



R4D PROJECT:
**CHALLENGES OF MUNICIPAL WASTE MANAGEMENT:
LEARNING FROM POST-CRISIS INITIATIVES IN SOUTH ASIA**

PROJECT WORKING PAPER #2

**INSTITUTIONAL ARCHITECTURE OF MUNICIPAL SOLID WASTE
MANAGEMENT (MSWM) NEPAL**

**AUTHORS: BISHNU RAJ UPRETI, DRISHTI UPRETI, RENÉ VÉRON
SUDARSHAN RAJBHANDARI, YASH MAN KAMACHARYA**



NEPAL CENTRE FOR
CONTEMPORARY
RESEARCH



Unil
UNIL | Université de Lausanne



PUBLISHED: June 2020

ONLINE: [HTTPS://WASTEOLIFE.HOME.BLOG](https://wasteoflife.home.blog)

AUTHORS: B. Raj Upreti, D. Upreti, R. Véron, S. Rajbhandari, Y. Man Kamacharya

CO-EDITOR: P. Hollenbach

ACKNOWLEDGEMENT:

The authors would like to acknowledge their sincere gratitude towards representatives of private sectors of Kirtipur Municipality, the staffs at KMC's environment division, representatives of local government of Kirtipur municipality, Lalitpur metropolitan city, Kakani rural municipality and Dhunibesi municipality for sharing first hand information on the current scenario of municipal solid waste management.

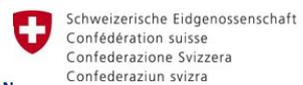
Special acknowledgement is extended towards the Mayors of Kirtipur and Kathmandu for giving permission to conduct research.

We further extend our deepest gratitude towards the informal waste workers at Teku of KMC and Sisdol landfill site for sharing their experiences on/with waste.

Project Partners



Project Funders



Executive Summary

This paper focuses on the issues that are pre-dominant in the institutional architecture of municipal solid waste management (MSWM) in Kathmandu. The paper also gives a brief history of solid waste management (SWM) in Kathmandu. It provides an overview of the generation and disposal methods of wastes and the challenges associated in the management of solid waste especially in the purview of two major crises of 2015, the earthquake and the Indian blockade. The objectives of this paper are to highlight i) waste governance practices of the municipalities and the central government, ii) the limitations in the existing policies of solid waste management, and iii) actors and projects relevant in SWM in Nepal. This paper applies primary data collection methods using qualitative interviews including key informant interviews and in-depth interview, field observations and focus group discussions (FGDs). This working paper also draws upon a mix of secondary sources, including documents, papers and journal articles related to experiences of MSWM in the context to Nepal.

TABLE OF CONTENTS

1. INTRODUCTION	5-6
1.1. Evolution of Solid Waste Management (SWM) in Nepal: Brief History	6-9
1.2. Policies in SWM.....	10-14
2. INSTITUTIONAL FRAMEWORK FOR SWM IN NEPAL.....	15-24
2.1. Kathmandu Valley: institutional setup.....	18-19
2.2. Organizational Structure of KMC Environment Division.....	19-22
2.3. Institutional Arrangements on Disaster and Post-Disaster Risk Management (DRM).....	22
	-24
3. LEGISLATIONS IN FORCE.....	25-27
4. INSTITUTIONAL ACTORS RELEVANT FOR SWM IN THE PROJECT SITES .	28-
31	
4.1. Project Sites	28-31
• Kathmandu Metropolitan City (KMC), Teku Ward No. 12	28-29
• Teku-12, KMC	29
• Kirtipur Municipality	30
• Sisdol Landfill Site, Nuwakot District	31
4.2. Institutional Actors	32-35
5. INITIATIVES AND PROJECTS.....	35-41
5.1. Integrated Solid Waste Management Project (ISWM) and privatization of SWM	35-38
5.2. Issues and challenges associated with the landfill site	38-40
5.3. PRISM project and role of informal waste workers (IWWs)	41
6. CONCLUSION.....	41-42
REFERENCES	43-49
LIST OF ABBREVIATIONS	

BOT	Build-Operate-Transfer
CBOs	Community Based Organizations
CNG	Compressed Natural Gas
DoE	Department of Environment
DoHS	Department of Health Services
Dol	Department of Industries
DoUDBC	Department of Urban Development and Building Construction
DPRP	Disaster Preparedness and Response Plan
DPR	Detailed Project Report
DRM	Disaster Risk Management
DWM	Disaster Waste Management
DWSS	Department of Water Supply and Sewerage
EIA	Environmental Impact Assessment
EPA	Environmental Protection Act
EPR	Environment Protection Rules
FGD	Focus Group Discussion
FNCCI	Federation of Nepalese Chambers of Commerce
GoN	Government of Nepal
GIZ	German International Cooperation
GLS	Gokarna Landfill Site
GTZ	German Technical Cooperation Agency
HCI	Health Care Institutions
HMG	His Majesty's Government
IBN	Investment Board Nepal
IEE	Initial Environmental Examination

IWW	Informal Waste Workers
ISWM	Integrated Solid Waste Management
KMC	Kathmandu Metropolitan City
KWMS	Kirtipur Waste Management Service
LSGA	Local Self-Governance Act
LMC	Lalitpur Metropolitan City
MdM	Medecins du Monde
MoFAGA	Ministry of Federal Affairs and General Administration
MoFE	Ministry of Forests and Environment
MoHP	Ministry of Health and Population
MoICS	Ministry of Industry, Commerce and Supplies
MoLD	Ministry of Local Development
MoU	Memorandum of Understanding
MoUD	Ministry of Urban Development
MoWS	Ministry of Water Supply
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
NDRF	National Disaster Response Framework
NEPCEMAC	Nepal Pollution Control and Environment Management Center
NGOs	Non-Governmental Organizations
NPC	National Planning Commission
NRRC	Nepal Risk Reduction Consortium
OBA	Output Based Aid
PPP	Public-Private Partnership
PPUE	Public-Private Partnerships for Urban Environment

PRISM	Poverty Reduction of Informal Workers in Solid Waste Management Sector
PVC	Poly Vinyl Chloride
RDF	Refuse Derived Fuel
SRF	Solid Recovered Fuel
SWM	Solid Waste Management
SWMRMC	Solid Waste Management and Resource Mobilization Center
SWMRMA	Solid Waste Management and Resource Mobilization Act
SWMTSC	Solid Waste Management Technical Support Center
UNDP	United Nations Development Programme
WHO	World Health Organization

1. Introduction

Solid waste management (SWM) is an important environmental health service, and is an integral part of basic urban services. One of the major causes of municipal solid waste (MSW) generation in developing countries is a fast increasing population level, rapid urbanization, changing consumption patterns, booming economy and rise in the community living standards (Guerrero, Maas, & Hogland, 2013). According to Kathmandu Metropolitan City (KMC), the Kathmandu Valley which is home to about 2.6 million people (CBS, 2012) generates about 853 tonnes of wastes daily and 70,080 tonnes annually (Basnet, 2019). The problem of SWM is clearly becoming an increasing threat to the urban dwellers within the Kathmandu Valley and the locals residing within the periphery of Valley's sole landfill site at Sisdol, Nuwakot. The local governments (municipalities) especially, as well as the central government, are incapable of dealing with this challenge effectively due to inadequate financial, technical, and managerial capacities.

This paper provides a brief overview of the waste value-chain scenario that includes generation, collection, and disposal of municipal solid waste in three sites within the Kathmandu Valley: the neighborhood of Teku in Kathmandu City, the peri-metropolitan municipality of Kirtipur, and the landfill site at Sisdol in Kakani rural municipality. It mainly discusses the issues that are predominant to the institutional architecture of solid waste management. In particular, the paper highlights:

- i) waste governance practices of the municipalities and the central government,
- ii) the limitations of the existing policies of solid waste management,
- iii) the actors, projects and initiatives relevant in SWM in Nepal.

The paper further examines the prospects of private sector actors, informal waste workers and petty entrepreneurs engaged in the collection, management and selling of recyclable wastes and their roles during and after the two major crises that occurred in Nepal namely, the earthquake and Indian blockade of 2015. The paper draws upon primary data collected with methods, such as qualitative interviews, field observations, household questionnaire survey and focus group discussion (FGD) and upon secondary data sources. Since the study has focused on three sites within the Kathmandu Valley, it does not represent the solid waste management practice of

entire Nepal. The paper may also lack the views of officials at KMC as it has so far been difficult to motivate them to participate in SWM research.

1.1. Evolution of Solid Waste Management in Nepal: Brief history

The history of formal solid waste management in Kathmandu dates back to 1970 when F. Flintoff of the World Health Organization (WHO) and Professor Tabasaran from the University of Stuttgart/Germany pointed to the problems and issues associated with urban waste in the Kathmandu Valley. Soon after, in 1980, the Solid Waste Management Center was established under the Ministry of Housing and Physical Planning (Nyachhyon, 2010). Before the 1970s, solid waste in Kathmandu was managed at the household level because almost all the wastes were organic in nature (Dhakal, 2013).

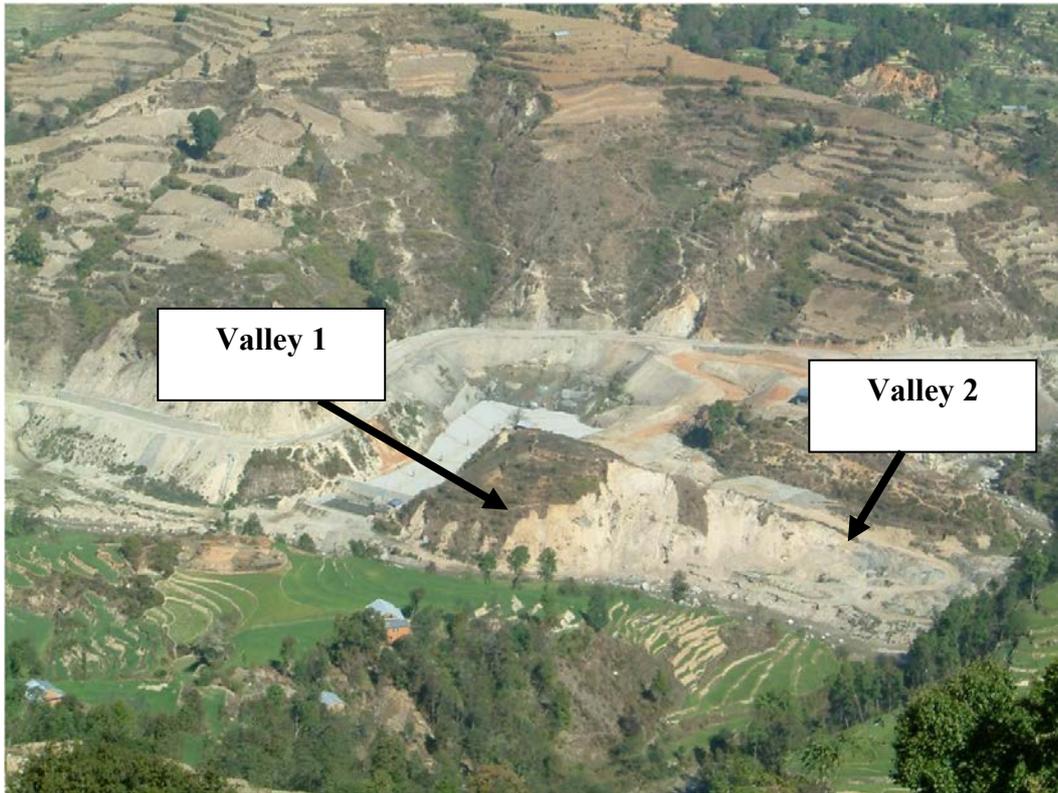
'Scientific' SWM in Nepal was strengthened during the 1980s when the Solid Waste Management and Resource Mobilization Center (SWMRMC), supported by GTZ, the German Technical Cooperation Agency now GIZ (German International Cooperation), took up the responsibility for the management of wastes in three municipalities of the Kathmandu Valley, namely, Kathmandu, Patan and Bhaktapur. In April 1993 the project was, abruptly withdrawn due to insufficient funds, leaving the garbage in Kathmandu pile up (Thapa, 1998). This situation, in turn, led to a considerably stronger involvement of municipalities in SWM in general.

With the withdrawal of GTZ, the rapid growth of population and urbanization, waste management in Kathmandu became a challenging task. Already before, compost production and resource recovery were established at Teku in 1985 (Giri, 2011) but after closure of this facility in 1992, the waste of the Kathmandu Valley had to be deposited at an alternative landfill site. For this purpose SWMRMC built a permanent facility-the Gokarna Landfill Site (GLS) (Dangi, Schoenberger, & Boland, 2015) on government owned land (Pradhan, n.d.). In 1994-1995, the locals of Gokarna protested and demanded closure of the landfill site. Subsequently, the wastes were dumped on the riverbanks of Bishnumati River. The landfill was closed in 1999 since the site was considered full after which KMC and Lalitpur were forced to start the dumping along Bagmati River (Anderzen & Blee, 2004) as no official landfill or disposal site existed. Initially, waste was dumped at Teku Dobhan, slowly reaching to

Sundarighat, triggering protests from local residents and environmentalists. In an attempt to diffuse the protests, KMC and Lalitpur shifted their dumping sites from one place to another along the banks of the Bagmati River. In 1996, the government endorsed a plan to develop a new 41-ha landfill site in Okharpauwa of Nuwakot (KMC, 2010). Since 2005, the only legal and official option available for the final disposal of Kathmandu's waste has been Sisdol landfill site (Tamang, 2010) that was initially planned for 2 years. The landfill site which is situated at Nuwakot is at a 25 Km distance from Kathmandu center and takes about an hour drive for the waste trucks to reach there. When Sisdol landfill site first came into operation in 2005, all the urban waste was dumped below the road, also called as "Valley 1". After a year, when the landfill exceeded its capacity, the urban waste Kathmandu Valley was dumped in a landfill approximately 600 metres west from Sisdol named *Aletar* landfill site. However, after the capacity of *Aletar* landfill site exceeded, the authorities went back to dispose the wastes in Sisdol creating "Valley 2" (Shrestha S. , 2020) (see figure 1).

