and sub-metropolitan cities (63.6%) were collecting 61% - 80% of their waste; whereas 25.5% of the municipalities reported no waste collection at all. The average waste collection was higher among the sub-metropolitan cities (67.8%) and less (48.4%) among the municipalities (Table 2.34).

2.6 TRANSFER OPERATIONS

Waste management of the cities depends largely on the available facilities and also their capacities and practices. Use of waste transfer station helps in reducing and segregating waste before reaching landfill sites. Among the surveyed municipalities, only 15 (5.5%) municipalities were using transfer stations; whereas a large majority (82.3%) of the municipalities did not have such facility and 12.2% of the municipalities did not respond about whether they are having this facility.

Table 2.34: Distribution of Municipalities by Percentage of Waste Collected

Categories	Not at All	1-20 %	21-40%	41-60%	61-80%	81-100%	Total Reporting	Average % of Waste Collected
Metropolitan City			2 (40.0)		3(60.0)		5(100.0)	60.0
Sub-Metropolitan City		1 (9.1)	1(9.1)		7(63.6)	2(18.2)	11(100.0)	67.8
Municipality	65(25.5)	39(15.3)	48(18.8)	41(16.1)	62(24.3)	22(8.6)	255(100.0)	48.4
Overall	65(24.0)	40(14.8)	51(18.8)	41(15.1)	72(26.6)	24(8.9)	271(100.0)	49.7

Note: Figures in parenthesis indicate percentage.

Table 2.35: Number of Municipalities Managing Transfer Stations

Categories	Area of Transfer Station		Capacity of Transfer Station	
	Number Reporting	Size of Station (m2)	Number Reporting	Capacity (m3)
Metropolitan City	1 (20.0)	20,000	1 (20.0)	10,000
Sub-Metropolitan City	1 (9.1)	2,000	1 (9.1)	200
Municipality	10 (3.9)	3,169	4 (1.6)	1,517
Overall	12 (4.4)	4,474	6 (2.2)	2,711

Note: Figures in parenthesis indicate percentage.

2.6.1 Facilities Available in the Transfer Stations

The survey revealed 12 (4.4%) municipalities were using transfer stations for processing of municipal solid waste (Table 2.35). These included 1 metropolitan city, 1 sub-metropolitan city and 10 municipalities. The size and capacity of the transfer stations varied considerably with municipalities showing better position for the metropolitan cities in compared to the municipalities. The capacity of waste transfer stations

was 10,000 m³ for the metropolitan and less than 1517 for sub-metropolitan cities and municipalities (Table 2.35).

2.6.2 Activities in the Transfer Stations

Out of the total, only 15 municipalities were using different facilities/methods for managing their waste in the transfer station. Among them, 5 municipalities were having compaction facilities, 4 were having segregation facilities, 3 were having sorting facilities and 2 municipalities

Table 2.36: Number of Municipalities with Waste Weighing Facility in Transfer Centre

Categories	Yes	No	Total	Daily Waste Transported from Transfer Centre to Waste Management Centre	
				Number Reporting	Quantity (Ton/ Day)
Metropolitan City	1 (100.0)		1 (100.0)	1 (100.0)	150.00
Sub-Metropolitan City	1 (100.0)		1 (100.0)	1 (100.0)	6.00
Municipality	3 (17.7)	14 (82.4)	17 (100.0)	3 (17.7)	9.10
Overall	5 (26.3)	14 (73.7)	19 (100.0)	5 (26.3)	36.66

Note: Figures in parenthesis indicate percentage.

Table 2.37: Number of Municipalities Reporting Different Facilities in the Transfer Centre

Categories	Compaction	Segregation	Sorting	Other	Reporting at Least One	Total Using Transfer Centre
Metropolitan City	1 (100.0)				1 (100.0)	1 (20.0)
Sub-Metropolitan City		1 (100.0)		1 (100.0)	1 (100.0)	1 (9.1)
Municipality	4 (100.0)	3 (75.0)	3 (75.0)	1 (25.0)	4 (30.8)	13 (5.1)
Overall	5 (83.3)	4 (66.7)	3 (50.0)	2 (33.3)	6 (40.0)	15 (5.5)

Note: Figures in parenthesis indicate percentage.

Table 2.38: Number of Municipalities Taking Measures to Prevent Foul Smell at the Transfer Station

Categories	Yes	No	Not Reporting	Total Reporting
Metropolitan City	1 (100.0)			1 (100.0)
Sub-Metropolitan City	1 (100.0)			1 (100.0)
Municipality	3 (23.1)	8 (61.5)	2 (15.4)	13 (100.0)
Overall	5 (33.3)	8 (53.3)	2 (13.3)	15 (100.0)

Note: Figures in parenthesis indicate percentage.

were having other facilities to reduce the volume of wastes (Table 2.37). The limited facilities available with the municipalities are an indication of inadequate waste management practices of the municipalities.

In order to control the foul smell of the wastes, transfer stations are essential in waste management as these are located close to the settlements, market centres, roads, health facilities (hospitals, health centres, clinics), educational institutes, etc. In this survey, only 5 municipalities reported that they are having the transfer stations for controlling the foul odour indicating large number of municipalities not having transfer stations for controlling bad smells of the wastes (Table 2.38).

In solid waste management, other necessary equipment/facilities include front end loaders, cranes, conveyor, walking floors, compactors, etc. But these equipment were available for very few municipalities, i.e. only 2 municipalities reported to have front end loaders, 2 were having conveyors, 3 were having walking floors and 3 were having compactors. Among the municipalities, 8 municipalities were adopting measures to prevent negative effects in the environment while transporting the waste from transfer sites. These included 1 metropolitan city, 1 sub-metropolitan city and 6 municipalities.

