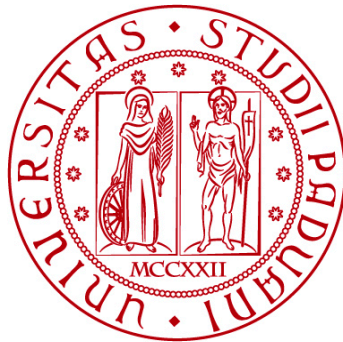


UNIVERSITÀ DEGLI STUDI DI PADOVA
DIPARTIMENTO DI INGEGNERIA CIVILE, EDILE E AMBIENTALE
Department Of Civil, Environmental and Architectural Engineering

**International Master's Degree in Sustainable Territorial Development:
Climate Change, Diversity and Cooperation**



Master Thesis

**SOLID WASTE MANAGEMENT IN THE KATHMANDU
VALLEY: CHALLENGES, INITIATIVES AND
PERSPECTIVES**

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BATCH XI
ACADEMIC YEAR 2022-2023





THESIS APPROVAL

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Place Padova Date 05/09/2023

Signature_____

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude for the incredible support and opportunities that have made my research journey in Kathmandu possible.

First and foremost, I want to extend my heartfelt thanks to my professor and supervisor, Alberto Lanzavecchia, who granted me the opportunity to embark on this research endeavor in Kathmandu. Without his guidance and support, none of this would have been achievable. My time in Kathmandu not only marked a period of significant academic and personal growth but also provided me with the privilege of meeting precious individuals who played an essential role in bringing this thesis to fruition.

I want to thank Bharat Thapa and Gayatri Thapa for welcoming me into their wonderful family and providing unwavering support throughout my research journey. They made me feel like a cherished member of their family, for which I am truly grateful.

I would also like to extend my heartfelt thanks to Subash Adhikari Neupane and Bindu Adhikari Neupane for their hospitality, as well as the entire team at Apex Life School, who embraced me enthusiastically and involved me in all their activities. Each one of them contributed to making this one of the most beautiful and meaningful experiences of my life, which I hope to convey through this written work.

Special thanks are due to all the interviewees and individuals who supported and contributed to my data collection, including Nabin from BW2V, Hitesh from Nawa Paila, Ashok from Paramva Biotech, and others from DokoRecyclers, Myriam from Sasaja Cooperative, and the cooperative members who served as a source of inspiration and motivation for this project. I hope that, in some small way, this work can raise awareness about their circumstances and inspire greater action from both the public consciousness and institutions.

ABSTRACT

With the relentless increase in population and urbanization, solid waste management has become a significant and urgent issue, especially in developing countries where waste management and disposal face numerous challenges due to various internal and external factors. This study focuses on the state of solid waste management in Kathmandu, addressing its challenges and potential. In light of this, the study questions whether local alternatives and innovations can make a difference and the informal sector's role in solid waste management, which plays a substantial role in the sector, exploring whether formalizing this sector could yield multiple benefits.

To achieve these aims, the study establishes a theoretical framework in the first part for problem comprehension and analysis. This groundwork is complemented by field research conducted on-site in order to address the posed questions and hypotheses while broadening the discussions on the issue with on-site insights. The evidence from the study highlights that Kathmandu's waste management is inadequate for the city's population flow. The existing waste collection and disposal methods are not only inefficient but also harmful to both people and the environment. Informal waste workers, though essential, remain unrecognized and lack social, health, and financial support.

In this context, while the presence of local alternatives is crucial, they remain constrained due to inadequate government support and sometimes even hindrances. Regarding the formalization of informal waste workers, the situation in Kathmandu revolves around limited recognition and partial protection through the establishment of a local cooperative whose role in the formalization still seems to be limited. Despite data limitations, this study sparks a dialogue on Kathmandu's solid waste management, its challenges, opportunities, and the existing alternatives. The study calls for increased support to foster substantial change within the solid waste management system.

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INTRODUCTION

Waste is an inevitable outcome of human activities and always drawn attention throughout history due to its generation and the imperative for effective management strategies. The issue becomes significant as countries progress from lower to high economic tiers, together with urbanization and population growth, yielding multifaceted environmental, social, political, and economic implications (Baabereyir, 2009).

In the context of urbanization, despite its universal character, yet in developing nations, this process takes on distinct characteristics: unchecked densification, the proliferation of informal settlements and economies, urban sprawl, all of which place stress on essential urban services, including waste management. This rapid urbanization stems from population growth and the migration of rural residents seeking better job prospects in urban areas. This scenario presents a complex challenge, as growing cities demand more services and structured urban governance, notably waste management.

Managing the waste generated by growing cities is a substantial concern in developing countries (Ahmed & Ali, 2006). The organized approach to handling this waste, known as Solid Waste Management (SWM), encompasses a spectrum of tasks, from collection and separation to storage, transportation, processing (including recycling), treatment, and disposal (Tchobanoglous, Theisen, Vigil, & Alaniz, 1993). As urban areas continue their remarkable expansion, ensuring proper waste management becomes pivotal for public health and environmental preservation in these developing country cities. In addition, experts predict that until 2050, most of the population growth will occur in urban areas (Cohen, 2004), which will have a particular impact on economically struggling regions and exacerbate urban poverty issues while placing a strain on the ability of governments to provide adequate public services (Marshall & Farahbakhsh, 2013).

In this context, the thesis dives into the mentioned intricacies of solid waste management in the Kathmandu Valley that I had the opportunity to experience during an internship in the region. The pervasive presence of waste across urban landscapes

and the livelihood activities centered around it sparked a profound curiosity to delve into the root causes, potential alternatives, and actionable solutions for this situation.

Over the course of nearly three decades, Nepal has undergone profound transformations, marked by rapid urbanization and population expansion. These shifts tests for local administrations, urban locales, and their inhabitants. The tangible manifestation of this challenge manifests as in Kathmandu waste is everywhere on the streets and on the riverbanks, while informal waste workers wonders around looking for waste to segregate, collect and sell in order to earn a living. This scenario underscores a systemic issue, which is linked to many factors and drivers behind the present state of affairs, which this thesis aims to investigate, together with ongoing initiatives within the nation and potential avenues for amelioration.

Starting from chapter one this work establishes a foundational comprehension of pivotal themes intrinsic to this study: urban waste management, the roles played by the informal sector and waste pickers, and the interlinked complexities they bring. The primary intent is to furnish study groundwork to understand the intricate challenges with waste management in the Kathmandu milieu.

In the second chapter of this thesis, the established groundwork will transition to a comprehensive examination of waste generation and handling within the context of the Kathmandu Metropolitan City. This phase of inquiry aims to provide an in-depth comprehension of the prevailing waste management dynamics within this specific urban setting. By delving into the waste management practices in Kathmandu, this chapter will illuminate the intricate interplay between the formal and informal sectors. This coexistence of diverse waste management approaches underlines a dynamic that needs to be understood. Through this exploration, the distinctions and interactions between these sectors will be unveiled, revealing challenges and opportunities that need to be analysed.

The third chapter focuses on the field research that aims to explore practical initiatives functioning as alternatives within the context of solid waste management in Kathmandu undertaken by local stakeholders and actors. Through a blend of on-site observations and interviews, this chapter aims to provide valuable insights engaging a diverse array

of perspectives from stakeholders and actors within the solid waste management landscape. This is particularly significant because it shows the various intricacies and complexity of the waste management domain, which further clarifies the opportunities and challenges faced by these stakeholders. This chapter also explores the challenges and circumstances faced by informal waste workers through observations directly drawn from interviews.

The information gathered through this field research project is significant because it does more than just provide a snapshot of the current situation; it also serves to support or disprove the research questions and hypotheses of this thesis.

These data provide support for the discussion of the main question regarding the viability of sustainable alternatives in Kathmandu as well as the approaches to formally establish the informal garbage sector. In this sense, this work serves as a link between theoretical investigation and actual application. It provides a thorough awareness of regional dynamics and aims to open doors inside Kathmandu's solid waste management system.

CHAPTER ONE: CONCEPTUAL FRAMEWORK OF THE RESEARCH

1.1 Introduction to Urban Solid Waste Management

The management of municipal solid waste (MSW) is a critical aspect intertwined with urbanization, development, and climate change. As the world's population gravitates toward cities, these urban areas play an increasingly pivotal role in shaping policies related to land-use planning, transportation, and energy consumption, all of which significantly impact greenhouse gas (GHG) emissions and bear consequences on both people and the environment. It is evident that MSW generation rates are surging worldwide, with projections indicating a rise to a staggering 2.2 billion tonnes annually by the year 2025 (World Bank, 2012).

When considering MSW, it's crucial to acknowledge that definitions of Municipal Solid Waste (MSW) can vary significantly across different countries. Generally, MSW encompasses discarded materials originating from households, industrial processes, commercial marketplaces, and construction and demolition practices. However, a noteworthy distinction exists between European countries and most developing nations. In the European context, construction and hazardous wastes are excluded from the MSW category, whereas in many developing countries, they are included (Oteng-Ababio et al., 2018).

Developing countries, despite these disparities, generate a substantial amount of MSW, contributing to approximately 648 million tonnes annually across more than 170 countries. This figure is nearly comparable to the combined garbage generation in developed countries, which predominantly consists of contributions from just 20 countries. However, the average waste generated per person per day in impoverished nations falls within the range of 0.45 to 1.1 kilogrammes, in stark contrast to the 2.2 kilogrammes per capita per day observed in OECD countries (World Bank, 2012).

A closer examination of MSW reveals various categories, including biodegradable materials like food and garden waste, recyclable items such as paper, glass, metal, and plastics, as well as other products like textiles and leather. World Bank data from 2012 highlights that low- and middle-income nations exhibit a higher share of biodegradable

waste, accounting for 40-80% of the total MSW volume. In contrast, high-income countries display a distinctive waste composition, with a greater proportion of paper and glass, and a smaller percentage of biodegradable waste (approximately 30-40%).

This thesis, which delves into urban solid waste management in Kathmandu Valley, Nepal, holds particular significance due to the region's robust and rapid urbanization. The challenges faced by government officials, residents, and those working within the waste management sector in this context are monumental, making it a compelling subject for investigation.

1.1.2 Life Cycle of MSW

Municipal Solid Waste (MSW) management encompasses several key phases, each contributing to the overall process of handling waste efficiently and responsibly:

1. **Sorting and Collection:** Waste sorting serves as a crucial initial step, involving the separation of MSW into distinct categories before or after collection. This encompasses the gathering of waste from residences, community bins, street receptacles, and bulk generators. The waste is then transported using larger containers or vehicles, which involves activities such as driving between collection points, idling, loading, and compacting the garbage.
2. **Recycling:** The process of recycling begins once the waste has been effectively sorted. Recyclable materials are reprocessed to create new goods, a practice that plays a pivotal role in resource conservation and waste reduction. By diverting materials from traditional waste streams, recycling helps minimize the environmental impact.
3. **Transfer and Transportation:** This phase involves the crucial task of delivering the collected waste to transfer stations or treatment facilities, where further processing takes place. This intermediate step ensures that waste is appropriately handled before its final destination.
4. **Waste Treatment and Disposal:** The final stage involves the treatment and disposal of waste. The specific approach depends on the nature of the garbage. Options may include burial in landfills or incineration. Additionally, non-

recyclable waste has the potential to be transformed into valuable resources like compost or energy, generating useful heat, power, or fuel.

1.1.3 SWM in Developing Countries

In developing countries, the commitment of municipal budgets to waste collection is substantial, ranging from 80% to 90% (Oteng-Ababio et al., 2018). However, the effectiveness of this expenditure is hindered by persistent inefficiencies in waste collection (ibid). Typically, municipal waste is a heterogeneous mixture, blending food waste with other materials. Sadly, a common sight in urban areas is roadside dumping, a practice marked by inefficiency. The transfer of waste often relies on open vehicles, a less-than-ideal solution.

The crucial role of waste pickers, found predominantly in informal sectors, is a critical aspect of recycling efforts in developing nations (ibid). These individuals undertake the essential task of collecting recyclable items, yet their contribution tends to be underappreciated.

When it comes to waste treatment and disposal in these regions, open dumping and landfilling prevail, encompassing a staggering 70% to 90% of total municipal solid waste (World Bank, 2012). While these methods are cost-effective, they bring about significant environmental and health risks, including soil and water contamination, air pollution, and the spread of diseases. Incineration, due to its high costs and unsuitability for certain waste compositions, is limited in its application. Likewise, composting faces obstacles, both at the household and municipal levels, making it more suitable for small-scale or pilot initiatives (Oteng-Ababio et al., 2018).

Developing nations grapple with an array of waste management challenges, including inadequate administrative and financial resources, the absence of comprehensive legislative frameworks, inefficient treatment technologies, and a lack of stakeholder involvement. Addressing these complexities demands innovative and comprehensive approaches, spanning various aspects. These include the development of appropriate financing mechanisms, the utilization of suitable treatment technologies, the establishment of waste separation and minimization regulations, capacity-building

initiatives for local governments, and fostering collaborative partnerships between citizens and local authorities in planning and implementing effective waste management strategies.

1.1.4 Challenges and opportunities of informal recycling

In the realm of waste management, the landscape of recycling presents mounting challenges for many impoverished nations. The formal recycling initiatives face intricate obstacles stemming from technological limitations, high costs, and institutional complexities. Consequently, a preference for informal and straightforward approaches has emerged as the pragmatic choice (Oteng-Ababio et al., 2018). Within these informal systems, individuals, families, and households, particularly those less fortunate, engage as scavengers, diligently collecting reusable and recyclable materials. Often, middlemen and organized pickers play a role in this ecosystem (Oteng-Ababio et al., 2018; Samson, 2009).

Interestingly, the world of informal waste workers is more extensive than one might assume. They are a critical force in recycling operations, making a substantial contribution to waste reduction and, remarkably, playing a significant role in mitigating greenhouse gas (GHG) emissions. One of the reasons for this is the nature of their operations, characterized by non-motorized transportation and the utilization of multiple transfer points for recyclable materials, factors that markedly reduce GHG levels when compared to formal collection systems (UN-Habitat, 2010).

The impact of recycling, whether within formal or informal sectors, extends beyond waste management. It positively influences public health, enhances sanitation, and underscores environmental sustainability by effectively curbing GHG. However, an intriguing avenue emerges: the integration of existing informal recycling initiatives into the formal framework holds potential to further alleviate GHG emissions stemming from solid waste management. Additionally, by diversifying the livelihoods of garbage collectors and recyclers, the empowerment of marginalized communities can be strengthened, offering a valuable step in the direction of poverty alleviation (Oteng-Ababio et al., 2018).

1.1.5 Landfilling's Environmental Impact and Alternatives

The method of landfilling, employed for waste disposal, entails an organic waste component that undergoes decomposition in an anaerobic environment. This decomposition process, while seemingly mundane, gives rise to a concerning issue: the release of environmentally harmful greenhouse gases (GHGs), including methane, carbon dioxide, and trace gases (UNEP, 2006).

Disturbingly, these emissions persist for years following the disposal of the waste, posing a lasting environmental challenge (ibid).

Notably, in underdeveloped nations, many landfills suffer from critical deficiencies, lacking essential components like high-quality liners, leak detection systems, leachate collection facilities, and effective treatment systems (Oteng-Ababio et al., 2018). This deficiency exacerbates the problem, rendering landfills in these regions significant contributors to GHG emissions, particularly concerning biodegradable waste (ibid). When compared to alternative waste treatment methods such as composting, incineration, home composting, and anaerobic digestion, landfills emerge as notably substantial emitters of GHGs, highlighting a considerable gap in emission reduction (ibid).

In contrast, the environmental impact of composting, as an alternative method, stands in stark contrast. Composting, a process that fosters organic waste decomposition, demonstrates a remarkable attribute: it releases insignificant levels of GHGs. This characteristic underscores its potential as a sustainable waste management solution, offering a promising avenue for reducing GHG emissions, particularly when juxtaposed with the emissions associated with landfilling (ibid).

1.2 Literature review on the Informal sector

1.2.1 Emergence, evolution and global significance of the informal sector

In the academic realm of the 1970s, Keith Hart, a British anthropologist, introduced the groundbreaking concept of the "informal sector." His pioneering research in Accra, Ghana, illuminated a previously uncharted economic realm, populated by self-employed

individuals operating outside the confines of the traditional wage-based economy, generating their own income streams (Chen, 2012). A subsequent analysis by the International Labour Organisation (ILO) in Kenya during 1972 further dissected this concept, revealing that the informal sector encompassed not only marginal activities but also efficient and profitable enterprises (ILO, 1972).

Both Keith Hart's observations and the Kenya Mission report expressed optimism regarding the informal sector. Hart's exploration revealed that despite external constraints and capitalist dominance, a significant portion of internal migrants in Accra engaged in informal endeavors, generating income independently. Concurrently, the Kenya Mission highlighted the capacity of the informal sector to create jobs and alleviate poverty (*ibid.*).

During the 1950s and 1960s, a prevailing belief held that with appropriate economic policies, traditional low-income economies could evolve into modernized counterparts. Petty trade, small-scale production, and casual labor were anticipated to assimilate into the formal capitalist system, ultimately vanishing (Chen, 2012). W. Arthur Lewis bolstered this theory, forecasting a "Lewis Turning Point" marked by economic expansion and the absorption of surplus labor from the traditional sector (Lewis, 1954).

Yet, by the mid-1960s, growing concerns over persistent unemployment in developing nations eroded this optimistic perspective. In 1970, Hans Singer, a development economist, articulated that the expected "Lewis Turning Point" was elusive in emerging economies (Singer, 1970). Singer foresaw a dualistic labor market, characterized by substantial temporary and intermittent employment, along with disguised or open unemployment. He also warned of employment challenges stemming from land shortages in overloaded farming towns and the dearth of jobs in overcrowded metropolitan areas.

Contrary to the initial notion that the informal sector would vanish with economic progress, by the 1980s, shifts in industrialized capitalist economies led to the formalization of the informal sector, establishing it as a permanent and integral facet of capitalist development (Chen, 2012).

On a global scale, the informal sector has undergone evolution and expansion, currently contributing a significant yet often overlooked portion of the global economy and employment. It now constitutes a substantial 61% of total global employment, with even more substantial shares in emerging and developing economies, reaching 67% and 90%, respectively (ILO, 2018).

Recent years have witnessed a renewed interest from academia, policy makers, and international agencies in the realm of informality, driven by the recognition of its intricate connections to economic growth, poverty, inequality, and its unique position as a substantial contributor to the global labor force, all while remaining beyond the purview of state protection and regulation.

1.2.2 Approaches to the Informal Economy

The informal economy, a significant yet often underappreciated component of various nations' economic landscapes, has garnered substantial attention from scholars and policymakers alike. Differing approaches to understanding and managing this complex phenomenon have emerged, each with its unique implications.

The dominant approach in affluent countries has typically been one of control, deterrence, and elimination, driven by concerns about income loss, regulatory challenges, unfair competition, labor rights, and productivity issues (Sharma, 2022). In contrast, emerging nations, where the informal economy plays a more pivotal role in economic contribution, have often adopted a more laissez-faire stance. Surprisingly, it is estimated that the informal economy might account for up to 50% of economic activity in developing countries (ibid), which may explain the less aggressive formalization initiatives in these regions.

Debates surrounding the informal economy revolve around four major schools of thought: the dualist perspective, the structuralist view, the legalist approach, and the voluntarist viewpoint. Additionally, a relatively new perspective known as the co-production approach is gaining traction.

1. **Dualist Perspective:** The dualist school of thought, embraced by the International Labour Organisation during its 1972 mission in Kenya (ILO, 1972), emphasizes the minimal linkages between the informal sector and the official economy. This perspective views the informal sector as a safety net, providing income for the poor during times of crisis. The key features of the informal economy, according to this view, include ease of entry, family ownership, labor intensity, small scale, and a competitive nature. The suggested strategy is for governments to create more formal job opportunities and provide financial services to the informal sector, facilitating a transition toward a more integrated economic scenario.

2. **Structuralist Perspective:** The structuralist viewpoint, pioneered by Manuel Castells, Alejandro Portes, and Caroline Moser in the late 1970s and early 1980s, perceives the informal sector as subordinated economic entities that supply low-cost inputs and labor to larger capitalist enterprises. According to structuralists, informality is driven by the nature of capitalism, with formal firms seeking to reduce labor costs and enhance competitiveness (Chen, 2005). Factors such as organized labor's power, state regulation of the economy (including taxes and social legislation), global competition, and the industrialization process play a crucial role in shaping informality.

