



R4D PROJECT:

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

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**PROJECT WORKING PAPER #12**

**SOLID WASTE MANAGEMENT PRACTICES IN  
KIRTIPUR MUNICIPALITY, NEPAL  
FINDINGS FROM A HOUSEHOLD SURVEY**

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PUBLISHED: September 2023

ONLINE: [HTTP://LIFEOWASTE.COM](http://lifeofwaste.com)

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### **Acknowledgements**

This survey was implemented by Nepal Centre for Contemporary Research in Kirtipur Municipality under the leadership Dr. Basu Prasad Subedi and overall guidance of Dr. Yamuna Ghale and Dr. Bishnu Raj Upreti. Ms. Drishti Upreti of NCCR operationally coordinated the survey process under the guidance of NCCR Manager Ms. Apsara KC.

The authors would like to thank all the respondents of Kirtipur Municipality who provided their time and valuable information. Without them this study would not have been possible.

This study was conducted with financial support from the Swiss National Science Foundation and the Swiss Agency for Development Corporation under the r4d project “challenges of municipal solid waste management; learning from post-crisis governance initiatives in South Asia”.

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# Table of Contents

Executive Summary.....	v
1 Introduction .....	1
1.1 Background of the Study.....	1
1.2 Objectives of the Study .....	3
2 Methodology.....	4
2.1 Research Approach .....	4
2.2 Population and Sampling .....	4
2.3 Study Sites .....	7
2.4 Data Collection Instrument .....	7
2.5 Field Plan and Data Collection.....	7
2.6 Data Management and Analysis .....	8
2.7 Ethical Consideration .....	8
3 Results and Discussion .....	9
3.1 Demographic Composition of the Households .....	9
3.1.1 Gender of the Respondents .....	9
3.1.2 Age of the Respondents .....	9
3.1.3 Ethnicity/caste of the Respondents .....	10
3.1.4 Religion of the Respondents.....	11
3.1.5 Responsible Person for Household Decision Making.....	12
3.1.6 Education level of the Respondents.....	12
3.1.7 Income Source of the Respondent Families.....	13
3.1.8 Income Level of the Households .....	14
3.1.9 House Type .....	15
3.1.10 Number of Children in the Respondent Household.....	16
3.1.11 Number of People in the Household.....	17
3.2 MSWM Practices in the HH.....	17
3.2.1 Responsible Persons Dealing with Waste .....	18

3.2.2 Practice of Segregation of Household Waste.....	19
3.2.3 Primary Method of Disposing Waste.....	21
3.2.4 Type of the Service Provider.....	22
3.2.5 Gender of Waste Collectors.....	23
3.2.6 Payment for Waste Collection Service .....	25
3.2.7 Money Received from Selling Waste.....	26
3.2.8 Timeframe for Waste Production.....	28
3.2.9 Timeframe for Waste Disposal .....	29
3.2.10 Problems with the Waste Management Service .....	30
3.2.11 Problems with Waste Workers.....	32
3.2.12 Cleanliness of the Neighborhood .....	34
3.3 Waste Governance .....	35
3.3.1 Satisfaction Level of the Household with the Waste Collection .....	35
3.3.2 Comparison of Current Waste Collection Practice between 2016 and 2021 ..	36
3.4 MSWM and Crises .....	38
3.4.1 Changes in Waste Management after Earthquake and the Indian Blockade ..	38
3.4.2 Changes in Household Waste Practices after Earthquake and Indian Blockade .....	39
3.4.3. Improvement in Current Waste Management System .....	41
3.5. Waste Management Activities amid the COVID-19 Lockdown Period .....	42
3.5.1 Changes in Waste Collection/Management Activities during the COVID-19 Lockdown.....	42
3.5.2 Changes in Waste Management Activities in Home during COVID 19 Lockdown .....	43
3.5.3 Level of Comfort in Dealing with Waste Workers during COVID-19 Lockdown.....	45
3.5.4 Additional Initiatives to Manage Solid Waste by Local Government during COVID-19 Lockdown .....	46
5. Conclusions and Suggestions .....	48
4.1. Summary of the Findings .....	48

4.1.1 Demographic Household Information.....	48
4.1.2 MSWM Practices in the HH .....	48
4.1.3 Waste Governance .....	49
4.1.4 MSWM and Crises .....	49
4.1.5 Waste Management Activities amid the COVID-19 Lockdown Period .....	50
4.2 Conclusions.....	51
4.3 Suggestions.....	52
REFERENCES .....	53

## List of Tables

Table 1: Total Household Population of the Kirtipur Municipality	6
Table 2: Sampling Frame	7
Table 3: Gender Distribution of the Respondents (N=402)	9
Table 4: Age of the Respondents (N=401)	10
Table 5: Ethnicity/Caste of the Respondents	11
Table 6: Religion of the Respondents	12
Table 7: Household Decision-making	13
Table 8: Highest Level of Education Achieved by the Respondents	14
Table 9: Income Source of the Families	15
Table 10: Monthly Household Incomes	16
Table 11: House Type	17
Table 12: Number of Children in the Households	19
Table 13: Number of People in the Households	20
Table 14: Responsible persons dealing with waste in the HHS primarily	21
Table 15: Practice of Segregation of Household Wastes	23
Table 16: Primary method of disposing wastes	25
Table 17: Types of the Service Provider	26
Table 18: Sex of the Waste Collector	28
Table 19: Payment for Waste Collection Services	30

Table 20: Money Received from Selling Wastes	31
Table 21: Timeframe for Waste Collection:	32
Table 22: Timeframe for Waste Disposal	33
Table 23: Problems with the Waste Management Services	34
Table 24: Problems with the Waste Workers	36
Table 25: Cleanliness of the Neighborhoods	37
Table 26: Satisfaction Level of the Household with the Waste Collection	39
Table 27: Comparison of Current Waste Collection Practice with Five Years Back	40
Table 28: Changes in Waste Management after Nepal Earthquake 2015 and the Indian Blockade in 2015	42
Table 29: Changes in Household Waste Practices after the Earthquake and the Indian Blockade	44
Table 30: Changes in Waste Collection Activities during the COVID-19 Pandemic and the Lockdown	47
Table 31: Changes in Waste Management Activities in Home during the COVID_19 Pandemic and the Lockdown	49
Table 32: Level of Comfort in Dealing with Waste Workers during the COVID_19 Pandemic and the Lockdown	50
Table 33: Additional Initiations to Manage Solid Waste by Local Government during the COVID-19 Pandemic and the Lockdown	52

## **Abbreviations and Acronyms**

ADB	Asian Development Bank
SWM	Solid Waste Management
MSW	Municipal Solid Waste
COVID	Coronavirus Disease
SWMTSC	Solid Waste Management Technical Support Center
HH	Household
C&D	Construction and Demolition
PPP	Public Private Partnership
KWMS	Kirtipur Waste Management Service
BMC	Bharatpur Metropolitan City

## Executive Summary

Many urban areas in Nepal face difficulties with the provision of basic services such as water supply, wastewater treatment, and solid waste management (SWM). Solid waste management is one of the major environmental issues in cities of many developing countries, including Nepal. In order to identify the MSWM practices at the household (HH) level (segregation, recycling, disposal, burning), to analyze the waste governance practices of the municipality and to provide pragmatic policy options for MSWM, a survey was conducted at Kirtipur Municipality of Nepal. Kirtipur is one of the historical cities of the Newar community. It was declared as municipality under the Municipal Act in 1997 within the Kathmandu Valley. It is situated seven kilometers south-west of Kathmandu Metropolitan City.

This study is a part of a larger Research for Development (r4d) project implemented in South Asia (India, Nepal and Sri Lanka). In the r4d project, the problem of municipal solid waste management (MSWM) is perceived to be going beyond technological, formal institutional, managerial and financial issues to look at awareness, attitudes, social mobilization, public participation, tensions and conflicts seen within a broader political context embedded in informal (everyday) governance structures. Therefore, the project focuses on sociocultural and political processes at various scales that determine the development of socially acceptable and political feasible MSWM systems. In this context, the project examines the emergence of new SWM governance initiatives by diverse actors, including governments, municipalities, private actors, NGOs and community organizations. In particular, it looks at SWM initiatives that emerged spontaneously and endogenously in response to natural and human-induced crises, such as natural disasters, garbage strikes, etc.

This survey examines household (HH) practices as an entry point to study governance and provide policy options for effective solid waste management. The specific objectives of this survey are a) to identify the waste practices in the HH (segregation, recycling, disposal, burning, etc.) in Kirtipur Municipality, b) to investigate the waste management strategy in the Kathmandu Valley with special reference to Kirtipur during crises (Earthquake/Indian blockade/ COVID-19), c) to analyze the waste governance practices of Kirtipur Municipality and d) to provide pragmatic policy options for MSWM in Nepal (see chapter 1).

Chapter 2 presents the methodology. We applied a mixed-methods approach. The quantitative and qualitative data were collected simultaneously. Out of ten wards of Kirtipur Municipality, four wards (wards 1, 2, 3 and 10) were selected purposively where a random selection of 402 were included in a household survey (total number of households in Kirtipur: 19,441). The questionnaire included closed and open (qualitative) questions. Collected data were cleaned and then entered into the Statistical Package for Social Science (SPSS) software for analysis and for the generation of tables and graphs. The quantitative data was interpreted by using qualitative information, which was collected through field observations and informal communications with community people.



Before engaging household members as study respondents, they were informed about the purpose of the study and the expectations of the study team. They were free to refuse participation and assured the protection of their privacy. The study team took the potential misuse of the data and possible harm to the participants serious and followed common ethical guidelines of research.

Chapter 3.1 provides information on the demographic profile of the households sampled for the survey. The majority of the 402 respondents were female (57%) in comparison to male respondents (43%). Most of the respondents are self-employed (43%) while 35% have a salaried job and 22% follow another employment type. Overall household decisions are made by a male member of the household (67%), mostly the husband (35%). In 27% of the surveyed households, decisions are made jointly while women were the primary decision makers in only 7% of the households. However, the responsibility of dealing with waste at the household level falls in 82% of the cases to women.

Chapter 3.2 presents the findings regarding household-level waste practices and collection. The survey has revealed that 55% of the household segregate household wastes at source; almost all these households (54% of the total sample) segregate kitchen waste. 44% of the waste volume is collected by third parties (private companies) in mixed form. More than 90% of the respondents reported that they do not have any problems regarding waste collection. 80% of the surveyed households do not have any problems with waste workers either, but 20% of them reported to have faced unsociable behavior of waste workers or informal extra charges. People of older generations and mainly higher caste groups still believed that cleanliness related works should be carried out by the lower caste group (*podeyand chyame*) belonging to Newar caste groups.

Chapter 3.3 describes the (household perceptions of) waste governance in Kirtipur. While few households pointed to particular problems (see above), only 55% of the respondents were satisfied with waste collection. They think that the service is timely and regular. The respondents who were not satisfied with the waste collection service (45%) reported that the service was expensive, irregular and untimely or that the behavior of the waste workers was unsociable. However, 59% of the households reported that waste collection practices have improved over the past 5 years. Our qualitative research has found that Kirtipur Municipality is proactive in MSWM especially through policy formulation, partnerships with private companies, forging interlinkages of sectoral collaborations within municipal arrangements, and providing safety measures to waste workers.

Chapter 3.4 presents our findings on MSWM during crises, such as the 2015 earthquake and the 2020-22 COVID-19 pandemic. The majority of the respondents (80%) were unaware about the initiatives of the local government to manage solid waste during COVID-19 lockdown. Most of them (81%) did not perceive any changes in the waste management activities after COVID-19 lockdown either. However, 12% of the households opined that waste collection service has become more regular after the earthquake.

Chapter 4 presents the conclusions of the study and the suggestions for the improvement of MSWM.

A few households in Kirtipur still have not taken up waste membership (i.e., subscribed to the services of a private waste company) due to various reasons, such as costs, the quality of service or the negligible amount of (non-biodegradable) waste they produce. Therefore, the municipality should engage with households to make them understand the importance of having household waste membership and to show them the costs and benefits of individual and collective membership. At the same time, the Municipality should improve the quality of service through the mobilization of private companies, and it should advocate that membership fees are linked to the amount of waste produced and collected.

Waste segregation is still one of the main concerns in Kirtipur. Therefore, the municipality should device an operational policy (e.g., awareness raising and training on the segregation of waste at source). This should be accompanied by the provision of waste bins and other equipment facilitating segregation of waste at source.

Furthermore, volumes of mixed waste going to the landfill site are relatively large. Households are to be encouraged to make compost from organic waste through training and facilitating a market for the sale of excess compost. This would drastically reduce the volume of mixed waste.

The management of non-biodegradable waste remains a challenge. The municipality needs to provide the required support for promoting the many innovative approaches that have been emerging from different actors to commercialize urban waste. It should facilitate the process for different actors to promote the recycling of non-degradable waste.

# 1 Introduction

## 1.1 Background of the Study

Many urban areas in Nepal face difficulties with the provision of basic services such as water supply, wastewater treatment, and solid waste management (SWM). According to the Asian Development Bank, many municipalities of Nepal are not well equipped to fulfill their functions (ADB, 2013). According to the ADB (2013), a few have basic data on waste generation and composition. Almost all lack corresponding institutional mechanisms, technical human resources, and finance and management capabilities to be both effective and efficient in SWM. Rapid and unregulated urbanization, lack of and tokenistic participation of local communities, and poor management by municipalities have intensified environmental problems in towns in Nepal including unsanitary waste management and disposal. While solid waste management has become a major concern for municipalities and the country as a whole, the status of SWM is not fully understood due to the lack of baseline data, longer-term impacts on human and planetary health as well as on the interconnected role of different sectorial units which are also essential for effective planning, implementation and monitoring for its process as well as results.

Solid waste management is one of the major environmental issues in cities of many developing countries, including Nepal. According to ADB (2013), the analysis of household waste composition indicated that the highest waste category was organic waste with 66%, followed by plastics with 12%, and paper and paper products with 9%. The composition analysis of institutional wastes revealed 45% paper and paper products, 22% organic wastes, and 21% plastics. Urban population growth and economic development lead to increasing generation of municipal solid waste (MSW).

The use of products that generate hazardous waste is another concern. Unmanaged disposal of medical wastes from hospitals and clinics also contribute to pollution and public health hazards in the localities. The pandemic of COVID-19 has created additional challenges in waste management in Nepal. Inadequate and inappropriate handling of healthcare waste may have serious public health consequences and a significant impact on the environment. Sound management of these wastes, in addition to municipal solid waste and other growing waste streams such as electric and electronic waste (E-waste), construction and demolition (C&D) waste and industrial waste, is thus a crucial part of environmental and health protection. Nepal has faced problems to manage waste after the earthquakes in 2015 and Covid-19 pandemic. Earthquake waste created a lot of environmental problems. Debris contains many hazardous wastes including lead, mercury, acid, and glass. According to the Nepal Reconstruction Authority, the earthquakes fully damaged 499,921 buildings and partially damaged 258,655, with total damaged buildings reaching 758,576 in number. With no permanent landfill sites allocated to unload the earthquake debris, people used open spaces and riverbanks for dumping. Additionally, proper management of healthcare waste has become a concern with the COVID-19 pandemic 2019 (Institutes for Global Environmental Strategies, 2020). Therefore, SWM has become a major concern for the municipalities of Nepal.