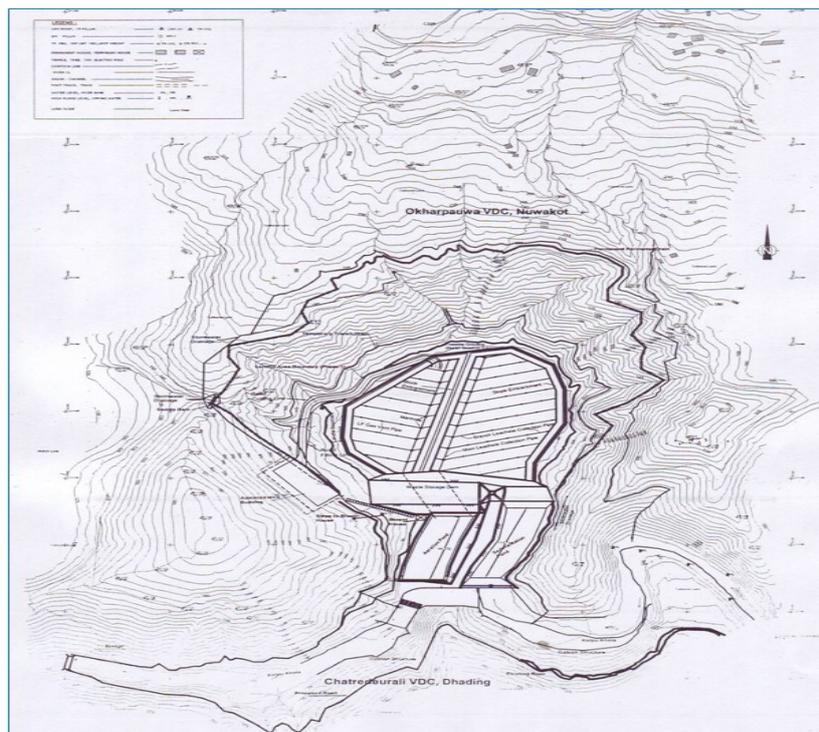
A new official landfill in Bancharedanda is currently under construction and planned by the Government of Nepal in order to secure the solid waste management of Kathmandu Valley in the future. The landfill falls under Kakani Rural Municipality ward number 2, which is located 28 km west of Kathmandu valley and covers an area of 13.21 Hectare with a dam length of 256 m, dam height: upstream 30 m and downstream 45 m. It covers 53 ha of buffer zone area and has the capacity of storing wastes of a volume of 2,500,000m³ (Solid Waste Management Technical Support Center (SWMTSC, n.d.)). The landfill site, which lies 1,900 metres away from the Sisdol landfill site, is estimated to operate for the next 30 years (Sisdol landfill site in-charge, 2019).

Figure 1: Image showing Sisdol semi-aerobic sanitary landfill pilot project along with Valley 1 and 2



Source: Sharkaardeep Shrestha, KMC, 2020

Figure 2: Sketch Map showing the location of the under construction Bancharedanda sanitary landfill site in Nuwakot



Source: SWMTSC. N.d.

1.2. Policies in SWM

The Constitution of Nepal 1990 clearly states the need for environmental conservation in the Directive Principle of the State by saying, "The State shall give priority to the protection of the environment of the country and also prevent damage due to physical development activities by making people conscious of environmental cleanliness and by making special arrangements for the protection of rare animal species, forest and vegetation" (Shakya & Tuladhar, 2014).

In Nepal, specific national policies on waste management were absent until 1996. Measures related to solid waste were only considered in the Eighth and Ninth Plan (1992/97 and 1997/02, respectively)¹. The Eighth Plan investigated the causes for air, water, and land pollution through on-the spot observation and management mitigation plans. The Ninth Plan considered the engagement of NGOs (Non-Governmental

¹ The genesis of planned economic development in Nepal commenced on the year 1956 A.D with the inception of the First Five-year Plan (1956-1961). The Ninth Plan came into effect from the year 1997/02 on the completion of Eighth Plan (1992/97)

Organizations) and private sector actors for the management of solid waste and it emphasized the need for composting of municipal wastes and for, capacity building of local municipalities in the field of solid waste management (Yadav, Devkota, & Aryal, 2002).

The 10th National Plan (2002-2007) highlighted the problem of creating a final disposal site as the major challenge in SWM, especially in the Kathmandu Valley, for which it prioritized the construction of a long-term landfill site on the Okharpauwa-Banchare hill. The plan also summarizes the current general policy approach to solid waste management in Nepal quite well by advocating:

- the "polluters pays principle" to be applied to manage the waste in urban areas.;
- the involvement of the private sector in waste management of the urban areas.;
- municipalities outside the Kathmandu Valley to formulate and implement appropriate programs on solid waste management.;
- the control of pollution through mandatory, land use and waste disposal measures municipalities;
- programs for solid waste management and environmental protection at the local level for improved service delivery (NPC, 2002).

Before and after the formulation of the general policy approach regarding SWM in the 10th National Plan, the country has disposed several legal instruments for solid waste management, namely, the Solid Waste Management and Resource Mobilization Act (SWMRMA, 1987), the Environmental Protection Act (EPA, 1997), the Local Self Governance Act (LSGA, 1999), the Solid Waste Management Act (2011), the Solid Waste Management Rule (2013), the Local Government Operations Act (2017), the National Urban Policy (2007). However, the strategies for the implementation of these policies remain unclear.

Yet, after the exit of GTZ from waste management in Kathmandu in the year 1993 and in order to avoid financial crisis and possible waste disaster, the Kathmandu municipality increased its budget for the management of wastes after which the significance of local resource mobilization was realized.

Furthermore, under the provision of the Solid Waste Management and Resource Mobilization Act, 1987, the Solid Waste Management and Resource Mobilization

Center (SWMRMC) was established in 1980, became responsible for the authorization of solid waste collection, transportation, storage, disposal, resource recovery, and the collection of service fees, within the three municipal areas of Kathmandu Valley, KMC, Lalitpur Metropolitan City (LMC) and Bhaktapur Municipality² (Thapa, 1998; Maskey, 2018).

Under the Local Self-Governance Act (1999) and SWM Act (2011), furthermore, solid waste management is one of the basic essential services that need to be provided by municipalities to keep urban centers clean (LEAD, 2015). The Local Self-Governance Act (LSGA, 1999) in section 96 subsection C under the heading of Functions, Duties and Power of Municipality and Relating to Water Resources, Environment and Sanitation specifies that all responsibilities for solid waste management including collection, transportation and final disposal have been transferred over to the municipalities by the then His Majesty's Government (HMG), together with other duties and authority to protect the local environment (Udash, 2004; SWMRMC, 2005). The LSGA empowers local authorities to manage wastes within their jurisdiction based on public and private participation. In particular, local authorities are authorized and responsible to:

- fine up to NPR 100 and retain the expense to dispose the waste or order the individual or institutions to remove the waste in a safe place;
- maintain the sanitary conditions of streets and squares, and launch awareness programs for people to this end;
- manage sanitation programs including solid waste management (OBA, n.d.).

The Solid Waste Management National Policy, 1996 is the primary policy document that concerns the matters of Municipal Solid Waste Management (MSWM). This policy aims to promote cooperation amongst members of society including citizens, industry, and NGOs for the reduction of detrimental effects on the environment and public health caused by the mismanagement of solid waste (Shrestha Z. , 2018).

The Environment Protection Act (EPA, 1997) entails provisions relevant to the management of solid waste. In Sections 3 and 4 of the act, there are provisions for

² Kathmandu district comprises Kathmandu Metropolitan City and Kirtipur Municipality, Lalitpur District comprises Lalitpur Metropolitan City, and Bhaktapur District comprises Bhaktapur Municipality

conducting Environmental Impact Assessment (EIA) or Initial Environmental Examination (IEE) and prohibition on implementation of proposal requiring IEE or EIA without approval. This requirement affects the operation of landfill and waste disposal sites. Section 7 of the EPA Act emphasizes the prevention and control of pollution (Udash, 2004) and Chapter 3 of Environment Protection Rules (EPR) (-rules 15-20) mentions: "Nobody shall create pollution in such a manner as to cause significant adverse impacts on the environment or likely to be hazardous to public life and people's health (GoN, 1997).

The National Urban Policy, 2007, furthermore, advocates a strategy of developing healthy cities by giving priority to issue of environmental protection in the operation of urban activities and mobilization of natural resources with the view of achieving an improved living standard of urban population, developing healthy, safe and prosperous urban environment. The policy aims to encourage necessary policy and legal arrangements for the urban sanitation and solid waste management, cooperation between the government and local bodies, the creation of landfill sites within five years, the employment of the central Solid Waste Management Technical Support Center (SWMTSC, formerly known as the SWMRMC³) in order to provide necessary assistance to local bodies for the management of the solid waste, the implementation of mandatory environmental and social impact assessments for infrastructural projects of the local bodies, etc (OBA, n.d.).

The first law targeting solid waste management, the SWM Act came into force on 15 June 2011. It has the objective to maintain a clean and healthy environment by minimizing the adverse effects of solid waste on public health and the environment (LEAD, 2015). "Under this legislation, municipalities (local bodies) were given the responsibility for the construction, operation, and management of infrastructure for the collection, treatment, and disposal of MSW and also the promotion of 3R (reduce, reuse, and recycle) strategies including waste segregation at source" (Shrestha Z. , 2018). As per chapter 2, section 6 of the act, the responsibility to separate solid waste into at least organic and inorganic components lies with the local bodies. These are

³ SWMRMC: The first authorized body to be established under the provision of Solid Waste Management and Resource Mobilization Act. It was renamed as Solid Waste Management Technical Support Center (SWMTSC)

obliged to provide the required technology, goods, equipments and containers while the waste producer (person or institution) is responsible for waste separation at source and the transportation of solid waste to the collection center (GoN, 2018). The SWM Act 2011 has put significant emphasis on the following aspects:

- Segregation of waste at source
- Responsibilization of the waste producer responsibility
- Responsibility of local government
- Introduction of waste collection schedule
- Establishment of waste collection centers in the neighborhood
- Environmental protection
- Collection of fees for waste management services based on the polluters' pay principle (Nepal, 2016)

The SWM Rules of 2013 is a modified version of SWM Act 2011 that clarifies the role of the private sector and the rules on composting (Pradeep Amatya, environmental engineer, LMC, 2019).

The Local Government Operations Act 2074 B.S. (2017) encourages coordination, cooperation and partnership with the private and non-governmental sectors in waste management and it promotes sanitation and waste management at the local level. This act also addresses the issue of medical wastes by imposing regulations for their collection, reuse, processing, disposal and the assessment of services charges (MoFALD, 2017).