3. **Legalist Perspective:** The legalist school of thought, popularized by Hernando De Soto in the late 1980s, categorizes the informal sector as comprised of microentrepreneurs who intentionally avoid registration due to bureaucratic complexity, associated fees, and time consumption (Chen, 2005, 2012). The recommended approach is to streamline bureaucratic procedures, extend legal property rights, and support informal enterprises, thereby unlocking their full potential.

4. **Voluntarist Perspective:** According to the voluntarist perspective, the informal sector primarily consists of entrepreneurs who willingly evade taxes and the everyday expenses linked with formal business operations (Chen, 2005). Some might even resort to informal criminal activities when realizing the advantages

of informality over formality. In this approach, formality is seen as a choice rather than a consequence imposed by stringent laws.

The ongoing dispute between the formal and informal sectors has led to an extensive debate regarding the appropriate conceptualization of the informal sector and its perception by the formal economy (Coletto & Bisschop, 2017). This analysis has often revolved around the dynamic relationship between the informal sector and the regulatory framework of the state. Informal activities are frequently deemed in need of regulation, which has resulted in a prevailing negative sentiment among the general public and authorities. Nowhere is this stigma more evident than in the waste industry, where individuals engaged in rubbish collection, transportation, and segregation face social discrimination, leading to a lower socioeconomic status (Chen, 2012).

The research undertaken in Nepal delves into the informal waste industry, with a specific focus on its fundamental importance in waste management and its role in filling the gaps left by formal and governmental management. Within the Nepalese context, the public and authorities have consistently held overwhelmingly negative attitudes and perceptions toward the informal sector, driven by cultural norms, religious systems, caste and economic disparities, and ethnic distinctions. This unfavorable view has disproportionately affected individuals involved in waste collection, transportation, and segregation, leading them to endure societal stigma due to their association with waste-related activities (Chen, 2012).

The investigation of the informal garbage sector in Nepal also delves into how the government's limited acknowledgment and policies concerning this sector have contributed to the current negative perspective, ultimately affecting the living conditions of the informal workers involved in it.

1.2.3 The Informal Sector's Crucial Role and Vulnerabilities in Urbanizing Nations

In countries grappling with significant urbanization and population growth, the informal sector assumes a vital role, fostering production, employment opportunities, and income generation. While developed nations employ around 18% of their population in the

informal sector, South Asian countries, like Nepal, see an astonishing 80% of their workforce engaged in informal activities (World Bank, 2020). Nepal's informal economy consists of various operational units and activities distinct from the formal sector concerning technology, scale, labor intensity, and accounting practices. Operating beyond government regulation, it leaves workers highly vulnerable to exploitation, often receiving wages well below legally mandated minimums (ibid). Moreover, the informal economy is characterized by factors such as poor organizational structure, limited investment, intermediary hierarchies, risk exposure, constrained access to training, informal labor relations, restricted market access, absence of social protection, innovation gaps, and underreporting of income (ibid).

The International Labour Organisation (ILO) estimates that an enormous two billion people, constituting approximately 61% of the global working population, find employment in informal jobs (ILO, 2020). Nepal is no exception; more than 62.2% of its workforce, totaling 4.4 million individuals, operates in the informal sector (Central Bureau of Statistics, 2018). This diverse informal sector encompasses a range of activities, from precarious jobs to profitable businesses, distinct from the formal sector due to its lack of regulation and taxation by the government. Consequently, informal workers often face barriers to essential services, social protections, and fundamental rights, rendering them susceptible to exploitation, unsafe working conditions, and poverty (ILO, 2020).

The term "informal economy" refers to smaller-scale, unorganized economic activities operating outside formal regulation or oversight, often breaching tax laws. Within Asia, the informal economy, inclusive of the informal waste sector, plays a significant role in employment, constituting a substantial portion of non-agricultural jobs (ILO, 2004). While "informal sector" and "informal economy" are occasionally used interchangeably, the informal sector represents a more specific component within the broader informal economy. It encompasses the informal waste industry, along with associated informal enterprises and individuals (ibid). It's essential to note that "informal" denotes economic activities occurring outside formal, state-controlled channels, not necessarily indicating illicit activity.

People engage in the informal economy for diverse reasons, including the scarcity of opportunities in the formal sector, insufficient academic qualifications for formal employment, the flexibility offered by the informal sector for self-employed individuals, and its accessibility during times of precarious survival (ibid).

1.3 Waste Pickers: a comprehensive literature review

1.3.1 Waste Pickers in Urban Waste Management: Roles, Schools of Thought, and Policy Implications

With the world producing 1.3 billion tonnes of waste annually (World Bank, 2012), developing countries face a significant challenge in building Integrated and Sustainable Waste Management (ISWM) systems. Inadequate waste collection services affect nearly three billion people in the developing world (UNEP, 2015). As urbanization exacerbates fiscal and environmental challenges, the informal sector, especially waste pickers, has emerged as a possible solution.

In many cities of the Global South, waste pickers work to "revalorize" waste by collecting recyclable items and transferring them to depots, providing a service to the community. For them, garbage is a primary source of income and fills the void left by the state (Prahalad and Hammond, 2002; Thieme, 2010).

To move beyond stereotypes and understand waste pickers' conditions and interactions in waste management, it is essential to analyze the literature and debates on this topic.

Navarrete-Hernandez's paper examines the theoretical framework encompassing the urban informal sector, particularly waste picker cooperatives in Santiago de Chile. The study identifies four main schools of thought: dualist, structuralist, legalist, and voluntarist. Additionally, the research introduces the co-production theory, expanding this theoretical framework.

1. Dualist: This school views waste picking as a last resort activity resulting from a lack of formal employment opportunities. Advocating for repressive measures and the creation of formal jobs, dualist policies aim to reduce the number of waste pickers.

2. Voluntarist: The Voluntarist School sees formal and informal labor markets as interconnected, with waste pickers engaging in informal self-employment. However, voluntarists are skeptical of their role in development.
3. Structuralist: Waste picking is seen as an integral part of the capitalist system, providing low-cost recyclable materials to formal enterprises. Structuralists emphasize enhancing bargaining power and working conditions through waste-picker associations and unions.
4. Legalist: Waste pickers are considered micro-entrepreneurs, providing cost-effective raw materials to local industries. Legalist policies focus on decreasing government involvement and promoting waste-pickers' economic potential.
5. Co-production Theory: Recognizing the informal economy as a provider of public services, co-production arrangements involve partnerships between citizens and the state, aiming to deliver basic services, including waste management.

Despite ongoing debates and negative perceptions, the informal sector accounts for a substantial portion of worldwide employment, particularly in emerging and developing countries. This study aims to analyze the operation of the solid waste management system in Kathmandu, Nepal, focusing on the role and challenges faced by the informal waste sector, the relationship between waste pickers and institutions, and the sector's integration into the waste management framework. By shedding light on the significance of waste pickers and understanding their interactions within waste management, this research contributes to the broader discourse on sustainable waste management practices.

1.3.2 Vulnerabilities and Challenges Faced by Informal Waste Workers in Nepal

The Vulnerability Assessment (CSC, 2021) defines vulnerability as a predisposition to harm from external events, affecting poor and vulnerable groups' well being, particularly in the aftermath of risks. This concept applies to Nepal's informal waste workers, who face exposure to harm due to social, economic, and environmental factors, leading to increased risks and limitations on rights and opportunities. Their involvement in hazardous informal waste management activities renders them

extremely vulnerable, as indicated by susceptibility to poverty, health risks, social discrimination, and limited employment options. These vulnerabilities encompass three dimensions: economic, occupational, and social, with a focus on health and workplace hazards.

Economic vulnerabilities are a pressing concern for informal waste workers in Nepal. Their limited access to credit and financial services, as highlighted by the Centre for Social Change's Assessment, leaves them with unreliable savings methods and heightened susceptibility to financial crises (CSC, 2021). These workers, unfamiliar with conventional banking systems, often rely on informal channels, exposing them to risky practices like purchasing gold jewelry or farm animals. Lack of financial literacy further compounds their economic insecurity. Informal workers, driven by low and erratic wages, frequently turn to loans for basic necessities, subjecting themselves to unstable terms and high-interest rates.

Another significant dimension of vulnerability lies in the absence of social protection for informal waste workers. This lack of benefits, including social security and health insurance, leaves them at a severe disadvantage, particularly considering their already low wages and informal status (CSC, 2021). When faced with pay reductions, mounting debts, or loss of employment, the consequences are dire, impacting their lives and livelihoods, especially when they are the sole providers for their families.

Social and political vulnerabilities stemming from discrimination and stigma are also pervasive. Despite their essential contribution to the community and the economy, informal workers bear the reputation of engaging in illegal activities due to their unregulated status, leading to social ostracization (CSC, 2021). This discrimination extends beyond the workplace, making them susceptible to exploitation and harsh treatment from society, employers, and the government.

Occupational vulnerabilities in the informal waste sector result from low pay, limited negotiation skills, and inadequate bargaining power, creating a higher likelihood of dangerous working conditions (CSC, 2021). The lack of formal employment contracts and registration further hampers government intervention, making it difficult for informal workers to access essential protections such as health insurance and workers'

compensation. Despite national and international efforts, uninsured informal workers remain exposed to workplace hazards without proper support.

In summary, the multifaceted vulnerabilities faced by informal waste workers in Nepal encompass economic instability, limited access to credit, absence of social protection, discrimination, and occupational hazards. Addressing these challenges requires comprehensive policies that enhance financial inclusion, provide social safety nets, combat stigma, and improve working conditions. By recognizing the critical role of informal waste workers and implementing targeted interventions, Nepal can create a more equitable and supportive environment for this essential sector.

1.3.3 Health and Occupational Hazards Faced by Informal Waste Workers in Nepal

Workplace sanitation poses a significant challenge for Nepal's informal waste workers, who play a crucial role in delivering essential services to communities, yet often face disregard for their health and safety. They encounter dangerous and unsanitary conditions, with limited access to clean water and public restrooms (CSC, 2021). This lack of proper facilities affects their well-being and highlights the need to address occupational vulnerabilities related to workplace sanitation.

The health issues and occupational hazards faced by these informal workers remain a pressing concern. Their work is physically demanding, exposing them to toxic fumes, air pollution, and physical exertion (MDM, 2018). A cross-sectional survey reveals that depressive symptoms are more common among informal workers due to irregular employment, low income, and social stigma, leading to their exclusion from society (Karki et al., 2022). Furthermore, the prevalence of injuries, especially glass and metal cuts, and incidents of workplace violence underscore the importance of better safety protocols and protection for waste-related workplaces (MDM, 2018).

Informal workers' knowledge of health risks primarily comes from personal experiences, relatives, friends, or neighbors, but their awareness of risks remains limited. While some use personal protective equipment (PPE), many lack proper knowledge of protection measures (MDM, 2018). Additionally, access to clean drinking

water and sufficient restrooms is lacking, leading to concerns about personal hygiene (CSC, 2021). The survey raises significant questions about the accessibility, affordability, and availability of PPE for informal waste workers, as many resort to improvised solutions to mitigate job-related risks.

Addressing the health and occupational vulnerabilities faced by informal waste workers is essential to ensure their well-being, safety, and recognition as vital contributors to waste management in Nepal.

1.3.4 The Benefits and Necessity of Integrating the Informal Waste Sector

The existing body of literature presents compelling evidence highlighting the advantages and positive outcomes of integrating the informal waste sector into official solid waste management systems. Global examples showcase the potential for beneficial impacts on the economy, society, and the environment. Acknowledging these benefits, a key question arises: how can this integration be effectively achieved?

The findings from the GIZ Sector Project "Recycling Partnerships" and the study on the "Economics of the Informal Sector in Solid Waste Management" provide robust support for the essential role of the informal sector in solid waste management, offering significant opportunities for favorable economic, social, and environmental consequences.

1. **Cost-Effectiveness:** The study underscores the affordability of waste management options provided by the informal sector. Focusing on valorization and recycling of valuable materials, the informal sector outperforms the official sector in profitability and cost per tonne. For instance, Lusaka's informal waste management costs a mere 2 Euros per tonne compared to the formal sector's 15 Euros per tonne. These cost-effective practices can yield substantial savings for cities, with potential yearly savings as high as €14 million in Lima and €12 million in Cairo.
2. **Social Impact:** The involvement of the informal sector in waste management brings about several positive social effects. Over 73,000 workers across six cities benefit from the sector, offering more livelihood options than the formal

industry. The lives of waste pickers are improved by informal valorization operations that provide better wages than the minimum legal requirement. Additionally, women play a significant role in the informal economy by participating in picking, sorting, trading, and establishing community-based businesses. Addressing health and safety concerns and facilitating formalization further enhance these social advantages.

3. Carbon Footprint and Environmental Benefits: Informal sector recycling initiatives contribute significantly to reducing the carbon footprint of waste management. By preventing disposal, minimizing raw material extraction, and reintegrating secondary raw materials into manufacturing cycles, the informal sector plays a crucial role in greenhouse gas emission reduction. Compared to formal methods, informal recovery actions, especially in low- and middle-income cities, make substantial contributions to carbon emissions reduction, offering potential environmental gains through improved waste management.
4. Economic and Operational Impacts: The study's modeling scenarios demonstrate that integrating the informal sector into solid waste management can boost the sector's income while saving costs for the formal sector. This integration enhances material recovery and reduces environmental costs by utilizing animal or human power instead of energy. However, logistics and treatment options impact overall system costs, with cities like Cairo, Cluj, and Quezon demonstrating significant gains from informal sector participation.

In conclusion, evidence from case studies in the six cities unequivocally supports the notion that the informal sector plays a pivotal role and offers significant opportunities for achieving favorable economic, social, and environmental outcomes in solid waste management. Recognizing and incorporating the informal sector into waste management policies and practices is essential due to its cost-effectiveness, positive social impact on livelihoods, carbon footprint reduction, and economic and operational benefits.

1.3.5 Informal Waste Sector integration: Brazil and India case studies

Brazil's Exemplary Formalization of Informal Waste Workers: Brazil's : The information presented here is sourced from the article titled "Developing urban waste

management in Brazil with waste picker organizations," authored by Oscar Fergutz, Sonia Dias, and Diana Mitlin (2011). This article explores strategies for enhancing urban waste management through collaboration with waste picker organizations in Brazil.

experience serves as an exemplary case study showcasing the successful formalization of informal garbage workers, highlighting the positive outcomes that result from transformative practices.

- **Official Recognition:** Central to the Brazilian model is the official recognition of waste picking as a distinct profession within the country's occupational framework. In response to the National Movement of Waste Pickers' requests, the Brazilian government took a historic step in 2002 by designating waste pickers, or *catadores* as a separate category under the Brazilian Classification of Occupations (CBO). This recognition not only granted respectability to waste pickers but also facilitated comprehensive data gathering, enabling the government to gain a better understanding of their demands and challenges.
- **Collecting Data and Analysis:** The recognition of waste pickers as legitimate workers enriched national databases such as the National Household Sample Survey (PNAD) and the Annual Listing of Social Information (RAIS) with valuable information about waste pickers in both formal and informal employment settings. This data-driven approach has been instrumental in developing targeted policies and programs that address the socio-economic characteristics and working conditions of waste pickers more precisely.
- **Support for Co-operatives and Associations:** The Brazilian model places significant emphasis on the importance of organizations and co-operatives in improving the lives of informal waste pickers. Municipalities actively involve co-operatives in managing public restrooms and providing public cleaning services, providing garbage collectors with an additional source of income. These co-operatives play a crucial role in organizing and empowering waste pickers, enabling them to collectively negotiate for better working conditions and access to essential resources.
- **Policy Framework:** In addition to formal recognition, a robust policy framework supports waste pickers and their organizations. For instance, Law 11.107, passed in 2005, enables municipalities to enter contracts with waste picking

organizations (MBOs). Furthermore, Decree 5940, known as "Coleta Seletiva Solidária," established in 2006, mandates federal institutions to donate recyclables to these organizations, thereby supporting their economic activities.

- Financial and Fiscal Incentives: Another pillar of the Brazilian model is the provision of financial and fiscal incentives, which critically support recycling companies and regional programs through collaboration with waste picker cooperatives and associations. This support promotes the growth and sustainability of waste picker organizations, making it easier for them to integrate into the legal waste management system.

SWaCH Initiative: Integrating Informal Waste Pickers in Pune, India: The information about the SWaCH initiative provided here is derived from the website <https://swachcoop.com/>.

A remarkable and effective example of integrating informal waste pickers into the formal waste management system can be found in Pune, India, through the SWaCH (Solid Waste Collection and Handling) concept. This innovative initiative emerged as a collaborative effort between the Pune Municipal Corporation (PMC) and the Kagad Kach Patra Kashtakari Panchayat (KKPKP), a collective of waste pickers. Their primary goals were to address the challenges arising from escalating waste generation in the city while simultaneously enhancing livelihood opportunities for waste pickers.

- Recognition: A significant step in the Pune case study was recognizing waste pickers as "workers," achieved by registering the association as a trade union and distributing photo-identity membership cards. Based on the vital role waste pickers play in urban solid waste management, these identity cards were presented to the municipalities for acceptance. The Pune and Pimpri Chinchwad Municipal Corporations formally approved these identity cards in 1996 and 1997, allowing adult scrap collectors to legally gather recyclable materials (Estrada et al., 2023)
- Organizational Transformation: Informal waste pickers, who were once marginalized and often subjected to social stigma, have now gained recognition

as an essential component of the waste management workforce. The establishment of the SWaCH Cooperative has provided them with a sense of unity and has significantly enhanced their bargaining power.

- **Formal Employment:** Waste pickers employed by the SWaCH Cooperative experience formal employment status, leading to improved job security, access to social benefits, and participation in various government programs.
- **Door-to-Door Collection:** A pivotal move in the Pune case study was the introduction of a program for source-separation of waste, where licensed wastepickers, authorized by local government-issued cards, collect recyclable and organic waste directly from homes. Recyclable materials are preserved, while organic waste is either disposed of in vermiculture pits or public trash containers. Residents are required to pay a service fee to the wastepickers for the collection service. This program benefits approximately 300 wastepickers, serving 25,000 households and businesses. Although mandatory segregation at the source is not yet fully adopted, the Pune and Pimpri Chinchwad municipalities endorsed the initiative by approving identity cards and raising public awareness about waste segregation.
- **Social Security Initiatives:** To address the lack of social security for scrap collectors, SWaCH introduced various initiatives, including group insurance plans and a savings-linked credit cooperative. The KKPKP association, in collaboration with the Life Insurance Corporation of India, developed a group insurance plan offering coverage for natural and accidental deaths or disabilities. Additionally, the KKPKP established a savings-linked credit cooperative in 1997, allowing members to deposit monthly savings and access credit up to three times the saved amount at a lower interest rate (18% per year) than the unofficial credit sources they previously relied on, providing more financial security and job stability for scrap collectors.
- **Integration with Formal Waste Management:** The collected waste is handed over to the PMC's formal waste management system, ensuring that recyclables are adequately processed while non-recyclables are disposed of responsibly.

CHAPTER TWO: SOLID WASTE MANAGEMENT IN KATHMANDU VALLEY

2.1 Background

The issue of municipal solid waste collection and disposal is a significant concern in both urban and rural areas of various developed and developing countries. The global population residing in urban areas is projected to reach 66% by the year 2050 (U.N., 2015), indicating a rise in urbanization and its associated challenges, including the generation of municipal solid waste (MSW) (Maharjan et al., 2019).. Factors such as improving community living standards and changes in consumer patterns further contribute to the increased generation of MSW, making it a prominent problem for modern society and public authorities (ibid.).

Global data and statistics on MSW demonstrate that there are no indications of a slowdown in waste production. Over 2 billion tons of MSW are generated annually worldwide, and this figure is expected to increase to 3.4 billion tons by 2050, with current recycling rates standing at less than 20%. Consequently, a significant portion of waste is still sent to landfill sites, while hazardous open dumpsites are frequently used, particularly in developing nations¹. Although wealthier countries produce more waste, they typically possess better waste management systems to address these challenges (HWH Environmental, 2023).

Looking specifically at the Asian continent, regions with high population densities struggle with waste management, resulting in health effects, social concerns, and environmental risks (Maharjan et al., 2019). Solid waste management (SWM) is a major issue in many urban areas of Nepal, such as Kathmandu.