The Government of Nepal enacted the Solid Waste Management Act of 2011 effective from 15 June 2011. The objectives of the act include maintaining a clean and healthy environment by minimizing the adverse effects of solid waste on public health and the environment. However, it is not in line with the Constitution of Nepal 2015. As per the provision of the new Constitution 2015, municipalities are fully responsible for the collection, transport, treatment, and final disposal of

solid waste. In the constitution of Nepal (Part 3, schedule 30) there is a provision of the right to clean environment. The Constitution states that every citizen shall have the right to live in a clean and healthy environment and the victim shall have the right to obtain compensation, in accordance with law, for any injury caused from environmental pollution or degradation (Nepal Law Commission, 2015). The local bodies, such as municipalities, have been made responsible for the construction, operation, and management of infrastructure for collection, treatment, and final disposal of MSW. The act mandates local bodies to take the necessary steps to promote reduce, reuse, and recycle (3R), including segregation of MSW at source. It also authorizes the local bodies to formulate rules, by-laws, and guidelines, with the approval of the municipal board.

As provisioned in Solid Waste Management Act 2011, the SWM Technical Support Center<sup>1</sup> under the Ministry of Urban Development shall provide technical support to all local bodies for effective and sustainable SWM and advance research and development in this sector. Managing solid waste has been accorded a low priority mainly because the demand is higher for other public services in many municipalities in Nepal. Local bodies are experiencing difficulties in developing management plans due to the lack of SWM baseline information and data related to the functional elements of SWM. Furthermore, the spread of COVID-19 is posing significant challenges to the household (HH) waste management sectors putting waste personnel and concerned bodies under massive pressure. The chain of collection, segregation, recycling, and disposal of household generated wastes is interrupted (Acharya, et al, 2021).

Similarly, while discussing SWM, the role of women in the waste management chain cannot be overlooked. Women in general are the waste manager at home, but the waste collectors are mostly male. During the COVID pandemic, women waste workers were impacted differently than men ranging from joblessness to stigmatization, higher risk of being exposed to COVID-19 as well as threatening of their livelihoods. To be more specific, the safety gears were not women-friendly, not all women waste workers had isolation rooms arranged by their offices such as municipalities, most of them (being informal workers) did not have health insurance and their access to health service was not easily accessible due their nature of job and loss of income. Furthermore, women working in SWM are not part of policy platforms, their concerns are hardly heard. It is, therefore, highly important to understand, recognize and value the role of the women in waste management practice. Hence, this study has been carried out to find the existing situation of the solid waste management practice in Kirtipur municipality to understand role of local governments in SWM practices in the federalized context and generate learning to come up with pragmatic options for the policy improvement of the MSWM, which were also confirmed by the previous publication under this r4d project (Upreti, et al., 2022; Véron et. al., 2018; Upreti, et al., 2020).

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<sup>1</sup> Government abolished this Centre after 1017

## 1.2 Objectives of the Study

1. To identify the MSWM Practices of the HH (segregation, recycling, disposal, burning) in Kirtipur Municipality
2. To investigate the waste management strategy in Kathmandu with special reference to Kirtipur during crisis (Earthquake/Indian blockade/ COVID-19)
3. To analyze the waste governance practices of Kirtipur Municipality
4. To provide pragmatic policy options for MSWM, specifically in Kirtipur.

## 2 Methodology

This section specifically deals with the entire process adopted to conduct the study. More specifically, this section discusses the research approach, sampling strategies for the survey, study sites, study instruments, field plan, data collection procedure, data management and analysis, and ethical consideration for conducting this scientific study.

### 2.1 Research Approach

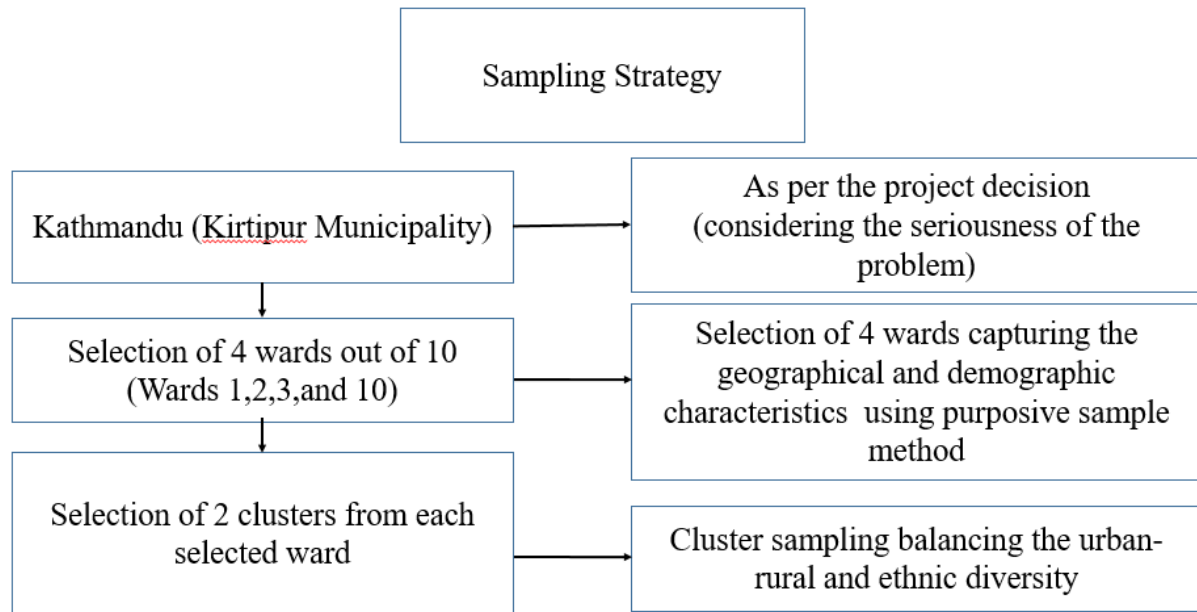
As per the nature of the objectives of the study, the mixed method approach had been used for the study. The quantitative and qualitative data were collected simultaneously. Hence, concurrent or parallel mixed method design was used as the research approach.

### 2.2 Population and Sampling

Applying purposive sampling technique, one municipality – Kirtipur - of Kathmandu district was selected. According to district profile of Kathmandu there were 19,441 households (CBS, 2014) in the Kirtipur municipality. The municipality has been officially divided into ten wards. There was the diversity among the households in terms of ethnicity, migration status, and setting along the rural-urban continuum. While selecting the households for the study, it was attempted to capture the stated diversity. For this, out of ten wards of the municipality four wards with 8 clusters (wards 1, 2, 3 and 10) were selected purposively. From ward 1, two clusters namely Dey Pukhu-Bagh Bhairab and Tyanglaphant were taken for the study. Likewise, Samal-Indrayani Temple-West Tyanglaphat cluster from ward 2, Khashi Bazaar-Sasa restaurant cluster from ward 3 and Chilancho-East of hillock-Tyanglaphat-TU cluster from ward 10 were taken as the study areas.

Following figure shows the sampling strategy of the study.

Figure 1: Sampling Strategy



While selecting the representative sample from the municipality, random sampling technique had been used. Both male and female household heads had been interviewed in equal number as a primary respondent as far as possible. The field researchers had collected additional qualitative information from the households and the persons or family who were renting rooms or flats. The entire number of the households of the municipality was the target population of the study. There were altogether 19,441 households in the municipality. The following Yamane’s formula has been used (Yamane, 1967) to calculate the representative samples for the Kirtipur Municipality:

$$n = \frac{N}{1 + N e^2}$$

Where, n = the sample size

N = the population size e = the acceptable sampling error (95% confidence level and p = 0.05 are assumed)

$$\text{So, } n = \frac{19441}{1 + 19441 * (0.05)^2}$$

or, n = **392**

The minimum representative sample size of household was 392. However, to manage the possible errors, a few more data had been collected. The final sample data size was determined as 402 for the study. Adopting the idea provided by Ahmed (2009), a cluster sampling strategy was applied to select the required sample. While selecting the sample, effort was made to include male and female headed HHs, indigenous and migratory communities, township and peripheral residential area as well.

Table 1: Total Household Population of Kirtipur Municipality

Ward No.	Households	Males	Females	Total Population
1	1915	3674	3034	6708
2	1863	3610	3118	6728
3	1414	2738	2382	5120
4	1426	3079	3079	6158
5	2027	3821	2937	6758
6	1678	3586	3696	7282
7	1722	2934	1727	4661
8	1359	2447	1759	4206
9	2845	4911	3331	8242
10	3192	5676	4063	9736
Total	19441	36476	29126	65602

Source: CBS, 2014



Table 2: Sampling Frame

Ward	Total Household	Occupied %	Sample Size
1	1915	23	90
2	1863	22	86
3	1414	17	67
10	3192	38	149
Total	8384	100	392

Source: CBS, 2014

## 2.3 Study Sites

Kirtipur is one of the historical cities of the Newar community<sup>2</sup>. It was declared as municipality under the Municipal Act in 1997 within the Kathmandu Valley. It is situated seven kilometers south-west of Kathmandu Metropolitan city. It is also known as the city of glory, as it is one of the old and typical Newar settlements of the valley. It lies at 27° 38' 37" to 27° 41' 36"N and 85° 14' 64" to 85° 18' 00"E with altitude ranging from 1284m to 1524m above mean sea level. In the municipality there were more innovative practices in SWM like public private partnership (PPP) with the Kirtipur Waste Management Service (KWMS) and other private companies to manage the waste properly. The municipality had also exhibited high level responsiveness to conduct study on MSWM. Furthermore, the municipality also concentrates on modern business area. Considering the elaborated reasons, the municipality was selected as the study site.

## 2.4 Data Collection Instrument

There was the common questionnaire by the r4d project team. The questionnaire was contextualized and translated into Nepali language. After finalizing the questionnaire in Nepali language, it was pretested to check its reliability and validity and finalization was made as per the input obtained from the pre-test.

## 2.5 Field Plan and Data Collection

Twelve experienced enumerators were recruited and an orientation was provided to the them as well as to the project staff and the project officials. The enumerators were oriented on study tools as well as nature of the field. The field plan was prepared with the participation of the enumerators, project staff and project officials in the natural setting. The enumerators were deployed in the field with the close supervision of the project staff and the project officials. During

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<sup>2</sup> The historical inhabitants of the Kirtipur and its surrounding areas in Nepal, who have specific "SAGA" practice of waste management (keeping waste in one corner of the house by covering it with straw or other materials).

the survey, both the quantitative and qualitative data were collected. The field work was conducted during the month of April 2021.

## **2.6 Data Management and Analysis**

After collecting the data, it was edited and entered into Statistical Package for Social Science (SPSS) software for further analysis. After entering the data into SPSS, data was cleaned and necessary tables and graphs were generated. In addition to descriptive statistics, inferential statistics had also been used to make appropriate decision while analyzing the data. While doing the analysis, the data was interpreted blending both the quantitative and qualitative information. In order to develop the capacity of the data processing, analysis and interpretation of the data, a SPSS data analysis training was also conducted for the project staff and the project officials.

## **2.7 Ethical Consideration**

The study team strictly followed the ethical principles while conducting the study. Adopting the suggestions provided by Hartsas (2010) and Halai (2006), the study team took informed and voluntary consent from the respondents; maintained the confidentiality of information shared; and also maintained anonymity committing guaranty of beneficence or no harm to any respondents. Before engaging household members as study respondents, they were informed about the purpose of the study and what the study team expected from them. They were not forced to take part in the study process and also assured to maintain the privacy of the data obtained from them. The study team maintained seriousness against the misuse of the data and possible harm to the participants.

## 3 Results and Discussion

In this section, results related to demographic composition of the households, MSWM practices in the HHs, MSWM during the crisis including earthquake/Indian blockade and the COVID-19 Virus are discussed. Both quantitative and qualitative data have been considered and consulted for the interpretation.

### 3.1 Demographic Composition of the Households

#### 3.1.1 Gender of the Respondents

For the survey purpose, a household primary respondent to be a person who looks after and usually, make decision in household waste management. Following Table 3 depicts the gender wise situation of the primary respondents. Though male dominate in overall decision here women's decision related issue is concerned with the decisions regarding waste.

Table 3: Gender Distribution of the Respondents

Gender	Frequency	%
Male	174	43.3
Female	228	56.7
Total	402	100

Source: Field Survey, 2021

Gender relations are one of the most influencing factors that determine family member's role in SWM at home. To ensure that women's experiences, needs and priorities about the SWM at home, the survey team had made an intentional effort for more or less equal representation of female in the survey by focusing the female respondents from the selected household for the study.

In total, 402 respondents were surveyed. Out of the total, the majority of the respondents were female (56.7%) in comparison to male respondents (43.3%). The data shows that the female members in the family are more responsible than the male in dealing waste management.

#### 3.1.2 Age of the Respondents

Age is the crucial demographic variable for this survey study. This helps in determining what age group is the ideal target audience. For the study, considering the maturity level and experiences on waste management, the respondents of the age of 15 years and above has been taken. Even though children below 15 also supports in SWM but with decision of parents/guardians.

Table 4: Age of the Respondents

Age Group	Gender		Total (N=402)
	Male	Female	
15-20	3 (1.73%)	3 (1.31%)	6 (1.49%)
21-30	17 (9.82%)	27 (11.84%)	44 (10.97%)
31-40	37 (21.38%)	59 (25.87%)	96 (23.94%)
41-50	35 (20.23%)	45 (19.73%)	80 (19.95%)
51-60	33 (19.07%)	48 (21.05%)	81 (20.19%)
61-70	29 (16.76%)	33 (14.47%)	62 (15.46%)
71-80	15 (8.67%)	13 (5.70%)	28 (6.9%)
Above 80	5 (2.31%)	-	5 (1%)
Total	174	228	402

Source: Field Survey 2021

The respondents of the age group 31- 40 were found in large number (23.94%) followed by the age group 51-60 and 41-50 with (20.19%) and (19.95%) respectively. The respondents of the age group 15-20 and above the age 80 were found in small number (1.49% and 1.00 %) respectively. The data indicates that the more respondents of the age group 31- 40 were engaged in dealing with households' solid waste management.

### 3.1.3 Ethnicity/caste of the Respondents

An ethnic group or an ethnicity is a grouping of people who identify with each other on the basis of shared attributes that distinguish them from other groups. The sub-culture of the ethnic group may influence the behavior of the waste management. The following table shows the situation of ethnicity/caste of the respondents.

Table 5: Ethnicity/Caste of the Respondents

Ethnicity/Caste of the Respondents	Gender of the Respondents		Total (N=402)
	Male	Female	
Brahmin	20 (11.5%)	26 (11.40%)	46 (11.44%)
Chhetri	11 (6.32%)	17 (7.44%)	28 (6.05%)
Newar (Janjati)	139 (79.88%)	175 (76.75%)	314 (78.1%)
Dalit	1 (0.57%)	6 (2.63%)	7 (1.74%)
Others	3 (1.72%)	4 (1.75%)	7 (1.74%)
Total	174	228	402

Source: Field Survey 2021

The larger volume of the respondents was from the Janjati (including Newar) ethnic community<sup>3</sup> (78.1%) followed by Brahmin ethnic community (11.44%). Since Kirtipur is inhabited mainly by Newar ethnic group, majority of the respondents under Janjati belonged to Newar ethnic group. There were a very few respondents (1.74%) of Dalit community and other unidentified ethnic groups.

