



COVID-19 AND MUNICIPAL SOLID WASTE MANAGEMENT IN SRI LANKA

A preliminary qualitative study of solid waste management in selected local councils

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CONTENTS

1 Introduction	1
1.1 COVID-19	1
1.2 Covid-19 and waste management globally	1
1.2 Key objectives	2
1.3 Research methodology	2
1.3.1 Type of data	2
1.3.2 Selection of field locations	2
1.3.3 Sample selection	3
1.3.4 Data collection tools	3
1.3.5 Data collection	4
1.3.6 Data analysis	4
2 National level initiatives	5
2.1 The global onset of the Covid-19 Virus	5
2.2 Covid-19 in Sri Lanka	5
2.3 Measures taken by the government to control the pandemic	5
2.4 Covid -19 and waste management in Sri Lanka	7
2.5.1 Types of waste generated	7
2.5.2 Challenges to MSWM	7
2.5.3 Coping and adaptive strategies adopted by the government	8
2.6 The role of non-government and intergovernmental organizations	10
2.7 Lack of integration of LA with the national disaster management mechanisms	10
3 The Covid-19 impact in two selected local councils	12
3.1 Introduction	12
3.2 Dehiwala – Mt. Lavinia Municipal Council	12
3.2.1 Municipal solid waste management of DMMC	12
3.2.2 Municipal waste management architecture of DMMC	13
3.3 The Boralesgamuwa Urban Council	15
3.3.1 Municipal solid waste management of BUC	15
3.3.2 Municipal waste management architecture of BUC	16
3.4 Impact of COVID-19 on the waste management architecture	16
3.4.1 Impact of COVID-19 on the organizational hierarchy	17
3.4.2 Impact of COVID-19 on the waste management services	17

3.4.3 Impact of COVID-19 on waste workers	25
3.5 Impact of COVID-19 virus on the waste value chain	30
3.5.1. Impact on waste generation	30
3.5.2 Impact on formal collection and transportation	31
3.5.3 Impact on informal waste collection and transportation.....	31
3.5.4 Impact on formal disposal	31
3.6 General waste value chain in COVID -19 period.....	32
4. Conclusion	34
bibliography.....	35

1 INTRODUCTION

1.1 COVID-19

The COVID-19 pandemic can be identified as one of the most difficult challenges experienced by humankind in the last few decades (Chakraborty & Maity, 2020; Feehan & Apostolopoulos, 2021; Spunei et al., 2022). Even though the world has experienced pandemics such as Ebola, Cholera, SARS and Swine flu in the recent decades, these pandemics were largely localized to certain regions of the world. As a result, the impacts of these viruses were minimal compared to the COVID-19 virus (Mahase, 2020; Cyranoski, 2020). COVID-19 managed to spread beyond regional borders and became a global pandemic threatening the lives of millions around the world. It changed human life in a manner never seen before, pushing governments to close down economies, companies to restrict functions, workers to work from home and children to study online (Ward, 2020; Briggs et al., 2020; de Figueiredo et al., 2021). These changes were not limited to the day to day lives of humans - rather the virus compelled central governments to formulate new policies and guidelines to sustain activities such as solid waste management as the pandemic impacted their functions and the labor force in direct and indirect ways (Torkashvand et al., 2021; Yousefi et al., 2021, Singh et al., 2022; Requena-Sanchez et al., 2023; Ramitha, 2023).

1.2 COVID-19 AND WASTE MANAGEMENT GLOBALLY

Sarkodie and Owusu (2021) discuss the impact of Covid-19 on waste management by drawing examples from different countries. The authors emphasize that management of waste is critical to human development and health outcomes, especially during a pandemic such as Covid-19. According to the study, waste generation increased during the pandemic, thereby causing an additional burden on waste management. For an example, they identify that panic buying increased the disposal of perishable products and leftovers, generating tons of waste. Generation of medical waste also accelerated; in 15 countries in Africa alone, the total face masks per day are reported as 586,833,053 based on 80% acceptance rate and an average of two face masks daily per capita (Nzediegwu and Chang 2020). Therefore, the volume and categories of waste changed due to the pandemic, causing a strain on governments to address the large amount of waste that was generated on a daily basis. They also note that the recycling market had been affected due to social distancing measures. In similar work, Roy et. Al. (2021) add to the discussion by indicating challenges faced by the workforce during the outbreak as waste management personnel who continued to work throughout the pandemic were more likely to be exposed to the virus due to close contact with other employees or due to contact with contaminated materials. These factors led to other trends such as absenteeism, straining of workforce and affecting their operability. Further to the above, the authors also reveal relationships between changed consumption patterns and generation as changed lifestyles of people, such as work from home, altered typical waste trends and volumes requiring adjustments to program delivery. Recurrent lockdowns led to an increased use of single-use plastics for packaging of instant food and food delivered to residences. In addition to the above, they reveal changes in the source of waste as residential waste generation rate noticeably increased in Ontario, Canada but declined in commercial sectors. They also reveal that increased volumes of waste have forced different countries to modify their waste management systems, revealing several adaptive measures of facing the imminent challenge. Methods such as co-incineration in cement plants (Spain), onsite and mobile treatment (China), onsite incineration in hospitals (Romania), recycling of sharp medical waste like needles/syringes in the steel industry (co-incinerated with coke) in Australia have been adopted to face the challenges associated to waste management.