Kathmandu, the gateway to the Nepalese Himalayas, possesses remarkable cultural beauty. However, its streets are marred by piles of plastic and organic waste. Stray dogs and wild monkeys rummage through these piles in search of food, spreading waste

¹ According to statistics of HWH Environmental about waste China [accounts for](#) 15.55% of all global

around. Additionally, trash accumulates on rocks and has polluted the holy Bagmati River. The Kathmandu Valley alone generates more than 1,000 tons of solid waste daily, with over 60% of it being organic waste that is theoretically compostable (Woima Corporation, 2022). Due to the lack of waste separation and poor access roads, only around 50% of the collected waste in Kathmandu reaches the landfill (ibid.). Consequently, many locals resort to littering or burning their waste, exacerbating the overall inefficiency of waste management. This situation is particularly concerning considering that Kathmandu frequently ranks among the most polluted cities in the world (ibid.). Plastic and disposable wrappers constitute more than 10% of the waste in Kathmandu, a percentage that continues to rise due to the absence of regulations and the continuous increase of population and flow of tourism. The year 1951 saw the opening of Nepal's borders to tourists, which was followed by a substantial increase in visitors starting in the 1960s (Gurung., 1998). While the country has reaped significant economic benefits from the booming tourism sector, it has also faced significant socioeconomic and environmental issues, which have outpaced its level of readiness (ibid.).

This section aims to introduce the complex issue of solid waste management in Nepal, with a specific focus on the Kathmandu Valley. The problem is not solely discussed from an environmental perspective but also includes social and institutional analyses. After describing the demography and social structure of Nepal and their relevance to SWM, the chapter outlines the chronology of SWM efforts in Kathmandu Metropolitan City (KMC) and the institutional structure of the sector. Despite the lengthy history of solid waste legislation adoption, solid waste management continues to be a persistent issue due to various factors, including the lack of baseline SWM statistics necessary for effective planning (Dangi et al., 2017).

2.2 Demography and social structure of Nepal

Nepal's current population, as per the 2021 census, stands at 29,164,578, with a population growth rate of 0.92% per year. Despite its relatively small area of 147,181 square kilometres, Nepal exhibits significant diversity. The country is home to 126

different ethnic groups², approximately 123 languages, and various religions³, making it a subject of considerable research interest due to its complexity (MoFA., 2021).

For the Nepalese social structure, the caste system's influence on various aspects of Nepalese society, including occupational roles. The origins of the caste system in Nepal can be traced back to King Jayasthi Malla in the 14th century, during his reorganization of the Newars. In 1854, Nepal's first prime minister, Junga Bahadur Rana, established the *Muluki Ain* ("National Code"), which marked the beginning of the 104-year authoritarian Rana reign. Despite numerous movements against the caste system and its abolishment in national laws, it remains prevalent in Nepal (Dangi., 2009). Dangi argues that the caste system became institutionalized in Nepal upon its formation as a unified country, with work allocation aligning with caste divisions. Consequently, the management of solid waste or cleaning tasks were assigned to *kuchikars*⁴(cleaners), who belong to the low-caste community of Newars⁵.

Although the caste system still exists, its regulations are not as stringent as they once were. The New Muluki Ain-1963 law, which made discrimination against other castes illegal, ensured equal treatment of all castes under the law (Wikipedia., 2021). Furthermore, education is intended to be accessible and free for individuals of all castes. However, due to the structural class differences perpetuated by the caste system, lower castes and ethnicities generally face socio-economic inequality compared to higher castes, especially through inter-caste marriages.

² Nepal is home to a variety of ethnic groups. The major ethnic groups include the Chhetri, Brahman, Magar, Tharu, Tamang, Newar, Gurung, Rai, Limbu, Sherpa, and others. Each group has its own distinct language, culture, and traditions.

³ The majority of the Nepalese population practices Hinduism, which is the country's main religion. However, Buddhism, Islam, Christianity, and various indigenous religions are also followed by smaller segments of the population.

⁴ In the context of Nepal, if "Kuchikars" refers to individuals working as cleaners in the field of solid waste management and belonging to lower castes, it is likely associated with the Dalit community. Dalits, historically known as "untouchables," have faced social discrimination and marginalization in Nepal.

⁵ The Newar are the indigenous population found in the Kathmandu Valley in Nepal. It is also a caste system which has a specific division into groups according to their hereditary occupations

Family units hold a fundamental position in Nepalese society, where the extended family system forms the cornerstone. Multigenerational households are common, emphasizing strong bonds among relatives. The concept of a joint family and the reverence for elders are highly cherished values.

Traditional customs in Nepal significantly influence the gender structure. Women traditionally assume substantial roles in household management and caregiving, while men typically hold more power and influence in society. Nevertheless, efforts are being made to promote female emancipation and gender equality.

Education is a vital aspect of consideration. While Nepal has made progress in improving access to education, challenges persist, particularly in rural areas. Although literacy rates have been increasing, disparities between urban and rural areas, as well as gender-based differences, remain significant obstacles to sustainable development in the country. Disparities in infrastructure, access to services, and opportunities between rural and urban regions are evident, with urban areas, especially Kathmandu, offering greater economic prospects and superior facilities, while rural areas often rely on agriculture and face resource limitations.

It is important to acknowledge that the demographic and socio-economic structure of Nepal is dynamic and subject to change. Globalization, various initiatives, and societal developments significantly influence the demographics and social dynamics of the nation.

2.3 Chronology of Solid Waste Management in KMC

Over the past two decades, the waste management system in Kathmandu Metropolitan City has faced increasing strain due to population growth and urbanization. The Kathmandu Valley alone generates 1,200 tonnes of solid waste daily, with nearly 60% originating within the Kathmandu Metropolitan City. Experts estimate that over 60% of the organic waste produced in the Valley can be converted into compost, while 30% of the non-biodegradable waste can be sold for recycling (Kathmandupost, 2023).

As of March 2023, the city currently disposes of its solid waste at the Sisdol landfill site, which is under significant stress and is scheduled for closure in the near future. In the interim, municipal waste is being sent to the Banchare Danda landfill, located just 3km away from Sisdol.

The subsequent sections will delve into the evolution of solid waste and its management to better understand the process that has led to the current situation.

2.3.1 SWM Before 1980s

In the past, before the urbanization of the Kathmandu Valley, the majority of the city's solid waste was organic in nature. At the household level, residents used to manage their generated waste through recycling and internal utilization or composting at individual residences. Traditional homes in Kathmandu often had shared courtyards, which served as social gathering spaces or defensive barriers. As the population grew, these spaces gradually transformed into common areas for waste disposal, with nearby households responsible for collecting waste from these courtyards at regular intervals. However, public sanitation and cleaning were not major concerns, and individuals could own plots of land where they could compost their own waste (Dangi, 2009).

In 1919, during the Rana regime, Prime Minister Chandra Shamsher established the *Safai Adda* (a sanitary office) to address the waste issue. The responsibility of waste collection and disposal was assigned to *kuchikars*, who belong to a lower caste and are employed as cleaners. Additionally, historical sources mention the use of *saaga* and *nauga* for waste collection. *Nauga* refers to pits dug beneath the steps on the ground floor of homes, while *saaga* represents communal pits used for waste collection by the entire community. These pits collected kitchen waste, urine, and occasionally even human waste, which were then composted and either sold to farmers or used in yards (ibid). In 1931, *Safai Adda* was transformed into the Municipality office, but this name change did not significantly impact the work performed by the people involved. In the 1960s, waste production increased due to urbanization, trade, and consumption, leading people to resort to dumping domestic waste along the Bagmati River due to the absence of a proper waste management system (Rana, 2013).

2.3.2 Brief history of Solid Waste Management

The current waste management system in Nepal was established over three decades ago with the establishment of the Solid Waste Management Resource Recovery Mobilization Centre (SWMRMC) in 1980, which aimed to implement an organized solid waste management approach (Dangi., 2009). Starting in 1981, the three

municipalities in the Kathmandu Valley (Kathmandu, Lalitpur, and Bhaktapur) received funding and technical support from the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) for the GTZ Solid Waste Management Project (ibid).

In 1986, the Gokarna landfill site was constructed and put into operation to address the environmental constraints resulting from indiscriminate waste dumping along riverbanks. The same year saw the opening of the Teku Composting Facility and Transfer Station. Furthermore, improved waste collection containers and more efficient trucks were introduced, while the Solid Waste Management and Resource Mobilization Centre was established to oversee waste management operations. The GTZ's SWM project ran for approximately ten years throughout the 1980s until the Government of Nepal assumed project management. However, the waste management system in Kathmandu deteriorated in the 1990s and eventually collapsed when the Gokarna landfill site closed in 2000, leading to haphazard waste dumping along riverbanks. From 2003 to 2005, dumping along the banks of the Bagmati River was permitted until the construction of the Sisdol landfill site (ibid.).

2.3.3 Present situation

The management of waste in Kathmandu is under the jurisdiction of Kathmandu Metropolitan City (KMC), specifically overseen by KMC's Environment Management Division. The predominant practice for household waste disposal involves dumping it on the streets, while a door-to-door system is implemented to collect some trash using trucks, which are then unloaded onto tractors at a major collection point along the Bagmati River. Waste collectors on cycle carts can be observed amidst the bustling city traffic, soliciting recyclables from houses and shops, which are later sold to scrap dealer shops. Before being transported to the Sisdol dumpsite, the collected waste is initially taken to the Teku Transfer Station for sorting and loading onto larger vehicles. The primary location for the final disposal of solid waste in Kathmandu has been the Sisdol landfill site, operational since 2005 and overseen by the Solid Waste Management Technical Support Centre (SWMTSC) (ibid.). Despite its initial designation as a temporary solution, Kathmandu Valley residents continued to deposit waste at Sisdol for over a decade until the landfill site exceeded its capacity a few years ago.

As local communities began to oppose the dumping of garbage at Sisdol, the Banchara Danda landfill site was proposed and completed in late 2021 after facing opposition from villagers along the route to Nuwakot, who demanded better facilities⁶. After setting forth certain conditions, the disposal of garbage at Banchara Danda is now permitted.

In recent years, there has been a growing emphasis on waste-to-energy projects in Kathmandu Metropolitan City and Nepal as a whole. These initiatives aim to convert waste into energy using technologies such as biogas plants and waste incineration with energy recovery. The objective is to harness the energy potential of waste while reducing the volume of waste sent to landfills.

In conclusion, Kathmandu currently lacks a systematic recycling system. At the household level, some waste is sorted, and a few non-governmental organizations are involved in recycling activities. Scavengers play a significant role in sorting through and gathering a considerable amount of waste on the streets or at the Teku Transfer Station. The materials they collect, including plastics, paper, glass, and metals, are sold to private businesses, primarily for resale in India (Sharma., 2022).

2.4 Legal and Regulatory Framework of Solid Waste Management (SWM) in Nepal

Municipal solid waste management (MSWM) constitutes a pivotal responsibility for municipal governments in Nepal. Yet, the intricacies of waste management at the local level are exacerbated by a lack of proper infrastructure: insufficient sanitary dumping sites, composting facilities, source segregation, and an effective collection system are just a few of the daunting challenges faced (Shakya and Tuladhar, 2013). To understand the waste management landscape, it is essential to delve into the legal and regulatory framework that guides the sector's operations.

2.4.1 Dual Roles of Federal and Local Governments in SWM Sector

⁶ see the article <https://kathmandupost.com/national/2022/05/31/sisdole-locals-say-they-won-t-allow-garbage-at-banchara-danda-until-their-demands-are-met>

The solid waste management sector in Nepal operates under the joint jurisdiction of both federal and local governments. Federal agencies hold the responsibility of formulating policies, enacting laws, providing financial support, and creating frameworks for private sector investments, with the aim of safeguarding the environment from adverse impacts (World Bank, 2020). On the other hand, local governments are tasked with delivering SWM services within their respective areas. Despite being a concurrent matter according to the Constitution, active engagement from neither level is currently observed in SWM.

2.4.2 The Institutional Landscape: Ministries and Authorities

Several key ministries and authorities play pivotal roles in Nepal's waste management framework. The Ministry of Federal Affairs and General Administration (MoFAGA) is the primary federal ministry overseeing local government operations. The Ministry of Forest and Environment (MoFE) is entrusted with creating environmental protection laws, monitoring pollution, and ensuring sound waste management practices (ibid). Additionally, the Ministry of Finance (MoF) handles fiscal devolution, while the Investment Board Nepal (IBN) facilitates public-private partnerships, a crucial avenue for project implementation. The Ministry of Energy, Water Resources and Irrigation (MoEWRI) has set up the Alternative Energy Promotion Centre (AEPC), which aids local governments in establishing biogas plants that harness biodegradable organic waste in various sectors.

2.4.3 Solid Waste Management Policies

The legal framework for solid waste management in Nepal is anchored in various acts and regulations. The Local Government Operation Act of 2015 (LGO Act) empowers local governments to enact local laws, manage environmental pollutants, and handle solid waste within their jurisdiction, among other responsibilities. The government has enacted the Solid Waste Management Act, 2011 (SWM Act), and the Solid Waste Management Rules, 2013 (SWM Rules) with the primary objective of maintaining a clean and healthy environment. Additionally, the Environmental Protection Act of 2019 (EPA) and the Environment Protection Rules of 1997 (EPR) address broader environmental pollution concerns.

2.4.4 The Evolution of Relevant Laws

Over time, Nepal has seen the emergence of several crucial acts aimed at addressing solid waste management. The Solid Waste Management and Resource Act of 1987, while an early attempt to ensure public health, faced limitations in its implementation. The subsequent Solid Waste Management Act of 2011 played a significant role in reinforcing local government responsibilities for SWM and promoting waste reduction through reuse and recycling. The Constitution of Nepal, 2015, guarantees every citizen the right to a clean and healthy environment, including provisions for compensation in cases of environmental pollution or degradation.

Solid waste management challenges persist, particularly in urban areas undergoing rapid urbanization and population growth. Effective implementation of existing laws and regulations, coupled with appropriate financial incentives and technology policies, can significantly contribute to resolving these challenges. Recognizing the importance of community concerns and public feedback is paramount before enacting laws that impact the general population. Solid waste management is not just an environmental concern; it's an intricate tapestry interwoven with legal, regulatory, and social elements that demand careful consideration (Maskey, 2018).

2.5 Waste generation and practices in Kathmandu

2.5.1 Overview

In recent years, Nepal has experienced a rapid increase in urbanization, largely driven by rural migrants seeking better job prospects and a better life in cities like Kathmandu. Despite urban areas accounting for just 21% of Nepal's population, based on 2021 estimates, the nation faces significant challenges in handling the environmental, sanitation, and health aspects that come with this expanding urban populace, all while dealing with limited land availability and resources (Statista, 2023; WorldBankData, 2021). The issue of managing solid waste, particularly finding suitable landfill sites for the municipal solid waste (MSW) generated within the Kathmandu valley, has sparked

extensive debate among Nepal's media, government entities, and non-governmental organizations (Pokhrel, 2005).

To fully comprehend the intricacies of the solid waste management system in the Kathmandu Valley and develop viable alternatives, a comprehensive examination of municipal waste generation, waste composition, and the current practices and key stakeholders involved is essential. This analysis reveals a diverse range of participants in the solid waste management arena, including the Kathmandu Metropolitan City (KMC), private waste management companies, non-governmental organizations (NGOs), and community-based organizations (CBOs).

Furthermore, the solid waste management system in Kathmandu displays a distinctive combination of formal and informal components. In the formal sector, we encounter officially authorized waste collection and disposal services managed by both governmental bodies and private enterprises.

At the same time, the informal sector, although operating independently from the established formal system, plays a considerable role in waste recovery and recycling, making a significant contribution to reducing waste and conserving valuable resources.

A comprehensive understanding of the interplay between the formal and informal sectors holds the key to crafting effective waste management strategies in Kathmandu. By harnessing the strengths of both sectors and addressing their respective challenges, a more sustainable and inclusive solid waste management system can be established in the city.

Trash from homes, businesses, and other sources, such as parks, highways, and other public spaces, is included in municipal solid trash. According to a prior study by ADB (2013), municipal trash generation in KMC comprises 50% of household waste and 50% of waste from other sectors. With this in mind, it is estimated that the average daily municipal trash generation at KMC is 360 grams per person while 513 metric tons of municipal waste is produced daily on average (City Planning Commission et al., 2020).

2.5.2 Household generation rate

According to the Final Report of the Baseline Study of Solid Waste Management (2020) conducted in Kathmandu Metropolitan City (KMC), the rate of household garbage production is 180 grams per person per day. Figure 1 illustrates the typical household waste produced in five sampled wards⁷ of KMC as documented in the Final Report.



Figure 1 Ward wise waste generation (City Planning Commission et al., 2020).

2.5.3 Institutional waste and commercial waste generation

Due to the lockdown restrictions in 2020 during the latest Baseline Study on Solid Waste Management in KMC, the statistics on institutional and commercial waste have been affected as banks, financial institutions, government offices, shops, and schools were partially closed. However, the estimate provided by the Asian Development Bank (ADB, 2013) regarding the contribution of the institutional and commercial sector to total municipal waste in KMC has been utilized as a reference. According to this estimate, the average municipal waste generation in KMC accounts for 50% from households and 50% from the remaining sectors. Based on this reference, the average municipal waste generation is calculated to be 360 grams per capita per day, resulting in

⁷ five wards (2, 5, 8, 25 and 31) out of 32 wards of KMC were selected on the basis of population density and waste management system. See the SWM Baseline Study 2020 pag. 2 to have more information about the methodology and the research design employed. General information of sampled wards at pag. 9.

a total estimated municipal waste generation of 513 metric tons per day (City Planning Commission et al., 2020)

2.5.4 Household waste composition

The average breakdown of household garbage in KMC is as follows: 75.50% organic waste, 10.35% plastics (including 6.55% plastic polythene bags and other plastics), 3.85% paper and paper products, 1.94% glass, 1.61% textiles, 0.47% metal, 0.26% rubber, 0.22% e-waste, and 5.81% other materials (City Planning Commission et al., 2020). Notably, the composition of waste differs from the ADB report (2013), with a higher proportion of paper- and organic-based waste. The decrease in paper and paper products in the waste could be attributed to a shift towards digital media and reduced packaging during the national lockdown (ibid.).

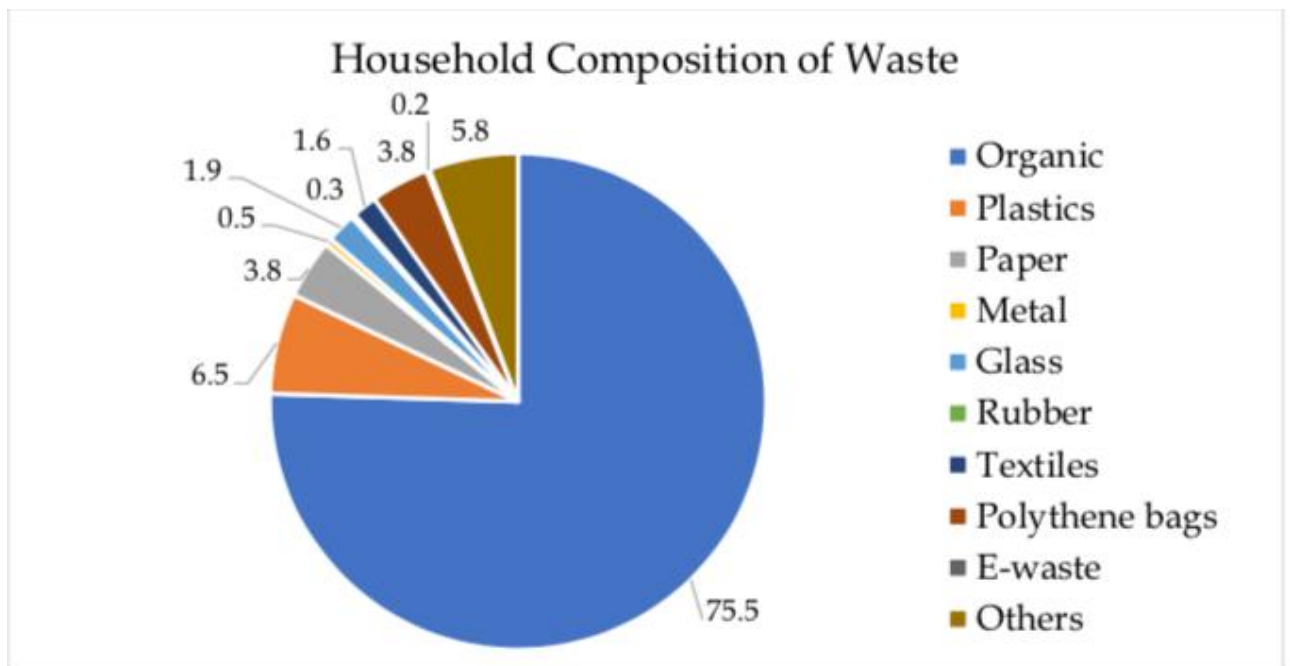


Figure 2 Household composition of waste (City Planning Commission et al., 2020).