### 3.1.4 Religion of the Respondents

The religion is the belief in and worship of a superhuman controlling power, especially a personal gods/goddesses. The religious belief of the respondents may influence the behavior in waste management. For example, majority of Buddhists believe on simple living and respect nature. They also emphasized on living 'skillfully ' means to live without producing waste. Similarly, Hindu community belief nature as creation of god and therefore it should not be polluted by waste or any means. The following table 6 shows the situation of religion of the respondents.

Table 6: Religion of the Respondents

Religion of the Respondents	Gender of the Respondents		Total (N=402)
	Male	Female	
Hindu	108	122	230 (57.21%)
Buddhist	61	97	158 (39.30%)
Muslim	-	4	4 (0.99%)
Christian	5	3	8 (1.99%)
Kirat	-	2	2 (0.49%)
Total	174	228	402 (100%)

Source: Field Survey 2021

Data presented in table 6 above reveals that a larger volume of the respondents were Hindu (57.21%) followed by Buddhist (39.3%). The percentage of Muslim, Christian and Kirat were found minimal. The data indicates that almost 97% respondents were from Hindu and Buddhist religion. As per the data presented in Table 5, larger numbers of respondents are from the Janajati ethnic group such as Newar, however, Table 6 above indicates that the majority of the respondents are Hindu. During the field survey it was noted that the Newars of Kirtipur are found to have faith on both Hinduism and Buddhism. The Newars are divided into castes, each with its own language and customs where Hinduism and Buddhism are represented in this group (Manandhar, 2019). Usually, people belonging to Newar community follow religion based on the traditions that have been passed on through generations or heredity (*banshanugat*) or based on the practices at the community level (*karmakanda*- rite to heaven).

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<sup>3</sup> Janajatis are the indigenous people including Newar community of Nepal forming 35.6 percent of Nepal's population and spread over all the 77 districts of the country.

### 3.1.5 Responsible Person for Household Decision Making

In Nepalese society, decisions are taken by the household head; either husband or wife. The study aims to identify the authority of final decision in household activities from the gender perspective in the surveyed area.

Table 7: Common Household Decision-making

Household decision-maker (Relationship with respondent)	Number/percentage		
Husband	140 (34.8%)		
Wife	26 (6.5%)		
Husband and Wife Jointly	36 (9%)		
Father	31 (7.7%)		
Mother	15 (3.7%)		
Father-in-law	12 (3%)		
Son	9 (2.2%)		
Daughter-in-law	3 (.7%)		
All together	3 (.7%)		
Others	15 (3.4%)		
Respondent himself or herself	M	F	Total
	75 (18.6%)	37 (9.1%)	112 (27.86%)

Source: Field Survey 2021

The data presented in Table 7 indicates that there is very low participation of women in common household decision making process other than waste management. As per the indication of the data, less than one third (29%) female were found involved in general decision-making process including husband and wife jointly. As per the data of Nepal Demographic Health Survey (NDHS) (2016), 31 percent of households are headed by women including single women and widows. In comparison to the NDHS data, the situation of the women participation in household decision making process was found low in Kirtipur municipality.

### 3.1.6 Education level of the Respondents

The educational status amongst the inhabitants can notably influence the prosperity of awareness programs aimed at evolving solid waste management practices. The more a family gets educated and aware of the adverse impacts of improper solid waste management, the more it recognizes the importance of effective management of solid waste.

The following Table 8 shows level of education achieved by the respondents.

Table 8: Highest Level of Education of the Respondents

Highest level of education	Gender of the respondents		Total
	Male	Female	
No formal education	38 (21.83%)	107 (46.92%)	145 (36.06%)
Primary education	40 (22.98%)	40 (17.54%)	80 (19.9%)
Secondary education	59 (33.90%)	42 (18.42%)	101 (25.12%)
Undergraduate/Graduate	23 (13.21%)	31 (13.59%)	54 (13.43%)
Postgraduate	14 (8.04%)	8 (3.5%)	22 (5.47%)
Total	174 (100%)	228 (100%)	402(100%)

Source: Field Survey 2021

Out of 402 respondents, the majority of the respondents (63.94%) do have formal education and 36.06% found just literate without any formal education. In comparison to the male (21.8%), more female respondents (46.9%) were found in “No formal Education” category. It indicates that the educational status of the female is weaker than the male. The low level of educational status of the respondents directly influences the management of household waste (Fredrick, Oonyu & Sentongo, 2018). The knowledge of waste disposal is necessary for health of people. According to Saseanu, Gogonea, Ghita, & Zaharia (2019), households whose members have a higher education are more likely to increase the amount of waste generated, but also have a higher probability of managing their waste amount, compared to households have a lower level of education.

### ***3.1.7 Income Source of the Respondent Families***

Income source of the family is the crucial demographic variable for analyzing the household waste management practices. The nature of the income generating activities might influence the generation and management of the waste.

Table 9: Main Income Source of the Family

Main Income Source of the Family	Number	Percentage
Salaried employment	142	35.3
Daily wage employment	47	11.7
Own business (self-employed)	171	42.5
House rent	29	7.2
Remittance	5	1.2
Pension	3	0.7
Senior citizen allowance	2	0.5
Nothing	3	0.7
Total	402	100

Source: Field Survey 2021

Out of 402 respondents, the majority (42.5%) of the respondents were found engaged in their own business (self-employed) followed by salaried job (35.3%). Around 12 % families were found engaged in daily wage employment. Around 7% families were generating income from the renting out their house. According to the filed observation, the households having own business and providing house for rent have been generating more waste in comparison to the salaried employment and remittance and pension owner households. Likewise, the households generating more waste have the practice of segregation of waste at source.

Growing urbanization has drastically led to increase in internal migration leaving less land for agriculture. This has led many *Newars* (example-*Jyapu*) whose main occupation is farming to switch to other small and large businesses including garment shops, handicraft business, wage laborers, etc. because they need to generate money (Pokhrel, 2020). Due to this reason, there is the high percentage of the self-employed family in the study area followed by salaried employment and daily wage employment.

### 3.1.8 Income Level of the Households

Income level of the households is the influential variable for generating and managing household waste (Noufal, et al., 2020). The field data obtained from the survey related to monthly household income has been presented in Table 10 below.

Table 10: Monthly Household Income of the Responding Families

Monthly Household Income	Ward No. of Municipality				Total
	1	2	3	10	
Poor (below poverty line)	2 (2.17%)	3 (3.3%)	10 (15.62%)	2 (1.3%)	17 (4.22%)
Lower middle	7 (7.6%)	8 (8.8%)	8 (12.5%)	19 (12.25%)	42 (10.44%)
Middle class	76 (82.6%)	62 (68.13%)	44 (68.75%)	129 (83.22%)	311 (77.36%)
Upper middle	7 (7.6%)	18 (19.78%)	2 (3.123%)	5 (3.22%)	32 (7.96%)
Total	92 (100%)	91 (100%)	64 (100%)	155 (100%)	402 (100%)

Source: Field Survey 2021

As per their estimated monthly income, the households were classified into five groups namely, poor (below poverty line), lower middle, middle class and upper class. More than two third of the respondents from four surveyed Wards, 1, 2, 3 and 10 belong to the middle-class income category (77.36%). The data shows that the ward 3 is the poorest and the ward 2 is the richest ward. The percentage of families under poor (below poverty line) was found comparatively low which is encouraging data since the Nepal Living Standard Survey (NLSS) 2010/11 shows that 25 percent of



Nepali people are below the absolute poverty line. According to Saseanu, Gogonea, Ghita, & Zaharia (2019), households whose members have a higher income are more likely to increase the amount of waste generated, but also have a higher probability of managing their waste amount, compared to households in a lower level of income. A study conducted in Islamabad, Pakistan by Saseanu, Gogonea, Ghita, & Zaharia (2019) indicated that standard of living and waste generation are directly related, i.e., high income group has the highest waste generation rate and low-income group has the lowest. The waste generation rates of high, middle and low-income groups were 0.89, 0.612 and 0.346 kg/capita/day, respectively, during the study period. The rate of waste generation varies between higher- and lower middle-income residents and between higher- and low-income residents. In addition to this, quantity of plastics generated is dependent on the wealth of the strata (Dangi, Pretz, Urynowicz, Gerow & Reddy, 2011).

### 3.1.9 House Type

The type of the house is also a key demographic variable related to household waste management. The common residential house or apartment or the rental house has the different impact on waste generation and management.

Table 11: House Type

House Type	Ward No. of Municipality				Total
	1	2	3	10	
House with home garden	21 (22.82%)	33 (36.26%)	15 (23.43%)	24 (15.48%)	93 (23.13%)
House without home garden	60 (65.21%)	56 (61.53%)	43 (67.18%)	128 (82.58%)	287 (71.39%)
Apartment	2 (2.17%)	0 (0%)	0 (0%)	1 (0.64%)	3 (0.74%)
Rent	9 (9.78%)	2 (2.19%)	6 (9.37%)	2 (1.29%)	19 (4.72%)
Total	92 (100%)	91(100%)	64(100%)	155(100%)	402(100%)

Source: Field Survey 2021

The data presented in Table 11 shows that around one-fifth (23%) households were found with home garden. More than two third of the households (71.39%) from four surveyed Wards 1, 2, 3, and 10 did not have any home garden. There were only three (0.74%) apartment and 19 (4.7%) rental households. The households having home garden can manage their organic waste as compost manure. In study area, though there is not cross calculation, as per the eye-witnessed of the field researcher, most of the households having home garden had been using the compost manure prepared from the organic waste in their garden plants. The apartment and rental houses produce more waste in comparison to the ordinary households.

Growing urbanization has led to the transformation of traditional urban spaces. Increased commercial activities have changed the building structures losing many open spaces such as courtyards and garden spaces. Kitchen gardens have now been replaced by high-rise buildings (Shrestha, 2020) leaving very less options for home-based composting of organic wastes.

It was reported during the qualitative interview that households with home garden in Kirtipur were more inclined to making compost. Those having no kitchen garden or land for cultivation were more concerned for producing less kitchen waste. On the other hand, households without home garden do not have space for making compost. Similarly, in apartments, as more families live together, there are chances of more amounts of wastes being produced. Moreover, the survey site is composed of mixed communities due to inflows of more diverse communities and their practice of SWM may also differ due to their awareness level. Main problem of management of waste is often found among people living on rent because often the house owners/landlords do not take the responsibility of wastes for those living on rent. During the field work time, the field researchers have experienced this reality.

### 3.1.10 Number of Children in the Respondent Household

The number of children is one of the key determinants of the household-based waste generation and management. It is obvious that if the number of children increase, the volume of household waste also increases. The following table presents the number of children in the households.

Table 12: Number of Children in the Household

Number of Children	Ward No. of Municipality				Total
	1	2	3	10	
No child	49 (53.26%)	36 (39.56%)	24 (37.5%)	63 (40.64%)	172 (42.78%)
One child	17 (18.47%)	35 (38.46%)	17 (26.56%)	53 (34.19%)	122 (30.34%)
Two children	25 (27.17%)	17 (18.68%)	16 (25%)	31 (20%)	89 (22.13%)
Three children	1 (1.08%)	1 (1.09%)	5 (7.81%)	2 (1.29%)	9 (2.23%)
Four children	0 (0%)	0 (0%)	2 (3.125)	5 (3.22%)	7 (1.74%)
Five children	0 (0%)	2 (2.19%)	0 (0%)	1 (0.645%)	3 (0.746%)
Total	92(100%)	91(100%)	64(100%)	155(100%)	402(100%)

Source: Field Survey 2021

The data presented in Table 12 reveals that majority (52%) of the households have 1 to 2 children and very few households (5%) have 3 to 5 children. Likewise, large percentage (43%) households have not any children. It indicates that there is the less possibility to generate waste in the households.

This survey included children below the age of 5. It can be assumed that when there are children belonging to this age group in the house, the types of wastes may include packets of processed foods such as noodles, biscuits, as well as medical wastes, juice bottles, diapers, paper wastes of old stationaries and batteries used in toys etc. (Khadka, et al. 2021). Though there was not the cross

statistical analysis in this specific case, the field researcher has experienced this sort of fact in the study area.

### ***3.1.11 Number of People in the Household***

Family size is an important component in determining the amount of household waste (Khadka, et al. 2021). In this study, family size refers to the overall people living in the same house with shared kitchen.

Table 13: Family Size in the Household

Number of People in the Household	Number	Percentage
1-5 people	268	66.7%
6-10 people	124	31%
11-15 people	9	2.1%
16-20 people	1	0.2%
Total	402	100

Source: Field Survey 2021

Out of 402 households, majority of the households (66.7%) have a minimum of 5 members living in the same house whereas 31% of the households have up to 10 people living in the same house. According to CBS (2016), the average size of family in Nepal is 4.6 person which is 4.2 in urban and 4.8 in rural. The previous studies showed that the household size had a positive influence on the waste generation rate. While it is apparent for more members of a family to generate more waste, some researchers described the phenomena of “group living” and “common consumption” of the family as the household operates as a unit and most of the food items are shared. Therefore, the fewer amount of food crumbs, leftovers, and packaging waste will be produced in the household. On the contrary, many studies have also supported the negative relationship between the household size and the waste generation rate (Khan, Kumar & Samadder, 2016; Miezah, Obiri-Danso, Kadar, Fei-Baffoe, & Mensah, 2015).

The concept of living together in joint families (both in Buddhists and Hindu families) has been practiced in Nepal since the beginning of civilization. It could also be impacted by the country’s agrarian nature, which requires active engagement of all family members in agricultural tasks (Manandhar, 2019).

## **3.2 MSWM Practices in the HH**

Solid Waste Management relates to the control of generation, collection, storage, transfer and transport, processing and disposal of solid wastes in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetics and other. The following subsections deal the MSWM practices in the HH level of Kirtipur Municipality of the Kathmandu district.

### 3.2.1 Responsible Persons Dealing with Waste

The respondents were asked about the responsible person of dealing with waste during the household survey. The response of the respondents has been presented in Table 14 below.

Table 14: Responsible persons dealing with waste in the HH Primarily

Source: Field Survey 2021

The majority of the respondents (25.1%) dealing with the waste in the household primarily reported to be wives. In comparison to the male respondents (16.75%), female respondents (83.24%)

Responsible persons for dealing with waste	Number	Percentage
Wife	101	25.1
Daughter-in-law	51	12.7
Mother	19	4.7
Father	1	0.2
Mother and Father Jointly	2	0.5
Joint responsibility (family)	16	4.0
Husband	8	2.0
Husband and Wife Jointly	13	3.2
Domestic Worker	4	1.0
Daughter	3	0.7
Son	1	0.2
Respondent himself	30	7.5
Respondent herself	149	37.0
Others (landlord, staff, aunt)	4	1.0
Total female	330	82.1
Total male	41	10.2
Total joint	31	7.7
Total	402	100

reported that they themselves deal with the household waste primarily. The data indicates that in primarily female member of the family taking lead role in waste management. This finding has interesting correlations with the finding as presented in Table 3 and 7 above. As per the indication of the data of Table 3 and 7, waste management is mainly with the female members, whereas less than one third (29%) female were found involved in household decision making process including husband and wife jointly. This shows that the role of female is found feeble in the case of higher decision-making process of the households whereas while dealing waste the role of female was observed crucial.

Often women are regarded as the “de facto” waste managers of the household because they are found to be taking primary responsibility of care-giving activities including cooking chores in the

kitchen that includes managing household waste (Seager, Rucevska & Schoolmeester, 2020). In the Nepalese community, cooking chores are often considered as women’s job. Therefore, most of HH-level waste management including of kitchen waste falls under the responsibility of women.