2.6.3 Waste to Energy

Waste to energy is a process to convert the waste into energy which is becoming popular globally. But, this process requires use of effective technological processes. Among the surveyed municipalities, only 3 municipalities were producing energy from waste. These were Kathmandu

and Lalitpur Metropolitan cities from Bagmati Province, and Pokhara Metropolitan City from Gandaki Province.

2.7 RESOURCES AVAILABLE FOR WASTE MANAGEMENT

The survey revealed that the most of the municipalities own one or other types of vehicles for transporting the wastes. Out of the total surveyed municipalities, 232 (85.6%) were having at least one or other type of transportation means. The higher numbers of municipalities (70.7%) were having tractor/power tiller followed by 61.6% municipalities were having tippers/trucks and (23.7%) municipalities were having dozer. Other means of waste transportation pose by the municipalities include mini trucks/pick-ups, loaders, excavators, boomers, jet machines, rickshaw, etc. Among others, tractor/power tillers and tripper/trucks were the major means of transportation commonly used in the municipalities. In average, most of the municipalities were having more than 1.0 tractor/power tiller and 1 tripper/truck. The limited waste transportation facilities with the municipalities clearly suggest their constraint in the solid waste management.

2.8 WASTE MANAGEMENT METHODS

The survey revealed different waste management practices adopted by the municipalities. Most of the municipalities were adopting one or more methods of waste management. The three main methods of waste management adopted by all the municipalities were: i) piling up in landfill site by 48.6% municipalities, ii) burning by 32.1% municipalities, and iii) piling up in the

Table 2.39: Percentage of Municipalities Reporting the Management of Waste Collected

Categories	Percentage of Municipalities Reporting							Municipalities Reporting (N)
	Manure Making	Pile-up in Landfill Site	Pile-up in the River Side	Open Dumping	Burning	Send for Re-cycle	Excavator	
Metropolitan City	40.0	60.0	20.0		40.0	40.0		5
Sub-Metropolitan City	20.0	60.0	20.0	30.0	30.0	50.0	10.0	10
Municipality	8.6	47.7	27.9	20.8	32.0	11.7	10.2	197
Overall	9.9	48.6	27.4	20.8	32.1	14.2	9.9	212

(Due to multiple responses, total may not add-up to 100)

river side by 27.4% municipalities (Table 2.39). Among the municipal categories, the 60% of the metropolitan cities and sub-metropolitan cities and 47.7% of municipalities were adopting pile up of the wastes in the landfill sites.

2.9 RECYCLE AND REUSE OF WASTE

Among the total municipalities surveyed, 212 (78.2%) municipalities reported handling wastes in different ways. Out of them, 30 (14.2%) municipalities were recycling their waste and those included 2 metropolitan cities, 5 sub-metropolitan cities and 23 municipalities. By municipality categories, 50% metropolitan cities, 40% sub-metropolitan cities and 11.7% municipalities were recycling their wastes. Although, the municipalities were involved in recycling of waste, the quantity used for recycling was low. The recycled quantity of the waste account only 4.1% of the total waste collected. In the present context of involvement of less number of the municipalities in recycling of waste using fewer amounts of waste materials, there is a good opportunity to scale up the waste recycling in the municipalities. Similarly, manure making was also low among all the municipalities with an average of 9.9%. The practice of manure making was higher among the metropolitan cities (40%) followed by the sub-metropolitan cities (20%) and the municipalities (8.6%).

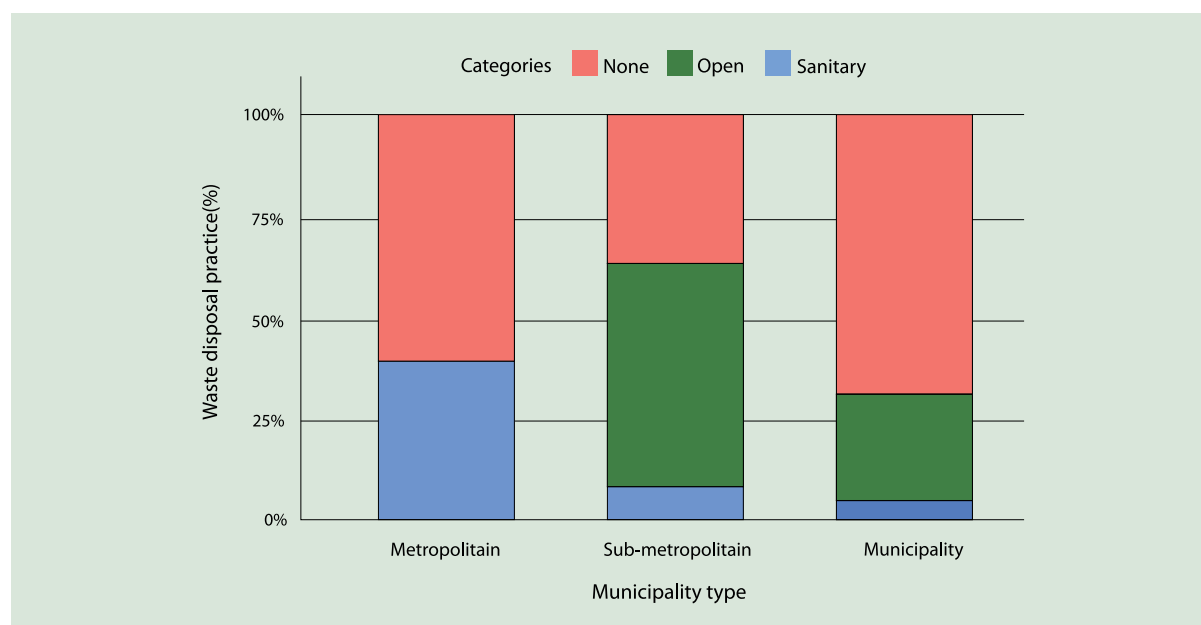
2.10 LANDFILL SITES

Among the total municipalities surveyed, 114 (42.0%) municipalities were using the landfilling practices, 117 (43.2%) municipalities were

not practicing the approaches and remaining 40 (14.8%) municipalities did not respond about the landfill sites. In this connection, 60% of the metropolitan cities, 63.3% of sub-metropolitan cities and 40.8% of the municipalities were using landfilling practices. Among the municipalities using the landfilling practices, 85.1% were having their own landfilling sites against 14.9% who were using others' landfilling sites.