2.5.5 Waste composition at Teku transfer station

The Teku transfer station, operated by KMC, serves as the initial collection point for municipally collected waste before it is transported to the Sisdol dumpsite. On average, 106 metric tons of waste are collected daily, while 105 metric tons are transported to the Sisdol landfill site (ibid.). The waste composition at the Teku transfer station consists primarily of organic materials (52.32%), plastics (18.74%), paper and paper products (10.13%), textiles (9.44%), glass (2.71%), metal (0.73%), rubber (0.29%), and other materials (5.56%) (ibid.). Informal recyclers present at the site separate recyclable items from the waste, reducing the amount of trash ultimately dumped in landfills.

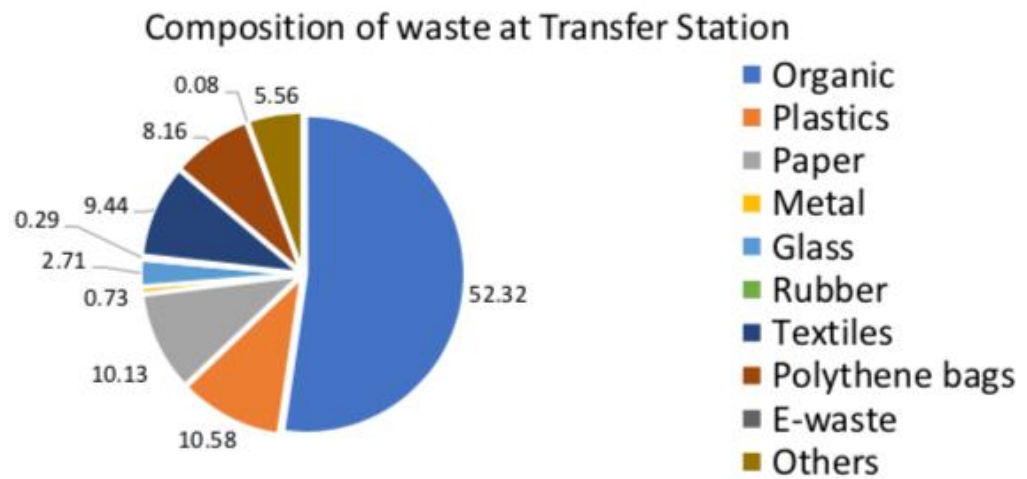


Figure 3 Composition of waste at Teku Transfer Station (City Planning Commission et al., 2020).

2.5.6 Waste composition at Sisdol landfill site

The Sisdol landfill site receives an estimated 419 metric tons of waste from KMC, with 314 metric tons coming from the private sector and 105 metric tons from municipal vehicles (ibid.). Vehicles entering the landfill site must meet certain requirements and present a landfill voucher. The waste composition at the Sisdol landfill site, as identified in The Final Report (2020), consists of 26.48% organics, 28.95% plastics (including 15.09% other plastics and 13.86% polythene bags), 19.51% textiles, 10.39% paper and paper products, 3.66% glass, 1.58% e-waste, 0.36% metal, 0.36% rubber, and 8.71% other materials.

Waste Composition at Sisdol Landfill Site

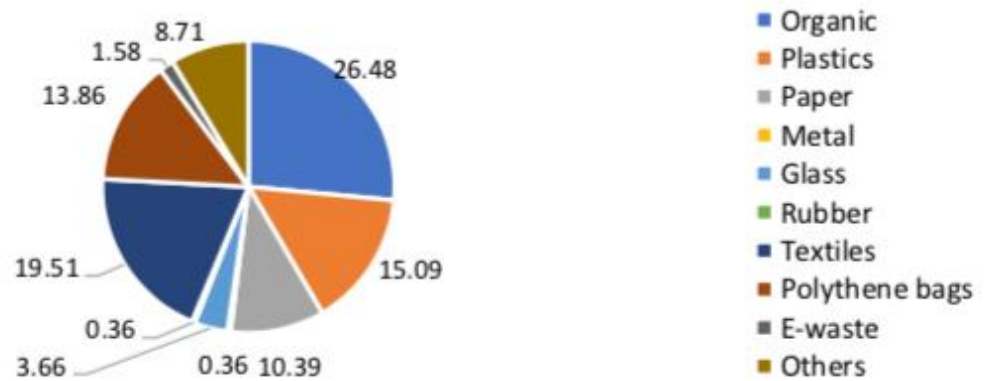


Figure 4 Waste composition at Sisdol Landfill Site (City Planning Commission et al., 2020).

One striking observation is the change in the percentage of plastics as waste progresses from the household level to the landfill site. At the household level, plastics constitute 10.35% of the waste, including 6.55% polythene bags and other plastics. However, as the waste reaches the Sisdol landfill site, the percentage of plastics increases significantly to 28.95%, with a notable portion attributed to polythene bags (13.86%) and other plastics (15.09%).

This substantial increase in the percentage of plastics raises questions about the reasons behind this phenomenon. One possible explanation is the persistence of plastic materials due to their non-biodegradable nature. While other components, such as organic waste, may decompose over time, plastics endure, leading to their accumulation in the waste stream. Additionally, inadequate recycling and disposal methods for plastics, coupled with the lack of effective waste management policies, could contribute to this escalation.

Moreover, the shift in plastic composition from households to landfills may also reflect the challenges in recycling and proper disposal. The informal recycling processes at the Teku transfer station attempt to salvage recyclable items, thereby reducing the overall amount of waste destined for the landfill. However, plastics, especially polythene bags

and certain types of plastics, may be more challenging to recover through informal recycling due to their lightweight and potentially limited market demand for recycling.

2.5.7 Management practices in household

Figure 5 indicates that the predominant method of residential waste management involves disposing of mixed waste during collection. Approximately 62% of respondents dispose of their mixed trash during pick-up, while 11% separate their waste and compost. About 3% of survey participants burn or bury their garbage. Composting and rooftop gardening instruction sessions have been conducted in almost all wards of KMC, and ward offices have received composting instruction and free compost bins.

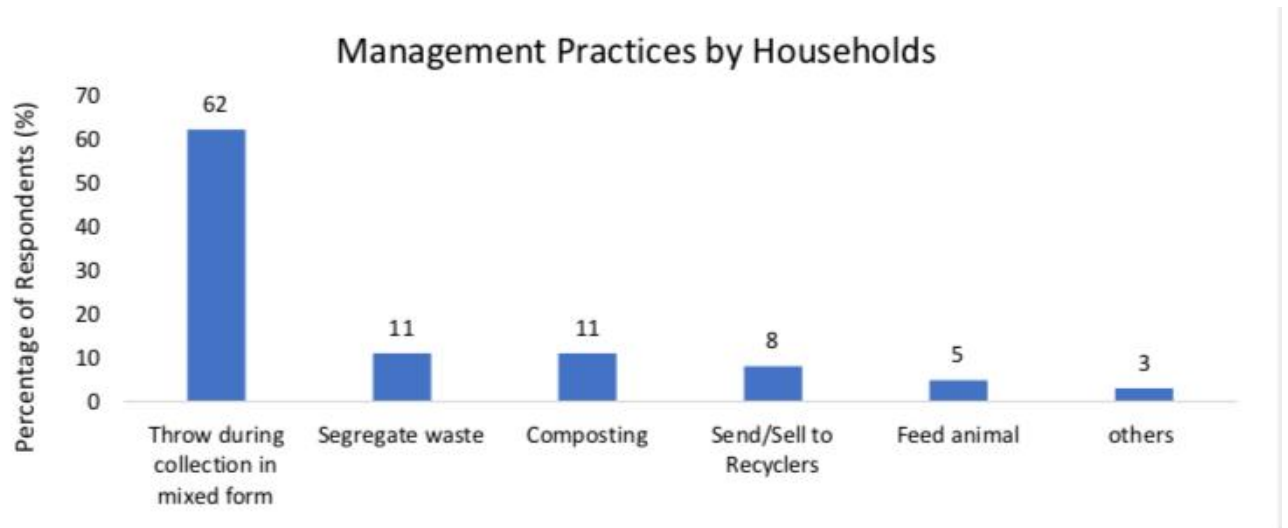


Figure 5 Management practices at households (City Planning Commission et al., 2020).

Due to the lack of waste segregation during collection and inadequate supervision, most households are reluctant to segregate their trash. Figure 6 demonstrates that the sale of recyclables is more prevalent in wards 5, 25, and 31 compared to wards 2 and 8. Notably, municipal collection checkpoint areas tend to accumulate waste on street curbs compared to private collection areas.

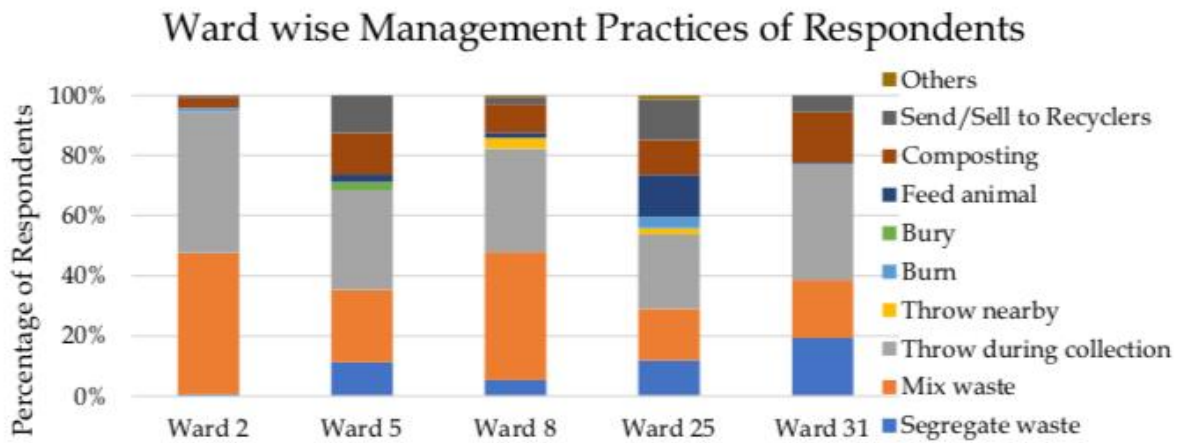


Figure 6 Ward wise management practices by respondents (City Planning Commission et al., 2020).

A significant percentage of respondents dispose of hazardous waste, such as chemicals, electronics, radioactive materials, infectious and combustible goods, and expired pharmaceuticals, in the same manner as regular garbage (ibid.). Only 7% of respondents separate these hazardous items for potential recycling, while 85% simply dump them with the regular trash during collection. This practice is consistent across all sampled wards.



Figure 7 Hazardous management practices by respondents (City Planning Commission et al., 2020).

2.5.8 SWM responsibility and fee

Figure 8 reveals that nearly 70% of households in the sampled wards use waste management services from private or non-government sectors, while the utilization of municipality services is comparatively lower. Ward 25 is entirely covered by the municipality's collection area since it is located in the heart of Kathmandu. Wards 2, 5, and 31 rely solely on private collection services, while ward 8 is only partially covered.

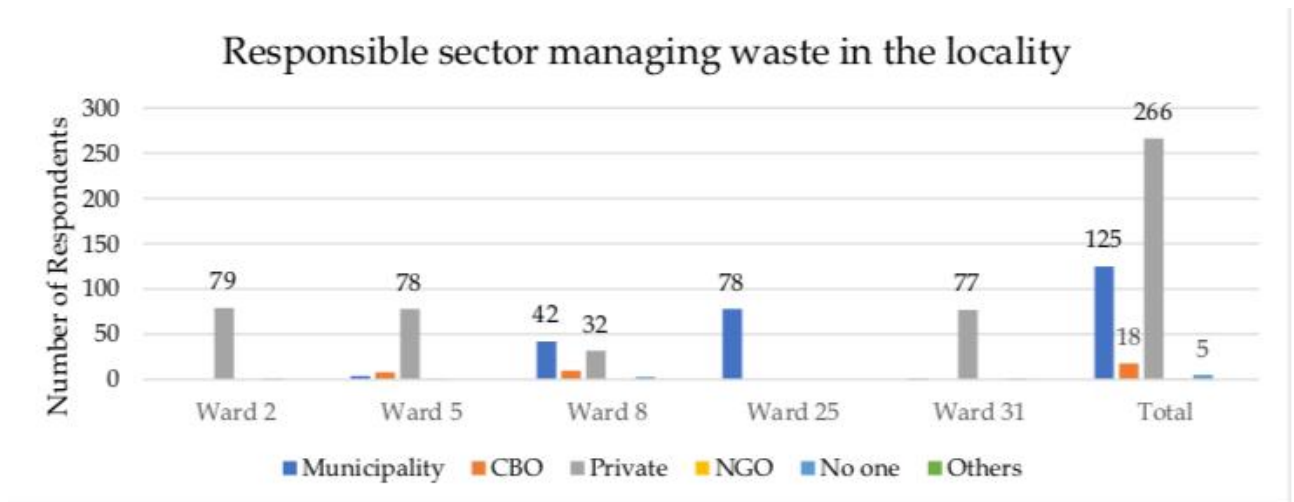


Figure 8 Responsible sector managing waste in the sampled wards (City Planning Commission et al., 2020).

All respondents from the wards with private collection services (Wards 2, 5, 31, and partially 8) pay a monthly fee for waste management services. On the other hand, respondents receiving waste collection services from municipal vehicles do not pay for them. Private organizations have started charging monthly fees to households to cover their operational costs and investments. The monthly fees have gradually increased to around Rs 300 to 400 based on market conditions and mutual understanding between the companies and the members.

2.6 Existing Solid Waste Management system

The solid waste management system in Kathmandu Metropolitan City (KMC) encompasses various administrative sectors and departments. KMC is divided into five

sectors: the Central Sector, the East Sector, the North Sector, the City Core, and the West Sector, further divided into 32 administrative wards. The key entities involved in solid waste management include:

- **Environment Department:** the Environment Department of KMC is responsible for formulating and implementing policies and guidelines related to environmental conservation, including solid waste management.
- **Solid Waste Management Division:** this Division is responsible for the planning, execution and monitoring of waste management initiatives such as the collection, transportation and disposal.
- **Ward Offices:** KMC is divided into multiple administrative wards. Each ward has its own ward office, which plays a significant role in coordinating waste management activities at the local level within their respective areas.
- **Public Health Department:** the Public Health Department of KMC is involved in various health-related initiatives, including waste management. It collaborates with the Environment Department and other relevant stakeholders to address health concerns associated with improper waste disposal and promote hygiene and sanitation practices.

These administrative entities work together to devise strategies, implement waste management plans and address challenges related to solid waste management in Kathmandu Metropolitan City.

2.6.1 MSWM stakeholders

Numerous stakeholders contribute to the overall process of solid waste management in Kathmandu. The stakeholders can be broadly categorized into the formal and informal sectors. The formal sector includes entities such as the Kathmandu Metropolitan City (KMC) and private waste management companies. These organizations play a vital role in waste collection, transportation and disposal, operating within, more or less, regulated frameworks and adhering to waste management guidelines.

On the other hand, the informal sector is comprised of a network of individuals who engage in informal waste collection and recycling activities. The informal sector holds significant importance in the waste management ecosystem. Key actors within the

informal sector include waste pickers (or rag pickers), scavengers, scrap buyers and dealers, and rag pickers. These workers, often marginalized and economically disadvantaged, actively participate in waste recovery and recycling efforts.

The informal sector's participation in waste management not only contributes to the reduction of waste burden but also serves as a source of income for marginalized communities. Recognizing the value of their work and integrating them into formal waste management systems could enhance recycling efforts, improve livelihoods, and foster sustainable waste management practices in Kathmandu.

Here a description of the different types of informal waste workers involved in waste management in Kathmandu observed during my field research:

Waste Pickers: Waste pickers are individuals who collect recyclable materials directly from various places, such as households, streets, and dumping sites. They manually sort through the waste to extract items like plastic bottles, glass, paper, cardboard, and metals. While walking through the streets of Kathmandu it is also common to come across a type of waste pickers who walk the streets with rickshaws going door to door to collect recyclable materials shouting to warn of their arrival.

Scavengers: Scavengers are individuals who search for and collect discarded materials from landfills and dumping areas. They often operate informally and work in hazardous conditions to salvage items of value from mixed waste.

Scrap Dealers: Scrap dealers are individuals or businesses that purchase various types of scrap materials, such as metals (iron, steel, aluminium), electrical wires, and machinery parts. They usually act as intermediaries between informal waste workers and formal recycling industries. Scrap dealers accumulate scrap materials from waste pickers, rag pickers, and other sources and then sell them to recycling companies or factories.

Scrap Buyers: Similar to scrap dealers, scrap buyers are individuals or organizations involved in purchasing scrap materials. They often work directly with waste pickers, rag pickers, and scavengers to buy recyclable items at negotiated prices. Scrap buyers may specialize in specific types of scrap, such as metal scrap or plastic scrap, and play a crucial role in facilitating the recycling supply chain.

It's important to note that the terminologies and roles in the informal waste management sector can vary in different contexts, and individuals or entities may engage in both buying and dealing activities.

2.6.2 Life cycle of Solid Waste

The life cycle of solid waste in the informal sector typically involve several stages, from the initial collection by waste pickers to the final phase where it reaches scrap dealers and potentially gets exported to India (Sharma., 2022):

Waste Collection by Waste Pickers: The life cycle begins with waste pickers who collect solid waste directly from various sources such as households, streets, and dumping sites. They manually sort through the waste, separating recyclable materials like plastic, glass, paper, cardboard, and metals from the non-recyclable components.

Sorting and Aggregating: Waste pickers then sort the collected materials based on their type, quality, and value. They separate different types of recyclables and categorize them into specific groups for easier handling and selling. This sorting process helps prepare the materials for further processing and recycling.

Selling to Scrap Dealers: Waste pickers typically sell the sorted recyclable materials to scrap dealers. Scrap dealers act as intermediaries, purchasing the materials from the waste pickers at negotiated prices. They accumulate the collected recyclables from multiple waste pickers and store them at their own premises.

Transport and Trade: Once the scrap dealers have accumulated a significant amount of recyclable materials, they organize the transportation of the materials to recycling companies or factories. This transportation can involve loading the materials onto trucks or other vehicles for shipment to the appropriate destinations.

Export to India: In some cases, the collected recyclable materials, especially certain types of plastics, metals, and paper, are exported to neighbouring countries like India,

where the materials are further processed and incorporated into the recycling industry in India.

It's important to note that the life cycle of solid waste in the informal sector may vary based on factors such as the type of waste, market demand, and specific arrangements between waste pickers, scrap dealers, and other actors.

2.6.3 Collection: between the Municipality and the private companies

The waste management system in Kathmandu faces significant challenges, as the city lacks a comprehensive network of rubbish bins. Instead, waste collection heavily relies on a fleet of garbage trucks that traverse the city at various times, responding to the random delivery of waste by residents upon hearing the trucks' horns or the drivers' loud whistles.

Kathmandu Metropolitan City (KMC) holds the primary responsibility for waste management in the city. KMC oversees the overall planning, policy formulation, and coordination of waste management activities. The city is divided into multiple administrative wards, each with designated areas for waste collection. However, due to the high population density and diverse mix of residential, commercial, institutional, and industrial zones, waste collection services are not available in every location. Therefore, the Municipality assumes responsibility for waste management in Kathmandu's central areas, including key highways and public spaces. Additionally, the Municipality handles waste collection from government buildings, hospitals, schools, and banks.

To facilitate waste collection, a portion of the waste management operations is outsourced by KMC to private companies. Approximately 31 private businesses are involved in the collection of solid waste within KMC. These businesses collectively collect around 407 metric tons of rubbish each day, accounting for approximately 79% of the total waste produced in KMC (City Planning Commission et al., 2020).

In most wards, private organizations provide door-to-door waste collection services and operate various collection checkpoints along rivers or roadsides twice a week. These

organizations employ notification methods such as sirens, whistles, or doorbell rings to inform residents of the waste collection schedule. However, it is important to note that there is generally no separation of biodegradable and non-biodegradable waste during collection. Waste collectors typically separate only a portion of recyclable materials at the processing facility or within the collecting trucks.