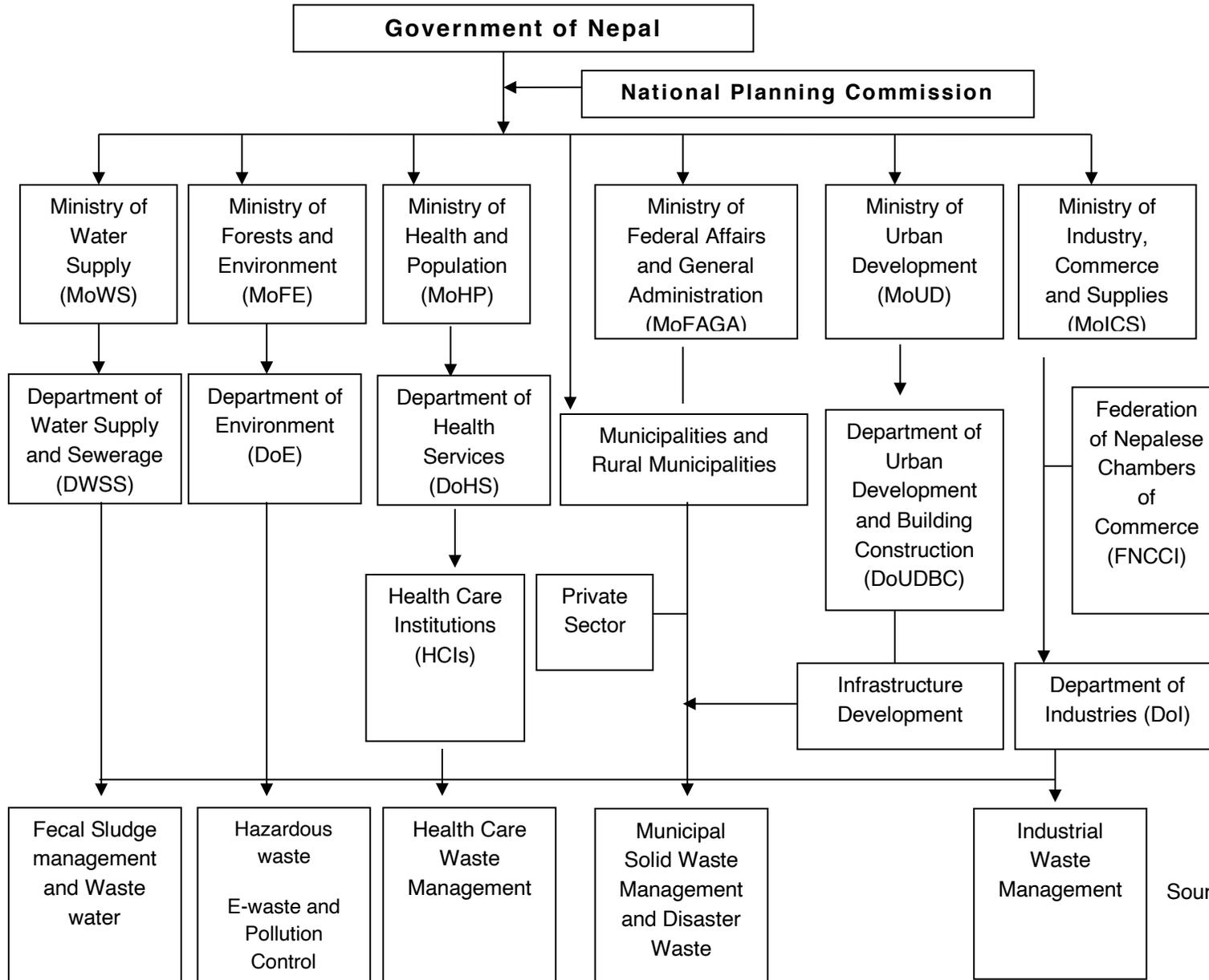
Since the introduction of the Local Self Governance Act in 2017, legislations and policies specifically relating to solid waste, such as the Solid Waste Management Act 2011, Solid Waste Management Regulations 2013 and the National Policy 2007 have not been revised. This has led to a situation of legal ambivalence and uncertainty, particularly in regard to the division of responsibilities between the central and local bodies.

In the context of Nepal, it is also important to pay attention to the management of disaster waste of all kinds. The relevant legislations and policies in this regard include the Constitution of Nepal (2015), the Natural Calamity (Relief) Act (1987), the National Action Plan for Disaster Management (1996), the Local Disaster Risk Management

Planning Guidelines (2011), the Guiding Note to Disaster Preparedness and Response Plan (DPRP, 2011), the National Disaster Response Framework (NDRF, 2013) and, the Nepal Risk Reduction Consortium (NRRC, 2009). The already discussed, National SWM Act (2011), Environmental Protection Act (EPA, 1997) and Local Self Governance Act (1999) also have specific provisions for disaster waste management (DWM) (LEAD, 2015).

2. Institutional Framework for Solid Waste Management in Nepal

Figure 3: Organogram showing the institutional framework of SWM in Nepal



Source: Gyawali, 2019)

The Government of Nepal (GoN) functions under the new constitution of 2015. The constitution has transferred full rights and responsibilities for solid waste management and environment protection to the local level governments (LMC, 2019). However, several national level government agencies, ranging from ministries to authorities, remain involved in solid waste management. However, the new constitution leaves roles and responsibilities for national level agencies in solid waste management ill-defined.

For example, the Ministry of Forests and Environment (MOFE) is responsible for formulating SWM policy although it does not play any role in the implementation, for which the municipalities and the rural municipalities now have the authority. Since the earthquake of 2015, however, the Ministry has been deeply involved in the management of disaster waste (Pradeep Amatya, 2019); for common household wastes, however, the municipal level Committees for Environment and Solid Waste Management are in operation and guide the Environment/SWM section of the municipality (SWMTSC. N.d.).

By contrast, sanitation governance has remained centralized. The Ministry of Water Supply (MoWS) formerly known as the Ministry of Water Supply and Sanitation, continues to be responsible for planning, implementation, regulation, and monitoring and evaluation of sanitation programmes (WHO, 2019).

At present, the following government agencies are the major stakeholders involved in solid waste management in Kathmandu Valley (Kunwar, 2019):

- Ministry of Federal Affairs and General Administration (MoFAGA)⁴,
- Ministry of Urban Development (MoUD),
- Kathmandu Metropolitan City (KMC),
- Investment Board
- The other 17 municipalities of Kathmandu Valley (Lalitpur, Kageshwori, Kirtipur, Gokarneshwor, Shankharapur, Chandragiri, Tokha, Tarkeshwor, Dakshinkali, Nagarjun, Budhanilkantha, Godawari, Mahalaxmi, Changunaryan, Bhaktapur, Madhyapur Thimi and Suryabinayak)

⁴ MoFAGA: Previously known as Ministry of Federal Affairs and Local Development (MoFALD) and Ministry of General Administration

Table 1: Table showing the different institutional actors in SWM and their responsibilities

STAKEHOLDERS	RESPONSIBILITIES
Ministry of Federal Affairs and General Administration (MoFAGA)	MoFAGA is one of the responsible bodies for managing the wastes. Though the Ministry does not include a separate body for SWM, it helps to coordinate between the federal and the local governments (Pradeep Amatya, 2019). At present, the local government is operating under MoFAGA that is responsible for looking after the municipalities and the rural municipalities. However, the role of MoFAGA has not been clearly specified. When SWMTSC ⁵ was in function, MoFAGA provided technical support, design layout for the construction of the landfill site and search for donors.
Investment Board	Investment Board Nepal (IBN) is a high-level government body chaired by the Right Honorable Prime Minister and established under Public-Private Partnership and Investment Act, 2019. IBN functions as a central fast-track government agency established to facilitate economic development in Nepal by creating an investment-friendly environment, mobilizing and managing domestic as well as foreign investments. It is responsible for coordinating

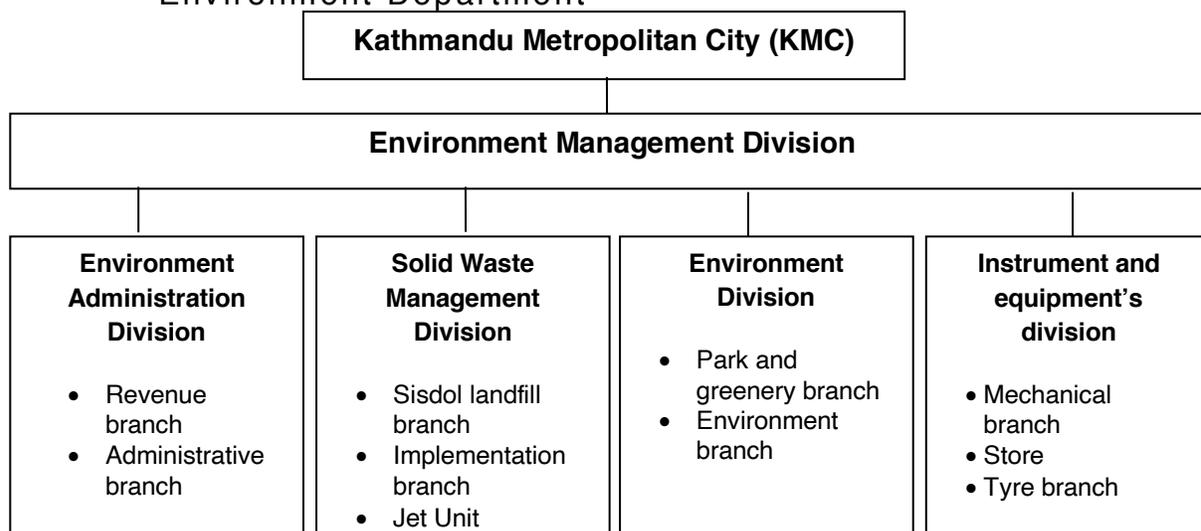
⁵ SWMTSC: Solid waste management technical support center was a governmental organization established according to Solid Waste Management Act (2011) under Ministry of Local Development (MoLD). SWMTSC which was responsible for providing technical support to manage solid waste has now been dissolved by the government under federal set-up.

	between the investors and the municipality for the management of wastes at Sisdol landfill site (Kunwar, 2019)
KMC's Department of Environment	The job description of the deputy secretary of KMC's Department of Environment includes the responsibility of environmental management but without specifically mentioning solid waste management
Ministry of Urban Development (MoUD)	Ministry of Urban Development works on integrated urban planning and development in municipalities.

2.1.Kathmandu Valley: institutional set-up:

KMC has been responsible for managing solid waste and carrying out sanitation activities within the entire Kathmandu Valley since its establishment in 1919 (Shrestha Z. , 2018). KMC is the authorized government organization responsible for the overall management of solid waste in Kathmandu Valley and looks after day-to-day affairs concerning solid waste management. Figure 4 shows the organizational structure of KMC environment division.

Figure 4: Organizational Structure of Kathmandu Metropolitan City (KMC) Environment Department



Source: (KMC, 2019)

As of now, the Department of Urban Development and Building Construction (DoUDBC) under the Ministry of Urban Development (MoUD) has initiated the construction of the long-term Bancharedanda landfill. The Investment Board Nepal (IBN) decided in 2017 to divide waste collection in the Kathmandu Valley in three "packages" and assign collection and transportation responsibilities to two private companies (SWMTSC n.d.).

- Package 1: NepWaste will collect wastes from the households of KMC and 10 additional municipalities, including Dakshinkali, Chandragiri, Nagarjun, Tarkeshwor, Tokha, Budhanilkantha, Gokarneshwor, Kaageshwori-Manohara and Shankharapur.
- Package 2 and 3: Clean Valley will be given the responsibility for the management of wastes from Kirtipur municipality, Lalitpur Metropolitan City and all the municipalities of Bhaktapur district (Mali, 2019).

Within the municipalities, private service providers are also engaged in the collection and management of the wastes. Though the role of municipal and central government is important in the integrated approach of solid waste management especially, where financial and institutional support is concerned, the role of private sector also becomes important in the institutional arrangement of MSWM where appropriate (Shekdar, 2009). As per the chapter 4 of SWM Act, 2011 of Nepal, the section 13 on provisions of licensing suggests that the involvement of private and community sector requires obtaining a license from the local body to carry out activities relating to the management of solid waste (GoN, 2018). It provides for the involvement of private sector firms, CBOs (Community Based Organizations) and NGOs in solid waste management through competitive bidding and provides procedures for bidding, selection of successful bidder, authority of the bidder for collecting tipping fees against solid waste management services (OBA, n.d.). As per the coordination between the local government of Kakani Rural Municipality and KMC, a service provider at Sisdol said,

" KMC has a direct dealing with Kakani rural municipality. Since Kakani rural municipality is a waste affected area, KMC offers a deal of yearly compensation to certain wards of Kakani rural municipality. This compensation is to be used in the health, education and infrastructural development. KMC makes a deal with Kakani rural municipality directly"- (KII, Sisdol)

Interview with a local councilor of LMC revealed that currently 13 private sectors are working in the waste management sector in LMC. As per the Environmental Engineer at LMC's Output Based Aid (OBA)⁶ these 13 private sectors are working under the authority of LMC. However, they haven't signed any written agreement with LMC and are working on their own.

"LMC views private sectors as profit-generators more than service providers...we don't have MoU with the private sectors. There is no transparency in how the private sectors collect the waste fee."(KII, Environmental Engineer, LMC, 2019)

The institutionalized form of Public Private Partnership (PPP)⁷ in Nepal started with the initiation of the then Ministry of Local Development (present, MOFAGA) and the funding of United Nations Development Programme (UNDP) for the project called "Public-Private Partnerships for Urban Environment (PPUE)" in 2002 (Acharya, 2019). In 1997, the involvement of private sectors in SWM was first introduced in Biratnagar, in the Terai of eastern Nepal. Before that, it was the municipal governments who were solely responsible for all waste management activities such as street sweeping, household waste collection and waste disposal (UNDP, n.d.).

At present, both private companies and the KMC have responsibilities for collecting household waste. The municipality is divided into sectors to which particular companies are assigned and responsible to collect waste from door-to-door. In other parts, KMC remains responsible for waste collection, either door-to-door or at neighborhood collection centers. In Teku, a neighborhood in the south-western part of Kathmandu, for example,

⁶ Output Based Aid (OBA) project was approved as the project "Output-Based Aid in Municipal Solid Waste Management in Nepal" (the OBA project) in which The World Bank acted as administrator for the Global Partnership on Output-Based Aid (GPOBA) and approved a grant of USD 4.3 million to the Government of Nepal. It's main objective is to improve access to high quality and financially sustainable SWM services in Participating Municipalities in Nepal.

⁷ Public-private partnerships (PPP): PPP can be defined as the transfer and control of a good or a service currently provided by the public sector, either in whole or in part, to the private sector

private companies only serves the central parts while the KMC manages waste in more peripheral the more peripheral wards (no. 12-23).