Among 117 municipalities reporting landfilling practices, only 88 municipalities further reported about nature of landfilling they were practicing (i.e., landfill sites and open dumping). Out of them, 72 municipalities (6 sub-metropolitan and 66 municipalities) were using open dumping, whereas 16 municipalities (2 metropolises, 1 sub-metropolis and 13 municipalities) were practicing sanitary landfill (Figure 2.11). Out of the total (5), 40% metropolitan cities reported that they are using sanitary landfill, 9.1% sub-metropolitan and 5.1% municipalities were using the sanitary landfills. The less reporting of landfill sites and their use by the municipalities is a clear reflection of need of increasing the practice of sanitary landfill for wastes and their proper management in the municipalities.

In the sanitary landfills, for the municipalities, adequate area for landfill sites is critically important for waste management. Among the municipalities which reported the information, the average area of their landfill sites was 1.5 ha (Table 2.40). However, the area varied with the type of municipalities. The sub-metropolitan cities showed the higher land area (3 ha per landfill site) followed by the municipalities with hav-

Fig 2.11: Use of Landfill Sites by the Municipalities

ing 1.4 ha and metropolitan cities with having 0.3 ha. These data suggest that the metropolitan cities have been greatly constrained by limited land area available for landfill sites.

In terms of capacity of landfill sites, the capacity varied from 22516 m³ for the municipalities to 115000 m³ for the metropolitan cities and 68293 m³ for the sub-metropolitan cities. The average capacity of the landfill site for the municipalities

was 29877 m³. Among the surveyed municipalities, only 66 municipalities reported about the area of landfill sites.

In terms of landfill sites capacity, it also varied with the municipalities located in different ecological zones. In terms of their waste disposal capacities, the landfill sites of Terai revealed higher capacity in compared to the municipalities of the mountains (Table 2.41).

Table 2.40: Number of Municipalities Reporting the Area of Landfill Site and their Capacity

Categories	Municipalities Reporting Area of Landfill Site			Average Area of Landfill Site (ha)	Average Capacity of Landfill Site (m ³)
	Reporting Area	Not Reporting Area	Total Reporting		
Metropolitan City	2 (100.0)		2 (100.0)	0.3	115,000
Sub-Metropolitan City	5 (71.4)	2 (28.6)	7 (100.0)	3.0	68,293
Municipality	59 (67.1)	29 (33.0)	88 (100.0)	1.4	22,516
Overall	66 (68.0)	31 (32.0)	97 (100.0)	1.5	29,877

Note: Figures in parenthesis indicate percentage.

Table 2.41: Number of Municipalities Reporting the Area of Landfill Site in Different Ecological Zones

Categories	Municipalities Reporting Area of Landfill Site			Average Area of Landfill Site (ha)	Average Capacity of Landfill Site (m ³)
	Reporting Area	Not Reporting Area	Total Reporting		
Mountain	6 (54.6)	5 (45.5)	11 (100.0)	1.9	18,586
Hill	39 (78.0)	11 (22.0)	50 (100.0)	1.4	25,630
Terai	21 (58.3)	15 (41.7)	36 (100.0)	1.7	43,817
Overall	66 (68.0)	31 (32.0)	97 (100.0)	1.5	29,877

Note: Figures in parenthesis indicate percentage.

Table 2.42: Distribution of Landfill Sites by Distance from Main City

Categories	Distance from Main City (km)					Average Distance from Main City (km)
	Up to 1 km	1 - 5 km	More than 5 km	Not Reporting	Total Reporting	
Metropolitan City			2 (100.0)		2 (100.0)	17.5
Sub-Metropolitan City	1 (14.3)	3 (42.9)	3 (42.9)		7 (100.0)	4.4
Municipality	13 (14.8)	53 (60.2)	15 (17.1)	7 (8.0)	88 (100.0)	4.0
Overall	14 (14.4)	56 (57.7)	20 (20.6)	7 (7.2)	97 (100.0)	4.3

Note: Figures in parenthesis indicate percentage.

Among other, location of landfill sites is very important for the municipalities. The landfill sites close to the city areas and settlements are often problematic in many ways. The survey revealed varied distances of landfill sites with different categories of the municipalities. The average distance of landfill sites was 4.3 km with the higher average distance (17.5 km) for the metropolitan cities as compared to the sub-metropolitan cities (4.4 km) and the municipalities (4.0 km) (Table 2.42). Out of the total landfill sites, the higher numbers (57.7%) of landfills were 1-5 km away, whereas 20.6% of the landfill sites were located more than 5 km away from the main city areas.

The landfill sites of the municipalities were established in different periods. In this connection, 86 municipalities could specify the years of establishment of landfill site. As a whole, the average year of landfill site establishment was 5.7. However, the corresponding figure for the metropolitan city was higher (15.5 years) as compared to the sub-metropolitan cities and municipalities. It is to be noted that maximum numbers (71) of landfill sites of the municipalities were established after 2070 BS.