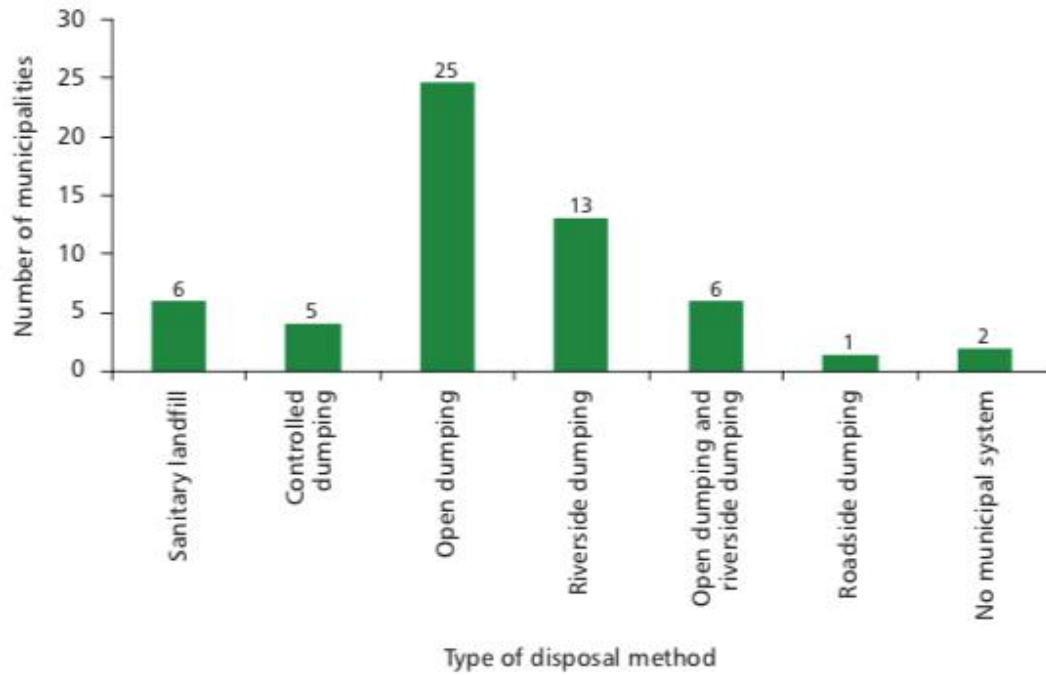
2.6.4 Transport and final disposal

The waste collection trucks operated by both the municipality and private companies are responsible for transporting the collected waste to designated disposal sites. The types of vehicles and equipment used for waste collection and transport vary across municipalities. Generally, rickshaws and carts are commonly used for primary waste collection, tractors for secondary collection or transport, and dump trucks for transportation to disposal sites (ADB, 2013).

In Kathmandu, the waste generated in the several wards is gathered and transported to the Teku Transfer Station. At this station, the waste is loaded onto larger vehicles and subsequently dumped at the disposal sites. However, the lack of a comprehensive transportation system poses challenges in managing proper waste transportation in urban and semi-urban settings. Moreover, the existing number of waste collection containers and transport trucks is insufficient to cater to the size of the population (Ghimire, 2008). Furthermore, the current waste disposal infrastructure in the city is inadequate to handle the increasing waste generation, exacerbating the issue.

Concerning waste disposal, many towns have yet to identify suitable locations for treatment facilities and sanitary landfills. As a result, garbage is currently dumped in open dumping grounds without proper treatment, endangering public health and causing environmental issues. Figure 8, from ADB's study (2013), illustrates the current methods of final waste disposal in the 58 surveyed municipalities. As many as 45 out of the 58 municipalities practice open dumping, including riverside and roadside dumping. Only six municipalities, namely KMC, Lalitpur, Pokhara, Ghorahi, Dhankuta, and Tasen, have established sanitary landfillsites⁸.

⁸ Tansen municipality started to operate a sanitary landfill site in October 2012 after construction of an access road. For Kathmandu and Lalitpur, a sanitary landfill site at Sisdol, Okharpauwa was constructed



Source: Asian Development Bank.

Figure 8 Types of disposal methods in 58 surveyed municipalities (ADB., 2013)

For KMC and neighboring municipalities, the Sisdol Landfill site in Nuwakot, located 26 km to the north-west of KMC, served as the landfill. However, the landfill has recently been declared out of use, and a new sanitary landfill at Banchare Danda, 2 km away from the previous site, has been constructed. The Sisdol and Banchare Danda dumpsites are also utilized by neighboring municipalities, including Banepa, Lalitpur Metropolitan City, and KMC. However, KMC and Lalitpur face challenges such as persistent local unrest, poor administration, and a lack of equipment and technical support. These issues contribute to unhygienic disposal practices and other environmental implications, including flooding, shallow water tables, highly permeable soil, and slope instability (ADB, 2013).

with grant funding from the Government of Japan and operated as a sanitary landfill site in the early stage of operation, although currently it is not operated as a sanitary landfill site. The sanitary landfill in Pokhara was financed by ADB. Landfills in Dhankuta, Ghorahi, and Tansen were financed by the municipalities, with technical support from the SWMTSC (ADB., 2013)

2.6.5 Special Waste Management

Special waste types, such as animal carcasses, construction and industrial waste, and hazardous or infectious waste from healthcare facilities, require distinct management approaches compared to regular municipal solid waste (MSW). Within the healthcare sector, hospitals often resort to incineration as a means of disposal for medical waste, although this typically involves burning the waste either in dedicated chambers or in open areas within the hospital premises (ADB., 2013). Unfortunately, the handling of medical waste lacks a robust system, and many hospital personnel, including medical staff, remain unaware of the potential impacts on patient health. Some hospitals, like Bir and a few others in Kathmandu, have taken steps to properly manage all forms of medical waste. However, none of the municipalities surveyed had an authorized slaughterhouse facility. Consequently, animal bodies are either buried or illegally dumped, with burial occurring at dumpsites, in remote forested areas, or adjacent to riverbanks (ibid.).

2.6.6 Issues concerning the privatisations of SWM sector

The privatisation of solid waste management in Kathmandu Metropolitan City is subject of several challenges and criticism as highlighted by various experts in the field.

Nabin Manandhar, spokesperson for KMC and chief of its ward 17, acknowledges the presence of a "big syndicate and politics" in waste management, where companies subcontract the task without proper agreements or government oversight. This lack of transparency and regulation raises concerns about the authority and jurisdiction of waste management companies. Manandhar questions how these companies operate with impunity and suggests that a strong hold on waste management territories limits competition (CIJ Nepal., 2023).

In the Center for Investigative Journalism article (2023) about the waste business in Kathmandu, Environmental expert Bhusan Tuladhar emphasizes that waste management is not a priority for the state. He points out the absence of a clear methodology for waste management and a lack of responsibility allocation. Tuladhar

observes that public services, including waste management, have become lucrative businesses, prioritizing profit over effective waste management practices.

The concerns expressed by these experts shed light on the complexities and shortcomings of privatized waste management in Kathmandu. The lack of oversight, unclear responsibilities, and profit-oriented approaches hinder effective waste management practices. It highlights the need for stronger regulation, better allocation of responsibilities, and a more proactive role from the metropolitan city to address the persistent waste management problem.

2.6.7 Dominance of the private companies

The dominance of private companies in the solid waste management system of Kathmandu Metropolitan City is evident from the information provided CIJ Nepal (2023).

These companies levy fees on households, shops, and businesses without any legal basis, setting their own rates based on their registration with the company registrar's office and local units. For example, 'Baneshwar Mahila Batabaran Sewa Pvt Ltd' collects waste from specific wards and charges its members monthly fees ranging from Rs450 to Rs10,000, depending on the quantity and type of waste collected. Similarly, 'Paribartan Sewa Samiti' collects the most significant amount of waste in the valley and charges fees based on the quantity of waste collected, ranging from Rs50 for a single shutter shop to thousands of rupees for larger establishments.

Private companies operate without a binding contract with the government, and there is no record of their financial earnings. The lack of regulation and oversight allows these companies to charge fees as they please, potentially evading taxes and operating as illegal enterprises. Local units and government agencies have not forged any formal agreements with these companies, with the metropolis only charging them for rented containers (ibid.).

The absence of clear regulations and formal agreements with private companies raises concerns about the accountability and transparency of the solid waste management

system. The unregulated practices of these companies indicate a significant gap in waste management governance, and the lack of action by the metropolis and stakeholders to address the situation is alarming. Efforts should be made to establish proper control mechanisms and ensure that private companies adhere to legal requirements and contribute to the efficient and sustainable management of solid waste in Kathmandu.

2.7 Resource and recovery methods

Resource and recovery methods in solid waste management refer to techniques and approaches aimed at extracting value from waste materials and maximizing their potential for reuse, recycling, or energy generation. These methods focus on minimizing the amount of waste sent to landfills and promoting a circular economy model where waste materials are treated as valuable resources.

In Kathmandu, as in Nepal in general, there are significant problems and limitations concerning resource and recovery methods in solid waste management. These challenges include insufficient infrastructure, limited segregation at the source, dominance of the informal sector, inadequate policy and regulation, low public participation, and a lack of financial resources

2.7.1 Recycling

The results of a residential garbage composition survey indicated that, excluding organic waste, more than 25% of household waste, as well as a significantly higher proportion of institutional and commercial waste, could be potentially recycled or reused (ADB, 2013). However, the majority of municipalities in Nepal, including the Kathmandu Metropolitan City (KMC), lacked a structured and organized recycling and reuse mechanism. After waste trucks unload the collected rubbish, some waste collectors engage in the separation and sale of recyclable materials to recyclers or *Kabadi centers*⁹, while other businesses extract valuable recyclables for their own use.

⁹ Kabadi centers in Kathmandu are informal establishments where waste pickers and scavengers sell the recyclable materials they collect from the streets and households such as plastic bottles, paper, cardboard, metals, and other recyclables. At the Kabadi centers, the collected items are weighed, sorted, and

At the vehicle or transfer point, approximately 23% of the 407 metric tons of waste collected by private companies undergo recycling, while the remaining 77% is transported to landfills (City Planning Commission et al., 2020). Despite some recyclable materials being sold to formal waste management businesses or the informal sector, a significant amount of recyclable material is still indiscriminately dumped on streets and ultimately ends up in landfills.

Several organizations and NGOs in Kathmandu, such as Khalisisi.com, Doko recyclers, Nepsemyak, Blue trash to Value, Pariwartan Sewa, Practical waste Solution, Sirjanship Sewa, Clean Nepal, Environment Conservation Initiative, women's groups, and many others, are actively involved in recycling initiatives to address this issue.

2.7.2 Composting and organic waste management

Despite the predominance of organic waste in Nepal's urban areas, the effective management and composting of this waste remains minimal. In the case of Kathmandu, a limited number of households engage in composting their organic waste. Previously, the municipality established the Bhaktapur Compost Plant, which successfully composted approximately 10% of the city's waste. However, due to technical challenges, the plant has ceased operations. To address the management of organic waste, the Kathmandu Metropolitan City (KMC) constructed a waste-to-energy plant at the Teku transfer station in November 2016 with support from the European Union (EU). This plant processed three metric tons of solid organic waste daily and generated 14 kilowatts of electricity. Unfortunately, the plant faced operational issues and is currently non-functional.

2.7.3 Waste to energy in Nepal

Waste-to-energy is a solid waste management process that involves converting solid waste into usable forms of energy, such as electricity, heat, or fuel. It aims to reduce landfill volumes while harnessing the energy potential of the waste. Various technologies, including incineration, anaerobic digestion, gasification, and landfill gas

purchased by the center owners or agents representing recycling industries. It is important to note that Kabadi centers operate without formal registration or official recognition from regulatory authorities.

recovery, can be employed to extract energy from organic and combustible waste components. Waste-to-energy plays a crucial role in sustainable waste management by minimizing environmental impacts, reducing landfill space requirements, and generating renewable energy.

In Nepal, waste-to-energy initiatives have been considered as a potential solution to address the country's solid waste management challenges. However, their effectiveness has been limited, as observed in other developing countries as well (Khan et al., 2022). Despite initial expectations, waste-to-energy projects have faced significant hurdles and have fallen short of delivering the desired outcomes in Nepal.

The article "Waste to Energy in Developing Countries" (2022) provides a comprehensive overview of the variations in waste-to-energy practices between developed and developing countries. It examines waste composition and management practices in South Asia and Sub-Saharan Africa, highlighting the prevalence of organic waste and low proportions of recyclable components in these regions. The article addresses the increasing waste generation, common open dumping practices, and lower waste collection rates compared to developed countries. It emphasizes that higher-income countries with better waste collection rates tend to adopt advanced waste-to-energy technologies, while incineration is considered unsuitable due to cost, inefficiency, and environmental impact. Instead, the article suggests anaerobic digestion as a more appropriate waste-to-energy solution, given the dominance of organic waste in developing countries. It focuses on the challenges and opportunities in waste-to-energy generation in the developing world, emphasizing the need for proper implementation guidelines.

In Nepal, waste-to-energy projects face significant challenges, including high implementation costs. The expenses associated with infrastructure development and equipment acquisition have proven to be prohibitively expensive, limiting the adoption of waste-to-energy initiatives to a few industries (ibid.). Additionally, the purification and refinement of methane gas derived from waste pose challenges due to impurities, further diminishing the cost-effectiveness of such projects. As stated by Hitesh Raj

Pant, founding member of Nawa Paila¹⁰, during one interview, the lack of consumption options for the energy produced is another hindrance, as the market for waste-to-energy products remains underdeveloped compared to readily available alternatives such as LPG gas, electrical energy, or petroleum gas. The overall input and processing costs outweigh the benefits obtained from the end product, creating an unfavourable economic situation that hampers the success of waste-to-energy initiatives in Nepal.

To overcome these challenges, a multi-faceted approach is necessary. This includes providing financial incentives, policy support, capacity building, and public awareness campaigns (ibid.). Collaborations between government agencies, private sector entities, and community stakeholders are crucial for finding more cost-effective solutions. Additionally, proper waste management strategies, technology selection based on waste composition, sufficient financial resources, and comprehensive policy development are vital for achieving sustainable waste management and energy recovery in Nepal.

¹⁰ Nawa Paila is an independent, non-profit motive organization registered in Nepal and mainly focused in the field of water, sanitation and hygiene (WASH)

CHAPTER THREE: FIELD RESEARCH

3.1 Waste Management initiatives in Kathmandu

The content of this chapter delves into the various entities and initiatives that I had the privilege of engaging with during my field research conducted in Kathmandu between March and April 2023. These local realities and initiatives, which are instrumental within the Kathmandu context, aim to address and further explore the inquiries and aspects left open in the preceding literature review section. By presenting these on-the-ground realities, this chapter aims to not only support the response to the research questions posed in this thesis but also to verify, through direct observation, the validity of the hypotheses formulated within this work.

The case studies and entities to be showcased in this chapter serve as crucial pieces in the puzzle of understanding the intricate dynamics of informal waste workers in Kathmandu and the integration efforts in place. These real-world examples hold the potential to illuminate, substantiate, or challenge the assertions made in the preceding sections. By delving into these local experiences, we can gain valuable insights into the practical implications of policy measures, social initiatives, and cooperative efforts, providing a tangible link between theoretical concepts and on-the-ground realities. This triangulation of theoretical frameworks, literature findings, and field research results establishes a robust foundation for a comprehensive analysis of the subject matter at hand.

3.1.1 Paramva Biotech Nepal

During my field research in Kathmandu, I sought to broaden my understanding of waste management beyond the limited scope of municipal efforts. My objective was to explore companies and initiatives actively involved in composting, aiming to gain insights into the practical application of recycling practices within the city. This approach was essential to address gaps in the municipal waste management system and to comprehensively examine the effectiveness of such initiatives. One of the companies I had the privilege to personally meet and interview is Paramva Biotech Nepal.

Established in 2011 by three biotech graduates from Kathmandu University, Paramva Biotech Nepal has emerged as a prominent player in the realm of waste management solutions, with a specialized focus on composting and vermicomposting. The company's mission aligns with diverting organic waste from landfills, reducing environmental pollution, and promoting sustainable resource utilization in agriculture and soil enrichment.

One of the central initiatives of Paramva Biotech Nepal is their emphasis on vermicomposting, a method that employs earthworms to decompose organic waste and produce high-quality vermicompost. Their approach involves setting up vermicomposting units and providing guidance on best practices for utilizing vermicompost in various applications, such as agriculture and horticulture. This approach not only demonstrates their commitment to sustainable waste management but also highlights their efforts to bridge the gap between waste management and resource utilization.

Mr. Ashok Kumar Bhattarai, the director of Paramva Biotech Nepal, shared invaluable insights during our interview, shedding light on the company's journey, challenges, and innovative initiatives. The company initially faced challenges when dealing with green waste from Kalimati market, highlighting issues with sourcing, relationships, and waste perception in the community. However, they successfully shifted their focus to cattle waste, specifically cow dung, as the primary raw material for their vermicomposting operations. This shift allowed them to address challenges while contributing to sustainable waste management.

One of the remarkable projects introduced by Paramva Biotech Nepal is the Smart Bucket, an innovative approach to solid waste reduction at the source, particularly focusing on the significant proportion of organic waste in the overall waste composition. The Smart Bucket functions as a two-bucket system, with the first bucket acting as a filter with legs. Users are instructed to place their kitchen waste in this bucket and add a specially designed decomposer containing decomposing microbes, a teaspoon at a time. This 20-liter bucket can hold kitchen waste for approximately 20 to 25 days, and for each addition of green waste, two spoonfuls of the decomposer are added. After a week, the decomposing microbes initiate the breakdown of the waste, resulting in the production of leachate, a nutrient-rich liquid byproduct.

To utilize the leachate, it should be drained and diluted with water at a one-to-two ratio. This diluted liquid can then serve as a fertilizer for gardens or flowerpots, promoting sustainable agricultural practices. Once a week, the first bucket is opened, and the leachate is collected. When the second bucket is needed, the same procedure is followed. When it is full, typically taking around 49 to 50 days, more than 90% of the organic waste in the first bucket has decomposed. The 90% decomposed organic matter can be transferred to a cardboard box placed on soil, allowing the moisture to evaporate. Any remaining material can be added to this box. This composting process yields both compost and liquid fertilizer that can be utilized.

Despite its simplicity and ease of implementation, the Smart Bucket holds immense potential to bring about significant and transformative changes in solid waste reduction at the source, considering the substantial proportion of organic waste in the overall solid waste composition. However, the collaboration with the larger Kathmandu municipality has faced obstacles due to bureaucratic constraints. This lack of coordination and collaboration among stakeholders hampers effective solid waste management efforts and prevents the implementation of innovative solutions proposed by companies like Paramva Biotech Nepal.

3.1.2 Doko Recyclers

Among the waste management entities that I had the privilege to encounter during my field research in Kathmandu there is Doko Recyclers. Doko Recyclers addresses the pressing issue of inadequate waste management in a region where daily waste generation has reached a staggering 1000 tonnes, with a significant portion ending up in landfills or being incinerated due to inconsistent recycling practices and an informal waste management landscape.

Doko Recyclers firmly believes in the fundamental principle of source separation as the cornerstone of effective waste management. Collaborating with various institutions and homes across Kathmandu, the company provides critical support in establishing essential infrastructure for waste segregation while conducting comprehensive garbage separation training. The company's commitment to waste management extends to

collecting segregated waste from its partners and further processing it before distributing it to recycling facilities across Nepal.

Beyond waste collection and segregation services, Doko Recyclers is actively engaged in raising waste awareness through workshops targeting a diverse range of entities including institutions, schools, corporations, restaurants, and hotels. This proactive approach educates these stakeholders about the critical importance of recycling and the substantial benefits derived from waste segregation. As a result, the impact of Doko Recyclers' initiatives has been felt across the region, with an increasing number of households and institutions participating in their comprehensive waste management programs.

An area of paramount concern for Doko Recyclers is the management of electronic waste (e-waste), given the significant health and environmental hazards associated with improper disposal. In response, the company launched ewastenepal.com, an initiative aimed at increasing awareness about e-waste and providing a responsible disposal solution for electronic devices.

To address waste items that cannot be recycled, such as glass, Doko Recyclers introduced Tatwa, an innovative upcycling venture. Tatwa creatively repurposes waste materials into a diverse range of recycled items, showcasing waste as a valuable resource and fostering a culture of sustainability.

Doko Recyclers is also proactive in tackling the organic food waste challenge, which constitutes a considerable portion of household waste. In collaboration with BioComp Nepal and Paramva Biotech, the company launched the Smart Bucket, a user-friendly home composting device. This solution empowers households to transform organic waste into handmade organic compost for agricultural use.

A fundamental belief of Doko Recyclers is that waste separation should be mandatory at individual, household, and commercial levels. The company's comprehensive waste management solutions play a pivotal role in promoting the growth of a green and sustainable circular economy, contributing to a cleaner and healthier Kathmandu.