Wastes from about 50-60% of the areas of the Kathmandu Valley are collected by about 60 private companies with the help of a fleet of about 100 waste vehicles such as waste trucks. These usually, focus on business areas. The private companies usually engage workers to segregate the wastes after collection. By contrast, KMC collects and transports waste in different stages. People from the household are required to place their waste outside on the curb. The municipal collectors take the waste and bring it to containers placed in designated areas. From the containers, waste is then transferred in rickshaws to the central transfer station in the neighborhood. KMC staff does not segregate the waste, which is transported by KMC's 30-35 garbage trucks from the transfer stations to the landfill site in Sisdol. Today, informal waste workers are not allowed to operate at transfer stations anymore. A municipal waste worker posted in the neighborhood of Teku told us:

"Until 2010, Teku waste transfer station had around 100 waste pickers who used to engage in waste segregation as soon as the waste trucks used to bring the wastes. However, the segregation process was removed after 2010 because the waste pickers started becoming very "swarhi" (selfish). They started to demand the land (of the transfer station) in their own names. They even demanded for the land ownership document in their names. They started asking for their rights. The waste pickers used to work close to the waste truck when the truck disposed wastes at the waste transfer station because of which some of the waste pickers even lost their lives as they got hit by the waste truck."- (KMC staff, IDI, Teku-12)

2.2. Institutional Arrangements on Disaster and post Disaster Risk Management

The constitution of Nepal 2015 highlighted under part 4 of the "Directive Principles, Policies and Obligations of the State" in Article 51(G) (9)- "policies related to protection, promotion and use of natural resources" the need for disaster risk management and it assigned disaster risk management (DRM) for the first time in the history of the country (GoN, 2018).

Table 2: Post Disaster Scenario: Solid Waste Management (SWM)

Districts	Fully and Partially Destroyed Houses	Weight (Tons)	Volume (m ³)
Kathmandu	87,726	2,345,159	7,468,662
Lalitpur	25,508	799,100	2,544,906
Bhaktapur	27,954	871,932	2,776,855
Total	141,188	4,016,191	1,279,042,3

Source: Solid Waste Management Technical Support Center (SWMTSC, 2015) as cited by (Khanal, n.d.)

Immediately after the earthquake of 2015, the Government of Nepal initiated rapid emergency rescue based on Natural Calamity (Relief) Act, 1982 along with the formation of a Natural Calamity (Relief) Committee at the central, regional, district and local level. Since the earthquake damaged buildings and their structure, the Demolition (Removal) Guidelines 2015 were formulated. However, the guidelines lack information on the proper management of disaster waste (LEAD, 2015). Table 3 above presents the post disaster scenario of SWM in terms of volume of wastes generated from destroyed buildings in three districts within Kathmandu Valley, Kathmandu, Bhaktapur and Lalitpur.

On 24th September 2017, the legislative-parliament unanimously passed a new Disaster Risk Reduction and Management Act. The Act legislates the following:

- risk reduction and management as integral parts of the task;
- institutional structure of DRM at the national, provincial, district, local/municipal, and community level;
- the provision of a Disaster Management Fund at the federal, provincial and local levels
(GoN, 2017).

As per the information provided by one of the representatives from the local government of LMC, 4 million cubic meters of wastes were expected to accrue after the earthquake

of 2015 and there was worry of how to manage the rubble waste. However, as the rubble waste was divided into residential waste and heritage waste, it became easier for the local government to manage. For instance, the debris of *Dharahara*, the tower in the centre of Sundhara in Kathmandu were used to gravel the muddy road at Sisdol landfill site in 2018 (KII, Output Based Aid for Municipal Solid Waste Management, LMC).

The ordinary waste management service of KMC was halted for few months immediately just after the earthquake. People collected their wastes to deposit in the KMC's office. Some of them even stored all their wastes in their home while threw their waste in the streets as well (IDI, field survey, 2019).

"During the earthquake, however, the vehicles couldn't run smoothly. The staff were not regular at work. The operation at the landfill site remained blocked for about 2-4 months because it was an emergency period"- (Staff at KMC Environment Division, Teku-12)

Following the earthquake of 2015, the Nepal government promulgated the reconstruction Act, 2015 to provide for reconstruction of the earthquake affected structures (GoN, 2016). Depending upon their nature and severity disasters such as earthquake, tsunami, flooding, and typhoon can cause physical damages leading to the destruction of buildings and infrastructure creating enormous amount of building waste (Karunasena, Amaratunga, Haigh, & Lill, 2009). The earthquake in Nepal during 2015 had generated waste or rubble consisting mainly of brick, stone, concrete blocks, tile, cement, concrete, steel bars, wood, steel pipes and tanks, poly vinyl chloride (PVC) pipes and tanks, electrical wires and cables, and broken glass pieces (Gautam & Chhetri, 2016). Often the wastes resulting from different type of disasters can be managed using four steps of pre and post disaster waste management strategies. These four steps are prevention, preparedness as pre-disaster waste management strategy and, removal, and recovery as post-disaster waste management strategy (Memon, 2016).

3. Legislations in Force

The administrative divisions of Nepal are sub-national administrative units of Nepal where the first level of country subdivisions are the Provinces. Each province is further subdivided into districts, and each district into municipalities and rural municipalities (see figure 5). Nepal currently follows the SWM Act, 2011 (2068 B.S.) which relates more specifically to SWM, is more comprehensive and goes further than the preceding acts. The Act confirms provisions of the Local Self Governance Act, 1999 (see below) that local governments are fully responsible for SWM related services. The SWM Act includes important provisions to ensure the protection of public health and the environment, to follow the 3R principles (reduce, reuse and recycle), to involve private actors and the local community in waste management, to increase public awareness, and to punish violators (Maskey, 2018). However, local government authorities are not authorized to prepare SWM plans. Neither are municipalities required to devise measures nor to set targets for the diversion of waste from going to the landfill site. While the introduction of a, door-to-door waste collection system, the establishment of a material recovery facility, and the punishment of waste violators with community service are also recommended, their implementation by the local authorities remains optional. As per Chapter-9 (of offences and punishment) of SWM Act, 2011, a person will be liable of offences for:

- "Throwing, placing or depositing any kind of harmful substance at the solid waste collection center, container or solid waste depositing place";
- "Placing, throwing or depositing solid waste from the house, compound and premises on the road or any other public place";
- "Throwing, placing, depositing or discharging any kind of harmful waste, except in places prescribed by the Local Body like a road or on any other public places, causing detrimental effect to the public health" (GoN, 2018).

Chapter-9 (of offences and punishment) of SWM Act, 2011 further mentions that the Local Body may impose a fine on an offender ranging from five thousand rupees to fifteen thousand rupees (GoN, 2018). One of the key informants cited that as per the Waste Management Act of 2068 B.S. (2011 A.D.), the wrongdoers are penalized from rupees

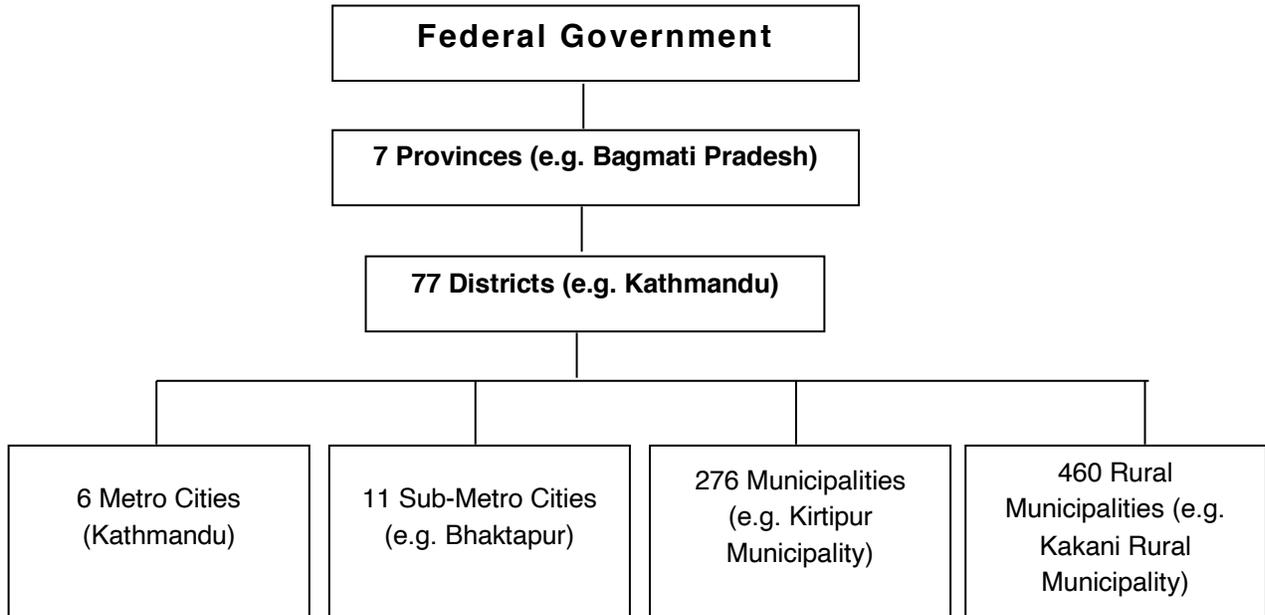
five hundred to fifteen thousand in case of individual, and fifteen thousand to one lakh rupees for institution for throwing wastes publicly (Kirtipur field, 2019).

Similarly, there is no binding obligation to convert open dumpsites into controlled disposal sites and to sanitary landfills in a later phase. Generally, the undefined nature and non-mandatory provisions of the SWM Act is an impediment to its effective implementation.

As indicated above, solid waste management became decentralized through the Local Self Governance Act, 1999, which delegated, together with other duties, waste collection, transportation and final disposal and the authority to protect the local environment to municipalities (Shakya & Tuladhar, 2014). Before the legislation of the polluter pays principle in the SWM Act of 2011, the municipality was the only actor collecting waste but now the involvement of private actors in waste collection is possible as they can charge a user fee from the households. The Government of Nepal itself came up with the policy of collecting waste fee from people who generate wastes. For example, the current written agreement or the MoU (Memorandum of Understanding) between Kirtipur municipality and the private waste companies involves everything related to the waste management from collection to segregation of wastes. It states about the provisions related to the awareness, billing and partnerships in the overall waste management. Though there is no provision related to direct support for these companies in the MoU, it includes extra provisions mentioning uniform for waste workers, health insurance and provisions regarding health safety as well. According to the MoU the private waste companies within Kirtipur municipality receive 2% profit as waste service fee for household waste collection of which 1% goes to Kirtipur municipality as per polluter pays principle. In case of Kirtipur, the municipality fixes the user fee. Currently, the waste fee range from Nepali rupees 150-300. The private waste companies are permitted to cover certain areas for waste collection. Currently, the private companies in Kirtipur are collecting wastes from around 7,000 households leaving 10,000 households still beyond the reach of private sectors (Kirtipur field, 2019). A private organization named Clean Nepal in Kirtipur has already started providing software billing to its customers that comes in a printed format.

Not all places in Kathmandu have been designated as waste-free zones, except the natural heritage sites. Furthermore, there are no systems in place (e.g., CCTV cameras or police patrols) to monitor littering or the disposal of hazardous waste.

Figure 5: Political administrative structure of Nepal



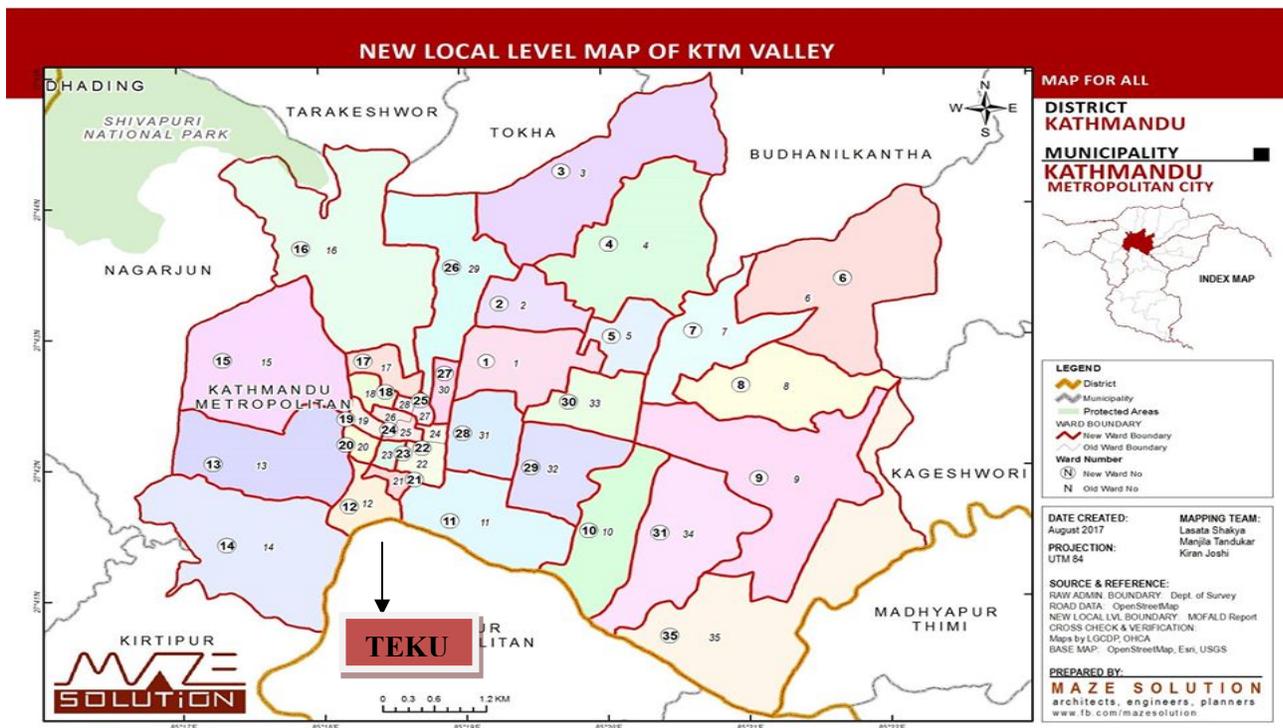
Source: CBS 2018

4. Institutional actors relevant for SWM in the project sites

4.1. Project Sites

The study concentrates on both rural and urban areas of Kirtipur municipality where the waste management is intervened by private waste companies practicing user-fee-based public-private partnership. Sisdol of Kakani rural municipality, where many wastes from Kathmandu end up along with Dhunibeshi municipality of *Dhading* district that neighbors Sisdol landfill site is chosen as a secondary research sites to study the issue of socio-environmental justice. Furthermore, Teku-12 of KMC is chosen to understand the dynamics of informal waste workers including scrap dealers, shoe-vendors, waste segregators and a cooperative called SaSaJa. Teku-12 is also the site where KMC's environment management division is located which acts as one of the key stakeholders in managing wastes of Kathmandu.