Therefore, it is evident that increased generation, novel types of waste, strains on the workforce, changes in sources of waste, and the need for changes in collection, storage and treatment, even in some of the most developed countries posed a threat to waste management systems worldwide.

The negative impacts of COVID -19 were also experienced in Sri Lanka as the central government had to devise new policies and regulations to guide municipal solid waste management and support local councils to carry out waste management activities with minimal disruption (Pswarayi-Riddihough, 2020; Singh et al., 2022; Jayasinghe et al., 2022). Moreover, local councils had to formulate new mechanisms and adapt architectural changes to the waste management system while spending a significant amount to assure that the health of waste collectors was unaffected by the pandemic and also to manage infectious waste according to national guidelines (Dampe & Rajapakse, 2021, Rathnayake & Sellahewa, 2022 Kankanamge et al., 2022.).

1.2 KEY OBJECTIVES

The key objective of this report is to explore the changes that took place within the municipal solid management architecture and the waste value chain by paying specific attention to different coping mechanisms and adaptation strategies utilized by selected local councils in Sri Lanka.

The report seeks to identify:

- the national level initiatives introduced by the central government to counter the challenges posed by the pandemic,
- the changes in the municipal solid waste management architecture and waste value chain of selected local councils during and after the pandemic,
- the coping mechanisms and adaptation strategies utilized by local waste management actors to cope with the challenges posed by the pandemic.

1.3 RESEARCH METHODOLOGY

1.3.1 TYPE OF DATA

Both primary and secondary data were utilized for the study in order to gain a comprehensive understanding regarding the changes that emerged in the municipal solid waste management mechanism as a result of the COVID-19 pandemic. Secondary data was gathered to identify the changes in national solid waste management policies and regulations. Accordingly, the authors utilized secondary data sources such as official reports, documents and guidelines issued by the central government and provincial and local waste management actors, reports of non-governmental organizations, etc. for the study.

Moreover, primary data was gathered using structured interviews from national and local level officials affiliated with municipal solid waste management. Primary data collected for the study added to the findings of the secondary data by elaborating on the factors that prompted national and local level actors to adopt new strategies and coping measures, impact and efficacy of the adopted measures, changes in the waste value chain and the waste management infrastructure, outcomes of the changes, etc.

1.3.2 SELECTION OF FIELD LOCATIONS

The study selected the Dehiwala-Mount Lavinia Municipal Council (DMMC) and the Boralesgamuwa Urban Council (BUC) for the study. This selection was made as the authors had studied the waste management mechanism of these local councils in detail for a previous r4d project (Fernando & De Silva 2020 a.; Fernando & De Silva, 2020b, Fernando & De Silva, 2022a. Fernando & De Silva, 2022b.) . The familiarity enabled the authors to easily identify the changes

that had taken place in the waste management architecture and the waste value chain in the mentioned local councils.

During these visits the authors collected quantitative and qualitative data using semi-structured interviews with elected officials, government officials, formal waste collectors and informal waste collectors. The semi-structured interview schedules included questions regarding the waste management architecture of each local council, waste management mechanisms, challenges posed by the COVID-19 pandemic, the adoptive and coping measures utilized by the respective local councils to tackle these challenges, etc.

The MSWM architecture, waste value chain and waste management activities of DMMC and BUC have been thoroughly discussed in the working paper series produced by the University of Colombo (UoC) team for the r4d study. Therefore, the authors resorted to include only a brief description regarding the waste management activities of the above mentioned two local councils in this report.

1.3.3 SAMPLE SELECTION

The study utilized the purposive sampling method to select the sample for the study. Accordingly, the Mayor, the Additional Commissioner-in-charge of MSWM, the officer-in-charge of MSWM, the Public Health Inspector(s) (PHI), formal waste collectors and informal waste collectors were selected for the sample. Table 1 given below expounds on the number of interviews conducted from each local council.