3.1.3 Blue Waste to Value

During my field research conducted in Kathmandu between March and April 2023, I had the privilege of meeting and interviewing Blue Waste to Value (BW2V), a notable social enterprise that has been actively addressing the pressing trash management issues in the Kathmandu Valley since its establishment in July 2014. Recognizing the urgency of waste management due to the region's increasing urbanization, BW2V emerged as a cohesive effort to develop proper waste management systems and processes for the people of the Kathmandu Valley.

At the heart of BW2V's mission is the goal to maximize the value derived from trash, advocating for recycling, reducing landfill waste, and creating employment opportunities in the green sector. Registered as a Private Limited Company with the Ministry of Industry, BW2V effectively utilizes Government Public-Private Partnership policies to implement diverse projects and foster collaborations with like-minded individuals, organizations, and commercial establishments, all aimed at introducing sustainable waste management practices.

The comprehensive scope of BW2V's responsibilities encompasses pickup, segregation, processing (reuse and recycling), logistics and disposal services, and even door-to-door garbage collection. Their trash management approach is marked by inclusion, ensuring the consideration of all stakeholders' interests within the waste management business. Employing a participative model, they synergize technical, financial, and managerial resources while actively involving local stakeholders.

A prominent area of focus for BW2V is e-waste, where they collect electronic waste from various sources, process it for resource recovery and environmental protection, and raise public awareness about the importance of reusing and recycling electrical and electronic products. By transforming end-of-life electrical and electronic products into recycled raw materials, BW2V aspires to contribute to the concept of a circular economy.

In addition to their core waste management services, BW2V offers a range of products derived from their waste management programs. Their Urbara compost, created from organic waste collected through various initiatives, is highly valued by farmers, gardeners, and plant growers due to its nutrient-rich characteristics. Introducing the "Kabaadi At Your Door Step" smartphone application is another innovative step,

enabling customers to connect with qualified scrap dealers and facilitating scrap collection and recycling operations.

Furthermore, BW2V is actively engaged in recycling paper waste, transforming it into useful products like office supplies, envelopes, bags, cards, and even jewelry. This endeavor is noteworthy for its social impact, as BW2V employs and trains specialized women's groups, including earthquake survivors and differently-abled women, demonstrating their commitment to equitable development.

In conclusion, Blue Waste to Value (BW2V) represents an innovative social organization that is tirelessly committed to generating value from trash. Their efforts involve developing effective waste management systems, promoting recycling, reducing landfill waste, and creating valuable green jobs.

3.1.4 *SASAJA Cooperative*

Among the stakeholders I interviewed in the diverse landscape of solid waste management, I had the opportunity to engage with the Sasaja Cooperative, including both its leadership and the informal waste workers who are part of this cooperative. The objective of these interviews was to explore the cooperative's role in the solid waste management of Kathmandu, particularly focusing on the significant topic of formalizing the informal waste workers, as discussed in the literature review.

The Samyukta Safai Jagaran (SASAJA) Cooperative was established in 2014 as a non-governmental, non-profit, and non-political organization, with a primary focus on the rights, advocacy, and recognition of Informal Waste Workers (IWWs). SASAJA seeks government acknowledgment of the crucial role played by IWWs in waste management and aims to provide them with access to social health insurance. The cooperative was funded to offer monthly educational sessions to its members, with a specific emphasis on solid waste management, credit, and savings. One of the noteworthy achievements of the organization is the formation of the cooperative itself, named the "Samyukta Safai Jagaran Saving and Credit Cooperative," which has brought together approximately 1000 members from the informal waste worker community, united by the common objective of addressing the rights and well-being of informal waste workers.

The Samyukta Safai Jagaran (SASAJA) Saving & Credit Cooperative Ltd. operates

offices in Mayalbari, Teku, and Kathmandu within Nepal's Metropolitan City. The cooperative's mission is to empower informal waste workers by creating a unified network and a significant organization aimed at enhancing their quality of life. The cooperative envisions providing sustainable financial support to IWWs, leading to improved social and economic conditions. Any waste worker can open an account by providing a copy of their citizenship for verification and record purposes. Members and shareholders are eligible for various types of savings with specific interest rates, and they can also avail loans as needed, with interest rates ranging from 15% to 18%.

The financial empowerment programs offered by the SASAJA cooperative are strategically designed to uplift IWWs by addressing the multifaceted challenges they face, such as unemployment, poverty, limited access to healthcare and education, and low income. Through programs that encourage savings, enhance loan accessibility, and provide support during difficult times, the cooperative aims to enhance the financial security of IWWs. Additionally, the cooperative places a strong emphasis on boosting the esteem and visibility of IWWs within their communities, acting as a robust support system that genuinely cares about their welfare. The cooperative's collaboration with the PRISM project seeks to empower IWWs for a more sustainable future, making a positive impact in their lives by pursuing these goals.

3.1.5 PRISM Project

During my field research in Kathmandu, I had the privilege of engaging with a diverse range of stakeholders in the vast landscape of solid waste management. Among these stakeholders, a noteworthy encounter was with the Samyukta Safai Jagaran (SASAJA) Cooperative, which comprised informal waste workers integral to the cooperative's functioning. This interaction served as a gateway to explore the cooperative's role in the solid waste management of Kathmandu, particularly in the context of formalizing the informal waste workers—an aspect previously addressed in the literature review. It came to light, through conversations with the informal waste workers, that the cooperative had a significant connection with the PRISM (Poverty Reduction of Informal Workers in Solid Waste Management Sector) project, a pivotal actor in the cooperative's establishment. Subsequently, I conducted a comprehensive bibliographic

investigation of the PRISM project to gain deeper insights into its content and influence on the cooperative's formation.

Objectives of the project:

The PRISM project's primary objectives encompassed several key aspects:

- **Improvement of Economic Empowerment:** The project aimed to enhance the economic status and living conditions of unorganized workers in the solid waste management industry.
- **Enhanced Working Conditions:** A key focus was on improving the working conditions and ensuring the health and safety of IWWs.
- **Integration into Formal Waste Management:** PRISM worked to foster the inclusion of informal waste workers within the formal waste management system.
- **Overall Well-Being:** By enhancing the well-being of informal waste workers and their families, the project aimed to reduce poverty and enhance the effectiveness and sustainability of waste management practices in Kathmandu Valley.

Stakeholders:

A diverse set of stakeholders played vital roles in the PRISM project within Kathmandu Valley. The project was coordinated by the NGO Practical Action, with substantial financial support from the European Union. The Centre for Integrated Urban Development (CIUD) was a significant collaborator, and the main beneficiaries and focal point were the informal waste workers and their representation organizations. The involvement of local citizens and communities was also emphasized during the project's implementation, aiming to spread knowledge and garner support for the effective execution of various activities.

The PRISM project initiated several critical actions to support informal waste workers and enhance their standards of living and social standing. These actions included the establishment of the waste pickers' organization Samyukta Safai Jagaran (SASAJA) Cooperative, social protection programs, health care services, child protection initiatives, women's protection through Community Resource Centres (CRCs), savings and credit mobilization plans, preventive health care and safe equipment programs, and efforts for recognition and issuance of identification (ID) cards. The PRISM project's

comprehensive approach aimed to empower informal waste workers, create a more inclusive society, and contribute to a sustainable and equitable waste management system in the Kathmandu Valley.

3.2 Methodology and research design

3.2.1 Introduction to the research

My field research took place between March and April 2023 in the Kathmandu Valley, a densely populated area of Nepal and therefore a rich place to explore the topic of urban waste management, addressing local issues, challenges and alternatives. Prior to immersing myself in the Nepalese context, I had a knowledge of waste management issues in developing countries focused especially on aspects of environmental inequalities.

However, during the documentation process, I realised the vastness and complexity of the problem. Initially, my thesis project had a more specific approach and was oriented towards project aspects related to waste disposal. But the analysis of the context and issue of urban waste management opened my eyes to a number of elements: the actors involved, cultural factors, socio-political and cultural characteristics of Nepal, and how these influence the waste problem.

This change of perspective, although initially a challenge, was essential. Dealing with such complex and varied issues in a context so distant and different from my home reality required a different approach. My desire was not to take many aspects and issues related to waste management for granted, but to examine them at first hand, thoroughly understanding the situation before making solutions or suggestions. This approach was the starting point for my research, which was then expanded and shaped in response to the complexity of the Nepalese context.

After extensively studying population growth, urbanization in the Kathmandu Valley, and the challenges linked to increased waste generation and its proper management, I recognized the necessity of a comprehensive exploration of the waste management system. My goal was to engage with all the key actors within the hierarchy of waste

management in Kathmandu, gathering as much information as possible before proposing any solutions.

During this process of understanding and analysis of the intricate urban waste management situation in Nepal, I uncovered a facet that often eludes conventional statistics: the informal waste management sector and its workers, commonly known as 'waste pickers'. Throughout the field research, I actively sought to connect with these individuals, aiming to comprehend their roles, stories, difficulties, and every aspect related to their marginalized social status.

This discovery added a qualitative dimension to my thesis, creating a significant link to direct research and uncovering alternative realities and positive examples that could contribute to Nepal's current situation, not only from environmental, health, and urban perspectives but also in terms of social and human rights considerations.

The research and documentation regarding the significance and characteristics of the informal waste management sector in Nepal were crucial, as they shed light on the value of informality within this specific context and geographic region, a point emphasized by numerous studies.

Furthermore, the exploration of informal work in the waste sector introduces new possibilities, including the potential integration of this sector as a valuable resource in the search for solutions to the prevailing challenges.

3.2.2 Research questions and hypothesis

In line with my thesis's overarching goal of delving into the complexities of the Kathmandu Valley's solid waste management system, comprehending its challenges, and exploring existing alternatives and prospects for formalising the informal sector, the following hypotheses underpin my research:

Hypothesis 1: Bringing the informal waste sector in Nepal into a formal framework could profoundly improve waste management, yielding substantial benefits for society, the economy, and the environment.

Hypothesis 2: The introduction of multiple alternatives and initiatives is predicted to create significant positive changes in the existing waste management landscape, paving the way for potential long-term solutions.

To investigate the viability of these theories, I designed a comprehensive field study technique that evaluates the relevant aspects. The following research questions lead the investigation framework and connect the research objectives to the study's major themes:

Question 1: How does the solid waste management system work in its various phases?

Objective: Gaining a comprehensive comprehension of the present waste management procedure, pinpointing obstacles and identifying areas with potential for enhancement.

Research Question 2: What factors influence the operation of Nepal's informal waste management sector?

Objective: Uncover the intricacies of the informal waste sector, shedding light on its strengths, weaknesses, and role within the larger waste management framework.

Research Question 3: How does the perception of informal waste workers, both within society and among institutions, impact their social status and well-being?

Objective: To explore the societal and institutional perspectives on informal waste workers, examining how these views impact the workers' overall quality of life and well-being.

Research Question 4: Are there any current programs or measures designed to formalize the informal waste sector?

Objective: Identify and evaluate the effectiveness of ongoing endeavors or initiatives aimed at bringing the informal garbage sector into a formal framework.

Research Question 5: What are the many initiatives, whether started by commercial, non-governmental, or public actors, that are existing in the context to improve the solid waste management scenario?

Objective: To build an inventory of activities and solutions addressing waste management concerns and evaluate their potential impact

By investigating these research questions, I hope to not only contribute to a better understanding of the complexities of waste management in the Kathmandu Valley, but also to provide insights into the prospects of formalising the informal sector, thereby fostering positive changes on multiple fronts.

3.2.3 Research approach

Within the scientific community, there has long been a discussion about whether to use qualitative or quantitative research methodologies to solve social issues. Both systems provide distinct methods for collecting and analysing data, each with its own logic and strengths. Whatever technique is used, both emphasise the necessity of "explaining phenomena" (Muijs, 2004, p. 7). In social science research, quantitative research adheres to positivist principles, whereas qualitative research is based on interpretivist assumptions (Bryman, 2012).

The qualitative methodology is exceptionally well-suited for the specific context of this dissertation, which centers on solid waste management (SWM) in the Kathmandu Valley. Qualitative research delves deeply into a phenomenon, aiming to achieve a comprehensive understanding.

Considering the intricacies of the SWM challenge in the Kathmandu Valley, including the intricate interplay between formal and informal sectors, cultural significance, and potential paths toward sustainable management, the qualitative research approach aligns with the study's objectives. The qualitative method's ability to provide rich narrative descriptions of individuals' experiences concerning the research problem is very relevant. This methodology enables researchers to view the subject matter through the perspectives of the individuals directly engaged (Bryman, 2012).

Although some critics point out potential limitations of qualitative research, such as its small scale and non-representativeness, which may make it challenging to apply findings beyond the specific case under investigation (Grix, 2004), it's essential to recognize both its strengths and weaknesses. Bryman (2012) argues that qualitative research lacks replicability, generalizability, transparency, and can appear subjective.

However, the qualitative approach is particularly well-suited for the present study's objectives, which involve unraveling the complexities of solid waste management (SWM) in the Kathmandu Metropolitan area and shedding light on sustainable practices and the potential formalization of the informal sector.

Considering the diverse aspects of solid waste management in the Kathmandu Valley, including complex social connections, cultural elements, and sustainability concerns, the qualitative research approach fits well with the research goals. Qualitative methods can provide a deeper understanding that quantitative approaches may struggle to capture fully, as they delve into the intricacies of the phenomena and explore interconnected dynamics.

This dissertation uses a case study method to analyse the issue of solid waste management in the Kathmandu Valley within its actual real-life context. This choice follows the recommendations of Yin (2003) and takes advantage of the case study's ability to answer "why" and "how" questions, supporting exploratory, descriptive, and critical interpretations of data (ibid).

The key strength of the case study approach lies in its capacity to deeply investigate real-life phenomena through extensive assessments of events, situations, and their interrelationships (Yin, 1984).

In this dissertation, we use a case study approach to examine and validate research hypotheses about formalizing Nepal's informal waste industry and the potential positive changes this formalization might bring to waste management practices. This approach, which focuses on a single detailed study is the right decision when dealing with issues specific to a particular location, which is the case with the solid waste management challenge in Kathmandu.

3.2.4 Selection of the study site

Kathmandu Valley, specifically the Kathmandu Metropolitan City (KMC), was chosen as the primary research site due to several compelling factors. KMC's unique status as a vanguard in Nepal's urbanization trajectory, as illustrated in (mention imagine), played a pivotal role in this selection. The city has undergone a significant shift in its waste

generation patterns over time, mirroring the impacts of urbanization and evolving waste compositions (Sharma., 2022). This transformation positions it as an exemplary case study, offering pertinent insights for other rapidly expanding urban centers in Nepal.

The selection of Kathmandu is also motivated by its significance as Nepal's gateway to the Himalayas and its status as the sole international airport hub in the country. This distinct context underscores the critical importance of effective waste management, particularly considering the historical challenge of waste accumulation during the 1990s, which adversely affected the city's aesthetics and had substantial repercussions on the tourism sector (ibid). This trend aligns with existing research that highlights the detrimental effects of inadequate waste management on economies reliant on tourism (Henry et al., 2006).

Kathmandu is one of the fastest-growing cities in South Asia, but its waste management struggles to keep up with this rapid urban expansion. The main landfill site serving multiple nearby areas is causing significant concerns, particularly because it should have closed already and local residents are opposing its operation.

The complexity of waste management in Kathmandu is increased by the involvement of a significant number of informal waste workers, estimated to be between 15,000 and 20,000 (Practical Action, 2014). Additionally, being Nepal's capital, Kathmandu brings together various authorities with considerable resources.

This complex interaction among governing bodies creates a unique situation to study how the city works and deals with issues, with garbage management being a constant focus for the public.

In short, I chose the Kathmandu Valley, with a focus on the Kathmandu Metropolitan City, because it's a leading example of urbanization in Nepal, has changing waste patterns, plays a vital role in tourism, is growing quickly, has complex waste management systems, involves many informal waste workers, and has a unique governance structure due to its capital status. This choice aligns with the research goal of exploring different aspects of solid waste management.

3.2.5 Data collection methods

This study gathered data using a qualitative approach, which aims to understand and analyze real-life situations by exploring the meanings given by people (Denzin & Lincoln, 2002).

A diverse method was employed to obtain primary data. Initial information was obtained through the comprehensive recording of papers, texts, national and international reports, studies, and current literature. Following that, the field-observation technique was employed to engage with various stakeholders in the solid waste management sector. This allowed for a more comprehensive understanding of their roles, viewpoints, and dynamics within the setting. Semi-structured interviews were utilized to offer a personalized approach, enabling adaptive questioning and responsive investigation of the participants' diverse perspectives.

Secondary data were drawn from a collection of pre-existing documents, texts, and reports to supplement primary data. These sources provided useful reference points both before and after the field research, aiding in the development of the research technique and offering important insights into the study's intents and objectives. Secondary data included a wide range of qualitative and quantitative information, ranging from surveys to graphs and charts, all of which contributed to a thorough grasp of the issue.

A variety of data collection methods were employed in accordance with the notion that mixing multiple procedures might strengthen research conclusions through mutual corroboration (Bryman, 2004). The synthesis of diverse data collection methodologies was aimed at providing a more comprehensive perspective, allowing for the acquisition of in-depth insights from the numerous parties involved in the solid waste management system of the city.

3.2.6 Sampling method

This study's data collection phase took place during March and April 2023 in the Kathmandu Metropolitan City. During this time, a diverse group of stakeholders were interviewed, including the Lalitpur Municipality's environmental officer, the head of the Lalitpur Metropolitan City Office of Solid Waste Management centre, the CEOs of Blue Waste to Value (a social enterprise), and a vermicompost enterprise. In addition, a

professor from Kathmandu's Engineering Study and Research Centre, the founder of a renewable energy company in Nepal, an associate professor from Tribhuvan University, the community mobilizer of a local waste pickers cooperative, nine informal waste workers in various roles (Teku transfer station, landfill site, itinerant), and a founding member of a Nepalese NGO focused on WASH and a social venture dedicated to recycling in Bhaktapur were also interviewed.

In this study, a mixed sampling approach was employed to address the challenges posed by constraints such as time limitations, information accessibility, and available contacts. This hybrid strategy combines elements of intentional (purposeful) sampling with probabilistic sampling to comprehensively capture the diverse landscape of stakeholders in Kathmandu's solid waste management.

Initially, a network of relevant contacts, organizations, and businesses was established, facilitating a purposive selection of specific individuals and groups, thereby ensuring the inclusion of stakeholders crucial to the study's objectives. This approach allowed for targeted interviews, enabling the exploration of key insights and local contexts that might have remained inaccessible through independent remote investigation.

In addition to the intentional sampling component, a probabilistic sampling approach was applied, especially in the selection of informal workers for interviews. This aspect introduced an element of chance, as the participants were drawn from those accessible through established contacts, geographical considerations, and shared language proficiency, with effective communication facilitated by an accompanying interpreter.

The mixed sampling approach adopted in this study acknowledges the complexity of the research context, enhancing the richness of the collected data. This dual structure, comprising intentionally selected stakeholders and those chosen through a probabilistic method, provides a more comprehensive representation of diverse socioeconomic, cultural, and professional backgrounds, thus forming unique links within Kathmandu's solid waste management network. Consequently, the findings from this study possess a degree of representation and offer potential insights with broader implications, contributing to a more nuanced understanding of the challenges and opportunities within the field.

3.2.7 Semi-structured interviews and observation

I gathered data for my research by conducting in-depth interviews with various people involved in waste management. This included municipal representatives, NGOs, informal garbage workers, waste experts, and social enterprises. Before starting the interviews, I made sure my questions would work well in the Nepalese context by getting feedback from my supervisor and a local university professor. This helped me tailor the questions to the diverse backgrounds of the interviewees, which included people from different sectors like public, commercial, social enterprise, and NGOs.

The interviews were semi-structured, meaning they allowed for flexibility in the conversation, based on the interviewee's skills and observations. Since the topic and setting were different from what I was used to, I conducted most of the interviews in English. However, for some participants who spoke Nepali or Hindi, I used an interpreter. I made sure to explain my research goals to each interviewee and got their consent for recording.

I selected participants using purposive sampling, based on their ability to provide important insights about the city's waste situation. This approach helped me capture diverse and to find common themes and patterns. By including actors from both formal waste management systems and the informal sector, purposive sampling and semi-structured interviews together gave a complete picture of the complex waste management situation in the Kathmandu Metropolitan City.

In addition to conducting interviews, I also used a comprehensive observation method in my field research in Kathmandu. According to Marshall and Rossman (1989), observation means systematically recording actions, behaviors, and things in the chosen social setting that is the focus of the study. This method was essential for collecting data, allowing me to directly analyze real events in the city's solid waste management.

My observation covered the entire process of garbage management, from daily collection to transportation, sorting at the collection center, and final disposal at the dump. This method gave me insights into how garbage management works in the city.