A similar study conducted in Bharatpur Metropolitan City (BMC), Nepal revealed that in over 80% of the households in BMC, waste was primarily managed by women that included segregation and disposal of wastes. The report highlighted that gender can act as an influencing factor to determine the attitudes and behavior of people with regard to household waste management (Rai, Nepal, Khadayat, Bharadwaj, 2019).

Based on our study, it was revealed that most husbands agree that their wives (25%) play the major role of waste managers in the household. Most of the in-laws also perceive their daughter-in-law (12.7%) to be the responsible person for dealing with wastes. The study has also shown that unmarried daughters (0.7%) are more responsible in dealing with waste than young sons (0.2%). This shows that no matter what relationship they hold in their family, women play a primary role of managing household wastes in comparison to their male counterparts. This is also because women relate management of wastes with daily household chores. Usually, male members of the household go to work outside home and engage less in household chores.

### 3.2.2 Practice of Segregation of Household Waste

Waste segregation refers to the separation of dry and wet waste, which determines the way for other concepts of waste management like composting, reusing and recycling. Its end goal is to reduce waste from being sent off to the landfill sites and eventually, prevent land, water and air pollution.

Table 15: Practice of Segregation of Household Waste as per the Ethnicity, Religion and Household Type.

Variables	Categories	Practice of segregation HH waste								
		HH waste segregation			Sorting out Kitchen waste			Recyclable Waste		
		Yes	No	T	Yes	No	T	Yes	No	T
Ethnicity	Brahmin	28 (60)%	19 (40)%	47 (100)%	28 (60)%	19 (40) %	47 (100)%	23 (49)%	24 (51) %	47 (100)%
	Chhetri	11 (39)%	17 (61)%	28 (100)%	11 (39)%	17 (51) %	28 (100)%	13 (46)%	15 (54) %	28 (100)%
	Janajati	179 (57)%	136 (43)%	315 (100)%	175 (56)%	140 (44) %	315 (100)%	179 (57)%	136 (43) %	315 (100)%
	Dalit	4 (33)%	8 (67)%	12 (100)%	4 (33)%	8 (67) %	12 (100)%	3 (25)%	9 (75) %	12 (100)%
	Total	222 (55)%	180 (45)%	402 (100)%	218 (54)%	184 (46)%	402 (100)%	218 (54)%	184 (46)%	402 (100)%

Religion	Hindu	112 (49)%	118 (51)%	230 (100)%	110 (48)%	120 (52)%	230 (100)%	105 (46)%	125 (54)%	230 (100)%
	Buddhist	101 (64)%	57 (36)%	158 (100)%	98 (62)%	60 (38)%	158 (100)%	85 (54)%	73 (46)%	158 (100)%
	Muslim	3 (75)%	1 (25)%	4 (100)%	3 (75)%	1 (25)%	4 (100)%	3 (75)%	1 (25)%	4 (100)%
	Cristian	5 (63)%	3 (37)%	8 (100)%	5 (63)%	3 (37)%	8 (100)%	6 (75)%	2 (25)%	8 (100)%
	Kirat	1 (50)%	1 (50)%	2 (100)%	1 (50)%	1 (50)%	2 (100)%	0 (0)%	2 (100)%	2 (100)%
	Total	222 (55)%	180 (45)%	402 (100)%	217 (54)%	185 (46)%	402 (100)%	199 (49)%	203 (51)%	402 (100)%
Household types	House with home garden	55 (59)%	38 (41)%	93 (100)%	57 (61)%	36 (39) %	93 (100)%	50 (54)%	43 (46) %	93 (100)%
	House without home garden	159 (55)%	128 (45)%	287 (100)%	153 (53)%	134 (47) %	287 (100)%	142 (49)%	145 (51) %	287 (100)%
	Apartment	1 (33)%	2 (67)%	3 (100)%	0 (0) %	3 (100)%	3 (100)%	1 (33)%	2 (67) %	3 (100)%
	Rent	7 (37)%	12 (63)%	19 (100)%	7 (37)%	12 (63) %	19 (100)%	6 (32)%	13 (68) %	19 (100)%
	Total	222 (55)%	180 (45)%	402 (100)%	217 (54)%	185 (46) %	402 (100)%	199 (49)%	203 (51) %	402 (100)%

Source: Field Survey 2021

It was reported that about 55% of the households segregate household waste at source. Out of them, 54% segregate kitchen waste as well as recyclable. The data presented in Table 15 shows that around 45 households were found disposing or supplying their waste in mixed form. Ethnically, more than 50 % Brahmin and Janajati participants were found practicing HH waste segregation whereas the percentage of that of the Chettri and Dalit is less than 40%. Likewise, regarding religion, the percentage of Buddhists found practicing waste segregation at sources is higher in comparison to the other religions as indicated in the Table 15. A chi-square test of independence was performed to examine the relation between ethnicity and religion of the participants with their practice of HH waste segregation, sorting out kitchen waste and recyclable waste. There was not significant relationship between the ethnicity of the participants with their practice of sorting out kitchen waste and recyclable waste. But, in in the case of religion, significant relationship was obtained with HH waste segregation,  $\chi^2 (4, N=402) = 9.6, p < 0.05 (0.04)$ . The data indicates that there was the association between the religion of the participants with their practice of HH waste segregation. As

indicated in the data presented in Table 15, the percentage of the participants having Buddhist (64%) seems greater than the Hindu (49%).

Regarding the house type, the percentage of the households having a garden were found only slightly higher (59%) in comparison to the households without a home garden (55%) in separating waste.

According to Maskey (2018), in Nepal, waste segregation at source is mandated by law but the government/municipality is not able to implement it successfully. According to this survey, about 67% of the respondents were willing to segregate waste in future if the government enforces the law and supports with associated services.

In Kirtipur, households with agricultural space are found to be segregating disposable waste from other wastes and using it to prepare manure for farming. Out of the 217 (54%) households who were involving in sorting out the kitchen waste 210 (97%) use the kitchen waste as compost manure. On the other hand, those households who do not have access to open spaces are found to be storing all the wastes in dry form and later send it away with the waste collectors.

### ***3.2.3 Primary Method of Disposing Waste***

In general, waste should undergo material recycling or thermal treatment including biological processing like composting. If this is not possible for technical reasons, or if it is not economically and environmentally viable, waste is deposited in landfills following suitable treatment. The survey was conducted to know the situation of primary method of disposing waste in the study area. The following table 16 shows primary method of disposing waste.

The primary method of disposing waste such as mixed, kitchen and other wastes like plastics, polythene, paper, cardboard, glass, metals, electric, electronic and medical as reported by the respondents is done through the collection by third parties. 92.8% of mixed waste is collected by third parties and around 2 Percent is burnt. Only 44.3% of the kitchen waste gets collected by the third party whereas the rest is understood to be managed at household itself. Additionally, the waste like plastics, paper, cardboard, glass, metals, e-waste, medical waste get collected by the third party in most of the cases. Hence, the data presented in Table 16 revealed that third party collection is the most dominated primary methods of disposing waste.

Table 16: Primary Method of Disposing Waste

Types of Waste	Primary method of Disposing Waste											
	Collected by a third party		Brought to a collection point in the neighborhood		Brought to a collection point in the building (compound)		Littered		Burnt		Other	
	N	%	N	%	N	%	N	%	N	%	N	%
Mixed Waste	373	44.0	1	.2	-	-	-	-	9	2.2	19	4.7
Kitchen Waste	178	44.3	1	.2	-	-	-	-	1	.2	222	54.9
Plastics	361	89.8	1	.2	-	-	-	-	-	-	10	2.3
Polythene	347	86.3	1	.2	-	-	-	-	23	5.7	9	2.2
Paper	322	80.1	-	-	-	-	-	-	51	12.7	7	1.7
Cardboard	266	66.2	-	-	-	-	-	-	40	10	3	.7
Glass	296	73.6	1	.2	-	-	-	-	-	-	16	3.9
Metals	287	71.4	-	-	-	-	-	-	1	.2	-	-
Electric (Wires, Battery)	253	62.9	-	-	-	-	-	-	-	-	2	.4
Electronic	228	56.7	-	-	-	-	-	-	-	-	1	.2
Medical Waste	266	66.2	1	.2	-	-	-	-	1	.2	5	1.2

Source: Field Survey 2021

More than 90% of the households in Kirtipur have taken waste membership with the private waste companies responsible for collection of wastes. Members have to pay a monthly user fee to the company in order to have their mixed waste taken away. Other wastes, such as old cycles or television sets, are usually sent away with the cycle-hawkers.

### 3.2.4 Type of the Service Provider

There are various kinds of waste service providers such as municipalities, informal waste workers such as rag pickers, door vendors and private companies. The survey result regarding the types of the service provider in the case of Kirtipur municipality has been demonstrated in the Table 17 Below.



Table 17: Types of the Service Provider (N=402)

Type of the Service Provider										
Types of Waste	Municipal		Informal Collector		Private Company		Respondent Self		Others (not known)	
	N	%	N	%	N	%	N	%	N	%
Mixed Waste	17	4.2	-	-	361	89.8	24	6	-	-
Kitchen Waste	8	2	-	-	174	43.3	220	54.5	-	-
Plastics	14	3.5	19	4.7	330	82.1	33	8.1	6	1.5
Polythene	12	3	11	2.7	326	81.1	33	8.2	20	5
Paper	4	1	108	27	211	52.5	54	13.3	25	6.21
Cardboard	1	0.2	91	22.6	178	44.3	39	9.7	93	23.1
Glass	9	2.2	25	6.2	265	65.9	20	5	83	20.6
Metals	6	1.5	120	30	161	40	3	0.7	112	27.9
Electric (Wires, Battery)	4	1	83	20.6	165	41	5	1.2	145	36.1
Electronic	2	0.5	56	14	171	42.5	4	1	169	42
Medical Waste	6	1.5	8	2	252	62.7	-	-	136	33.8

Source: Field Survey 2021

Private waste companies are found to be taking the major responsibility (89.8%) of collecting mixed wastes from the households. This also shows that the maximum number of households has already taken waste membership with the private waste company. In the case of kitchen waste, majority of the respondents (54.5%) reported that they have managed the kitchen waste themselves making compost manure applying domestic process. Likewise, in the case of plastics, paper, cardboard, metals and e-waste, private companies were providing the collection service followed by informal individual collectors. In the case of collection of cardboard, glass, metals, e-waste and medical waste more than 20 % respondents reported their ignorance about the service provider. In case of Kirtipur, four private waste companies are working to collect wastes from different wards of Kirtipur Municipality. These include, *Kirtipur Fohormaila Prasodhan tatha Byabasthapan Kendra* (Kirtipur Waste Processing and Management Centre), Clean Nepal Pvt. Ltd., *Sirjanshil Batabaran Samrakshan Kendra* (Nepal Clean Environment Protection Centre) and *Nepal Swachha Batabaran Srijana Kendra* (Nepal Clean Environment Innovation Centre). It shows the important roles of private sector in SWM and partnership with the Municipality within the framework of institutional arrangements for SWM.

### 3.2.5 Gender of Waste Collectors

The survey was conducted to know the gender of the waste collectors to analyze from the gender perspective of waste management related actors in the waste chain. The following table demonstrates the situation of gender wise distribution of the waste collector.

Table 18: Gender of the Waste Collector

Types of Waste	Female		Male		Not Specified	
	N	%	N	%	N	%
Mixed Waste	4	1	380	94.5	18	4.5
Kitchen Waste	25	6.2	194	48.3	183	45.5
Plastics	4	1	366	91	32	8
Polythene	4	1	349	86.8	49	12.2
Paper	7	1.7	326	81.1	68	16.9
Cardboard	6	1.5	275	68.4	120	29.9
Glass	2	0.5	299	74.4	101	25.1
Metals	1	0.2	287	71.4	114	28.4
Electric (Wires, Battery)	1	0.2	251	62.4	150	37.3
Electronic	1	0.2	229	57	172	42.8
Medical Waste	1	0.2	267	66.4	134	33.3

Source: Field Survey 2021

About 80-90% of the waste collectors for collecting all types of waste such as mixed, kitchen, plastics, polythene, paper, cardboard, glass, metals, electric, electronic and medical waste were found male. Gender mainstreaming activities are only available at upper administrative levels specifically in the government services and political sector. Training on gender mainstreaming for all staff in district and local offices related to waste management including private sector would build knowledge on the concept and benefits of the approach that could be shared and implemented within the sector at all levels. At present, Bhutan, Mongolia and Nepal do not collect gender-disaggregated statistics and information on the waste sector in any systematic way, though this is a change needed if they are to develop evidence based and gender-sensitive policies and responsive mechanisms. Collecting gender-disaggregated data for all relevant waste sector indicators in order to measure impacts and results will provide important benchmarks against which any changes within the sector can be assessed (UN Environment, 2019).

In the case of Kirtipur municipality, wastes that are collected within the household, for example, kitchen wastes and dust particles after sweeping are collected by the female members of the household. However, the wastes that are taken for disposal to the landfill site are mostly collected by male waste collectors engaged with private waste companies though there is the participation of few female workers.

### ***3.2.6 Payment for Waste Collection Service***

The private sectors dealing with solid waste management, charge for their services. During the survey, it was attempted to find out the payment for waste collection service. The following Table 19 presents the data related to the payment fee for waste service.

Each household has to pay a certain amount of fees agreed between the households and the company. These fees for waste collection range from NRs. 150 to NRs. 1000 depending upon the number of stories of the house, number of families staying in a house, volume of waste and the nature of the settlement-urban or rural. Usually, a household with a small family of 4 is charged NRs. 150 to NRs. 250 whereas a household with more than 3 families especially, residing outside the core city area is charged somewhere between NRs. 300-450. Apartments, household with hotels, guesthouse and those serving lodging facilities are charged a minimum of NRs. 350 which is increased as per the volume of wastes. For additional wastes, extra waste fee ranging from NRs. 500-1000 is charged. In case of tenants, the owner/landlord charges them based on the occupancy of the room and number of families residing in the rented house. For instance, a tenant occupying only 1 room may be charged NRs. 100 for waste. On the other hand, tenant with 3-4 families in a house maybe charged up to NRs. 500 with a minimum charge of NRs. 100-150. If the whole house is occupied by more than 5-6 families of tenant, then they may be charged up to NRs. 1000. This is mostly prevalent in the ward 2 and 10 of Tyanglaphant area of Kirtipur. The mode of operation of waste collection is similar in the different parts of the Kirtipur Municipality; standard rules are applied by the private companies involved in collection of solid waste in accordance to the memorandum of understanding (MoU) signed with Kirtipur Municipality and the four private waste companies.

Table 19: Payment for Waste Collection Services

Payment of Waste Collection Service for Mixed Waste (N=402)			
Type of Waste	Amount (NRs)	Number	Percentage
Mixed Waste	Up to 100	4	1
	150	80	20
	200	67	16.7
	250	25	6.2
	300	48	11.9
	350	66	16.4
	400	33	8.2
	450	15	3.7
	500	12	3
	600	5	1.2
	700	3	0.7
	800-1000	3	0.6
Do not pay / not subscribe to collection service	0	41	10.2
Total		402	100

Source: Field Survey 2021

20% of the respondents pay the minimum waste fee of NRs. 150 per month irrespective of the volume and types of waste. About 10.2% of the respondents reported that they do not pay any fees for waste service. This indicates that they haven't taken membership for a private waste collection service or they have been provided with free waste service by the local governments or other actors. For instance, the waste service in one of the *toles* of ward no 1, Thambahal *tole* is being taken care by *Lahana*, a local restaurant. This was a volunteer service of the restaurant.