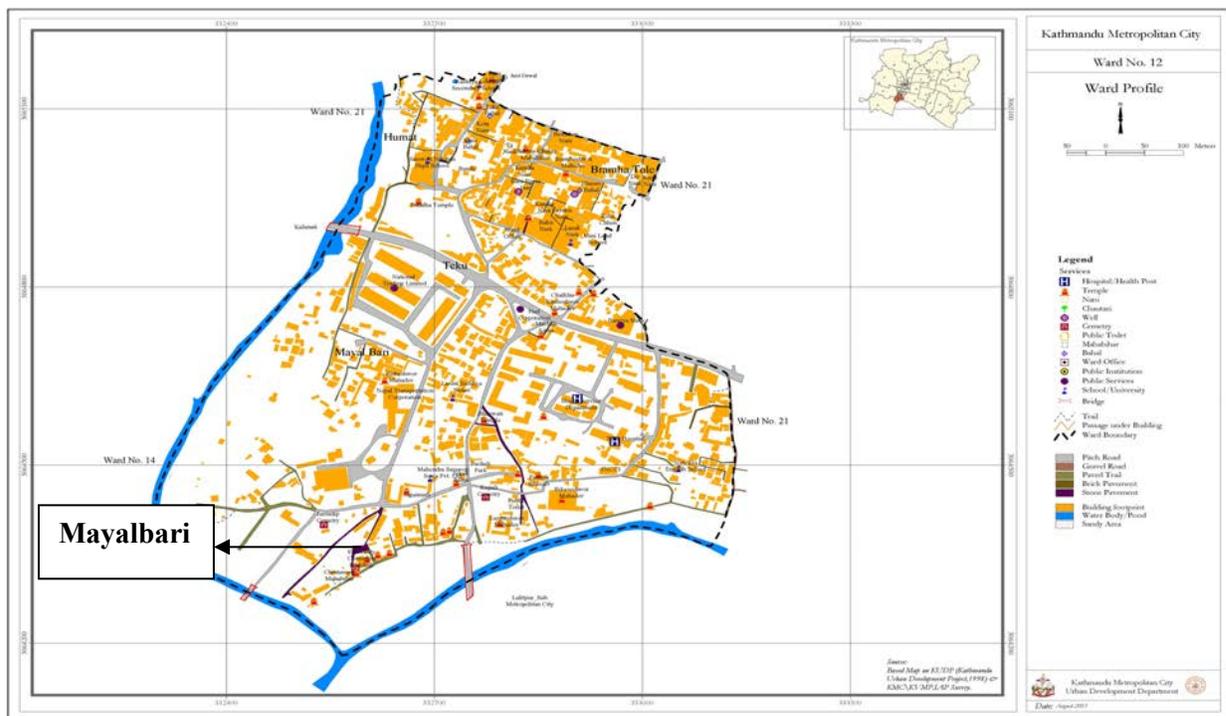
Figure 6: Map of Kathmandu Metropolitan City (KMC) with the highlighted project site at ward no 12, Teku



Source: Maze Solution, 2017

The population of Kathmandu in 2020 is estimated to be at 1,423,515. It is the capital and largest metropolitan city of Nepal. The metropolis Board of KMC consists of the Mayor, Deputy Mayor, 35 ward Chairpersons and two nominated members. The Metropolis council of the KMC consists of 17 the elected representatives and 20 nominated members. Kathmandu is rich in its ethnic and cultural diversity with Newars as the largest ethnic group at 30% of the population, followed by the Matwali (Tamang, Gurung, Sunuwars, Magars and others) at 25%, the Khas Brahmins at 20%, and the Chhetris at 18.5% of the population (CBS, 2020).

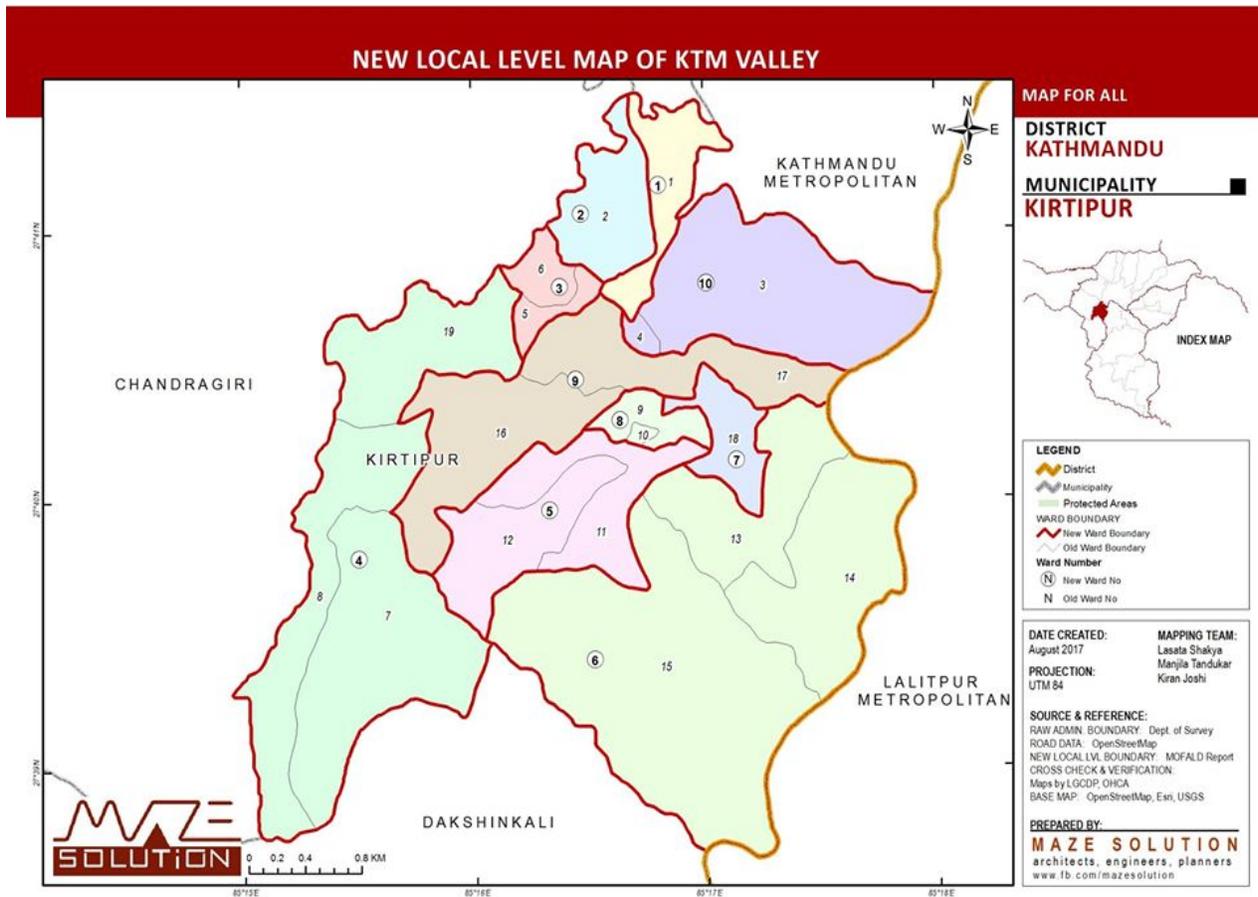
Figure 7: Map showing a project site at Teku, ward no 12 of KMC



Source: KMC, 2015

As of 2001, the populations of Teku ward no 12 stand at 10,313. Inhabitants belonging to *Newar* community dominate the ward. It has an area of 51 ha, and is surrounded by ward numbers 11 and 21 in the east, the Bishnumati River in the west; ward numbers 20 and 21 in the north, and by the Bagmati River in the south (KMC, 2015).

Figure 8: Figure showing map of Kirtipur Municipality along with its 10 wards

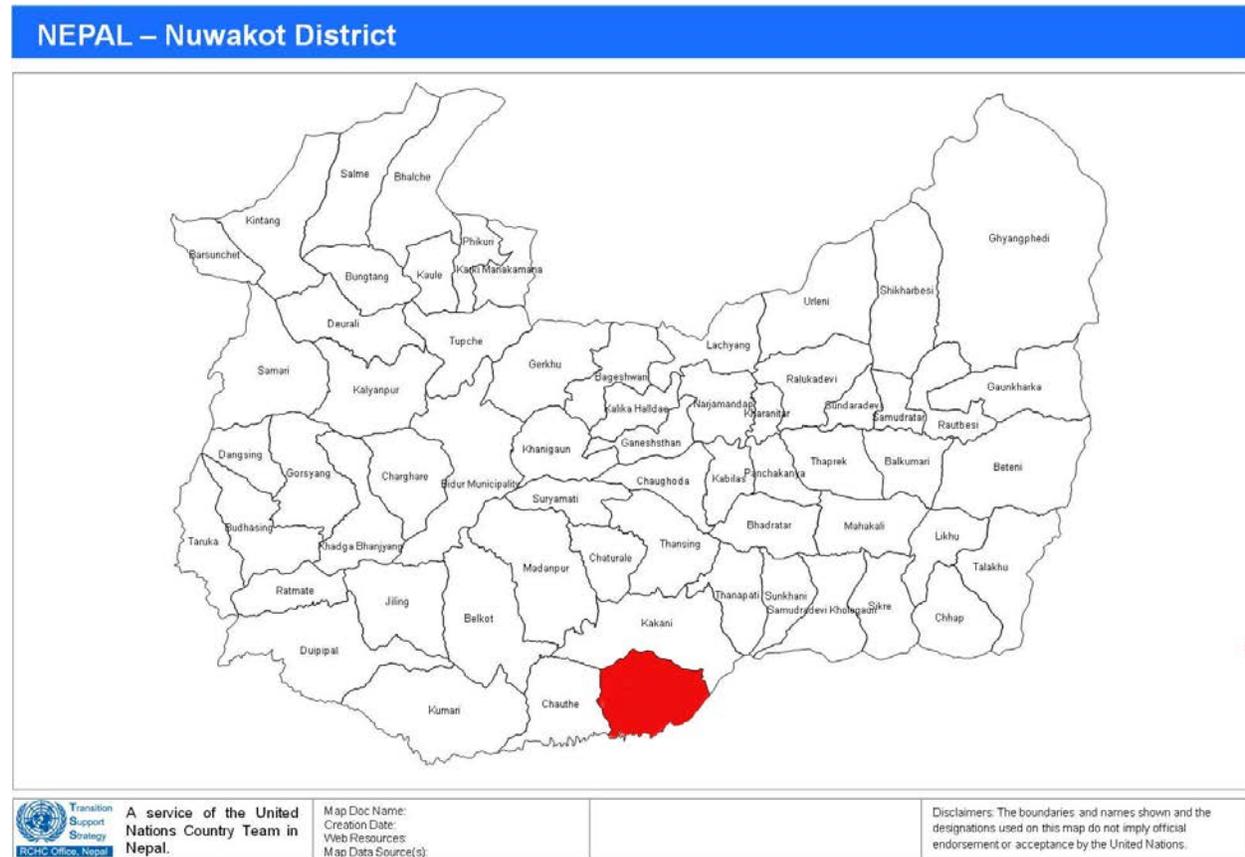


Source: Maze Solution, 2017

Dominated by Newar⁸ community, Kirtipur is an ancient and historical settlement, which was declared as municipality under the Municipal Act in 1996 (ENPHO, 2020). As per the statistics of 2011, the total area of Kirtipur Municipality is 14.8 km² with a total population of 67,171 out of which 37,485 are male and 29,686 are female population (CBS, 2017). Among the total of 19 wards (administrative boundaries), wards, 2, 3, 5, 9 and 18 are urban in nature and the rest are still rural with a population largely dependent on agriculture for livelihood (Singh S. , 2016).

⁸ Newar: the historical inhabitants of the Kathmandu Valley and its surrounding areas in Nepal

Figure 9: Figure showing map of Nuwakot district where one of the project sites, Sisdol landfill site is highlighted



Source: UN, Nepal Information Platform, n.d.