During the observation, I focused on actions that often go unnoticed by the public, like street trash, dumping along the riverfront, and open-air rubbish burning. I made sure to

observe discreetly, without being intrusive, to capture the true reality of trash management procedures. I also observed informal garbage workers at transfer stations and dump sites to understand the sector better, which was challenging because of the difficult accessibility and conditions of such places.

I took pictures of the garbage bins, storage facilities, transportation methods, and disposal sites as part of documenting my observations. This visual documentation added valuable insights to what I learned from interviews and document studies.

3.2.8 Challenges and limitations

In this section, I will discuss the limitations and challenges that have undoubtedly impacted the accuracy and reliability of my research. Recognizing these inherent weaknesses is essential for a critical examination of the findings and conclusions of this study.

Time constraints have inevitably restricted the comprehensiveness of this study. The two-month period for data collection, from March to April 2023, was insufficient to fully immerse themselves in the complex cultural environment of the Kathmandu Valley. Understanding the intricate dynamics of this context, especially concerning solid waste management, required more time and effort.

Looking back, I can see how my initial understanding of the subject and the surrounding circumstances significantly improved as the fieldwork progressed, highlighting the limitations imposed by the time constraint. It's important to acknowledge that, due to these time limitations, my perspective, perception, and the formulation of research questions might have been influenced by a restricted grasp of the broader context. Recognizing these inevitable time constraints, it's crucial to consider the potential for bias in this research.

During the data collection process, I encountered a significant limitation in the form of limited access to official data from Nepalese institutions. My attempts to gather comprehensive and reliable data revealed a substantial information gap in critical areas. There were insurmountable challenges preventing me from accessing essential data,

including waste route maps, the organizational structure of wards concerning municipal collection services and private businesses, documentation of waste management concessions tenders, and up-to-date statistics on waste generation at the household and institutional levels.

The few official documents I could access mainly consisted of reports authored by commercial companies, governmental or non-governmental organizations, as well as international organizations. Additionally, I faced challenges such as government officials being reluctant to provide documents on their latest plans and programs, redirecting me to other officials to find the information.

On a positive note, I did receive valuable assistance through interactions with professors and researchers, who generously shared scientific papers and insights through personal conversations. However, this data accessibility constraint underscores the difficulty of relying solely on secondary sources, which could introduce potential biases and limit the overall comprehensiveness of the study.

The data collection process encountered significant challenges when it came to securing interviews with respondents from various sectors, including government agencies, businesses, and the informal waste industry. Before my arrival in Kathmandu, many potential interviewees only partially responded to the initial email requests. This compelled me to build a network of contacts based on the few connections I already had. These contacts then facilitated introductions to the appropriate individuals or shared their phone numbers for direct conversations. Setting up appointments often required in-person interaction, leading to frequent delays that consumed valuable fieldwork time.

Engaging with informal waste collectors and scrap dealers proved particularly challenging. Scrap dealers were hesitant to disclose their procedures due to concerns about government inspection and potential tax consequences. Despite my efforts, I couldn't secure interviews with any scrap sellers due to these concerns and the difficulties in finding a suitable day for all parties involved. Additionally, conducting interviews with informal waste workers presented its own set of obstacles, including

access issues and language limitations. These workers often struggled to find time for interviews, given their responsibilities in sorting trash.

The environment during some interviews, characterized by strong odors and constant noise from large waste vehicles, added extra difficulties. Nonetheless, I managed to arrange a few interviews in quieter, safer locations near their workplaces to create a more conducive atmosphere for meaningful discussions.

The challenges faced during data gathering were further compounded by logistical issues. Navigating through Kathmandu's transportation system proved to be a significant challenge due to regular traffic problems and congested roads, especially when trying to reach the landfill site where road conditions were poor. These logistical challenges frequently resulted in longer than expected data collection times, impacting the efficiency of the process.

A major hurdle encountered in the data collection process was the language barrier. While I conducted interviews with municipality residents in English, it became apparent that some respondents had difficulty fully expressing themselves in the language. This language barrier naturally limited the depth and comprehensiveness of the information I could gather from these interviews. To bridge the linguistic gap with Indian waste workers and individuals within the cooperative, I took the help of a young Nepalese translator who was also fluent in Hindi. The translation was done on-site and in real-time during the interviews, leading to some nuances or details being omitted to maintain the flow of conversation. To compensate for this, I recorded the entire interpretation process to ensure no crucial details were overlooked. However, it's important to note that the interpreter's lack of familiarity with the intricacies of informality and solid waste management may have influenced how the interviewee's comments were reported.

Throughout the interviews, I couldn't help but observe signs of weariness among the informal garbage workers. They seemed to have engaged with various surveyors in the past without seeing tangible outcomes that addressed their concerns. This apparent frustration may have hindered their full participation in the interview process. These sentiments highlight the importance not only of collecting data but also of ensuring that research conclusions lead to meaningful and valuable improvements in the lives of the

individuals under examination. Recognizing and respecting these sentiments is crucial for researchers.

3.2.9 Ethical Considerations and positionality

Ethical considerations hold significant importance in all research endeavors, but they are particularly crucial in qualitative research, which delves into the exploration and description of individuals in their natural environments. It's imperative for the researcher to maintain objectivity and eliminate any preconceived beliefs that might impede the research process, as this type of research inherently establishes a power dynamic between the researcher and the participants (Orb, Eisenhauer, & Wynaden, 2001).

These ethical guidelines played a central role throughout the entire research procedure during my field study in Kathmandu. Before starting any interview, I obtained explicit consent from participants by explaining the study's objectives and content. I assured them that their personal information would remain confidential, and I always respected their preferences regarding the use of their names, offering the option of anonymity if it made them more comfortable.

I took great care to adopt a respectful and culturally sensitive approach when interacting with individuals, particularly informal garbage workers. I made a conscious decision to dress in a manner that was dignified, considerate, and aligned with local customs, aiming to bridge cultural gaps and foster a welcoming environment for the development of the interviews.

As an international researcher in a different culture, it's crucial to consider how my own perspective and background might influence the study. I came into this with a clear goal, wanting to learn about certain aspects of waste management. It's important to acknowledge that my position, shaped by my background, played a role in shaping the questions I asked, how I conducted interviews, and the topics I focused on.

There's an ongoing debate about whether a researcher is an insider or outsider in the area they're studying (Holmes, 2014). This affects the research in various ways. My

background, being from a different culture, affected how some of the people I interviewed saw me, which in turn impacted how I saw the research situation.

Reflexivity is the idea of constantly reflecting on my own role and how it might affect the study (Berger, 2015). It's about being self-aware and understanding how my beliefs and perspectives might influence the research process and the way I interpret the findings. It's important for me to acknowledge these factors in order to have a better understanding of the study's limitations and outcomes.

In conclusion, my international perspective and the biases I bring to the table have both positive and negative aspects for this study. I'm committed to conducting the research in an ethical way, respecting the viewpoints of the participants while being aware of how my position might affect the results. This involves recognizing and being mindful of the impact of my background and continuously evaluating my role in the study (D'silva et al., 2016).

3.3 Results and findings

The results and findings of this thesis are of a qualitative nature, as they are based on data collected through interviews conducted with various stakeholders involved in waste management in Kathmandu. This approach allows us to closely examine the perspectives, challenges, and opportunities that directly arise from individuals and organizations engaged in the intricate landscape of the waste management system in the city.

3.3.1 Challenges for Women in Informal Waste work

The experiences of these women shed light on the broader issue of vulnerability and limited opportunities within the informal economy. Analyzing their situation provides valuable insights into how individuals, particularly women, adapt and survive within this challenging economic context.

Socioeconomic Barriers for Women in Formal Employment: The interview underscores the limited educational opportunities for women, significantly affecting their prospects

in the formal job market. As a result, they face substantial challenges in finding well-paying and stable employment opportunities. The lack of viable job opportunities pushes these women into the realm of informal garbage work. They emphasize that this choice is not driven by personal preference but rather by the necessity to earn a livelihood in the face of limited alternatives. *"For us as women is even more difficult to find a job, especially because we are not well educated. "That is why we thought to do this job all together."* - Kumari T., Sunita T., Rubina L., three women waste workers at the Sasaja Cooperative.

Unity in Overcoming Vulnerabilities: The qualitative data illustrates how the women support each other within the cooperative, serving as a testament to the power of unity and cooperation in overcoming the challenges they face as vulnerable workers in the informal sector.

"We are friends and we can help each other while doing this job, like a family." - Kumari T., Sunita T., Rubina L., three women waste workers at the Sasaja Cooperative.

3.3.2 Aspirations and needs of Informal waste workers

These qualitative findings illuminate the economic challenges faced by informal garbage workers in Kathmandu, focusing on the allocation of income, aspirations for government assistance, the importance of education, and the desire for stable housing. The recurring theme of these priorities underscores their significance for the well-being and economic security of this vulnerable group.

Income Allocation for Necessities: The interviews reveal that the earnings of informal waste workers are primarily allocated to basic living expenses, such as rent and education for their children. Rubina L. emphasizes that the majority of her income goes towards these essential needs.

"The money I earn is to pay off living expenses such as the rent and my children's education." - Rubina L., 32 years old, women informal waste worker at Sasaja Cooperative

Aspirations for Government Assistance: Both Rubina L. and the couple, Puja D. and Pavan P., express the hope that the government will provide assistance, particularly in the form of educational benefits and stable housing. This assistance is seen as crucial in achieving better living conditions and financial security.

"I hope there will be different social government programs to help with children's education and some medical benefits so that I could spend my money differently and buy a car or a shop where to work." - Rubina L., 32 years old, women informal waste worker at Sasaja Cooperative

"We hope to get some parts of land to build our house, we can work for ourselves and earn and feed our children, but we need the education and the land to be subsidized." - Puja D., women informal waste worker, 20 years old and her husband Pavan P., 22 years old, both from India and with 2 children.

Importance of Education and Land Access: Both interviews emphasize the importance of education for the children of informal waste workers, and the desire for stable housing or land ownership as a means to improve their living conditions.

"Most of the money we earn we spent it on our children for their education, their well-being and food. I hope the Government could help us paying our children's education fee and live in a place like a land." - Puja D., women informal waste worker, 20 years old and her husband Pavan P., 22 years old, both from India and with 2 children.

3.3.3 Social stigma and challenging work conditions

These qualitative findings highlight the intersection of social stigma, challenging work environments, and the influence of these factors on the preferences and experiences of informal garbage workers, particularly for women in this field.

Social Stigma and Discrimination: The qualitative data from interviews with informal garbage workers in Kathmandu emphasizes the prevalence of social stigma associated with this profession. Sunita N. and Rubina L. both share their experiences of facing

discrimination and negative perceptions from society due to their work in the garbage industry.

"Before I didn't use to tell people I was working in the garbage industry in order not to be discriminated from the society. We are considered dirty and bad people." - Sunita N., women informal waste worker at the Sasaja Cooperative, 46 years old

"We are garbage workers and people think we are not so clean. Sometimes on public transportation they tell me not to sit next to them." - Rubina L., women informal waste worker at Sasaja Cooperative, 32 years old.

Challenges in the working environment: The interview with Gita T., a female informal garbage worker at Sisdol, reveals her preference for working at landfill sites instead of on the streets due to the discourteous and discriminatory treatment she and her coworkers encounter from bystanders in public spaces. Gita's experience suggests that the challenges of social stigma influence her choice of employment location.

"I would rather labour at landfills like Sisdole than on the streets... because of the unfavourable response they receive from the general population when doing so in public areas." - Gita T., woman informal waste worker at Sisdol

Moreover, Gita T. describes the harsh working conditions faced by informal garbage workers during the summer months, particularly in rainy and monsoon seasons. The presence of mud, even with raincoats, adds to the difficulty of the job, making it especially challenging during this period.

"During summer when there is a lot of rain and the monsoons working in the garbage is very hard even with the raincoat because of the mud." - Gita T., woman informal waste worker at Sisdol

3.3.4 Health Risks and Limited Support for Informal Waste Workers

Lack of Sanitary Facilities at Landfill Sites: The interviews with informal waste workers at landfill sites reveal a common issue of inadequate sanitary facilities. Gita T.,

a woman working at Sisdol, emphasizes the absence of proper washroom facilities or changing areas at the site.

"At Sisdol there is no place for us to change. No proper washroom facilities were we can go pee or anything." - Gita T., woman informal worker at Sisdol

Health Challenges Impacting Work and Earnings: Kumari T., another woman informal waste worker from the Sasaja Cooperative, discusses her frequent illnesses, which hinder her ability to work and earn a living. This health issue directly affects her livelihood, making her vulnerable when she is unable to work.

"I used to get sick very often and the problem was that I just stayed home and I couldn't work and earn something those days." - Kumari T., women informal waste worker at Sasaja Cooperative, 35 years old

Health Risks and NGO Support: Kumari T. also highlights the potential health risks faced by informal waste workers, particularly when handling medical waste in the garbage. She acknowledges the support provided by social organizations like *Médecin du Monde France*, which offers safety equipment and medical facilities, including free vaccines and medications for specific infections.

"Sometimes when we get the garbage that is medical waste it could have injections... Médecin du Monde France for example had medical facilities where they provided us with free vaccines or medicaments against some kinds of infections. I'm still taking some pills for not getting infected while working with that garbage." - Kumari T., women informal waste worker, 35 years old at the Sasaja Cooperative

Limited Support from Programs: Rajesh T., an informal garbage worker at Sisdole, mentions receiving helmets and masks three times a year as part of assistance from ongoing programs. This suggests some efforts to address safety concerns, but it highlights the need for more comprehensive and consistent support.

"Until the project runs we are given equipment, hats and masks three times a year." - Rajesh T., informal worker at Sisdole, 35 years old

3.3.5 Challenges in Waste Management and Environmental Concerns

Drawing from the interview with Nabin Bikash Maharjan, CEO of Blue Waste To Value, several crucial points emerge that highlight the inefficiencies and environmental risks within waste management:

Temporary Space Usage: Private waste management companies often resort to utilizing temporary spaces for waste segregation, indicating a lack of proper infrastructure and designated areas for efficient waste handling. This practice can lead to disorganized waste management and suboptimal practices.

"But the thing is, they are doing it because they don't have other space. They just take that space temporarily and try to segregate from their staff, in order to take it to the scrap centers to sell it."

Limited Segregation: Proper waste segregation seems to be lacking in the majority of cases among these private companies. Although some segregate waste for selling to scrap centers, the absence of effective systems for segregation points to potential inefficiencies in the waste management process, which can result in improper disposal or resource wastage.

"I'm not seeing that proper segregation in place."

Inadequate Vehicle Design and Lack of Securement: The vehicles used for waste transportation are not designed for handling waste, leading to safety concerns, potential spillage, and inefficiencies during transit. The absence of proper measures to cover and secure waste during transportation raises concerns about environmental hazards and improper disposal, particularly if waste materials are released along the route.

"The vehicles you see here are primarily designed for transporting construction materials, not for carrying rubbish."

Improper Lead Acid Battery Disposal: The interview highlights the alarming issue of lead acid battery disposal, with hazardous chemicals and acids being discarded into a

nearby riverbank. The environmental risks are significant, as valuable lead content is retrieved and sold while the hazardous acids are not being adequately managed, posing a threat to the river ecosystem.

"Unfortunately, individuals are discarding the batteries' chemicals and acids into the nearby riverbank. They retrieve and sell the valuable lead content, while the remaining acids are irresponsibly destroyed, ultimately finding their way into the river."

3.3.6 Challenges and Consequences in Landfill Management

The interview with Nabin Bikash Maharjan, CEO of Blue Waste To Value, reveals critical aspects concerning landfill management, highlighting the need for immediate attention and intervention to mitigate environmental and health risks:

Sanitary Landfill Lacking Proper Infrastructure: The intended purpose of the landfill as a sanitary facility is marred by a glaring oversight—the absence of a necessary permeable membrane for controlled leachate management. This oversight underscores a lack of foundational infrastructure required for the effective containment of leachate, a significant concern in landfill management.

"If we consider the landfill site, it was initially developed as a sanitary landfill. In a sanitary landfill, it is crucial to have a proper permeable membrane that allows for controlled leachate management. However, in this case, the new landfill site was constructed without such a system in place."

Insufficient Leachate Management: The lack of effective leachate management infrastructure results in the landfill experiencing overflows of leachate, particularly during rainy periods. This issue is exacerbated by the landfill's proximity to a clean water stream, leading to the direct contamination of the nearby water source due to inadequate containment measures.

"...As a result, the landfill is now overflowing with leachate, and just a short distance away, there is a stream of clean water. This situation arises because the landfill lacks a proper circulation and filtration system. Unfortunately, when rain comes, the leachate flows directly into the nearby clean water stream, ultimately polluting it."

Agricultural and Health Concerns: The interview underscores the unintended and hazardous consequences of this situation. People unknowingly use the contaminated water from the polluted stream for agricultural purposes, leading to crop spoilage and the introduction of toxic elements into the food chain. This scenario highlights the potential health risks associated with inadequate waste management practices.

"Some people unknowingly use this contaminated water for agricultural purposes, leading to the spoilage of crops and the introduction of toxic elements into the food chain."

3.3.7 Effective Solid Waste Management Through Formal Agreements

Nabin Bikash Maharjan, the CEO of Blue Waste To Value, highlights critical aspects that impact solid waste management practices and his vision for the future. His insights shed light on the need for formal contracts, integrated management, setting positive examples, and expanding waste management services:

Lack of Formal Contracts and Integrated Management: The CEO acknowledges the challenge posed by local authorities' failure to provide contracts for waste management services in specific areas. This absence of formal agreements or concessions impedes the ability to showcase proper waste management practices, hindering integrated city-wide management.

"For me, the main challenges are, you know, the local authority is not giving any contracts yet which they must have to provide us or some others either to us or some others, you know, showing them the particular area and how to do. And these all managed, you know, all integrated way to manage the city's waste."

Desire to Set a Positive Example: Nabin Bikash Maharjan emphasizes the significance of having a formal concession agreement as a means to showcase the correct approach to solid waste management. He expresses his company's commitment to leading by example, demonstrating effective environmental management practices to inspire others.

"If they had provided informally, formally, I think formal contract, that's called a concession, then it will be very easy for us to showcase this is the right way of management so that others also can start their business in a proper way."

3.3.8 Collaborative Solutions for Land-Constrained Solid Waste Management

The insights provided by Nabin Bikash Maharjan, CEO of Blue Waste To Value, highlight innovative collaboration between the public and private sectors as a solution to address land availability challenges and improve solid waste management practices:

Challenges with Land Availability: The CEO recognizes the significant hurdle posed by the lack of available land for waste management facilities, impacting the overall effectiveness of waste management.

"One challenge we face is the local authorities not providing contracts for waste management services in specific areas, mainly because of land scarcity for proper waste treatment and disposal sites."

Collaboration with Private Companies: Nabin Bikash Maharjan suggests a practical solution by proposing that local authorities collaborate with private companies to overcome this issue. The concept involves leasing land to private companies for the establishment of waste management facilities. These companies would engage with the surrounding communities, providing incentives and proper treatment, thus gaining community support for setting up waste treatment plants.

"In this scenario, local authorities can collaborate with private companies. The idea is to lease land to these companies for waste management facilities. Private companies can work with communities, provide incentives, and gain support to establish effective waste treatment plants."

Outsourcing and Monitoring: The CEO suggests outsourcing waste management to the private sector while local authorities provide the necessary facilities and provisions. Effective monitoring and enforcement of established policies and regulations would be

essential to ensure compliance. This approach allows the private sector to manage waste treatment operations while local authorities maintain oversight.

"In another approach, local authorities could outsource waste management to the private sector. The authorities provide the necessary facilities, while private companies operate and manage the waste treatment process. Proper monitoring and adherence to regulations are crucial to ensure the success of this collaboration."

Addressing Land Use Issues: Nabin Bikash Maharjan suggests that private companies willing to invest in waste management can negotiate with local communities and homeowners to address land use concerns while providing benefits to those affected. This approach demonstrates a proactive effort to align the interests of all stakeholders.

"Addressing land use concerns is crucial. Private companies willing to invest in waste management can engage with local communities and homeowners, addressing their concerns and providing benefits. This aligns the interests of all stakeholders, creating a more sustainable approach to waste management."

In summary, Nabin Bikash Maharjan's suggestions emphasize a collaborative approach, leveraging private sector involvement to overcome land availability challenges.

3.3.9 Formalization of Informal Waste Workers: Challenges and Contributions

Nabin Bikash Maharjan, CEO of Blue Waste To Value, offers valuable insights regarding the formalization of the informal waste management system, highlighting both the benefits and challenges in this process:

Belief in Formalization: The CEO firmly believes in the formalization of the informal waste management system. He emphasizes the intention to integrate informal waste workers as formal staff with training, benefits, a safe work environment, social protection schemes, and fair remuneration. This approach seeks to enhance the working conditions and dignity of informal waste workers.