### 3.2.7 Money Received from Selling Waste

In Nepal's urban area, households have the general practice of selling waste like plastic, polythene, paper, cardboard, metal, and e-waste. However, the practice of the households in Kirtipur was found different as per the data presented in the Table 20 below:

Table 20: Money Received from Selling Waste

Amount range of per kg waste (Rs)	Types of Waste													
	Plastic		Polythene		Paper		Cardboard		Metal		Electric (Wires, Battery)		Electronic	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
1-5	1	0.2	-	-	22	5.4	11	2.7	2	0.5	1	0.2	-	-
6-10	3	0.7	2	0.5	53	13	42	10.3	20	5	13	3.2	6	1.4
11-20	6	1.4	1	0.2	4	1	7	1.7	9	2.2	2	0.5	2	0.4
21-30	2	0.4	-	-	2	0.5	-	-	26	6.4	7	1.7	7	1.7
31-40	1	0.2	-	-	2	0.5	-	-	3	0.7	1	0.2	2	0.5
41-50	-	-	-	-	2	0.5	3	0.7	2	0.5	3	0.7	2	0.5
51-60	-	-	-	-	-	-	-	-	-	-	-	-	-	-
61-70	-	-	-	-	-	-	-	-	-	-	1	0.2	-	-
71-80	-	-	-	-	-	-	-	-	-	-	-	-	-	-
81-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-
100	-	-	-	-	-	-	-	-	1	0.2	-	-	-	-
150	-	-	-	-	1	0.2	1	0.2	-	-	-	-	-	-
500	-	-	-	-	-	-	-	-	-	-	1	0.2	1	0.2
Do not Sell	389	96.8	399	99.3	314	78.1	335	83.3	327	81.3	373	92.8	382	95

Source: Field Survey 2021

It is seen that the respondents receive minimum of NRs. 6 to NRs. 10 for selling wastes such as paper and cardboard per kg. For plastic and polythene wastes, the respondents (1.4% and 0.5%) reported to receive a very minimum amount respectively. By selling e-waste, the respondents can even earn up to NRs. 500 per month or more as per the volume of waste. But, the household of this category found nominal. Generally, the households segregate the waste like plastic, polythene, paper, cardboard, metal, e-waste and so on and collect for few days or more and the mobile individual waste collector (Cycle hawker) reach to the households to collect such wastes. The individual collector pays a certain sum of money to the households and they pick the waste through bicycle to the commercial waste collector (Kawadi), and the payments vary mostly as per the negotiations. The waste collector collects such waste from individual collectors in large volume and supply for the recycling industries. This sort of practices was observed in the study field. The households of most of the municipalities in Nepal have this sort of practice (CBS, 2020).

### 3.2.8 Timeframe for Waste Production

Generally, household waste generates daily, weekly, monthly or yearly as per the nature of the waste. Through the survey it was attempted to obtain the information regarding the timeframe for waste collection in the households of the Kirtipur Municipality. The following Table 21 provides the information on timeframe.

Table 21: Timeframe for Waste Production

Types of Waste	Timeframe for Waste Production (N=402)										
	Not Specified	Every-day	Weekly			Monthly			Yearly		
			Upto 2 times	2-4 times	More than 4 times	Upto 2 times	2-4 times	More than 4 times	Upto 2 times	2-4 times	More than 4 times
Mixed	27 (6.7)	329 (81.8)	41 (10.2)	4 (1)	329 (81.8)	1 (0.2)	-	-	-	-	-
Kitchen	225 (56)	169 (42)	5 (1.2)	-	171 (42.5)	1 (0.2)	-	-	-	-	-
Plastic	263 (65.4)	82 (20.4)	37 (9.2)	1 (0.2)	83 (20.6)	14 (3.5)	1(0.2)	-	-	-	-
Polythene	276 (68.7)	85 (21.1)	35 (8.7)	1 (0.2)	86 (21.4)	3 (0.7)	-	-	-	-	-
Paper	282 (70.1)	62 (15.4)	35 (8.7)	-	62 (15.4)	9 (2.2)	-	-	11 (2.7)	-	-
Cardboard	323 (80.3)	31 (7.7)	19 (4.7)	-	29 (7.2)	9 (2.2)	-	-	17 (4.2)	1(0.2)	1 (0.2)
Glass	340 (84.6)	18 (4.5)	6 (1.5)	-	18 (4.5)	5 (1.2)	-	-	29 (7.2)	-	-
Metal	348 (86.6)	17 (4.2)	2 (0.5)	-	18 (4.4)	4 (1)	-	-	27 (6.7)	-	-
Electric (Wire..)	353 (87.8)	17 (4.2)	2 (0.5)	-	17 (4.2)	2 (0.5)	-	-	23 (5.7)	-	-
Electronic	370 (92)	17 (4.2)	2 (0.5)	-	17 (4.2)	-	-	-	6 (1.5)	1 (0.2)	-
Medical	377 (93.8)	17 (4.2)	3 (0.7)	-	17 (4.2)	2 (0.5)	-	-	2 (0.5)	-	-

Source: Field Survey 2021

It is seen that up to four-fifth (81.8%) of the respondents reported that the mixed waste gets production on a daily basis or more than four times in a week. Similarly, 42% of the respondents reported that the kitchen waste gets production every day in general. Except the mixed and kitchen

waste, majority of the respondents were not able to specify the time while asking the question related to the time frame of collecting waste.

### 3.2.9 Timeframe for Waste Disposal

The waste disposal time also plays a crucial role in managing waste. As per the discussion made earlier, the private waste collectors collect the waste from the households as per the defined schedule. In addition to this, there is different practice of disposing decomposable waste. The Table 22 below provides the information regarding the disposal of various wastes.

Table 22: Timeframe for Waste Disposal

Types of Waste	Timeframe for Waste Collection										
	Not Specified	Everyday	Weekly			Monthly			Yearly		
			Upto 2 times	2-4 times	More than 4 times	Upto 2 times	2-4 times	More than 4 times	Upto 2 times	2-4 times	More than 4 times
Mixed	35 (8.7)	2 (0.5)	335 (83.3)	8 (2)	3 (0.7)	14 (3.5)	9 (2.2)	-	-	-	-
Kitchen	232 (57.7)	46 (11.4)	129 (32.1)	-	35 (8.7)	2 (0.5)	1 (0.2)	-	-	-	-
Plastic	238 (59.2)	2 (0.5)	139 (34.6)	-	1 (0.2)	18 (4.5)	1 (0.2)	-	-	-	-
Polythene	248 (61.7)	3 (0.7)	143 (35.6)	-	2 (0.5)	3 (0.7)	1 (0.2)	-	-	-	-
Paper	265 (66)	2 (0.5)	112 (27.9)	2 (0.5)	-	12 (3)	1 (0.2)	-	6 (1.5)	-	-
Cardboard	295 (73.4)	1 (0.2)	70 (17.4)	-	1 (0.2)	13 (3.2)	1 (0.2)	-	16 (4)	-	-
Glass	314 (78.1)	1 (0.2)	57 (14.2)	-	1 (0.2)	3 (0.7)	-	-	21 (5.2)	-	-
Metal	320 (79.6)	-	51 (12.7)	-	-	4 (1)	-	-	21 (5.2)	-	-

Electric (Wire....)	322 (80.1)	-	54 (13.4)	-	-	1 (0.2)	-	-	19 (4.7)	-	-
Electronic	336 (83.6)	-	52 (13)	-	-	-	-	-	6 (1.5)	-	-
Medical	337 (83.8)	-	53 (13.2)	-	-	1 (0.2)	-	-	2 (0.5)	-	-

Source: Field Survey 2021

It was reported that the waste from the household gets collected and disposed by the service provider at least twice a week. Four-fifth of the respondents (83.3%) reported to send away their mixed wastes with the waste collectors generally twice a week. Furthermore, people manage kitchen wastes on their own as well, 11.4% of the respondents reported that they dispose kitchen waste on a daily basis. As per the data presented in Table 22, except the mixed waste, there is no specific time frame of disposing the waste like plastic, polythene, paper, cardboard, metal, e-waste etc.

### 3.2.10 Problems with the Waste Management Service

It was attempted to obtain the information on the problems with the waste management service in the case of Kirtipur Municipality. The following Table 23 provides the information regarding this concern.

Table 23: Problems with the Waste Management Service

S.N.	Problems in Waste Management	Response	
		N=402	
		Number	Percentage
<b>Mixed Waste</b>			
1	No Problem	364	90.5
2	Inappropriate collection point, time or day	8	1.8
3	Charge high waste fee	10	2.5
4	Mixed wastes produce foul smell when not collected	1	0.2
5	Sometimes children blow the whistle for fun and people get confused with the waste workers	2	0.5
6	Service provider makes phone call if it gets late to pay waste fee	1	0.5
7	Municipality is not working properly/road are not clean and isn't well-managed	3	0.7
8	Behavior of money collector is not good	1	0.2



9	Pay same amount of waste fee even when the volume of waste is less	3	0.7
10	Less importance of getting waste membership	1	0.2
11	Piled up wastes get littered by stray dogs	3	0.7
12	Waste fee charged based on the number of stories of the house/families	4	1
13	Extra waste fee for shutter space (shop)	1	0.2
<b>Kitchen Waste</b>			
15	No problem	396	98.5
16	Refuse to take wastes left from a ceremony	2	0.5
17	Often waste spill from the waste vehicle while transporting	4	1
<b>Plastic Waste</b>			
18	No problem	399	99.3
19	Narrow alley for waste vehicles to pass	2	0.5
20	Cycle-hawkers refuse to take plastic wastes	1	0.2
<b>Polythene Waste</b>			
21	<i>No problem</i>	401	99.8
22	<i>Not collected milk and curd plastics from dairy shop</i>	1	0.2
Paper Waste			
23	<i>No problem</i>	400	99.5
24	<i>Bargains a lot</i>	2	0.5
Cardboard Waste			
25	<i>No problem</i>	402	100
Glass Waste			
26	<i>No problem</i>	398	99
27	<i>Cycle-hawkers refuse to take glass wastes</i>	3	0.7
28	<i>Waste collectors should be pre-informed about glass waste</i>	1	0.2
Metal Waste			
29	<i>No problem</i>	402	100
Electric (Wire, Battery) Waste			

30	<i>No problem</i>	402	100
Electronic Waste			
31	<i>No problem</i>	401	99.8
32	<i>Doesn't give satisfactory amount in return</i>	1	0.2
Medical Waste			
33	<i>No problem</i>	402	100

Source: Field Survey 2021

Most of the respondents (more than 90%) reported that they do not find any problems in waste management service in the collection of mixed waste, kitchen waste, plastic, polythene, paper and glass wastes. 100% of the respondents reported that they have no problems in the collection and management of wastes such as cardboard, metal, electric, electronic and medical wastes. However, few respondents raised the voice on high fees or the fee structure, irregular collection and its impacts on health.

### ***3.2.11 Problems with Waste Workers***

Human behavior is a complex phenomenon determined by a multitude of factors, including environmental factors (such as social support/barriers, ability to change one's own environment), behavioral factors (such as skills, practice and self-efficacy) and cognitive/personal factors (such as, knowledge, perceptions, expectations and attitudes). Considering these concerns in the case of waste workers, respondents were asked the problem relating to the waste workers while dealing with the waste of their households. The following Table 24 provides the detail information on this concern.

Table 24: Problems with the Waste Workers

S.N.	Problems with the Waste Workers	Response	
		N=402	
		Number	Percentage
<b><i>Mixed Waste</i></b>			
1	No problem	334	82.8
2	Sometimes waste collectors do not take wastes that are kept outside	2	0.5
3	Waste does not get collected during monsoon, when waste vehicle breaks down or the driver falls sick, during Dashain festival and if problem arises at Sisdol landfill site	12	3
4	Refuse to take high volume of waste; pay extra charge	4	1
5	Extra Dashain charge	21	5.2

6	Taking waste to the collection point unsatisfactory	7	1.7
7	Impolite behavior of the waste collector	13	3.2
8	Waste collectors do not wait if it gets late to take the wastes to the collection point	5	1.2
9	Refuse to take soil and grass weeds	4	1
<b>Plastic Waste</b>			
10	No problem	398	99
11	Refuse to take high volume of wastes; difficulty to carry	3	0.7
12	Neighbors throw wrappers of gutkha and mix their wastes with others	1	0.2
<b>Polythene Waste</b>			
13	<i>No problem</i>	402	100
Paper Waste			
14	<i>No problem</i>	402	100
Cardboard Waste			
15	<i>No problem</i>	402	100
Glass Waste			
16	<i>No problem</i>	369	91.8
17	<i>Refuse to take glass pieces; need to pay extra charge</i>	30	7.5
18	<i>Need to hide glass wastes with other wastes</i>	2	0.5
19	<i>Difficult to manage</i>	1	0.2
Metal Waste			
20	<i>No problem</i>	401	99.7
21	<i>Informal waste worker pays less amount to a girl/woman</i>	1	0.2
Electric (Wire, Battery) Waste			
22	<i>No problem</i>	402	100
Electronic Waste			
23	<i>No problem</i>	402	100
Medical Waste			
24	<i>No problem</i>	402	100

More than four-fifth (80%) of the respondents reported that they do not find any problems with the waste workers. 71% reported that sometimes waste collectors do not come for regular waste collection due to issues at the landfill site, conflict with the local community and the municipality of the waste disposal site, transportation related hurdles during monsoon. In addition to this, impolite behavior of the waste collector, refuse to collect the waste like soil, grass and glass waste, refuse to collect the high volume of waste, demand of extra charge for managing additional waste in specific time, nominal pay for the recycling waste by the individual commercial waste worker and so on were occasional problems with the waste workers faced by the households.

### 3.2.12 Cleanliness of the Neighborhood

The respondents were asked about the cleanliness of the neighborhood. Both the quantitative and qualitative data was collected during the survey. The quantitative data obtained from the survey has been presented in Table 25 below:

Table 25: Cleanliness of the Neighborhood

Ward Number	Cleanliness of the Neighborhood				
	Clean	Somewhat clean	Somewhat dirty	Dirty	Total
1	40 (43 %)	29 (32 %)	15(16%)	8(9 %)	92(100 %)
2	47(52 %)	30(33 %)	6(7 %)	8(8 %)	91(100 %)
3	31(48 %)	20(31 %)	4 (6 %)	9(15 %)	64(100 %)
10	89(57 %)	37 (24 %)	17(11 %)	12(8 %)	155(100 %)
Total	207(51%)	116(30%)	42(10%)	37(9%)	402(100%)

Source: Field Survey 2021

Most of the surveyed respondents (81%) reported that they find their neighborhood clean. Only 9.0% of the respondents reported that their neighborhood is dirty. In order to study the status of cleanliness of the neighborhood around Kirtipur, the survey respondents were asked to justify their opinions regarding the cleanliness of their neighborhood. While analyzing their views, five major concerns were raised that includes, (a) clean surrounding, (b) lack of awareness among people, (c) burning of the wastes (d) untimely waste collection and (e) role of renters. The majority of the respondents shared that they find their surroundings clean as they follow a tradition of sweeping every morning. In addition, installation of idols of Gods and temples has also motivated people to keep the surroundings clean. They further added that the road installation of flowerpots and gardens have also added to the beautification of the environment.