Sisdol landfill site, which was established in the year 2005 lies in the Nuwakot district of Nepal. Nuwakot is one of the seventy-seven districts of Nepal. Sisdol landfill site, which is situated in Kakani rural municipality of Nuwakot district, is the only waste disposal site identified for short-term disposal of wastes generated from within the Kathmandu Valley and its adjoining municipalities. It has already been over 14 years since the current operational landfill site has already surpassed its actual term of 2 years. (Shrestha S. , 2020).

4.2. Institutional Actors

Table 3: Institutional actors and actors at private sectors involved in the Solid Waste Management (SWM) in Kathmandu

INSTITUTIONAL ACTORS		SERVICE PROVIDERS AND PRIVATE SECTORS	
Municipalities	<ul style="list-style-type: none"> • Kathmandu Metropolitan City (KMC), • Kirtipur Municipality and • Dhunibesi Municipality ward 1 	Private SWM companies	<ul style="list-style-type: none"> • Kirtipur Waste Management Service (KWMS), • Clean Nepal, • Sirjansil Batabaran Samrakshan Kendra (Innovative Environment Conservation Center), • Nepal Swachha Batabaran Sirjana Kendra (Nepal Clean Environment Innovation Center) • Organic Life
Rural Municipalities	<ul style="list-style-type: none"> • Kakani Rural Municipality ward 1 and 2 	Cooperative	Sanyukta Sarsafai Jaagaran Savings and Cooperative Pvt. Ltd.
Ministries	<ul style="list-style-type: none"> • Ministry of Federal Affairs and General Administration (MoFAGA), • Ministry of Urban Development (MoUD), • Department of Urban Development and Building Construction (DUDBC) and • Nepal Investment Board 	NGOs/INGOs	<ul style="list-style-type: none"> • Medecins du Monde (MdM, France) • Phase Nepal (Nepal)

		<p>Social Enterprises</p> <ul style="list-style-type: none"> • Blue Waste to Value • Khaalिसि • Doko Recyclers • Hatti Hatti • Tyre Treasures • Dhasoo
--	--	---

Currently, municipalities and private companies are involved in the collection of wastes following wastes using the collection point method, waste collection through bell (whistle-blowing) and door-to-door collection (Sharma, 2017) and waste collection through mobile apps such as Khaalिसि.com, and doko recyclers. 4 private organizations were identified working in the waste management at Kirtipur field site. These include KWMS, Clean Nepal, Sirjansil Batabaran Samrakshan Kendra, and Nepal Swachha Batabaran Sirjana Kendra.

Nepal Swachha Batabaran Sirjana Kendra is taking the responsibility of managing the wastes from the public places such as the premises of temples. Clean Nepal has been engaging in the collection of household wastes every once or twice a week and is responsible for managing the animal carcasses within the Kathmandu Valley. Community groups such as *Asal Chhimeki (honest neighbors)* have also been working for the waste management and livelihood of the locals of *Kirtipur*. They have provided trainings on managing wastes and installed waste bins at *Chaarghare* of Kirtipur (Kirtipur field survey, 2019).

Similarly, Nepal Pollution Control and Environment Management Center (NEPCEMAC), Sarsafai Jaagan Sahakari (SaSaJa) cooperative and Sarsafai Jagaran Sanstha (SaSaJa) organization and few scrap dealers were identified working inside Teku Waste Collection Center. The organization Phase Nepal has been working for the safety and health of the waste workers at *Sisdol* landfill site with the support of the French INGO Medecins du Monde (Mdm).

Recently, members of the private company working for waste collection and transportation have made public a self-regulation directive on operation, monitoring and evaluation (2020) of the waste management. The directive includes provision regarding waste workers', uniform, security instruments, timetable for waste collection, working system, service cost and conducts with service recipients. Code of conduct of employees and minimum standards to be adopted while transporting and managing wastes are among other arrangements included in the directive (Khabarhub, 2020).

Kirtipur Waste Management Service (KWMS) that was established in 2013 is responsible for collecting wastes from *Panga* of Kirtipur. It is currently working on the partnership of Society for Environmental Conservation and Blue Waste to Value (BW2V) for recycling and reusing of wastes. BW2V, which was established in 2014, is a social enterprise focused on waste management, uses PPP model by promoting recycling, reducing the amount of waste sent to landfills, and creating green jobs. The enterprise currently comprises a team of 6 core members. KWMS has been managing the 25% of organic wastes by making compost manure out of it manually. Apart from organic wastes, the waste recovery center of KWMS has also been receiving electronic wastes such as old television sets and small radios, which they send away with the scavengers. As per the executive director of KWMS, Mr. Sarab Maharjan,

"Blue Waste to Value has been managing electronic wastes separately. They usually, contact NGOs, INGOs, bank and related firms to collect e-wastes. They dismantle those electronic wastes taking out all the coppers and metals and finally end up in the landfill site. For example PC (printed circuit) boards are valuable which also include silver and gold. We can even find gold in mobile phones."- (KII, KWMS, Kirtipur field, 2019)

Along with growing challenge of managing wastes, few social enterprises and youth social entrepreneurs of Nepal have taken up the challenge of converting waste to wealth with a common aim of bridging the gap between waste buyers and waste sellers through the implementation of zero-waste. "*Khaalisiin*" (*empty bottles*) which was founded in 2017 aims at mitigating the problem of disposing the waste at the landfill site and encourages recycling of wastes. Similar to Khaalisiin.com is another digitized form of waste recycling which is known as "Doko Recyclers". It was founded in 2017 and provides both household

and corporate waste management services. Doko and Khaalisiin both up-cycle specific wastes to create new marketable products. For instance, Doko recycles glass bottles into candleholders and other home décor items under a marketed brand name "Tatwa".

Hatti Hatti, Tyre Treasures, and *Dhaasoo* are among few other companies up cycling solid waste in Kathmandu. "HattiHatti" aims to educate and empower women from marginalized communities in Nepal to become entrepreneurs. They basically, collect and up-cycle fabrics (*saris*) into handmade garments and accessories. Tyre Treasures collects worn out tyres from automobile workshops to make furniture and home decor items. *Dhaasoo*, on the other hand, manufactures decor items from colored glass bottles combined with wooden handicrafts (Singh R. , 2019).

Another example of best practices in Solid Waste Management (SWM) was explored in the form of a private organization named "Organic Life". Organic Life is basically, agriculture cooperative. Currently, it broadcasts radio programme called "Fohor" (wastes) every Thursday. It aims to manage four kinds of organic wastes at source using the traditional method of *Saaga (compost pit)*. These four types of organic wastes include kitchen waste (urban wastes), agricultural waste (hay, twigs, weeds, etc), forest/jungle waste (fallen leaves, bushes, branches, etc) and the last type of organic waste includes animalistic waste (human fecal matter not included; mainly includes waste of cow and chickens). Currently, it also manages paper wastes besides managing organic wastes. In an interview with the representative of Organic Life:

"We found Saaga to be the best practice because it has been traditionally practiced by the inhabitants of Newar community of Kathmandu Valley. Usually, people of Newar community engage in plantation in every 3 months for which they require the fertilizer to be produced within 60 days time. They have been practicing "Naugaa" (ash pit) and "Saaga"(compost pit) under the stairs of their houses which I have experienced with my own eyes. I believed that this could act as a best practice in producing fertilizers. However, the practice of Naugaa and Saaga is slowly disappearing."- (KII, Organic Life, Raanibari, Lazimpat)

5. Initiatives and Projects

5.1. Integrated Solid Waste Management Project (ISWMP) and privatization of SWM

The Integrated Solid Waste Management (ISWM) project which was envisioned by the MoLD (present, MoFAGA) came into light to close the gap between policy and implementation and solve many of Kathmandu valley's waste problems. The project which was brought under the purview of a federal government agency, Investment Board Nepal after the enactment of the Investment Board Act 2011 (GoN, 2019) aims to formalize the system of waste collection (Republica, 2019).

In 2018, IBN signed a project development agreement (PDA) with two Nepali private companies called Nepwaste and Clean valley under \$50 million worth PPP ISWM project through build-operate-transfer (BOT) modality. Nepwaste pvt. ltd is a joint venture of Finland based Communication, Poyry, Bioste and the Dutch-Nepali enterprise, The Organic Village (service, 2018) on which the project has invested NRs six billion (Chikanbanjar, 2017). Similarly, Clean Valley company pvt. Ltd is a joint venture of BUG, Greenfield waste management company and Kryss International (Azoulay, 2018) on which the project has invested NRs two billion (Chikanbanjar, 2017) . According to the agreement, the two companies are responsible for managing wastes in three packages as discussed earlier. Before the signing of the PDA, IBN had put forward following conditions for the project developers responsible for taking over the management of valley's wastes:

- the government has the right over valuables found in the waste;
- segregation of bio-degradable and non-degradable wastes at the source and management of hazardous wastes;
- carry out activities including door-to-door collection of waste, street sweeping, cleaning of riverbanks, surface drainage and cleaning public places like temples, management of e-wastes, hold campaigns on waste management issues, manage medical waste and keep database of service recipients;
- come up with a scheme to absorb the existing workers of KMC and formal and informal workers associated with solid waste in Kathmandu within 3 months after

signing the PDA and the financial closure of the project should be completed within 9 months after the PDA is signed, with possible extension facility;

- to build processing and recycling units of the project at the landfill site;
- construction of necessary facilities for project implementation such as construction of new sanitary landfill at Bancharredanda and transfer station at Teku in Kathmandu should be completed within 2 years of signing the PDA;
- the project needs to be handed over to the government after 20 years of its commercial operation;
- should deposit maximum of 20 per cent of the total collected waste at the sanitary landfill site at Bancharredanda and recycle the remaining collected waste to produce compost fertilizer, refuse derived fuel (RDF), solid recovered fuel (SRF), electricity and compressed natural gas (CNG);
- should address any grievances related to solid waste from the public within 24 hours from the time of receiving the complaint (Subedi, 2016) (TKP, 2017)

The Detailed Project Report (DPR) of the ISWM project however, do not mention the project developer's plan on:

- segregation of wastes at source and
- plan to manage hazardous wastes (Subedi, 2016)

As IBN seeks the engagement of PPP modality through transnational companies, the small local initiatives engaged in SWM might have a hard time in the near future, unless they become ancillaries of the large companies with MoUs. MoUs with the two big companies, Nepwaste and Clean Valley will at the very least undermine the autonomy of the local municipalities as IBN is involved in the MoUs. To this undertaking, some of the participants seemed positive or had no objections about the privatization taking over SWM, while others seemed dubious about the same.

"As far as I know, the responsibility of management of wastes will be handed over to the private sector (NepWaste) who will build a recycling plant. They had even conducted survey for the same purpose... Almost all the existing issues will be resolved after privatization."- (KII, Health Post, Sisdol)

"For us, whoever is ready to take the responsibility for managing the landfill site in a proper manner, we are with them. We don't choose between the government and the private sector. Whoever does the job better, we prefer them."- (FGD, Sisdol)

"We are not scared of the intervention of the private sector because for us managing the wastes at a small-scale specified area such as Narayanhity Palace museum is enough. If we were to collect service fee at household level for managing wastes at large-scale, that might scare us. Managing the urban waste in itself is complex ...we at Organic Life are trying to break the existing system. We have installed Segregation Park at Narayanhity Palace Museum and Swayambhunath temple. ..."- (KII, Organic Life, Lazimpat)

A representative of *Dhunibeshi* municipality, *Dhading* on the outskirts of Kathmandu Valley seemed dubious about handing over the entire responsibility to the private sector and cautions that the responsibility should be handled under the proper guidance from the government.

"Firstly, handing over the responsibility to the private sector means solely for taking profit. Even if the private sector takes the responsibility or the government takes the responsibility for managing the wastes, monitoring is what plays an important role. The Nepal government must have handed over the responsibility of managing the wastes to the private sector with a design template. In order to fulfill that plan, the government must always remind the private sector from time to time. The private sector on the other hand must share their plans and design to the local representatives because we (local government) will also prepare a design from our side which we will hand over to the private sector. Even if the private sector recruits the existing waste workers or hires the new ones, the main challenge lies in focusing in the health of those 300 waste workers."- (KII, 38 years, Dhunibeshi, Dhading)

However, even after months of taking over the management of the valley's waste, the government-run project has failed to make a headway leaving the work of 988 staffers of KMC in limbo. The project has failed to start its work of waste collection, segregation and processing of degradable wastes. Instead, they call on few meetings on resolving the issues of 988 staffers of KMC only. According to the officials at KMC, "IBN is heedless to KMC's demand to get those employees hired by Nepwaste or providing voluntary retirement schemes". To counter this statement, officials at IBN said, "KMC has intervened in the process of transferring its staffs to the developer company" (Republica,

2019). This conflict between KMC and IBN may also point to the reason why the completion of the new sanitary landfill site at Bancharedanda is delayed.

5.2. Issues and challenges associated with the landfill site

Sisdol landfill site which was started in the Nepali year 2062/63 B.S. (2005) is the only landfill site in operation for disposing the wastes from Kathmandu. KMC is collecting 350 metric tonnes of waste daily which is being managed in *Sisdol* landfill site. Lalitpur Metropolitan City collects 40-50 metric tonnes of wastes on a daily basis (RSS, 2019). The current problems observed in the landfill site are negative impact on the agricultural activities, problem of bird hazard, problem of foul smell, contamination of pesticides in the agricultural land, problem of flies constantly hovering nearby the landfill site area, problem of leachate, and muddy road during the monsoon. Though the Local Government Operations Act (2017) promotes hygiene awareness and management of health-related wastes (GoN, 2017) health problems and lack of proper use of Personal Protective Equipment (PPE) among the waste workers remain prevalent.