Similarly, the survey revealed the average life span of the landfill sites to be 16.3 years with the

lower value (6.5 years) for the metropolitan cities which has been attributed to the lower land area and capacity against relatively large volume of waste generation. The average life span of landfill sites of municipalities was nearly 3 times higher than that of the metropolitan cities. The capacity of the landfill sites is normally determined by their land size as well as the depth that holds the waste. In case of the considered landfill sites, the average depth was 14.2 m (Table 2.43).

The landfill sites of the municipalities were located at varied distance from the permanent settlements. The average distance of the landfill sites was 1.7 km from the main settlements (Table 2.44). About 41% landfill sites were located more than 1 km away from the main settlements.

Considering the facilities available in the landfill sites, very few landfill sites consisted of leachate treatment facility. Out of the total 97 landfill sites under operation, only 7 sites were having treatment facilities (Table 2.45). Only 6 sites were having leachate control system, 5 were having leachate drainage system and 3 were having leachate treatment system. The few landfill sites with leachate treatment facilities with the municipalities reflect the need of activities for the

Table 2.43: Distribution of Landfill Sites by Average Depth of Waste

Categories	Average Depth of Waste (m3)					Average Tentative Life Span of Landfill Sites (Year)
	Up to 10	11 to 20	More than 20	Not Reporting	Total Reporting	
Metropolitan City				2 (100.0)	2 (100.0)	-
Sub-Metropolitan City	2 (28.6)	1 (14.3)		4 (57.1)	7 (100.0)	11.2
Municipality	22 (25.0)	2 (2.3)	6 (6.8)	58 (65.9)	88 (100.0)	14.5
Overall	24 (24.7)	3 (3.1)	6 (6.2)	64 (66.0)	97 (100.0)	14.2

Note: Figures in parenthesis indicate percentage.

Table 2.44: Distribution of Landfill Sites by Distance from Permanent Settlement

Categories	Distance from Permanent Settlement (km)					Average Distance from Permanent Settlement (km)
	Up to 0.5 km	0.5 to 1.0 km	More than 1.0 km	Not Reporting	Total Reporting	
Metropolitan City	1 (50.0)	1 (50.0)			2 (100.0)	0.75
Sub-Metropolitan City	3 (42.9)	3 (42.9)	1 (14.3)		7 (100.0)	0.81
Municipality	16 (18.2)	24 (27.3)	39 (44.3)	9 (10.2)	88 (100.0)	1.79
Overall	20 (20.6)	28 (28.9)	40 (41.2)	9 (9.3)	97 (100.0)	1.69

Note: Figures in parenthesis indicate percentage.

Table 2.45: Number of Municipalities Reporting Leachate Control, Leachate Drainage and Leachate Treatment System

Categories	Leachate Control System	Leachate Drainage System	Leachate Treatment system	Reporting at Least One	Total Operating Landfill Sites
Metropolitan City	1 (50.0)	1 (50.0)	1 (50.0)	1 (50.0)	2
Sub-Metropolitan City	1 (14.3)	1 (14.3)		1 (14.3)	7
Municipality	4 (4.6)	3 (3.4)	2 (2.3)	5 (5.7)	88
Overall	6 (6.2)	5 (5.2)	3 (3.1)	7 (7.2)	97

Note: Figures in parenthesis indicate percentage.

leachate management and control further contamination of the surrounding environment.

The survey also provided important information about the future planning of the municipalities on establishing landfill sites and waste management. Out of the total (271) municipalities surveyed, 102 (37.6%) municipalities reported their plans to construct landfill sites. Among the 102 municipalities, 42.2% were planning to construct the landfill sites in the existing sites; whereas 57.8% municipalities were planning to construct the landfill sites in new area. Only 10 (9.8%) municipalities reported that they were planning to have 2 landfill sites in future. The planned landfill sites of the municipalities were estimated to have an average area of 0.5 ha and will be at 3.3 km average distance from the main city. Among the 102 municipalities, 41.2% have plans to complete the landfill

sites by 2078 BS; whereas remaining municipalities reported to complete the sites in or after 2079 BS. The estimated lifetimes of the planned landfill sites vary substantially. Among the total planned landfill sites, 26.5% will have the lifespan less than 10 years, 30.4% will have 11 to 20 years and 22.6% will have more than 20 years lifespan.

2.11 WASTE MANAGEMENT PLANS

2.11.1 Waste Management Planning and Monitoring

The survey revealed that municipalities have formulated various plans for the solid waste management. These plans are important tools in providing guidance for waste management. In total, 149 (55%) municipalities have prepared their plans which were the basis to implement the waste management activities (Table 2.46).

Table 2.46: Number of Municipalities Reporting the Type of Waste Management Plan

Categories	Short (less than a year) Plan	Annual Plan	Periodic	Reporting at Least One	Total Operating Landfill Sites
Metropolitan City	2 (40.0)	3 (60.0)		4 (80.0)	5
Sub-Metropolitan City	2 (33.3)	4 (66.7)	3 (50.0)	6 (100.0)	6
Municipality	33 (23.9)	102 (73.9)	42 (30.4)	131 (94.9)	138
Overall	37 (24.8)	109 (73.2)	45 (30.2)	141 (94.6)	149

Note: Figures in parenthesis indicate percentage.

Table 2.47: Training and Awareness Campaign on Waste Management Conducted by Municipalities During 2075/76

Categories	Average Number of Trainings Conducted	Average Number of Persons Trained	Average Number of Awareness Campaigns Conducted
Metropolitan City	13.67	927	6.0
Sub-Metropolitan City	6.43	221	11.2
Municipality	4.63	322	18.8
Overall	4.96	332	18.1

The majority (109) of the municipalities showed annual plans, 37 municipalities reported shorter plans of less than one-year period and 45 municipalities reported to have periodic plans.