On the contrary, there were some groups of people who mentioned that they do not find time to clean their surroundings daily and completely depend upon the waste collectors. A few of the respondents mentioned that with the increased level of self-awareness among people, the surroundings have become cleaner as people have developed the habit of disposing wastes in the dustbins. However, some of the respondents believe that people like passerby, school children,

neighbors, renters and people from nearby place still lack awareness as they often throw plastic and *gutkha* wrappers, blades, masks and cigarette butts haphazardly on the road. Some of the respondents also showed their concern regarding the haphazard storage of construction materials on the road making the surrounding look dirty and unmanaged. A few of the respondents mentioned that the practice of burning of plastic wastes have caused environmental pollution. Some of the respondents showed their dissatisfaction regarding the untimely collection of waste after the private sector took the responsibility for waste collection. Few respondents shared that due to renters not being made accountable by the owner, some group functions such as church do not manage wastage properly, and some vendors do not manage their wastage.

Few respondents were complaining about the negligence of the municipality in managing wastes around the public places and roadsides. Additionally, disposing glass waste, and the different form of plastic waste, the waste generated in various religious spaces such as temples, church and waste generated from cultural functions of the households were the notable problems of waste management.

### 3.3 Waste Governance

#### 3.3.1 Satisfaction Level of the Household with the Waste Collection

To find the satisfaction level of the households with the waste collection, the 402 respondents were asked a close ended question with five options. The respondents were also asked to justify their choice of the selected option. The households were categorized as per their monthly income. The survey findings have been presented in the Table 26 below.

Table 26: Satisfaction Level of the Household with the Waste Collection (N=402)

Satisfaction with waste collection	Monthly Income				Total
	Poor (Below local poverty level) (N=17)	Lower Middle (N=42)	Middle (N=311)	Upper middle (N=32)	N=402
Completely Satisfied	5 (29)	23 (55)	175 (56)	19 (59)	222 (55)
Somewhat satisfied	7 (41)	11 (26)	80 (26)	6 (19)	104 (26)
Somewhat not satisfied	1 (6)	2 (5)	20 (6)	5 (16)	28 (7)
Completely dissatisfied	1(6)	2 (5)	17 (5)	1 (3)	21 (5)
Not applicable	3 (18)	4 (9)	19 (7)	1 (3)	27 (7)
Total	17 (100)	42 (100)	311 (100)	32 (100)	402 (100)

Source: Field Survey 2021

The result displayed in the Table 26 reveals that majority of the households except below local poverty level were found completely satisfied (55%) with the waste collection practice managed by the municipality. Likewise, around one fourth (26%) households also expressed their partial level of satisfaction with the waste collection practice. In this way, all together four-fifth of the households (81%) were found within the satisfaction zone. The percent of the household with complete

dissatisfaction level was found very low (5%) and the waste collection practice managed by the municipality for the few households (7%) was not found applicable for them.

A chi-square test of independence was performed to examine the relation between types of household on the basis of their income level and satisfaction with the waste collection management practice of the municipality. The relation between these variables was not significant,  $\chi^2 (15, N=402) = 21.5, p > 0.05 (0.120)$ . It indicates that there is no significant correlation between the income level of the household and the satisfaction level of waste collection.

Likewise, additional chi-square test of independence was performed to examine the relation between the ethnicity/castes, gender and location (wards) with the satisfaction of waste collection practice of the municipality. The relationship between the location (wards) and the satisfaction of waste collection practice of the municipality was found significant,  $\chi^2 (15, N=402) = 29.9, p < 0.05 (0.012)$ . It indicates that there is significant correlation between the location of the household and the satisfaction level of waste collection. Specifically, the households of the urban area found more dissatisfaction than the other location. But the result of chi-square test of independence for the ethnicity/castes with the satisfaction of waste collection practice of the municipality was not found significant. Same result was obtained in the case of gender as well. It indicates that there is no significant correlation between the ethnicity/castes and gender with the satisfaction level of waste collection.

In order to find the subjective experiences of the respondent regarding the satisfaction level with the waste collection, during the survey respondents were asked to justify their opinion regarding the satisfaction level. While analyzing their views, major three concerns (a) regularity, (b) behavior of the collector and (c) cost of the service were experienced. Majority of the respondents reported that the service was regular and timely. However, some respondents showed their concern over the collection only once in 3-4 weeks and there was no fixed routine for the waste collection, especially during COVID-19 lockdown. According to them, due to this reason when waste gets piled up it produces foul smell and gets littered by stray dogs as well. Regarding the behavior of the collector, majority of the respondents expressed their happiness that most of the collectors were polite and helpful. There is a practice of providing signal by blowing the whistle. On the contrary, a few respondents experienced that the behavior of some of the collectors was rude and do not respect elders in specific; sometimes waste collectors ignore small bags of wastes; sometimes they do not blow whistle in an audible volume; waste collectors do not wait for even a while to bring out the wastes and they become angry if the volume of waste is little high than usual. Another concern was about the cost of the waste collection. Some of the respondents expects to get free service for the waste collection and a few also suggested to fix the service charge as per the volume of the waste. In addition to these information, qualitative information tells that there were few households having no membership for the waste service and they throw the waste haphazardly. The data in Table 26, in the heading 'not applicable may represent the voice of this category HHs.

### ***3.3.2 Comparison of Current Waste Collection Practice between 2016 and 2021***

During the survey the respondents were asked to compare the practice of current waste collection with past five years. Both the quantitative and qualitative information have been collected during the survey. The following Table 27 shows the comparison of current waste collection practice with 5 years back.

Table 27: Comparison of Current Waste Collection Practice with 5 Years Back

Comparison of Current Waste Collection Practice with 5 Years Back	Monthly Income				Total
	Poor (Below local poverty level) (N=17)	Lower Middle (N=42)	Middle (N=311)	Upper middle (N=32)	N=402
Yes, there is improvement	8 (47%)	25 (69%)	188 (60%)	16 (50%)	237 (59)%
No improvement has experienced	6 (35%)	16 (38%)	116 (37%)	14(44%)	152(38%)
Not Applicable	3 (18%)	1 (3%)	7 (3%)	2 (6%)	13 (3%)
Total	17 (100%)	42 (100%)	311 (100%)	32 (100%)	402 (100%)

Source Field Survey 2021

The result displayed in the Table 27 reveals that majority of the household (59%) except below poverty level reported that there is an improvement in waste collection practice in comparison to the five years back. Likewise, for the few households (N=13, 3 %) it was not found applicable for them.

A chi-square test of independence was performed to examine the relation between types of household on the basis of their income level and their comparison of current waste collection practice with 5 years back. The relation between these variables was found significant,  $\chi^2 (6, N=402) = 14.1, p < 0.05 (0.03)$ . It indicates that the types of the household as per the income level does have effect on comparison of current waste collection practice with 5 years back. The lower middle (69 %) and middle income (60%) level family perceived the difference of current waste collection practice with 5 years back.

Likewise, additional chi-square test of independence was performed to examine the relation between the ethnicity/castes, gender and location (wards) with their comparison of current waste collection practice with 5 years back. The relationship between all the mentioned variables with comparison of current waste collection practice with 5 years back was not found significant. The result of chi-square test of independence for ethnicity/castes:  $\chi^2 (18, N=402) = 14.23, p > 0.05 (0.71)$ , gender:  $\chi^2 (3, N=402) = 4.27, p > 0.05 (0.118)$  and wards:  $\chi^2 (6, N=402) = 5.13, p > 0.05 (0.526)$  were observed. It indicates that households as per the ethnicity/castes, gender and location (wards) did not find any difference in the current waste collection practice with 5 years back.

The study aims to compare the present waste management practice with that of five years ago. For this, opinions of the respondents were collected on the changes that they have found in the waste management practices in the last five years. Three major concerns were identified in this regard. They are (a) no changes seen, (b) waste collection services and management have improved and (c) people are ignorant and lack self-awareness. Majority of the respondents expressed that they found changes in the waste management practices. The qualitative information on this reveals that people do not have distinct memories related to waste practices done five years ago. In addition, there are still some households that haven't taken waste collection related membership because of which they are not able to compare the waste collection and services. Few respondents who are living as renters and have just moved to Kirtipur were also not able to compare. Nonetheless, most of the

respondents said that they have found that waste collection services becoming regular and timely with the increase in the number of waste collectors. They expressed their satisfaction saying that waste gets collected at least twice a week and the environment has become comparatively cleaner with improved sewerage after the intervention of the municipality in the 48 collection centers. In addition, road construction and installation of roadside gardening have also added to the beautification of environment due to managing street waste properly. However, some of the respondents said that people have become ignorant and lack self-awareness regarding waste management as they are found to throw the wastes haphazardly which often get littered by stray dogs. People also practice burning of paper and cardboard wastes. Further probing to this practice revealed that usually, people use paper and cardboard wastes along with firewood while preparing homemade alcohol. Nonetheless, a large number of people expressed that people have now become aware about keeping the surroundings clean. The qualitative information revealed that a social initiative with a tagline, 'Who does it if I don't?' is also helping to improve the cleanliness in the surrounding areas. People have also developed a behavior of waste segregation and dustbins have been installed in every ward.

### 3.4 MSWM and Crises

#### 3.4.1 Changes in Waste Management after Earthquake and the Indian Blockade

The earthquake of 2015 and subsequent Indian blockade period have been posing significant challenges to the household waste management sector authorities, waste management chain related personnel and relevant actors. The chain of collection, segregation, recycling, and disposal of household generated wastes was regularly interrupted. During the survey, it was attempted to capture the views of the respondents regarding the changes in waste management after earthquake and Indian blockade. The Table 28 below presents the response of the participants.

Table 28: Changes in Waste Management after Earthquake and Indian Blockade

Changes in Waste Management after Earthquake and Indian Blockade	Monthly Income				Total
	Poor (Below local poverty level) (N=17)	Lower Middle (N=42)	Middle (N=311)	Upper middle (N=32)	N=402
Yes, it has changed	4 (24%)	10 (24%)	96 (31%)	12 (38%)	122(30%)
No, not any change has been experienced	10 (59%)	25 (59%)	173 (56%)	13 (41%)	221(55%)
Do not know	3 (17%)	7 (17%)	42 (13%)	7 (21%)	59 (15%)
Total	17(100)	42 (100%)	311 (100%)	32 (100)	402 (100)

Source: Field Survey 2021

The information displayed in Table 28 above reveals that around one third (30%) of the respondents reported that they have experienced change in waste management practices of the municipality after the earthquake, Indian blockade and during the COVID-19 pandemic. Likewise, majority of the



household (55%) of the entire economic group except upper middle level category reported that there were not any changes experienced during these times. Furthermore, the respondents of few households (15 %) reported that they were not able to compare the situation.

A chi-square test of independence was performed to examine the relation between types of households on the basis of their income level and their experience of changes in waste management after Earthquake and Indian blockade. The relation between these variables was not found significant,  $\chi^2 (6, N=402) = 4.5, p > 0.05 (0.61)$ . It indicates that there is no significant correlation between the income level of the household and experience of changes in waste management after Earthquake and Indian blockade.

Likewise, additional chi-square test of independence was performed to examine the relation between the ethnicity/castes, gender and location (wards) with their experience of changes in waste management after Earthquake and Indian blockade. The relationship between all the mentioned variables with their experience of changes in waste management after Earthquake and Indian blockade was not found significant. The result of chi-square test of independence for ethnicity/castes:  $\chi^2 (18, N=402) = 25.03, p > 0.05 (0.124)$ , gender:  $\chi^2 (3, N=402) = 1.32, p > 0.05 (0.516)$  and wards:  $\chi^2 (6, N=402) = 1.6, p > 0.05 (0.95)$  were observed. It indicates that households as per the ethnicity/castes, gender and location (wards) did not experience any changes in waste management after Earthquake and Indian blockade.

In order to know the changes that they observed in waste management after the two major crises of 2015, earthquake and Indian blockade to Nepal, the opinions of the respondents were collected. While analyzing their views, four major concerns were identified, (a) timely and managed waste collection service, (b) segregation of wastes at source, and (c) use of technology. Majority of the respondents said that they were unaware about the changes in the waste management before and after the crisis. Further qualitative information to this opinion revealed that few of the respondents had settled only recently in Kirtipur because of which they were unable to answer the changes that have occurred in waste management practice of their area over the years. In addition, most of the respondents have very vague memories of the two major crisis that occurred in 2015. Besides this, almost one third of the respondents (30%) have expressed that they have seen positive changes in terms of waste collection. It was reported that the waste collection service which was halted during Indian blockade but became regular and managed as private waste companies have taken up the responsibility for waste collection. Another group of respondents expressed that, learning from the crisis, people have now developed a habit of segregating waste at source. People disposed the wastes in their backyard or nearby agricultural land and were trying to grow organic vegetables for family consumption. Due to increased level of awareness among people, the surroundings are much cleaner and less volume of waste is produced. Few of the respondents even expressed their joy of waste billing also getting digitized. They also seemed supportive of the idea of installing CCTV on public places to monitor the waste littering activities in the surroundings.

### ***3.4.2 Changes in Household Waste Practices after Earthquake and Indian Blockade***

During the survey the respondents were asked about the changes in household waste practices after Earthquake and Indian Blockade. The response of the respondents has been presented in the table below:

Table 29: Changes in Household Waste Practices after Earthquake and Indian Blockade

Changes in Household Waste Practices	Monthly Income				Total
	Poor (Below local poverty level) (N=17)	Lower Middle (N=42)	Middle (N=311)	Upper middle (N=32)	N=402
Yes, I have changed	6 (35%)	10 (24%)	83 (27%)	8 (25%)	107 (27%)
No, I have not made any change	8 (47%)	25 (59%)	186 (60%)	15 (47%)	234 (58%)
Do not know	3 (18%)	7 (17%)	42 (13%)	9 (28%)	61 (15%)
Total	17(100)	42 (100%)	311 (100%)	32 (100)	402 (100)

Source: Field Survey 2021

When asked if the respondents changed waste practices in their household level after the earthquake and Indian blockade only 27% said that they did change waste practices in comparison to 58% who continued with the same waste practices even after the earthquake and the Indian blockade. Fifteen percentage of the respondents were found neutral in this regard.

A chi-square test of independence was performed to examine the relation between types of household on the basis of their income level and their experience on changes in household waste practices after earthquake and Indian blockade. The relation between these variables was not found significant,  $\chi^2 (6, N=402) = 6.1, p > 0.05 (0.41)$ . It indicates that there is no significant correlation between the income level of the household and experience on changes in household waste practices after earthquake and Indian blockade.

Likewise, additional chi-square test of independence was performed to examine the relation between the ethnicity/castes, gender and location (wards) with their experience on changes in household waste practices after earthquake and Indian blockade. The relationship between all the mentioned variables with their experience on changes in household waste practices after this crisis was not found significant. The result of chi-square test of independence for ethnicity/castes:  $\chi^2 (18, N=402) = 25.03, p > 0.05 (0.124)$ , gender:  $\chi^2 (3, N=402) = 2.11, p > 0.05 (0.34)$  and wards:  $\chi^2 (6, N=402) = 7.98, p > 0.05 (0.23)$  were observed. It indicates that households as per the ethnicity/castes, gender and location (wards) did not experience any changes in household waste practices after earthquake and Indian blockade.