Sisdol landfill site has remained controversial due to frequent dispute between the locals and the concerned stakeholders. As the capacity of *Sisdol* to accumulate wastes has reached beyond its capacity, the demands of the residents have been increasing day by day. Some of the demands made by the locals include, demand for compensation of land, houses, tents and cultivable land of highly affected and affected areas by forming expert committee related to waste management and taking necessary opinions, suggestions and reports from them. In addition, demand regarding managing leachate, planting trees and providing employment to the youth in the affected areas has also been established (Kunwar, 2019). The current method used to dispose wastes at *Sisdol* landfill site is very poor.

Though *Sisdol* landfill site is not short of controversies as it remains shut every once in a while, as per the study, it remains operational most of the times. As per the sources, the landfill site remained operational shortly after the earthquake and Indian Blockade of 2015.

"The wastes has been coming to the landfill site on a regular basis even during the earthquake 2015...usually, such crisis of indefinite closure doesn't put much impact on our work. We are sent for work even in such crisis...only when there is a dispute at the landfill site, the site remains closed. Otherwise, our work is not hampered by any kind of crisis". - (IDI, 48 years, Sisdol)

Similar to *Dhunibeshi*, one of the representatives from *Kakani Rural Municipality* too wasn't sure if the problems of landfill site would be resolved with the intervention of the private sector in the management of wastes as the government itself has not been able to bring any changes all these years.

"I don't think the intervention of the private sector will help to solve the existing problem related to the waste because when even the government couldn't bring about any changes then I don't think any private organization will be able to do so... However, if we observe the current scenario of the private sectors working at the landfill site, usually, the contractors are charging high cost but their work hasn't improved at all. Therefore, I have a fear that this will continue the same with the upcoming private firm... Firstly, the government has not been able to construct the road leading to the landfill site due to dispute with an individual person. How can we expect a private sector to do something which the government itself has failed to do so?"- (KII, Kakani Rural Municipality, Nuwakot, 2019)

The prevalence of lack of coordination among the local government and the central government has also made the future prospect of the private sector taking up the overall responsibility of the waste management along with the management of landfill site to be questionable.

"We need to take the responsibility for the upcoming landfill site because we don't want to make it similar to the existing Sisdol landfill site. We want to take the construction of the upcoming landfill site in a more scientific manner. However, most of the actions are being directly taken by the Ministry without letting us (local representatives) know... The authorities of Kakani rural municipality and even the Ward Chairman are unaware regarding the laying off of foundation and the infrastructures of the landfill site... the people at the Ministry hide many things from us (local representatives) as far as possible and do not provide us with information."- (KII, Ward Secretary, 63 years, Kakani Rural Municipality, Nuwakot)

5.3. PRISM project and role of informal waste workers (IWWs)

A project named the Poverty Reduction of Informal Workers in Solid Waste Management Sector (PRISM) was implemented by the Centre for Integrated Urban Development (CIUD), Solid Waste Management and Resource Management Centre (SWMRMC), Nepal Reuse and Recyclable Goods Entrepreneur Associations (NRREGA) and UN-Habitat's Water for Asian Cities Programme Nepal from June 2011 to May 2014 to improve the living conditions of informal workers engaged in the solid waste management sector (UNEP, 2017). The project formed groups of waste workers and provided them with trainings as well as health insurance. The children of the waste workers were provided with education and for every child studying in boarding schools, Rs 500 was borne by the project every month. Similarly, those children studying in governmental schools were provided with school bags and uniform. The project also provided trainings on taking up entrepreneurial businesses (Maya Tamang, 2019).

Prior to PRISM project, the current scrap dealers of Teku ward number 12 of Kathmandu were also working as waste collectors. Only after the initiation of PRISM project, the scrap dealers were asked to form a committee of their own and work in union. According to one of the scrap dealers at Teku waste transfer station, there are many partners of scrap dealers working together. However, with the help of two main investors from Solid Waste Management Unit (*Ekikrit purna prayogiya bastu sankalan tatha packaging sanstha*) and NEPSEMAC, they were able to form a union.

"Altogether we are 48 scrap dealers from our community including 2 chairmen. Thus, we are a union of 50 scrap dealers. These 48 scrap dealers work directly in the waste management including waste collection and segregation."- (IDI, Scrap dealer, 40 years, Teku transfer station, Teku)

Currently, a cooperative called *Sanyukta Sarsafai Jaagaran* (SaSaJa) which is Nepal's only cooperative formed by Informal Waste Workers (IWW) is working for the welfare of IWW through savings and loan facilities. According to Ms. Maya Tamang, the manager and treasurer of SaSaJa, the cooperative was established in the year 2012. The members of SaSaJa include all the people working in the waste management. Currently, 820 informal waste workers have taken the membership at SaSaJa. Though the government

has recognized the value of work done by the cooperative, it hasn't received any recognition in the organogram of KMC. It was the PRISM project, which acted as the main motivating factor behind the opening up of the cooperative. The cooperative has helped to transform lives of many waste workers and made them self-employed (<https://wasteoflife.home.blog/2020/04/08/waste-worker-to-self-employed/>).

Similarly, a French project Medecins du Monde through an organization called Phase Nepal has been providing Personal Protective Equipments (PPEs) to the waste workers at *Sisdol* landfill site that includes gloves, masks, boots, socks, hats and jacket. Phase Nepal is basically working for the health of the waste workers through peer education and awareness programmes. As per the health assistant at Phase Nepal, the waste workers are often divided into groups. Besides providing the waste workers with PPEs, they even monitor the usage of these PPE. Phase Nepal has also been able to collaborate with KMC for medicines supply at Sisdol Health Post. They have organized school health programmes as well as established outreach clinics. It was revealed that the project of MdM ended in December 2019 and Phase Nepal is in the process of bringing a new 3 years programme in collaboration with Green Peace to work for the health of the waste workers.

6. Conclusion

Clearly, there exists discrepancy between institutional actors at different levels. The local bodies are handed over the responsibilities for the management of solid waste but due to gaps in the policy and implementation, their work has been hindered. The intervention of two new transnational private waste companies seems to be an attempt of the national government to centralize SWM again with these large contracts is sure to bring conflict and gaps between the municipalities, the central government and the formal and informal workers who are currently, associated with waste in Kathmandu. Of course, total decentralized SWM is not feasible. For instance, the construction of landfill sites needs either a higher-level authority or inter-municipal coordination.

Reform and implementation of SWM related policies needs to be prioritized. For instance, SWM policy has made it mandatory for the waste producers to manage bio-degradable and non-degradable waste on their own. However, due to lack of systematic collection of such waste, and even after the private sector and municipalities addressing for segregation of wastes at source, it hasn't been implemented in practice.

In addition, one needs to make a distinction between the small private initiatives (e.g. Organic Life) and the transnational companies (e.g. Nepwaste and Clean Valley) with the subsidiaries in Nepal, who come to dominate the waste sector. Though both belong to the "private sector", they have very different approaches to SWM.

REFERENCES

- Acharya, B. (2019, September 26). *PPP in management of solid waste in municipal level: challenges and opportunities*. Retrieved April 30, 2020, from slideshare: <https://www.slideshare.net/harikafle944/ppp-in-management-of-solid-waste-at-municipal11>
- ADB. (2013). *Solid waste management in Nepal: current status and policy recommendations*. Mandaluyong City, Philippines: Asian Development Bank.
- Amatya, S. (2019, February 7). *Chakriya artha byabasthapan marfat fohor bata laabh [Benefits of waste through system of circular economy]*. Retrieved August 14, 2019, from Naya Patrika Daily: <https://www.nayapatrikadaily.com/news-details/5484/2019-02-07>
- Anderzen, C., & Blees, V. (2004). *Solid waste management in the city of Kathmandu, Nepal*. Kalmar, Sweden: University of Kalmar.
- Azoulay, J. (2018, July 02). *Waste management in Kathmandu: littered journey*. Retrieved June 06, 2020, from Spotlight: <https://www.spotlightnepal.com/2018/07/02/waste-management-kathmandu-littered-journey/>
- Baabereyir, A., & Jewitt, S. (2012). Dumping on the poor: the ecological distribution of Accra's solid-waste burden. *Environment and Planning, volume 44* , 297-314.
- Baker, S. (1997). Community organization and solid waste management in the Kathmandu valley. *Himalaya, the Journal of the Association for Nepal and Himalayan Studies: Vol. 17: No. 1, Article 7* , 39-48.
- Basnet, T. (2019, February 25). *Sisdole bhariyo, kaha falne fohor? [Sisdole is full: where should the wastes be thrown?]*. Retrieved March 29, 2019, from Naya Patrika Daily.
- Bharadwaj, B. (2016). *Plastic bag ban in Nepal: enforcement and effectiveness*. Kathmandu: South Asian Network for Development and Environmental Economics (SANDEE).
- CBS. (2017, May). *City Population*. Retrieved April 29, 2020, from <https://www.citypopulation.de/php/nepal-mun-admin.php?adm2id=2707>
- CBS. (2015). *Compendium of environment statistics*. Kathmandu: Government of Nepal; Central Bureau of Statistics.

- CBS. (2020). *Kathmandu population 2020*. Retrieved April 30, 2020, from World Population Review: <https://worldpopulationreview.com/world-cities/kathmandu-population/>
- CBS. (2012). *National population and housing census 2011 (national report)*. Kathmandu: Central Bureau of Statistics; Government of Nepal.
- Chikanbanjar, R. (2017, July 09). *Sustainable management of waste*. Retrieved June 06, 2020, from The Himalayan Times: <https://thehimalayantimes.com/business/perspectives/sustainable-management-waste/>
- Chong, T. L., Matsufuji, Y., & Hassan, M. N. (2005). Implementation of the semi-aerobic landfill system (Fukuoka method) in developing countries: a Malaysia cost analysis. *Waste Management* 25 , 702-711.
- CIUD. (2015, May 5). *Itagol- a community of Kirtipur, one of the hard-hit old cities of Kathmandu*. Retrieved August 26, 2019, from Centre for Integrated Urban Development: <http://ciud.org.np/new/?q=content/itagol-community-kirtipur-one-hard-hit-old-cities-kathmandu>
- Cobo, S., Dominguez-Ramos, A., & Irabien, A. (2017). From linear to circular integrated waste management systems: a review of methodological approaches. *ELSEVIER: Resources, Conservation and Recycling* , 1-17.
- Dangi, M. B., Schoenberger, E., & Boland, J. J. (2017). Assessment of environmental policy implementation in solid waste management in Kathmandu, Nepal. *Waste Management and Research, Vol.35(6)* , 618-626.
- Dangi, M. B., Schoenberger, E., & Boland, J. J. (2015). Foreign aid in waste management: a case of Kathmandu, Nepal. *Habitat International, 49* , 393-402.
- Dhakai, S. (2013). Inorganic solid waste recycling in Kathmandu metropolis, Nepal. *Bulletin of Nepal Geological Society, Vol.30* , 81-86.
- ENPHO. (2020, January 17). *SFD*. Retrieved April 29, 2020, from <https://sfd.susana.org/about/worldwide-projects/city/166-kirtipur>
- ENPHO. (2007). *Solid waste management in Siddhipur: final report*. Siddhipur: Environment and Public Health Organization (ENPHO).

- Ezeah, C., Fazakerley, J. A., & Roberts, C. L. (2013). Emerging trends in informal sector recycling in developing and transition countries. *ELSEVIER, Waste Management, Vol. 33 (11)* .
- Furedy, C. (1992). Garbage: exploring non-conventional options in asian cities. *Environment and Urbanization, Vol.4, No.2* , 42-61.
- Gautam, D., & Chhetri, T. B. (2016). Waste management: new challenge after the recent earthquake in Nepal. *Current Science, Vol.110, No.3* , 285.
- Giri, K. (2011). *Socio-economic and environmental impact of landfill site: a case study of Sisdole landfill site, Nuwakot district*. Kathmandu: Tribhuvan University.
- GoN. (2019). *Integrated Solid Waste Management*. Retrieved August 08, 2019, from Government of Nepal; Office of the Investment Board Nepal- OIBN: <http://ibn.gov.np/project/integrated-solid-waste-management>
- GoN. (2018). *Kirtipur Gazette*. Government of Nepal.
- GoN. (2017). *Nepal disaster report 2017: the road to Sendai*. Kathmandu: Ministry of Home Affairs, Government of Nepal.
- GoN. (2015). *Nepal earthquake 2015: post disaster needs assessment*. Kathmandu: Nepal Planning Commission (NPC).
- GoN. (1997). *Nepal Gazette*. lawcommission.gov.np; Government of Nepal.
- GoN. (2016). *Nepal Gazette*. Government of Nepal.
- GoN. (2017, September 22). *Nepal Law Commission*. Retrieved August 1, 2019, from <http://www.lawcommission.gov.np/np/archives/44921>: <http://www.lawcommission.gov.np/np/archives/category/documents/prevaling-law/statutes-acts/%E0%A4%B8%E0%A5%8D%E0%A4%A5%E0%A4%BE%E0%A4%A8%E0%A5%80%E0%A4%AF-%E0%A4%B8%E0%A4%B0%E0%A4%95%E0%A4%BE%E0%A4%B0-%E0%A4%B8%E0%A4%9E%E0%A5%8D%E0%A4%9A%E0%A4%BE%E0%A4%B>
- GoN. (2018). *Solid waste management act, 2068 (2011)*. Retrieved September 13, 2019, from Nepal Law Commission: <http://www.lawcommission.gov.np/en/archives/category/documents/prevaling-law/statutes-acts/solid-waste-management-act-2068-2011>