"I believe informal system. What I will do is I will bring them on board, give training, and then they should come in a formal way, and then I will hire them as staff, providing lots of benefits, a clean, safe environmental workplace, proper social protection scheme, and remuneration."

Challenges in Formalization: The CEO acknowledges the challenges in formalizing the informal waste sector, particularly in regions with open borders where seasonal migration for work is common. The dynamic nature of informal work, with individuals entering from neighboring countries, poses difficulties in providing a clear identity and regulatory framework for these workers engaged in waste management.

"We have an open border here. Lots of people are coming from India also. That's another issue for giving them identity. They come here for like nine more months, earning through informal jobs, and then take back lots of money for their family there."

3.3.10 Enhancing Waste Management: Short-term Action

From Nabin Bikash Maharjan's insights, we can discern the following crucial aspects aimed at improving waste management, with a focus on immediate policy action and accountability:

Advocacy for Short-term Policy Action: The CEO emphasizes the necessity of implementing short-term policies that effectively manage waste segregation and create a conducive environment for informal waste workers. He proposes that local authorities either take direct control of waste management or outsource it to private sectors, with clear stipulations that prevent independent work by informal workers. Establishing policies to ensure safe and eco-friendly working conditions is essential.

"I believe local authorities should either effectively manage waste themselves or outsource waste management to private sectors. If private sectors manage waste, informal workers would not be allowed to work on waste independently. Proper policies and conditions for working in safe and environmentally friendly situations should be established."

Quality of Life for Informal Workers: Maharjan emphasizes the need to enhance the quality of life for informal waste workers. He suggests that temporary solutions without comprehensive policies might not fully benefit these workers or provide adequate living conditions. The CEO advocates for integrating informal workers into formal waste management systems under well-defined standards and conditions, offering them greater advantages.

"I believe that the temporary solutions of encouraging informal workers without proper policies may not provide them with complete benefits or quality living conditions. I suggest that integrating informal workers into formal waste management systems under proper standards and conditions would be more beneficial."

Regulation of Informal Places: In his vision for waste management, Maharjan proposes regulating the informal places where informal waste workers operate. He envisions enforcing standards, including clear signage, proper handling systems, and provisions for healthcare, to ensure a secure and controlled work environment for these individuals.

"I would regulate the informal places where informal waste workers go to sell collected materials. I would enforce standards, such as proper signage, handling systems, and healthcare provisions, to ensure safe and regulated working environments for these workers."

3.3.11 Key challenges in SWM

Collaboration Challenges in Solid Waste Management: The interview with Hitesh Raj Pant reveals significant issues related to collaboration within the field of solid waste management. It's evident that stakeholders, including the Kathmandu Metropolitan City (KMC) and collectors, collaborate mainly based on mutual interests, while other valuable contributors, such as NGOs and external organizations, seem to be left out. This lack of collaboration hampers the development of comprehensive waste management strategies.

"That one is a major lag in our system. People don't collaborate at all. The thing is like the issue here, nobody collaborates with nobody. The KMC They collaborate with those who they have interest with, like the collectors. That's it. They don't want to collaborate with outsiders."

Funding and Landfill Preparation Challenges: The scarcity of proper funding and channels for waste management, especially for KMC, poses a significant challenge. Unlike collectors who generate funds from household waste collection, preparing landfill sites becomes complex due to political factors and stringent policy requirements. This financial constraint hinders the effective execution of waste management initiatives by municipal authorities.

"They don't have the proper funding, they don't have the channels they have collectors have their own fund because they are collecting it from the household. So they are doing that landfill site. They the money that comes from this, they try to prepare the landfill site area because it's a lot of politics in landfill side."

Policies and Lack of Interaction: While there are existing policies and regulations governing waste management, a lack of interaction, collaboration, and engagement is observed with various essential sectors, including educational institutions, academic bodies, and commercial sectors. This lack of broader engagement, not just in waste management but across Nepal, raises concerns about the effectiveness of waste management practices and the potential for missed opportunities for improvement.

"So there is no interaction, no collaboration at all in the case of Nepal, not in just solid waste. In every scenario, there is no collaboration with Educational Institute. There is no collaboration with academic, no collaboration with commercial sectors, nothing."

3.3.12 The Importance of Education

Education for Responsible Waste Management: The interview with Hitesh Raj Pant highlights the critical importance of early education and training in instilling responsible waste management practices. Pant emphasizes the need to educate children from a young age about waste segregation and its impact. This approach, rooted in early

education, is believed to cultivate a sense of responsibility, leading to positive behaviors such as refraining from littering outside buses.

"If you train the people, small kids about the waste and the importance of segregation, the importance why we have to separate the waste, what we can do from the waste, then it's more respectful... So they have to be trained properly from childhood about the waste."

Behavioral Impact of Education: While many adults might be aware of waste management practices, their adoption may be limited without proper training and education on the subject. Pant suggests that effective waste management requires a comprehensive approach that goes beyond awareness and includes educational initiatives to shape behavior. By establishing a culture of responsible waste handling through education, the likelihood of waste mismanagement is reduced.

"If you train the people, small kids about the waste and the importance of segregation, the importance why we have to separate the waste, what we can do from the waste, then it's more respectful... So they have to be trained properly from childhood about the waste."

Government Support and Collaboration: Hitesh Raj Pant mentions that government institutions should support waste management efforts, especially those carried out by organizations like Nawa Paila. He notes that there seems to be a lack of support from government institutions, leading to a clash between them and organizations working in waste management.

"The lack of support from government institutions is a significant challenge. We believe there should be more support for organizations like ours, which are actively involved in waste management efforts. Collaboration and support from the government would be crucial given the nature of our work."

3.4 Discussion

The insights garnered from the interviews with key figures - Nabin Bikash Maharjan, CEO of Blue Waste To Value; Hitesh Raj Pant, co-founder of Nawa Paila, Ashok Bhattarai of Paramva Biotech Nepal and the informal waste workers - paint a comprehensive picture of the multifaceted challenges within waste management. These insights hold significant implications for understanding the critical points of Kathmandu's waste management situation and offer essential guidance for shaping future actions.

Nabin Maharjan is aware of the space constraints for waste management facilities and underscores the pivotal role of spatial planning. The data collected underscore the inadequacy of the current waste collection, separation, transport, and disposal system, leading to severe consequences for urban life, city management, the environment, and public health. The scarcity of suitable land further complicates the creation of efficient treatment facilities, necessitating innovative solutions that prioritize the concerns of local communities while addressing the environmental impact at hand.

The interviews reveal a crucial challenge in involving the private sector in waste management, as highlighted by Nabin. Blue Waste To Value offers technical advice and handles waste for luxury hotels in Kathmandu. Yet, Nabin and his team seek concessions and systematic involvement in municipal-level waste management through collaboration with the municipality. This reveals that while private sector initiatives, like that of Blue Waste To Value, can bring localized improvements, a broader collaboration between the private sector and municipal authorities still faces obstacles. The discussions also reveals significant challenges rooted in political issues and a lack of cooperation from government institutions, as pointed out by Nabin. His remarks on the absence of government support for waste management initiatives, combined with the complex political challenges, signal a formidable obstacle to progress. If government institutions do not actively collaborate and support endeavors such as Nawa Paila's community engagement and educational programs for enhanced waste management, the path toward systematic improvements may remain arduous.

The same underlying theme emerges from Mr. Bhattarai's insights from Paramva Biotech. Their Smart Bucket proposal, a straightforward and highly adaptable initiative, holds the potential to create significant and transformative changes in reducing solid waste at the source, particularly given the significant share of organic waste within the overall composition. However, the limited-scale adoption of this project, coupled with Mr. Bhattarai's comments on the lack of cooperation and collaboration between his company and the municipality, brings to light a profound deficiency in coordination among the various entities engaged in waste management.

As highlighted in the interviews, the government has been distributing compost bins to households for more than 15-16 years. However, the issue lies in ineffective management and insufficient compost production. Technical challenges with compost bins, such as inadequate leachate drainage leading to problems like flies and unpleasant odors, have hindered their functionality. In response to these challenges, Paramva Biotech Nepal introduced an alternative, the indoor composting method, conveniently implemented within homes or kitchens using the Smart Bucket. However, when this initiative was proposed to the municipality, it encountered obstacles due to the municipality's adherence to its own rules and regulations. Although the company is deploying the composting system in the Budhanilkantha area, collaboration with the wider Kathmandu municipality was not possible due to bureaucratic constraints. This lack of coordination and collaboration between actors hinders effective solid waste management efforts and prevents the implementation of innovative solutions proposed by companies such as Paramva Biotech Nepal.

In summary, while both Nabin Bikash Maharjan and Mr Bhattarai of Paramva Biotech offer unique perspectives on addressing waste management challenges, the lack of support and collaboration from the municipality for sustainable and innovative initiatives is evident. Addressing these challenges requires greater coordination between the private sector, government institutions and the community to enable the implementation of practical and sustainable solutions that can radically improve the waste management landscape in Kathmandu.

An additional relevant aspect to this discourse concerns the imperative to formalize the informal worker sector, a point underscored by the CEO of Blue Waste to Value. He

also participated in the PRISM project, conducted in Kathmandu from 2011 to 2014 by the NGO Practical Action and the European Union. His commitment to offering proper training, integration, and benefits to informal waste workers aims to improve both their circumstances and waste management practices. This observation aligns with the idea that a well-regulated and inclusive approach can significantly improve waste segregation and overall waste management, leading to a more sustainable environment.

The discussion of the results of the interviews with Nabin Bikash Maharjan, Hitesh Raj Pant and Ashok Bhattarai indicates a substantial convergence with the second hypothesis of this thesis, according to which the emergence of alternatives and projects is expected to lead to significant improvements in the existing waste management landscape, promoting a possible pathway for long-term solutions. The perspectives offered by these interviewees highlight the potential of alternative and innovative initiatives to improve the waste management situation. In particular, Nabin's emphasis on the formalisation of the informal sector, training, and the integration of informal workers, together with the idea of educating from an early age in responsible waste management, suggests that such approaches could indeed contribute to sustainable improvements in the waste management landscape.

Ashok Bhattarai's innovative Smart Bucket initiative, although only adopted on a small scale due to bureaucratic hurdles and lack of institutional support, shows a practical approach to tackle the problem of organic waste at source. However, the difficulties encountered in working with municipal authorities indicate that institutional support and promotion of sustainable initiatives is still limited.

The lack of collaboration and coordination between actors involved in waste management, as highlighted by both interviewees and reflecting Hitesh Raj Pant's observation, is a significant obstacle to the full development of innovative projects. These findings suggest that despite the emergence of promising solutions, their large-scale adoption and success requires greater involvement and support from government institutions and municipalities.

To wrap up, the insights gleaned from these interviews provide solid evidence supporting our hypothesis: the rise of innovative alternatives and projects can make a substantial difference in enhancing the current waste management scenario. However,

the success of these initiatives hinges on cooperation, backing from institutions, and effective coordination among all parties involved in waste management in Kathmandu. An interesting and crucial contribution to the discussion of the findings and to the development of this thesis are the interviews conducted with informal waste workers in Kathmandu, which shed light on the challenges faced and thus the needs to be taken into account.

The data collected showed the socio-economic barriers faced by these women, such as limited educational opportunities, which have a significant impact on their access to formal employment. This reinforces the understanding that, for some marginalized groups, especially women, engaging in informal work isn't a matter of choice, but often a necessity driven by the absence of viable alternatives in the job market.

The research also reveals significant social stigmatization and discrimination faced by these workers, particularly women, compelling some to opt for working in the dumps to avoid mistreatment on the streets. Recognizing this issue underscores the vital importance of raising awareness and promoting activism to challenge societal perceptions, ultimately leading to better working conditions for informal waste workers.

Turning to the long-term implications of initiatives undertaken by Non-Governmental Organizations (NGOs), I would like to emphasise a key aspect emerged during my field research at the Sasaja cooperative and the subsequent interviews with informal workers. Through this process, I learned about the "PRISM Project" (Poverty Reduction for Informal Sector Management), an initiative implemented by the NGO Practical Action with support from the European Union. As mentioned earlier, this project played a pivotal role in establishing the Sasaja Cooperative, introducing training programs, financial education, educational support for the children of informal workers, and healthcare for the workers themselves.

In the interviews, some informal workers mentioned the project, highlighting provisions such as protective equipment and medical care for minor work-related injuries. The project was active from 2011 to 2014, and I tried to find more details about the long-term objectives, the impact analysis and the monitoring system adopted when it ended. Unfortunately, due to time constraints and limited access to information, I couldn't delve into the detailed results and objectives achieved during the decade following the

project's implementation through direct interviews with beneficiaries, including informal workers. As such, my assessment is based on my perception derived from my understanding of the context, my observation of the current state of the cooperative, and conversations I had with the managers and informal workers.

From my observations, it seems Practical Action's initiative had a substantial impact during its implementation phase, providing significant financial support to a reality that would otherwise have been entirely overlooked. However, ten years later, it appears that much of this influence has waned. Training courses are now less frequent, the provision of protective equipment is irregular, and informal workers still find themselves in a state of informality. Formalization efforts, initially resulting in identity cards and cooperative registration, though valuable, now seem to be time-limited and mainly confined to the Sasaja cooperative. In essence, the workers continue to endure conditions of informality and invisibility.

The initial hypothesis of this thesis suggested that the formalisation of the informal waste sector in Nepal could have a transformative impact on the entire waste management landscape, generating significant social, economic and environmental benefits.

In light of the evidence gathered during the research, we can state that the initial hypothesis was partly confirmed, but with some significant limitations. It emerged that there are initiatives, such as the NGO-supported PRISM project, that have had a positive impact in the creation of cooperatives such as Sasaja and have provided financial support and basic services to informal workers, leading to improvements in their living conditions. However, as discussed above, these initiatives have some limitations, such as the reduced frequency of training courses, the less frequent distribution of protective equipment, and the lack of a broader formalisation of the informal sector.

It is unfortunate that the process of formalising informal workers in Nepal remains so limited. In light of the available information and the reports cited in the bibliography, it is clear that in other contexts there are many similar initiatives that have demonstrated significant economic, social and environmental benefits. When the informal waste sector is properly formalised, it can contribute substantially to improving waste

management, with higher recycling and recovery rates and lower environmental impacts than the formal system. In addition, formalisation provides opportunities for decent work and income for informal workers, integrating them more fairly and sustainably into the system.

The presence of initiatives like PRISM and the Sasaja cooperative is a step in the right direction, but more support and more systematic implementation is needed to maximise their effectiveness, especially from the international bodies that implement them. The Kathmandu experience, with all its limitations, can be a valuable example to guide the implementation of similar initiatives on a larger scale and with greater impact, in line with similar experiences in other parts of the world.

Despite the limitations highlighted in this research, such as the selection of a small group of interviewees and the lack of a detailed analysis of the long-term impacts of NGO initiatives, this thesis aims to connect different parts of the complex solid waste management chain in Kathmandu, attempting to fill some of the gaps in the current discourse to offer a view from different perspectives.

This thesis I hope represents a call to action, highlighting the urgent need to formalise the informal sector, intensify collaboration between diverse actors and embrace the adoption of innovative approaches.

It is only through collective efforts, open dialogue and targeted measures that a more efficient, equitable and sustainable waste management system can be achieved for the city and those who are part of it, including the informal workers who play a key role and deserve to be recognised and supported in the challenges they face every day.

CONCLUSIONS

With the aim of comprehending the state of solid waste management in Kathmandu, this study delves into the intricate nature of this sector by adopting diverse perspectives, and explores the potential alternatives along with their current status and feasibility.

This dissertation starts by analysing the core elements constituting the challenging landscape of solid waste management within a rapidly urbanizing city of the Global South and unveils the fundamental dynamics at play.

Looking at the second chapter, the discourse focuses on the intricate solid waste management system of the Kathmandu Metropolitan City showcasing its complex dynamic roles enacted by both formal and informal stakeholders, each driven by distinct motives and fostering diverse degrees of interaction and cooperation amongst themselves. Starting here, the dissertation illustrates that solid waste management goes beyond written acts and regulations: private businesses play a major role in waste collection in urban settings, and the informal waste sector serves as a key player for recycling. These intricate processes take place in background of inadequate garbage collection and segregation, exemplified by the pervasive waste along roadsides and riverbanks.

The problem extends to the area of waste disposal techniques because sole dependence on landfills is no longer sustainable. The stress placed on the landfills surrounding the city of Kathmandu exacerbates this problem. These sites are now burdened by excess waste with no sanitary measure nor monitoring processes, posing a variety of difficulties. In this sense, beyond simple capacity issues, the research's observations from interviews highlight the significant consequences for the environment and public health.

The findings from the qualitative research show some proposals coming from social enterprises and local cooperatives. These propositions open new paths that encounter a variety of strategies ranging from reduce the organic waste at source, do door-to-door collection with a proper segregation at source and give social and health support to informal waste workers. However, the success of these initiatives encounters barriers

when it comes to widespread adoption and integration within the established waste management structure and for this reason calls for an effective coordination.

The research also give insights about the formalization of informal waste workers in Kathmandu starting by supporting the hypothesis that, as revealed by many studies, the formalization of this sector would be beneficial from an environmental, social and economic point of view.

By going deeper in the research, the social and economic obstacles faced by these workers are delved through the interviews done in the Sasaja Cooperative, an embodiment of the challenges and opportunities of this sector in Kathmandu. To investigate the impacts and the state of action of the initiatives of a waste pickers' cooperative in Kathmandu, the thesis discusses the "PRISM Project" which aimed to formalize and train informal waste pickers in order to reduce poverty among these workers and to give them better opportunities or at least a legal recognition by the state. But while these initiatives initially had a positive impact, their long-term effectiveness waned due to limited support and resources by the municipality and the same NGO after the project ended. This emphasizes the need for sustained efforts and systematic implementation, given the good examples and the virtuous cases from other countries of the world in the same situations.

To conclude, the research reveals an array of transformative initiatives set in motion by different stakeholders, which need more collaborations and partnerships between institutions and other actors in order to be implemented and to set a transformative change. At the core of this collaborative endeavour lies the notion of formalizing the informal sector, which, together with the rest of initiatives, hold the potential to reshape the waste management landscape of Kathmandu.

RECOMMENDATIONS

Transitioning the focus, the following section will delve into a series of recommendations coming from empirical observation of the reality of Kathmandu. They are directed to policy makers and entities actively engaged in the waste management and urbanization.

In first place it is fundamental to implement improved waste management infrastructures within the city. This requires joint commitment from both federal and provincial governments, working in collaboration with local authorities.

In addition, local governments should acknowledge the activity of the informal sector in the waste management of the city. There are no official documents which record the contribution of the informal sector nor waste regulations about it, so this thesis emphasizes the importance of systemically integrating informal waste workers into the waste management system especially looking to successful cases from other places in the world. A crucial step while acknowledging the informal sector's financial and environmental contribution to the formal system, it is important to formulate health and safety guidelines given the hazards associated with waste-related work

From the experience I went through while looking for data in order to start developing this research I can say that the Kathmandu scenario underscores a deficiency of updated data regarding solid waste management. The most comprehensive data on the status of solid waste management in Nepal's municipalities dates back to 2013, as documented by the Asian Development Bank.

Accurate information regarding the organic and inorganic components within household-generated waste, quantities of recyclables like plastics, paper, glass, and metals, as well as organic waste, is essential for shaping appropriate regulations.

Preserving precise records of the daily volumes of waste collected could serve as valuable inputs for a right estimation of costs and budget and suitable management strategies.

Notably, the current absence of records concerning revenue generated through waste managed by private waste companies is a notable gap. By maintaining data on the

quantities of waste collected by these companies and establishing a margin for waste fees charged to households and institutions, a clearer insight into the revenue generated through waste management by these entities can be achieved.

Waste segregation at source is one of the major problem of the city as most household don't properly separate their waste at home and there is no monitoring from the government to incentive it. The municipality should do more than just give out information by training people and women's groups through specific programmes with the participation of external organizations or cooperatives in order to settle a set of partnership that are fundamental to make things work.

As shown in this dissertation, the role of the informal sector in recycling efforts in Kathmandu is crucial, yet it often doesn't get the attention it deserves from authorities. To make a real difference, it's important for the informal waste workers to come together and organize themselves in cooperative as the Sasaja case shows. But, as already mentioned, local authorities should recognize these cooperatives and support their action with a formalization procedure for informal waste workers.

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