In order to find the subjective experiences of the respondents regarding the changes that they adopted in household waste practices after the earthquake and Indian blockade, the respondents were asked to give their personal opinions. To analyze their views, four concerns were experienced, (a) management of decomposable and recyclable wastes, (b) waste storage and reuse, (c) intervention of private sector, and (d) no changes found. Majority of the respondents said that they have found no changes in the household practice of managing wastes after the two major crises of earthquake and the Indian blockade of 2015. The qualitative information to this indicates that

people find no differences in the household management practices because they were residing in another place during the crises and have moved to this place recently. It could also mean that they haven't taken membership for waste and may continue to manage the wastes in a haphazard manner like disposing in neighbor's agricultural land or waste bin and even throwing the wastes in the river. The other group of respondents revealed that they have now learnt to manage organic waste by feeding it to the chickens and made compost used for rooftop farming. For managing recyclable wastes, they usually burn plastic wastes specially the ones which are not saleable. Another set of respondents reported that the surroundings have become comparatively cleaner than before, as people now have adapted to the habits of storing the wastes in the dustbins. They have also developed a habit of collecting and storing the wastes at home during crises period. Some of them are even engaged in reusing of recyclable wastes by making baskets from plastic and paper crafts from paper wastes. Plastic containers are used as flowerpots. Similarly, wastes generated from the earthquake were again re-used to build houses. Few of the respondents explained about the intervention of private waste companies in the waste collection.

### ***3.4.3. Improvement in Current Waste Management System***

During the survey, respondents were asked to provide views if they got the opportunity to lead the current waste management system. In order to find the subjective experiences of the respondents regarding the ways that needs to be taken for the improvement of the existing waste management system, during the survey respondents were asked to justify their opinion regarding the changes required to improve the waste management system. While analyzing their views, six major concerns emerged: (a) changes in waste collection service, (b) as usual, (c) environmental cleanliness, (d) 3Rs (reduce, recycle, reuse), (e) waste fee and fines, and (f) behavior of waste collectors were identified. Majority of the respondents reported that in order to improve the current waste management system, changes in waste collection should be brought. For instance, frequency of waste collection should be increased including separate days for the collection of decomposable and recyclable wastes. Regarding the environmental cleanliness, majority of the respondents reported that home garden/rooftop gardening programs should be initiated including composting at home, beautification of the surroundings through installation of flowerpots, promotion of greenery, installation of wastebins and cleaning the public spaces such as temples, churches etc. Likewise, they expressed that awareness should be increased among people to keep the surroundings clean. In addition, people also need to change their habit regarding throwing of plastic wrappers haphazardly. Some of the respondents recommended using 3R policies of reducing, recycling, and reusing the wastes. They suggested that the recyclable wastes such as plastics and papers be reused, recycling bottles, and reusing polythene to make floor mats. On the other hand, organic wastes are recommended to be turned into compost manure for agricultural purposes. Some of the respondents suggested that waste fee should be fair to all. Further probing to this revealed that people believe that waste fee should be based on the volume of wastes and the number of family members in the household. They also suggested that those who throw the wastes haphazardly in public places should be charged with fines. A few households recommended that the waste collectors should become professionals in terms of their uniform and behavior. They suggested to use personal protective equipment (PPE) for the waste collector in the times of pandemic like COVID-19 to protect themselves and the other community members.

To substantiate the survey results, different levels of interaction with the waste chain management related stakeholders confirmed that the safety gears were not women friendly, safe isolation rooms

for infected women waste workers were not allocated for, women waste workers were stigmatized by the community and they were the ones who lost the income opportunities as most of the solid waste were sent to landfill sites in the mixed form.

### 3.5. Waste Management Activities amid the COVID-19 Lockdown Period

#### 3.5.1 Changes in Waste Collection/Management Activities during the COVID-19 Lockdown

The respondents were asked about their experiences on changes in waste collection and management activities during the COVID-19 lockdown. The responses of the respondents have been analyzed in Table 30 below.

Table 30: Changes in Waste Collection Activities during COV 19 Virus Lockdown

Changes in Waste Collection Activities during COVID-19 Lockdown	Monthly Income				Total N=402
	Poor (Below local poverty level) (N=17)	Lower Middle (N=42)	Middle (N=311)	Upper middle (N=32)	
Yes, I have experienced the change	9 (53%)	20 (48%)	132 (42%)	16 (50%)	177 (44%)
No, I have not experienced any change	6 (35%)	17 (40%)	158 (51%)	15(47%)	196 (49%)
Do not know	2 (12%)	5(12%)	21(7%)	1 (3%)	29 (7%)
Total	17 (100)	42 (100%)	311 (100%)	32 (100)	402 (100%)

Source: Field Survey 2021

Almost half of the respondents (49%) reported that they do not see any changes in the waste management activities amid the COVID-19 lockdown period. The rest almost half (44%), however, said that there were changes in the waste collection activities during COVID-19 lockdown. Seven percentage of the respondents reported that they did not realize any changes.

A chi-square test of independence was performed to examine the relation between types of household on the basis of their income level and their experience on changes in waste collection activities during COVID-19 lockdown. The relation between these variables was not found significant,  $\chi^2 (6, N=402) = 4.9, p > 0.05 (0.54)$ . It indicates that there is no significant correlation between the income level of the household and experience on changes in waste collection activities during COVID-19 lockdown.

Likewise, additional chi-square test of independence was performed to examine the relation between the ethnicity/castes, gender and location (wards) with their experience on changes in waste collection activities during COVID-19 lockdown. The relationship between the location (wards) and their experiences on changes in waste collection activities during COVID-19 lockdown was found significant,  $\chi^2 (15, N=402) = 12.56, p < 0.05 (0.048)$ . It indicates that there is significant correlation between the location of the household and their experience on changes in waste

collection activities during COVID-19 lockdown. Specifically, the households of semi urban area were found more affected by the changes. But the result of chi-square test of independence for the ethnicity/castes with their experience on changes in waste collection activities during COVID-19 lockdown was not found significant. Same result was obtained in the case of gender as well. It indicates that there is no significant correlation between the ethnicity/castes and gender with their experience on changes in waste collection activities during COVID-19 lockdown.

Four major concerns were identified in order to know the subjective experiences of the respondents regarding the changes in the waste collection activities after COVID-19 lockdown. These concerns are: (a) no changes observed, (b) COVID-19 preventive measures adopted, (c) irregularity in waste collection, and (d) volume of wastes. Majority of the respondents mentioned that they haven't found any changes in the waste collection activities after/during the COVID-19 lockdown. The subjective analysis to this could mean that there are still households who have not taken waste membership and are not able to explain about the changes in the waste collection services. The other majority group of people responded that one particular change that they witnessed after COVID-19 lockdown is that in most cases, the waste collectors followed COVID-19 preventive measures. Thus, they were seen wearing personal protective equipment (PPE) and maintained social distancing while going for household waste collection. However, some of the households pointed out that the waste collection days were limited during the COVID-19 induced lockdown. Everywhere including Kirtipur municipality door-to-door waste collection service got halted due to Government announcement for restricted mobilities for several weeks and even months. The respondents also mentioned about how the waste had to be brought to collection points by them as waste collectors maintained social distance due to fear of transmission of the virus. They were disappointed that the waste collectors who in the past provided sacks to store the wastes stopped the exchange of waste sacks after the COVID-19. On the other hand, some of them mentioned that waste collectors were regular even during the lockdown. Very few respondents mentioned that the volume of wastes increased during the lockdown, due to all members of the family stayed at home during the lockdown.

### ***3.5.2 Changes in Waste Management Activities in Home during COVID 19 Lockdown***

During the survey period, the respondents were asked to share their experiences on the changes in waste management activities in home during COVID-19 Lockdown. The following Table 31 shows the changes in waste management activities in home during COVID-19 lockdown.

Table 31: Changes in Waste Management Activities in Home during COVID-19 Lockdown

Changes in Waste Management Activities in Home during COV 19 Virus Lockdown	Monthly Income				Total
	Poor (Below local poverty level) (N=17)	Lower Middle (N=42)	Middle (N=311)	Upper middle (N=32)	N=402
Yes, I did	3 (18%)	16 (38%)	67 (22%)	3 (9%)	89 (22%)
No, I did not	13 (76%)	21 (50%)	226 (73%)	28 (88%)	288 (72%)
Do not know	1 (6%)	5(12%)	18 (5%)	1 (3%)	25 (6%)

Total	17(100)	42 (100%)	311 (100%)	32 (100)	402 (100%)
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Source: Field Survey 2021

When asked if the respondents made any changes in managing household waste during COVID-19 lockdown, about two-third (N= 288, 72%) of the respondents said that they didn't make any changes in the household waste management. Likewise, few respondents (6%) reported that they were not aware about the changes made.

A chi-square test of independence was performed to examine the relation between types of household on the basis of their income level and their experience on the changes in waste management activities in home during COVID-19 Lockdown. The relation between these variables was found significant,  $\chi^2 (6, N=402) = 14.1, p < 0.05 (0.03)$ . It indicates that there is significant correlation between the income level of the household and experience on the changes in waste management activities in home during COVID-19 Lockdown. As per the data presented in Table 31, the lower middle-income families perceived the changes most in comparison to other income level household group.

Likewise, additional chi-square test of independence was performed to examine the relation between the ethnicity/castes, gender and location (wards) with their experience on the changes in waste management activities in home during COVID-19 Lockdown. The relationship between the location (wards) and their experience on the changes in waste management activities in home during COVID-19 Lockdown was found significant,  $\chi^2 (6, N=402) = 15.32, p < 0.05 (0.018)$ . It indicates that there is significant correlation between the location of the household and their experience on the changes in waste management activities in home during COVID-19 Lockdown. Specifically, the households of the semi urban area experienced the changes. Economically they were from the lower middle economic group. But the result of chi-square test of independence for the ethnicity/castes with their experience on the changes in waste management activities in home during COVID-19 Lockdown was not found significant. Same result was obtained in the case of gender as well. It indicates that there is no significant correlation between the ethnicity/castes and gender with their experience on the changes in waste management activities in home during COVID-19 Lockdown

Four major concerns were identified in order to know the subjective experiences of the respondents regarding the extra efforts made by the people in the household waste management during COVID-19 lockdown. These are: (a) didn't make any extra effort, (b) management of decomposable and recyclable wastes through source segregation, (c) recycle and reuse of waste, (d) use of disinfectant. Majority of the respondents said that they didn't make any extra efforts for household waste management during COVID-19 lockdown. The other majority group responded that they managed both organic and recyclable wastes at home. The organic wastes were buried in a pit or agricultural land to make compost manure which is used for kitchen gardening/rooftop farming. The other recyclable wastes such as plastic wastes were either burnt or collected in a sack to store in the backyard. The wastage bags were safely hung so that stray dogs didn't litter and diseases do not get spread. Some of the respondents were also found to be engaged in recycle and reuse of wastes like making crafts from paper and plastic wastes. Some of them even made rope out of plastic waste, sitting mats (*sukul*) from milk packets and polythene and traditional coin purses (*thaili*) from cloth pieces.

### 3.5.3 Level of Comfort in Dealing with Waste Workers during COVID-19 Lockdown

The following Table 32 shows the level of comfort in dealing with waste workers during COVID-19 Lockdown.

Table 32: Level of Comfort in Dealing with Waste Workers during SARS COVID-19 Lockdown (N=402)

Level of Comfort in Dealing with Waste Workers during COVID 19 Lockdown	Monthly Income				Total
	Poor (Below local poverty level) (N=17)	Lower Middle (N=42)	Middle (N=311)	Upper middle (N=32)	N=402
Yes, felt comfortable	11 (65%)	30 (71%)	260(84%)	27 (84%)	328 (82%)
No, I did not feel comfortable	2 (12%)	7 (17%)	27 (9%)	4 (13%)	40 (10%)
Do not know	4 (23%)	5(12%)	24 (7%)	1 (3%)	34 (8%)
Total	17(100)	42 (100%)	311 (100%)	32 (100)	402 (100%)

Source: Field Survey 2021

When asked about the comfortableness in dealing with waste workers during COVID-19 lockdown, majority of the respondents (82%) responded that they felt comfortable while dealing with the waste workers during COVID-19 lockdown in comparison to only 10% who felt uncomfortable dealing with the waste workers due to their antisocial behavior while using their language Likewise, few respondents (8%) reported that they did not experience any.

A chi-square test of independence was performed to examine the relation between types of household on the basis of their income level and their experience on the level of comfort in dealing with waste workers during COVID-19 Lockdown. The relation between these variables was not found significant,  $\chi^2 (6, N=402) = 10.4, p > 0.05 (0.10)$ . It indicates that there is not significant correlation between the income level of the household and experience on the level of comfort in dealing with waste workers during COVID-19 Lockdown

Likewise, additional chi-square test of independence was performed to examine the relation between the ethnicity/castes, gender and location (wards) with their experience on the level of comfort in dealing with waste workers during COVID-19 Lockdown. The relationship between all the mentioned variables with their experience on the level of comfort in dealing with waste workers during COVID-19 Lockdown was not found significant. The result of chi-square test of independence for ethnicity/castes:  $\chi^2 (18, N=402) = 21.93, p > 0.05 (0.34)$ , gender:  $\chi^2 (2, N=402) = 2.10, p > 0.05 (0.516)$  and wards:  $\chi^2 (6, N=402) = 12.50, p > 0.05 (0.052)$  were observed. It indicates that households as per the ethnicity/castes, gender and location (wards) did not experience any changes on the level of comfort in dealing with waste workers during COVID-19 Lockdown.

In order to find the subjective experiences of the respondents regarding any factors leading to uncomfortableness in dealing with waste workers during COVID-19 lockdown, two major concerns were identified: (a) didn't feel uncomfortable, (b) waste workers as source of transmission. Majority of the respondents mentioned that they didn't feel uncomfortable with the waste workers and the same practice of waste collection was followed even after the COVID-19 outbreak. The qualitative information on this revealed that the respondents used to put the wastes outside their houses

before the waste workers arrived. This way, they didn't have to come in contact with the waste workers physically. However, there was another group of respondents who were more concerned when dealing with the waste workers because of fear of contracting COVID-19 as it was reported that some of the waste workers particularly, from Kirtipur were tested positive for the virus. Few of the respondents even reported that they got into dispute with the waste collectors while one of them expressed dissatisfaction about waste fee for the waste collection service being high.

### 3.5.4 Additional Initiatives to Manage Solid Waste by Local Government during COVID-19 Lockdown

The following Table 33 shows the additional initiations to manage solid waste by local government during COVID-19 lockdown.

Table 33: Additional Initiations to Manage Solid Waste by Local Government during COVID-19 Lockdown (N=402)

Additional Initiations	Monthly Income				Total N=402
	Poor (Below poverty level) (N=17)	Lower Middle (N=42)	Middle (N=311)	Upper middle (N=32)	
Yes, I was aware	1 (6%)	7 (17%)	64 (21%)	6 (19%)	78 (19%)
No, I was not aware	15 (88%)	32 (76%)	228 (73%)	24 (75%)	299 (74%)
Do not know	1 (6%)	3 (7%)	19 (6%)	2 (6%)	25 (7%)
Total	17 (100)	42 (100%)	311 (100%)	32 (100)	402 (100%)

Source: Field Survey 2021

About two-third of the respondents (74%) reported that no additional initiations were made to manage solid waste by local government during COVID-19 lockdown. Likewise, few respondents (7%) reported that they were unaware about the initiation made by the government.