In waste management, monitoring is crucial as it provides feedback to the decision makers of the municipalities on various aspects of waste management. In this connection, 177 (65.3%) municipalities were monitoring of waste management. All the metropolitan and sub-metropolitan cities were performing monitoring; however only 63.1% of the municipalities reported their engagement in waste monitoring activities. The municipalities were monitoring and supervising different activities related to waste management including the employee performance and transportation of waste materials.

2.11.2 Awareness Raising for Waste Management

The survey found many municipalities conducting training to enhance the skills and capacity of the staff for waste management. In total, 182 (67.2%) municipalities were conducting training program for their staff. On average, the municipalities conducted about 5 training programs to their staff in 2075/76 with higher number (about 14) by the municipalities (Table 2.47). The average numbers of persons trained were 332 per

municipality. In 2075/76, each municipality organized on average 18.1 awareness campaigns.

2.11.3 Waste Management Plans and Strategies

The waste management plans and strategies are important for day to day operations of waste management activities. The surveyed municipalities varied in terms of availability of their plans and provisions and their implementation. Among the surveyed municipalities, only 99 (36.5%) municipalities reported their plans and strategies on waste management. However, higher (57.2%) proportion of the municipalities showed lack of such plans and strategies (Table 2.48) and 6.3% municipalities did not respond in this aspect.

In the solid waste management, having strategies in place are not enough to implement the activities effectively. The provisions need to be supported by operational level regulations and procedures. Among 271 surveyed municipalities, only 54 (19.9%) of municipalities were having the procedures (guidelines) on waste management. Among the municipal categories, only 1 metropolitan city, 3 sub-metropolitan cities and 50 municipalities were managing their solid waste based on the guidelines. The survey showed the lack of municipal level mea-

Table 2.48: Number of Municipalities Formulating Solid Waste Management Related Plans and Strategies

Categories	Yes		No		Not Reporting		Total	
Metropolitan City	5	(100.0)					5	(100.0)
Sub-Metropolitan City	6	(54.6)	5	(45.5)			11	(100.0)
Municipality	88	(34.5)	150	(58.8)	17	(6.7)	255	(100.0)
Overall	99	(36.5)	155	(57.2)	17	(6.3)	271	(100.0)

Note: Figures in parenthesis indicate percentage.

Table 2.49: Number and Percentage of Municipalities Imposing Punishment against Violators of Solid Waste Related Laws by Type of Beneficiary

Categories	Municipalities Reporting						Average Number Fined			
	Households/ Families	Institutions	Business House/ Commercial Complex	Other	Not Reporting	Total	Households/ Families	Institutions	Business House/ Commercial Complex	Other
Metropolitan City	2 (40.0)		2 (40.0)	1 (20.0)	2 (40.0)	4 (80.0)	31.0	-	52.0	1.0
Sub-Metropolitan City	2 (18.2)	2 (18.2)	3 (27.3)	1 (9.1)	2 (18.2)	5 (45.5)	7.5	4.5	137.0	11.0
Municipality	12 (5.1)	6 (2.6)	9 (3.8)	2 (0.9)	12 (5.1)	26 (11.1)	47.9	8.7	43.0	12.5
Overall	16 (6.4)	8 (3.2)	14 (5.6)	4 (1.6)	16 (6.4)	35 (13.9)	40.8	7.6	64.4	9.3

Note: Figures in parenthesis indicate percentage.

asures and guidelines as a major issue prevailing among the majority of the municipalities.

The survey revealed that some of the municipalities have punitive measures in place and implementing; but numbers of such municipalities were few. For instance, 35 (12.9%) municipalities were found to impose fines/punishments for the violation of the rules, whereas nearly 80% of the municipalities did not enforce any measures and 7.4% of the municipalities did not respond this aspect. In total, 4 (80%) metropolitan cities imposed fines/punishments to the violators of their rules and laws. These corresponding figures were comparatively low 5 (45.5%) among the sub-metropolitan cities and only 26 (11.1%) among municipalities (Table 2.49). The survey revealed that lack of effective rules and their en-

forcement as the fundamental issue among the municipalities for the poor waste management. The municipalities impose fines to households, institutions and business house/commercial complex. The numbers of violators included 41 households, 8 institutions, 64 business house/commercial complex and 9 others (Table 2.49).

2.11.4 Expectations from Federal and Provincial Governments

Waste management is largely the responsibility of the local governments. For the proper delivery of the responsibility, it requires adequate resources, including human and financial resources. The survey revealed, 257 (94.8%) municipalities were expecting funds from the federal and provincial governments indicating resource constraint situation with them (Table 2.50; Table

Table 2.50: Number of Municipalities Reporting First to Sixth Priority Support from Federal Government

Categories	% of Municipalities Reporting							Total Reporting (N)
	Policy Formulation	Technical Expert	Need Assessment on Waste Management and Basic Monitoring	Infrastructure Development	Budget	Coordination	Other	
First Priority	25.0	16.3	11.9	28.2	51.2	9.9	2.4	252
Second Priority	6.0	19.8	8.3	42.4	21.2	2.8	0.5	217
Third Priority	13.9	26.7	15.4	17.3	15.4	11.4	0.5	202

Categories	% of Municipalities Reporting							Total Reporting (N)
	Policy Formulation	Technical Expert	Need Assessment on Waste Management and Basic Monitoring	Infrastructure Development	Budget	Coordination	Other	
Fourth Priority	20.4	20.4	16.0	17.7	6.1	18.8	0.6	181
Fifth Priority	18.2	18.9	27.0	6.3	6.9	22.6		159
Sixth Priority	22.0	5.0	24.1	2.8	3.6	42.6		141

2.51). It implies that in absence of funds from the federal and provincial governments, the municipalities would be facing difficulty in bringing desirable improvement in waste management. The municipalities expecting funds from the federal and provincial governments included all the metropolitan and sub-metropolitan cities and 94.5% of the municipalities.