- Guerrero, L. A., Maas, G., & Hogland, W. (2013). Solid waste management challenges for cities in developing countries. *Waste Management, Vol. 33 (1)* , 220-232.
- Gyawali, A. (2019, July 15-16). *Regulatory, institutional and financial framework of waste management in Nepal*. Retrieved February 13, 2020, from Financing and institutional building for solid waste management in Nepal: https://www.ccet.jp/sites/default/files/inline-files/3-3_Nepal_updated_Regulatory%20Institutional%20and%20FinancialFramework.pdf
- Hossain, M. S., Shehab, M. G., Islam, M. R., Shah, M. S., & Pal, S. K. (2018). Review on solid waste management process and environmental impact due to solid waste in Sylhet City Corporation, Bangladesh. *International Journal of Environment and Waste Management, Vol.22, Nos. 1/2/3/4* , 296-306.
- ICNL. (2016). *Bill designed to provide for the operation of local government*. Retrieved September 26, 2019, from Local government act: <http://www.icnl.org/research/library/files/Nepal/LocalGovernmentAct.pdf>
- Kamaruddin, M. A., Yusoff, M. S., Rui, L. M., Isa, A. M., Zawawi, M. H., & Alrozi, R. (2017). An overview of municipal solid waste management and landfill leachate treatment: Malaysia and asian perspectives. *Environmental Science and Pollution Research 24(35)* , 26988-27020.
- Karki, J., Pohl, G., Baral, Y. R., Makai, P., Black, M., Lee, A. C., et al. (2018). *Health status and occupational risks in informal waste workers in Nepal: results from a cross-sectional study conducted in the Kathmandu valley*. Medecins Du Monde, PHASE Nepal.
- Karunasena, G., Amaratunga, D., Haigh, R., & Lill, I. (2009). Post disaster waste management strategies in developing countries: case of Sri Lanka. *International Journal of Strategic Property Management, 13:2* , 171-190.
- Khabarhub. (2020, March 3). *Self regulation directive on waste management unveiled*. Retrieved March 26, 2020, from Khabarhub: <https://english.khabarhub.com/2020/03/79408/>
- Khajuria, A., Yamamoto, Y., & Morioka, T. (2010). Estimation of municipal solid waste generation and landfill area in Asian developing countries. *Journal of Environmental Biology, 31(5)* , 649-654.

- Khanal, U. (n.d.). *Solid waste management system in municipality's of Nepal*. Retrieved February 14, 2020, from Solid waste management basic process: <http://dhankutamun.gov.np/sites/dhankutamun.gov.np/files/Solid%20Waste%20Management%20System.pdf>
- KMC. (n.d.). *Fohormaila byabasthapan sambandhi kaanuni byabastha [Lawsuits regarding waste management]*. Kathmandu: Kathmandu Metropolitan City.
- KMC. (2015, November 27). *Kathmandu Metropolitan City, Office of Municipal Executive, Bagmati Province*. Retrieved April 30, 2020, from [kathmandu.gov.np](http://www.kathmandu.gov.np): <http://www.kathmandu.gov.np/ne/node/108>
- KMC. (2010). *Mainstreaming disaster risk reduction in megacities: a pilot application in metro Manila and Kathmandu, sectoral profile*. German Federal Foreign Affairs Office and EMI.
- KMC. (2019). *Organizational structure of Kathmandu Metropolitan City (KMC)*. Retrieved September 12, 2019, from KMC: <http://www.kathmandu.gov.np/ne/node/6>
- Kumar, S., Smith, S. R., Fowler, G., Velis, C., Kumar, S. J., Arya, S., et al. (2017). *Challenges and opportunities associated with waste management in India*. Royal Science Open Society, Vol.4 (3).
- Kunwar, M. (2019, September 23). *14 barsa dekhi byabasthapan bhayena Sisdoile ko fohor [Sisdoile's waste has not been managed since 14 years]*. Retrieved September 24, 2019, from Naya Patrika Daily: <https://www.nayapatrikadaily.com/news-details/25822/2019-09-23>
- Kunwar, M. (2019, August 7). *Havoc of waste management: Bancharedanda still not readied; demand of Sisdoile residents increasing day by day*. Retrieved August 28, 2019, from Naya Patrika Daily: <https://nayapatrikadaily.com/news-details/22005/2019-08-07>
- Lamichhane, K. S. (2018, July 20). *Pokhara's plastic road*. Retrieved August 28, 2019, from Nepali Times: <https://www.nepalitimes.com/from-the-nepali-press/pokharas-plastic-road/>
- LEAD. (2015). *Disaster waste management: policy, strategy and action plan*. Kathmandu: Leadership for Environment and Development (LEAD)- Nepal.
- LMC. (2019). *Solid waste management handbook on improvement of solid waste management practices project (ISWMPP)*. Lalitpur.

- Maina, S., Kachrimanidou, V., & Koutinas, A. (2017). From waste to bio-based products: a roadmap towards a circular and sustainable bioeconomy. *Current Opinion in Green and Sustainable Chemistry, Vol.8*.
- Mali, P. (2019, October 22). *Board le license diyo, sthaniya tahama adkiyo [The board provided license, still stuck at the local level]*. Retrieved October 24, 2019, from epaper, ekantipur: <https://epaper.ekantipur.com/kantipur/2019-10-22>
- Marello, M., & Helwege, A. (2014). *Solid waste management and social inclusion of waste pickers: opportunities and challenges*. Boston: Global Economic Governance Initiative (GEGI), Boston University.
- Maskey, B. (2018). *Municipal solid waste management in Nepal: a case study of Gorkha municipality*. Hiroshima, Japan: Hiroshima University.
- Matter, A., Dietschi, M., & Zurbrugg, C. (2013). Improving the informal recycling sector through segregation of waste in the household- the case of Dhaka Bangladesh. *ELSEVIER-Habitat International, 38*, 150-156.
- MdM. (2018). *Health status and occupational risks in informal waste worker in Nepal: results from a cross-sectional study conducted in the Kathmandu valley*. Nepal: Medecins du Monde.
- Memon, M. A. (2016). Disaster waste recovery and utilization in developing countries: learning from earthquakes in Nepal. *Japanese Geotechnical Society Special Publication. 2*, 143-147.
- MoFALD. (2017, September 22). *Local government operation act, 2074*. Retrieved August 1, 2019, from <http://www.lawcommission.gov.np>: http://mofald.gov.np/sites/default/files/News_Notices/%E0%A4%B8%E0%A5%8D%E0%A4%A5%E0%A4%BE%E0%A4%A8%E0%A5%80%E0%A4%AF-%E0%A4%B8%E0%A4%B0%E0%A4%95%E0%A4%BE%E0%A4%B0-%E0%A4%B8%E0%A4%9E%E0%A5%8D%E0%A4%9A%E0%A4%BE%E0%A4%B2%E0%A4%A8-%20%E0%A4%90%E0%A4%A8%20.pdf
- MoUD. (2015). *Solid waste management of Kathmandu metropolitan city: Environment audit report*. Urban Development Ministry.
- Nepal, M. C. (2016). *Nepal SWM OBA-draft solid waste management service improvement plan (SWM-SIP)-Lalitpur*. Lalitpur, Nepal: Government of Nepal, Ministry of Urban Development, Solid Waste Management Technical Support Center.

- NLC. (2018). *Chapter-7 provisions on solid waste management council*. Retrieved September 24, 2019, from Solid Waste Management Act, 2068 (2011), Nepal Law Commission: <http://www.lawcommission.gov.np/en/archives/18615>
- NPC. (2002). *Tenth plan (2002-2007)*. Kathmandu, Nepal: His Majesty's Government; National Planning Commission.
- Nyachhyon, B. L. (2010). *Integrated solid waste management for Kathmandu valley and other cities of Nepal*. The Government of Nepal, High Level Committee on Solid Waste Management and Solid Waste Management and Resource Mobilization Centre.
- OBA. (n.d.). *Solid waste management general guideline for Lalitpur Metropolitan City*. Lalitpur: Output Based Aid.
- Pandey, R. (2004-2005). Solid waste management practice and health implication: a case of Kathmandu Metropolitan City, Nepal. *The Himalayan Review*, 35-36 , 33-47.
- Pradhan, N. (n.d.). Retrieved January 23, 2020, from Nepal Research: https://www.nepalresearch.com/publications/landfill_site_controversy.pdf
- Republica. (2019, January 24). *What ails Kathmandu valley's waste management project?* Retrieved June 6, 2020, from my Republica: <https://myrepublica.nagariknetwork.com/news/what-ails-kathmandu-valley-s-waste-management-project/>
- RSS. (2019, August 8). *Bancharedanda ma bandai "landfill site" [Construction of landfill site underway at Bancharedanda]*. Retrieved August 10, 2019, from Nagarik news: <https://nagariknews.nagariknetwork.com/news/86144/>
- service, H. n. (2018, March 08). *IBN, Nepwaste ink initial pact to manage valley's solid waste*. Retrieved June 06, 2020, from The Himalayan Times: <https://thehimalayantimes.com/business/ibn-nepwaste-ink-initial-pact-manage-valleys-solid-waste/>
- Service, H. N. (2018, March 08). *IBN, Nepwaste ink initial pact to manage valley's solid waste*. Retrieved June 06, 2020, from The Himalayan Times : <https://thehimalayantimes.com/business/ibn-nepwaste-ink-initial-pact-manage-valleys-solid-waste/>
- Shakya, S. M., & Tuladhar, B. (2014). State of municipal solid waste management in the municipalities of Nepal. In A. Pariatamby, & M. Tanaka, *Municipal solid waste management in asia and the pacific islands* (pp. 233-253). Singapore: Springer.

- Sharma, N. (2017). *Governance and women's group participation in solid waste management in Nepal: a case of Lalitpur Sub Metropolitan City*. Trondheim: Norwegian University of Science and Technology.
- Shekdar, A. V. (2009). Sustainable solid waste management: an integrated approach for asian countries. *Waste Management 29* , 1438-1448.
- Shrestha, S. (2020, March 15). *Human waste coexistence in Sisdol landfill site and its impacts*. Retrieved April 30, 2020, from Online Khabar: <https://english.onlinekhabar.com/human-waste-coexistence-in-sisdol-landfill-site-and-its-impacts.html>
- Shrestha, Z. (2018). *The integration of circular economy into the municipal solid waste management of Kathmandu metropolitan city in Nepal: present sector challenges and opportunities for waste material (re) utilization*. Netherlands: University of Twente.
- Singh, R. (2019, March 31). *The (re) cycle of waste*. Retrieved August 28, 2019, from The Kathmandu Post: <http://kathmandupost.ekantipur.com.np/news/2019-03-31/the-recycle-of-waste.html>
- Singh, S. (2016). Ecocity elements in the traditional settlement of Kirtipur in Kathmandu valley. *Sustainable Development, 24(6)* , 394-405.
- Subedi, B. (2016, June 23). *IBN to sign agreement to manage valley's waste* . Retrieved June 06, 2020, from The Kathmandu Post: <https://kathmandupost.com/money/2016/06/23/ibn-to-sign-agreement-to-manage-valleys-waste>
- SWMRMC. (2005). *Action plan on solid waste management*. Ministry of Local Development; Japan International Cooperation Agency (JICA).
- SWMTSC. (2014). *Solid waste management (SWM) strategic plan and action plan of Lalitpur sub-metropolitan city*. Ministry of Urban Development, Solid Waste Management Technical Support Center (SWMTSC).
- Tamang, R. L. (2010). *Internationalization of waste management companies in Kathmandu, Nepal*. Finland: Turku University of Applied Sciences.
- Thapa, G. B. (1998). Lessons learned from solid waste management in Kathmandu, Nepal. *Habitat International, Vol.22, No. 2* , 97-114.

- TKP. (2017, April 9). *IBN close to signing solid waste deal with Nepwaste*. Retrieved June 06, 2020, from The Kathmandu Post: <https://kathmandupost.com/money/2017/04/09/ibn-close-to-signing-solid-waste-deal-with-nepwaste>
- Udash, R. (2004). *Composting as an option in the municipal solid waste management of Kathmandu Metropolitan City*. Pokhara: School of Environmental Management and Sustainable Development (SchEMS), Pokhara University.
- UNDP. (n.d.). *Public-private partnership in solid waste management contributing to MDGs 1 and 7 in Biratnagar*. Retrieved April 30, 2020, from Public-Private Partnerships for Service Delivery: https://ppp.worldbank.org/public-private-partnership/sites/ppp.worldbank.org/files/ppp_testdumb/documents/Project%20Library_Stories%20from%20the%20Field_Nepal_Biratnagar.pdf
- UNEP. (2017). *Asia waste management outlook*. United Nations Environment Programme.
- WHO. (2019). *Nepal sanitation policy and planning framework case study for discussion*. Nepal: World Health Organization.
- Wilson, D. C., Araba, A. O., Chinwah, K., & Cheeseman, C. R. (2009). Building recycling rates through the informal sector. *ELSEVIER, Waste Management, 29*, 629-635.
- Yadav, C. S., Devkota, S., & Aryal, S. (2002). *National health care waste management guidelines*. Kathmandu: Nepal Health Research Council.