A chi-square test of independence was performed to examine the relation between types of household on the basis of their income level and their experience on the additional initiations to manage solid waste by local government during COVID-19 Lockdown. The relation between these variables was not found significant,  $\chi^2 (6, N=402) = 2.5, p > 0.05 (0.86)$ .

Likewise, additional chi-square test of independence was performed to examine the relation between the ethnicity/castes, gender and location (wards) with their experience on the additional initiations to manage solid waste by local government during COVID-19 Lockdown. The relationship between all the mentioned variables with their experience on the additional initiations to manage solid waste by local government during COVID-19 Lockdown was not found significant. The result of chi-square test of independence for ethnicity/castes:  $\chi^2 (18, N=402) = 8.40, p > 0.05 (0.97)$ , gender:  $\chi^2 (2, N=402) = 2.11, p > 0.05 (0.34)$  and wards:  $\chi^2 (6, N=402) = 11.35, p > 0.05 (0.078)$  were observed. It indicates that households as per the ethnicity/castes, gender and location (wards) did not experience any changes on the additional initiations to manage solid waste by local government during COVID-19 Lockdown



In order to find the subjective experiences of the respondents regarding the initiations taken by the local government to manage solid waste during COVID-19 lockdown, four major concerns were identified: (a) unaware about any initiations made by the local government, (b) initiatives made by the municipality, (c) no initiatives made, and (d) initiatives made at the household level. Majority of the respondents were unaware about the initiations made by the local government to manage solid waste during COVID-19 lockdown. On the other hand, around 20% of the respondents seemed aware about the initiatives made by the municipality during the lockdown in regards to management of solid waste. Kirtipur municipality provided broader framework for solid waste management, specially facilitating engagement of private sector engagement in collecting urban waste. Public have largely supported it.

They explained that the municipality was engaged in disinfecting the public places and also engaged in the collection of organic wastes. Similarly, the municipality also took the initiatives to make aware people regarding the spread of COVID-19 for which, water tanks were also installed at several places for hand washing as well as distributed face masks. In addition, the municipality also encouraged people to manage wastes at the household level by using organic wastes in the rooftop farming.

The private waste service providers also worked actively in managing the wastes even during the nationwide lockdown as waste management had been declared as one of the essential services to remain operational even during the lockdown by the government. In case of Kirtipur, Kirtipur Waste Management Services Pvt. Ltd. (KWMS) was engaged in the waste management in coordination with Kirtipur Municipality. For instance, they have been taking the initiative of turning organic wastes into compost manure in their own waste processing center. They also provided soap and encouraged handwashing among its frontline waste workers. Some of the respondents mentioned that no specific initiatives were made for waste during COVID-19. Few of the respondents mentioned about the initiatives taken at the household level. For instance, they were engaged in the installation of flower pots to add to the beautification of the environment. Likewise, they even mentioned to have started making compost out of decomposable waste and burnt recyclable wastes that were suitable.

Though the municipalities distributed PPE to the waste workers, it is however, unknown how the staffs utilize it during the COVID-19 situation. It is also questionable if the PPEs as such sanitizer, gloves and masks provided to the waste workers are favorable or causing discomfort while working on wastes especially for women. Actually, the PPEs as such are not women-friendly. There are instances where 5 families of waste workers stay together thus, raising the question on the effectiveness of PPE wearing by one person.

## 5. Conclusions and Suggestions

### 4.1. Summary of the Findings

#### 4.1.1 Demographic Household Information

In total, 402 respondents were surveyed. Out of the total, the majority of the respondents were female (56.7%) in comparison to male respondents (43.3%).

The respondents of the age group 31-40 were found in large number (23.94%) followed by the age group 51-60 and 41-50 with (20.19%) and (19.95%) respectively.

The larger volume of the respondents was from the Janjati ethnic community (78.1%) followed by Brahmin community (11.44%). Since Kirtipur is dominated by Newar ethnic group, majority of the respondents under Janjati belonged to Newar ethnic group.

The larger volume of the respondents was Hindu (57.21%) followed by Buddhist (39.3%).

It was seen that often the decision of the household is taken by the husband (34.8%) or another male member of the household (66.96%). Wives have only (6.5%) of decision-making level.

Out of 402 respondents, the majority of them do not have formal education (36.06%); most of them were female.

The majority (42.5%) of the respondents were found engaged in their own self-employed followed by salaried job (35.3%) and others (22.2%).

More than two thirds of the respondents from the four surveyed Wards belong to the middle income class (77.36%).

More than two thirds of the household (71.39%) from the four surveyed wards do not have a home garden.

Out of 402 households surveyed in the four wards, 42.78% do not have children whereas 30.34% households have one child, followed by 22.13% who have two children.

Out of 402 households, majority of the households (66.7%) have a minimum of 5 members living in the same house whereas 31% of the households have up to 10 people living in the same house.

#### 4.1.2 MSWM Practices in the HH

In the majority of the households (82%), women deal waste in the house. Male members of the households take this responsibility in only 10% of the cases. In 8% of the surveyed households, this chore is done jointly between men and women.

55.2% of the household segregate household wastes at source out of which 54% segregate kitchen waste whereas 49.5% segregate both kitchen and recyclable wastes.

44% of the waste volume with kitchen waste is collected by a third party in a mixed form. Whereas the rest is understood to be managed through composting, burying, burning, and selling.

Wastes such as plastics, metals, electric/electronics and medical wastes often do not get picked frequently (only once in 6 months). Thus, these kinds of waste are often collected and stored. After

a good number of recyclable wastes get collected, it is often sold to the cycle-hawkers (*kawaadi*) in a very low amount. The rest are thrown away with the mixed wastes.

Of the total respondents, about 20% pay a minimum waste fee of Rs. 150. About 10.2% of the respondents reported that they do not pay for waste service.

More than 90% of the respondents reported that they do not find any problems in the collection of the wastes in the mixed form.

More than two third (80%) of the respondents reported that they do not find any problems with the waste workers. 71% reported that sometimes waste collectors do not come for regular waste collection.

51.5% respondents find their neighborhood clean as they follow a tradition of sweeping every morning. In addition, the installation of idols of Gods and temples has also motivated people to keep the surroundings clean. The installation of flower pots and gardens have also added to the beautification of the environment.

As per the experience from the field, people of olden generation and mainly higher caste group still believe that cleanliness related works should be carried out by the lower caste group (*podeyand chyame*) belonging to Newar caste group. Therefore, this population finds it awkward to clean outside their houses. People belonging to the higher caste still relate the work of cleanliness with their dignity and thus, they hesitate to clean their surroundings.

#### ***4.1.3 Waste Governance***

55% of the respondents are satisfied with the waste collection service as they think that it is timely and regular. Only 5.2% of the respondents are not satisfied with the waste collection service and the rest were found indifferent.

While comparing the present waste management practice with that of 5 years ago, more than half of the respondents (59%) reported that waste collection has improved. It was revealed that people do not have distinct memories related to waste practices done 5 years ago. In addition, there were still some households that haven't taken waste membership because of which they were not able to compare the waste collection and services. Few respondents who were living as tenants and had just moved to Kirtipur were also not able to compare. Nonetheless, most of the respondents said that they have found the waste collection services becoming regular and timely with the increase in the number of waste collectors. They expressed their satisfaction saying that waste gets collected at least twice a week and the environment has become comparatively cleaner with improved sewerage after the intervention of the municipality in the 48 areas (tole);

With the federal structure of the governance and constitutional roles given to the local governments, Kirtipur municipality found to be active in SWM especially through policy formulations, partnership with private sectors, inter-linkages of sectoral collaborations within the municipal arrangements and providing safety measures to waste workers as possible.

#### ***4.1.4 MSWM and Crises***

Regarding the changes observed after the two major crises of 2015, about 30.3% of the respondents reported that they found changes in waste management after 2015 earthquake and Indian

blockade. Majority of the respondents reported that they were unaware about the changes in the waste management before and after the crises. Further qualitative information to this opinion reveals that most of the respondents had settled only recently in Kirtipur because of which they were unable to answer the changes that have occurred in waste management practice of their area over the years. In addition, most of the respondents have very vague memories of the two major crises that occurred in 2015.

Regarding the changes adopted in waste management services after the two major crises, about 11.7% of the respondents opined that waste collection service has become regular than before the earthquake. About 5.2% respondents reported that they have started engaging in the source segregation of wastes after the earthquake. People find no differences in the household waste management practices because they were residing in another place during the crises and have moved to this place recently.

#### ***4.1.5 Waste Management Activities amid the COVID-19 Lockdown Period***

Half of the respondents (48.8%) reported that they do not see any changes in the waste management activities amid the COVID-19 lockdown period. The qualitative information reveals that there were few changes seen. For instance, several respondents mentioned that the waste collection service became irregular and untimely. The waste collection service also got halted for several months which once used to get collected every week. However, on the positive side, after COVID-19 induced lockdown, people have become aware about source segregation of wastes through self-awareness. Thus, they are found to be managing both organic and recyclable wastes on their own. It was reported that the organic waste buried either in a pit or in agricultural land to make compost manure and used for vegetable farming. However, recyclable wastes such as paper and plastics were burnt while some of them stored such wastes separately in a sack.

7.6% respondents reporting irregularities in the waste collection, 2.8% of the respondents reported that they buried the organic wastes and used it in vegetable farming whereas burnt the paper and plastic waste.

When asked if the respondents made any changes in managing household waste during COVID-19 lockdown, about two thirds (71.6%) said that they didn't make any changes. The organic waste was buried in a pit or on agricultural land to make compost which is used for kitchen gardening. The other recyclable wastes such as plastics were either burnt or collected in a sac to be store in the backyard. The collected bags were safely hung so that stray dogs didn't litter and diseases did not get spread. Some of the respondents also engaged in recycling and reusing wastes, such as making crafts from discarded paper and plastic. Some of them even made ropes out of plastic waste, sitting mats (*sukul*) from milk packets and polythene and traditional coin purses (*thaili*) from cloth pieces. One of the respondents said that disinfectant solution was sprayed in the dustbin.

When asked about their level of comfort in dealing with waste workers during COVID-19 lockdown, most respondents (81.6%) responded that they felt comfortable while dealing with the waste workers during COVID-19 lockdown in comparison to only 10% who felt uncomfortable. The majority of respondents mentioned that they didn't feel uncomfortable with the waste workers and the same practice of waste collection was followed even after the COVID-19 outbreak. The qualitative information on this revealed that the respondents used to put the wastes outside their houses before the waste workers arrived. This way, they didn't have to come in contact with the

waste workers physically. However, there was other group of respondents who were more concerned when dealing with the waste workers because of fear of contracting COVID-19 as it was reported that some of the waste workers particularly, from Kirtipur were tested positive for the virus.

A majority (80.3%) of the respondents were unaware about the initiatives taken by the local government to manage solid waste during the COVID-19 lockdown. 9.5% of the respondents were aware about the municipality disinfecting the surroundings. 2.2% reported that the municipality made announcement regarding following COVID-19 related measures and engaging in rooftop farming. The municipality was engaged in disinfecting the public places and also engaged in the collection of organic wastes. Similarly, the municipality also took the initiative to make people aware of the spread of COVID-19 for which water tanks were installed at several places for hand washing as well as face masks were distributed. In addition, the municipality also encouraged people to manage waste at the household level by using organic wastes in rooftop farming.

SWM became better manageable with the active role played by the local government, i.e., the municipality, with continuity of services for waste collection and even processing, mobilization of private sectors and training and services for decomposable waste to use in rooftop gardening and homestead gardening specially to the women members of the HHs.

In terms of SWM workers, there was no specific measures taken up by the municipalities to diversify their employment and income opportunities. However, the municipality installed safety related services with gender friendly cleaning rooms for waste workers of the municipality, provided training to women members on waste management and kitchen gardening.

## 4.2 Conclusions

In the case of MSWM practices in the HH, in most of the cases female members of the household are responsible for dealing with waste. There is the practice of segregating the household wastes and most of the kitchen waste has been used for the compost manure. Regarding the unused waste of the kitchen and other mixed waste, there is the practice of collecting waste by a third party. Private waste management companies are responsible in collecting most the waste of the households providing the membership to the households for collecting the waste charging certain amount of money. More than 90% of the households have a membership (subscription) with a company for waste collection services. There is the practice of collecting and selling waste like plastics, metals, electric/electronics and medical wastes that are often do not get generated frequently. They are often sold to the cycle-hawkers (*kawaadi*) in very small amounts. Most of the households are satisfied with the waste management practice as well as the collectors. However, few households have grievances like irregularity of the waste collection including the undisciplined behavior of the collectors. As per the views of the majority of the respondents, their neighborhoods is clean as they follow a tradition of sweeping every morning. People of olden generation and mainly caste group still believe that cleanliness related works should be carried out by the caste groups (*podey, chyame, jyapu*) belonging to Newar caste group.

In the case of waste governance, the majority of the households are satisfied with the timely and regular service of waste collection. However, there are households complaining about the service. The majority of the households experienced that the waste collecting and managing service has

improved in comparison to the past five years. In spite of certain grievances, respondents are found to be satisfied with the service of the municipality.

Regarding the changes observed after the two major crises of 2015, there are no remarkable changes in the MSWM practices experienced by the respondents. However, it can be concluded that in comparison to the past, the practices of waste segregation and regular collection have been experienced.

Regarding the waste management activities amid the COVID-19 lockdown Period, a number of respondents mentioned that the waste collection service became irregular and untimely. The waste collection service also got halted for several months which once used to get collected every week. However, on the positive side, after the COVID-19 induced lockdown, people have become aware about source segregation of waste. Thus, they are found to be managing both organic and recyclable wastes on their own. During the lockdown period, some of the respondents were also found to be engaged in recycling and reusing wastes like making crafts from paper and plastic wastes. Some of them even made rope out of plastic waste, sitting mats (*sukul*) from milk packets and polythene and traditional coin purses (*thaili*) from cloth pieces. Additionally, majority of the respondents were unaware about the initiations made by the local government to manage solid waste during COVID-19 lockdown.

### 4.3 Suggestions

Still, some of the wards haven't received waste collection services due to steep uphill and narrow roads. Class differences among people are present because of which poor people do not have accessibility on waste services. Therefore, the municipality should focus on increasing the household waste membership through equal access.

A decade earlier, Kirtipur Municipality had started an awareness campaign and training programs on waste management, however, no initiatives followed up. The municipality didn't even monitor the effectiveness of the training. Often these training programs are politicized. Only those people having political connection are provided with such trainings.

Household should be trained on making compost out of organic waste and provision on buying the excess compost from the household level should be made.

Municipality should display the process of recycling non-degradable wastes.

Municipality should reward people who are carrying out the process of waste management.

Based on Chapter 9, Section 38 of Solid Waste Management Act, 2011, the Municipalities are liable to charge fines from five thousand rupees to fifteen thousand rupees for littering. Thus, the municipality should install informative boards regarding proper disposal of wastes and strictly charge fines to those who place, throw or deposit solid waste from the house, compound and premises on the road or on any other public places.

People of olden generation and certain caste groups still believe that cleanliness related works should be carried out by the caste group (podey and chyame). People still find awkward to clean outside their houses especially, those belonging to the certain caste still relate the work of cleanliness with their dignity and thus, they hesitate to clean their surroundings. Therefore, waste producers need change their perception towards waste workers.

The role of private organizations and informal waste collector was found crucial in waste management. The municipality should prepare the plan to collaborate these agencies to make the meaningful waste management plan and program in the municipality.

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