The survey showed that the municipalities have placed their priorities for different supports from the federal government. The majority (51.2%) of the municipalities reported their first priority on budget support from the federal government, 42.4% of the municipalities showed their priority on infrastructure development and 26.7% expressed their priority on technical expertise services (policy formulation, need assessment, coordination, etc.).

Regarding the priorities for supports from the provincial government, 52.5% of the municipalities expressed their first priority on budget support from the provincial government, followed by infrastructural development from provincial government (Table 2.51).

In terms of establishing collaboration, only 84 (31%) municipalities were coordinating with other agencies for waste management (Table 2.52). The higher (59.5%) of the municipalities were coordinating with other agencies for waste collection and management. Other areas of municipal coordination were policy formulation, need assessment, financial support and infrastructure development. The municipalities reported that thought coordination has been established; they were not as effective as expected.

Table 2.51: Number of Municipalities Reporting First to Sixth Priority Support from Provincial Government

Categories	% of Municipalities Reporting							Total Reporting (N)
	Policy Formulation	Technical Expert	Need Assessment on Waste Management and Basic Monitoring	Infrastructure Development	Budget	Coordination	Other	
First Priority	24.2	17.9	13.8	24.2	52.5	12.1	2.1	240
Second Priority	5.8	15.9	6.8	42.5	21.7	7.7		207
Third Priority	12.4	23.2	21.1	17.8	14.6	11.4		185
Fourth Priority	14.4	25.3	17.8	17.8	10.3	14.9	0.6	174

Categories	% of Municipalities Reporting							Total Reporting (N)
	Policy Formulation	Technical Expert	Need Assessment on Waste Management and Basic Monitoring	Infrastructure Development	Budget	Coordination	Other	
Fifth Priority	18.4	21.5	26.0	5.1	5.1	24.7		158
Sixth Priority	29.5	5.8	18.7	5.0	1.4	39.6		139

Table 2.52: Number of Municipalities Reporting Various Coordinating Activities for Waste Management

Categories	% of Municipalities Reporting								Total Reporting (N)
	Waste Collection and Management	Policy Formulation	Technical Expert	Need Assessment on Waste Management and Basic Monitoring	Financial Support	Infrastructure Development	Capital Equipment	Other	
Metropolitan City	50.0		50.0		50.0	50.0	50.0		2
Sub-Metropolitan City	62.5	12.5	62.5	12.5	25.0	50.0	37.5	12.5	8
Municipality	59.5	28.4	41.9	32.4	29.7	28.4	17.6	18.9	74
Overall	59.5	26.2	44.1	29.8	29.8	31.0	20.2	17.9	84

CHALLENGES AND NEEDS

3.1 CHALLENGES OF THE WASTE MANAGEMENT

Urban areas of Nepal are facing several challenges in waste management. Currently, only 45% municipalities have sewerage services and 9.4% households are connected with the underground drainage systems indicating limited sanitation facilities. The present increasing pace of urbanization and urban population growth are putting immense pressure on utility services like water and sanitation services. In the context of increasing challenges in waste management, the initiatives made addressing these issues are, however, limited. Issues related to municipal waste management need further improvement under the present federal structure in which the roles and responsibilities of waste management and sanitation lies with the municipalities. Apart from these, lack of adequate institutional structures and legislative measures along with

inadequate coordinating mechanism among the three levels of governments (federal, provincial and local) yet remains as a major issue.

The survey provided crucial data that the municipalities have considered waste management as a major challenge. Among the 247 municipalities who reported the challenges, 147 (59.5%) municipalities reported municipal waste management as a major challenge, 122 (49.4%) municipalities reported low level of awareness and 113 (45.8%) municipalities regarded lack of landfill sites as the major challenge of waste management (Table 3.1).

3.2 NEEDS OF THE MUNICIPALITIES

The survey revealed various needs and supports expected by the municipalities. The higher number (121) of municipalities expressed the need of

Table 3.1: Number of Municipalities Reporting Challenges in Waste Management

Categories	Metropolitan City	Sub-Metropolitan City	Municipality	Overall
Low Awareness	2 (40.0)	7 (63.6)	113 (48.9)	122 (49.4)
Insufficient Budget		1 (9.1)	61 (26.4)	62 (25.1)
Lack of Resources	2 (40.0)	4 (36.4)	51 (22.1)	57 (23.1)
Landfill Site Problem	3 (60.0)	3 (27.3)	107 (46.3)	113 (45.8)
Human Resources Shortages			55 (23.8)	55 (22.3)
Planning			11 (4.8)	11 (4.5)
Waste Management	4 (80.0)	5 (45.5)	138 (59.7)	147 (59.5)
Appropriate Technology		1 (9.1)	6 (2.6)	7 (2.8)
Inadequate Infrastructure		1 (9.1)	25 (10.8)	26 (10.5)
Law/ Regulations		1 (9.1)	1 (0.4)	2 (0.8)
Geographical Difficulties/ Scattered Settlements	1 (20.0)	2 (18.2)	31 (13.4)	34 (13.8)
Policies and Guidelines			30 (13.0)	30 (12.2)
Collaboration with Private Organizations/CBOs		1 (9.1)	15 (6.5)	16 (6.5)
Coordination Among 3 Level of Governments			12 (5.2)	12 (4.9)
Reporting at Least One	5 (100.0)	11 (100.0)	231 (90.6)	247 (91.1)

trained human resource and 120 municipalities reported need of constructing landfill sites (Table 3.2). Likewise, 105 (43.4%) municipalities re-

ported need of sufficient budget for waste management. The municipalities expressed further needs for the MSW (Table 3.2).

Table 3.2: Number of Municipalities Reporting the Current Need in Waste Management Sector

Categories	Metropolitan City	Sub-Metropolitan City	Municipality	Overall
Allocate Enough Budget		4 (36.4)	101 (44.7)	105 (43.4)
Build Landfill Site (Quality/Sufficiency)	3 (60.0)	5 (45.5)	112 (49.6)	120 (49.6)
Increase Awareness	4 (80.0)	2 (18.2)	76 (33.6)	82 (33.9)
Increase/Train Human Resources	2 (40.0)	4 (36.4)	115 (50.9)	121 (50.0)
Increase Machines/ Tools/Other Resources	1 (20.0)	8 (72.7)	93 (41.2)	102 (42.2)
Infrastructure (Build/Improve Quality)		3 (27.3)	41 (18.1)	44 (18.2)
Prepare Plan for Waste Management			8 (3.5)	8 (3.3)
Formulate Law/ Policies and Implement		2 (18.2)	37 (16.4)	39 (16.1)
Sort/ Dispose/ Recycle Waste	4 (80.0)	6(54.6)	48 (21.2)	58 (24.0)
Beneficiary (People) Mobilization			1 (0.4)	1 (0.4)
Coordination Among 3 Level of Governments			23 (10.2)	23 (9.5)
Increase Private Public Partnership		2 (18.2)	12 (5.3)	14 (5.8)
Apply Fine/ Punishment	1 (20.0)		4 (1.8)	5 (2.1)
Other			1 (0.4)	1 (0.4)
Reporting at Least One	5 (100.0)	11 (100.0)	226 (88.6)	242 (89.3)

IV. WASTE SECTOR BASELINE WITH NATIONAL SDG INDICATORS

4.1 SDGS FRAMEWORK ON WASTE MANAGEMENT

The SDGs framework provides a broader guideline on the targets and potential areas of interventions to attain the set goals in specific areas of development. The SDG-11 articulates about the municipal and other wastes management and also outlines interventions that contribute to effective waste management and attain SDGs goals both globally and country levels. The SDG-11, target 6 proclaims that “By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management”. In consistent with the SDG-11, target 6, Nepal has set two targets and indicators in the municipal waste management (Table 4.1).

Currently, about 45% municipalities have sewerage services and almost all (98%) hospitals segregate their waste. The SDGs aspires to attain 100% in municipal sewerage services by 2022. Similarly, it also envisions achieving 100% hospital waste segregation by 2022.

4.2 SURVEY FINDINGS VIS A VIS SDGS GOALS AND TARGETS

The survey has generated some important facts on the waste generation and waste management in different categories of municipalities. These data not only provide baseline status for the

many parameters related to different types of waste in the municipalities, but also give adequate insights for future planning and strategies for the municipal waste management. The key findings in relation to future waste management and the attainment of SDG goals and targets have been analyzed briefly hereunder.

Waste collection: Nepal has limited literatures on the waste collection and management sector. The waste generation of Kathmandu City was estimated to be 0.23 kg/capita/day and was compared with the figures of other cities of the neighbouring countries. The figures for some of the cities were: Gazipur city of Bangladesh - 0.25 kg/capita/day, Thimpu of Bhutan - 0.54 kg/capita/day, Lahore of Pakistan - 0.84 kg/capita/day and Doddaballapura of India - 0.28 kg/capita/day (Rijal & Adhikari, 2015).

Based on the waste generation and waste collection data, Table 4.2 presents the SDG indicator 11.6.1 “proportion of municipal solid waste collected and managed in controlled facilities out of total municipal waste generated, by cities” for the municipalities. The overall value of the indicator was 0.50. The highest value (0.60) was observed for the metropolitan cities and lowest value (0.48) for the municipalities (Table 4.2). The indicator was however, not considered for wastes collected and managed in controlled facilities, as most of the municipalities do not have such arrangements.

Table 4.1: SDG Targets and Indicators on Municipalities’ Waste and Sanitation

S.N.	Target and Indicators	2014	2017	2020	2022	2025	2030
1	Municipalities with sewerage services (%)	45	72	100	100	100	100
2	Private hospitals segregating waste (%)	98	100	100	100	100	100

Source: NPC (2015)

Table 4.2: Annual Waste Collection to Generation Ratio in the Municipalities

Year 2075/76	Metropolitan Cities (mt)	Sub-Metropolitan Cities (mt)	Municipalities (mt)	Average (mt Municipality)
SDG Indicator 11.6.1	0.60	0.68	0.48	0.50

Hazardous waste: The inorganic and toxic waste generated in the cities is likely to cause adverse impacts to the environment and the people. Inorganic waste generated by the metropolitan cities amounted to 7100 mt in 2075/76 with lower figures (1526 mt) for the sub-metropolitan cities and 552 mt for the municipalities.

The overall average quantity of other waste comprising hospital waste, e-waste, toxic and others amounted to 380 mt in 2074/75, 283 mt in 2075/76 and 283 mt in 2076/77. The quantity of waste collected by metropolitan cities was about 20 times higher than the quantity collected by the municipalities. Managing these wastes, although small, pose further challenge to the respective municipalities as these wastes are riskier and hazardous for people and the surrounding environment. The limited institutional experience and capacity of the municipalities, as most of which are established after state restructuring in federal structure, further add challenges in the municipal waste management.

Waste generated from the health care facilities (hospitals, clinics, medical research centres, and laboratories) is known as the healthcare waste. About 80% of such waste is normally non-hazardous in nature, about 20% of them are hazardous (infectious waste, pathological waste, chemical waste and sharps). It is important to think that although only about 20% of the healthcare waste is hazardous, if all the fractions of the wastes are mixed together, all of the waste becomes hazardous.

Intermediate facilities: The municipalities possessed very limited waste handling facilities which constrained them to manage the waste efficiently. Among the surveyed municipalities, only few (15) municipalities were using differ-

ent facilities to manage the waste in the transfer station and 5 municipalities were having compaction facilities, 4 were having segregation facilities, 3 were having sorting facilities and 2 were having other facilities to reduce the volume of wastes. The limited facility is an indication of inadequate waste management practices of the municipalities. Thus, concerned government agencies should emphasize in making the basic facilities available to the municipalities to handle the waste efficiently.

Waste treatment plants: Waste treatment facilities are available in limited municipalities which is an underlying factor for poor waste management. Among the surveyed municipalities, only 8 municipalities responded about the management of treatment plants with no further details. There is an urgent need to set up treatment facilities in the municipalities.

Leachate treatment facility: Out of the total 97 landfill sites under operation, only 7 sites reported as least one or other type of leachate treatment system. Among the landfill sites, 6 sites had leachate control system, 5 had leachate drainage system and 3 had leachate treatment system. The existence of few landfill sites with leachate treatment facilities confirms poor treatment facilities among the many municipalities.

Waste recycling: the survey showed 30 (14.2%) municipalities were recycling the waste indicating the poor waste management in the urban areas. These included 30 municipalities (2 metropolitan cities, 5 sub-metropolitan cities and 23 municipalities). Similarly, only 9.9% municipalities were using waste to produce manure. Thus, additional efforts need to be paid for recycling/reusing the municipal waste.

Low level of awareness: Awareness raising among the stakeholders is key to make municipal waste management efficient and functional. However, the low level of awareness was found in the present conditions.

Revenue generation: Revenue generation of the municipalities was very low in most cases. Among the surveyed municipality, only 83

(30.6%) municipalities were collecting fees for waste management. The large shares of the municipalities' resources were generated from the federal government. Among the municipalities, 129 (51.2%) municipalities showed their expectation of budget from the federal government which clearly indicates weak financial position of the municipalities for investing in the municipal waste management.

V. CONCLUSIONS

Waste collection and management is an integral part for the sustainable development of the municipalities. The first step of scientific and effective waste management starts from the categorization and collection of waste from the primary sources where they are generated. However, this remains as a major issue for most of the municipalities as many of them are newly established with limited institutional experience and capacity. The limited waste handling, collection, transport, resource recovery and safe disposal capacity of the many municipalities appear as the major constraints for the municipalities. The specific waste management issues of the municipalities include- limited waste handling equipment, lack of adequate internal revenue, high dependency on the federal government for budget, very few waste transfer stations, lack of adequate and appropriate landfill sites, etc. In addition, lack of long term and holistic waste management plans of the municipalities and their effective implementation further elevates the challenges of the waste management.

It is expected that waste generation is likely to increase further in the years to come. The increasing consumption and production activities in all the subsectors of economy along with the population growth, settlements, urbanization, industrialization, etc. will contribute increased waste generation. In the context of increasing waste generation, effective measures to respond the challenges have to be planned. Among all, the local governments have to play vital role in planning and implementation specific activities for waste management, remaining within the national framework of waste management plans

and policies. The holistic and integrated waste management plan needs to be developed for the municipal waste management. This plan should especially focus in strengthening in-house capacity in handling waste through human resource development, database management and effective training and skill enhancement of the municipalities' staff. The survey also necessitates the need of developing waste treatment plants, locating effective landfill sites, including waste transfer stations with adequate space and capacity to handle and manage the waste for the medium and long runs. Procurement and operation of efficient intermediate facilities for waste transportation, sorting/grading, compaction and management also helps in SWM. The municipalities can also develop efficient measures to convert waste to energy including recycling, reusing of waste and production of manure for use in farming. More scientific and inclusive basis of tariff collection can be initiated against waste collection and management to increase internal resource generation of the municipalities.

Increased programs on public participation and awareness raising among the citizens, and roles and responsibilities of other agencies (private and public sectors) are crucial in the management of solid wastes. Effective coordination with concerned local level stakeholders helps in managing the wastes efficiently. Similarly, strengthening data management systems, developing effective waste handling procedures and establishing strong institutional mechanisms help to respond solid waste management challenges.

References

- Asian Development Bank (2013). Solid Waste Management in Nepal: Current status and policy recommendations, Mandaluyong City, Philippines.
- CRISIL (2020). Strategic assessment of SWM services and systems in Nepal. Draft policy advisory note (submitted to the World Bank). CRISIL Risk and Infrastructure Solutions Limited.
- NPC (2015). Sustainable Development Goals, 2016-2030, National (Preliminary) Report. Government of Nepal, National Planning Commission, Kathmandu, Nepal.
- R Core Team (2016). R: a language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.
- Rijal K. and Adhikari S. (2015). Solid Waste Management: Status and Challenges in Nepal, Compendium of Environment Statistics, Nepal, 2015.
- Rodic L. and Wilson D.C. (2017). Resolving Governance Issues to Achieve Priority Sustainable Development Goals Related to Solid Waste Management in Developing Countries. *Sustainability*, 9, 404; doi:10.3390/su9030404.
- Tchobanoglous G., Theisen H. and Vigil S. (1993). *Integrated Solid Waste Management: Engineering Principles and Management Issues*. McGraw-Hill, Inc.



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