TABLE 1: STUDY SAMPLE

Local council	Sample size
Boralesgamuwa Urban Council	Mayor / Deputy Commissioner PHI in-charge of MSWM 25 - Formal waste collectors 08 - Informal waste collectors
Dehiwala- Mt. Lavinia Municipal Council	Mayor / Deputy Commissioner PHI in-charge of MSWM 22 - Formal waste collectors 09 - Informal waste collectors

1.3.4 DATA COLLECTION TOOLS

As the research objectives demanded the collection of qualitative data, the authors developed three separate interview schedules to collect data from government officials, formal waste collectors and informal waste collectors. The interview schedule developed to collect data from government officials paid specific attention to waste management activities during the pandemic, difficulties and challenges experienced by the municipal councils, adaptation measures and policy changes made at the local council level to counter the challenges posed by the virus and etc.

The interview schedule developed to collect data from formal waste workers focused on comprehending the changes that took place in the waste management architecture and waste chains. Accordingly, changes in waste collection, intermediate management and disposal, changes in the labour practices and facilities provided to workers was covered by this interview

schedule. Moreover, the interview schedule developed to collect data from informal waste collectors focused on identifying the impacts of the COVID-19 on the informal waste management sector such as the challenges experienced by the informal sector due to the regulations and policies of the government, collection, management, selling of waste and value addition activities. All the interview schedules were initially developed in English and were later translated to Sinhala and Tamil. Moreover, the interview schedule was pilot tested in DMMC and was further altered according to the findings.

1.3.5 DATA COLLECTION

The junior researchers of the project obtained formal approval from the municipal councils to collect data from formal waste collectors and informal waste workers within their area. The authors utilized the services of 12 Sociology Special graduates to collect data from formal and informal waste collectors of DMMC and BUC. Prior to the collection of data, the authors provided the graduates with a one-day training on administering the in-depth interview schedules. The research assistants were informed regarding the nature of the study and its key objectives during the training session. The research assistants collected data from formal and informal waste collectors for a period of two months- from 1st of September to 1st of November 2022.

The principal investigator and the coordinator of the MSWM project utilized previous affiliations they had developed with the DMMC and BUC to approach and interview officials of the two local councils. Data collection from the officials of the local councils and formal and informal waste collectors were carried out simultaneously. Interviews held with waste collectors and officials were recorded using audio recordings and were later transcribed by the research assistants in Sinhalese and Tamil languages.

1.3.6 DATA ANALYSIS

Data collected using the in-depth interview schedules were analyzed using the thematic analysis method proposed by Braun & Clarke (2022). Accordingly, authors familiarized themselves by reading the transcripts of the in-depth interviews. As the next step, the authors generated initial codes from the text in a semantic manner while collating data relevant to each code. After completing the initial coding, the collating codes were developed into potential themes. These themes were then reviewed against the coded extracts, thus developing a thematic map of the analysis. The authors named and defined the themes developed by refining and specifying different dimensions of themes thereafter.

2 NATIONAL LEVEL INITIATIVES

2.1 THE GLOBAL ONSET OF THE COVID-19 VIRUS

In December 2019, a cluster of pneumonia with unknown origin was reported from Wuhan City, China causing an immediate need for medical personal and experts to investigate its origin, diagnosis and treatment (She et. al, 2020). In the following month, on 12th January 2020, Chinese authorities shared the very first information regarding the virus, classifying it as a sequence of a novel coronavirus termed “Severe Acute Respiratory Syndrome Coronavirus 2” (SARS-CoV-2). As of 21st February 2020, the virus had spread rapidly not only in its country of origin but also to 28 other countries (Spiteri et. al, 2020). Given the nature of the virus and the inability of the health sector to control its spread, the World Health Organization declared Covid-19 as a global pandemic on 11th March 2020. The severity of the pandemic is evident as its impact is not only restricted to morbidity and mortality of human beings but has created unimaginable challenges to all aspects of life. Given this situation, most governments were forced to devise both short-term and long-term plans to counter the challenges posed by the pandemic as the long-term consequences to the built and human environment were almost unquantifiable. The explanation of Dr. Mushtaq Ahmed Memon of the United Nations Environment Programme clearly describes the threat and the ideal approach that needs to be adopted to counter the challenges imposed to waste management: “The pandemic created a longer-term disaster-like situation, requiring appropriate waste storage and treatment systems. Basic principles for disaster management—prevention, preparedness, response, and recovery—must be integrated into COVID-19 waste management strategies” (cited in Moyek, 2021).

2.2 COVID-19 IN SRI LANKA

The first patient reported in Sri Lanka was a Chinese national, identified on 27th January 2020. The patient was immediately subjected to treatment at the National Institute of Infectious Diseases (Amaratunga et. al, 2020) which is a national hospital dedicated to treat infectious diseases. Indications of the spread of Covid-19 in the country was evident as a local tested positive on 11th March 2020 (ibid). Numbers of patients escalated rapidly thereafter with 7 casualties recorded by mid-April 2020. Many factors contributed to the spread of the virus such as the continuous arrival of tourists from affected countries, return of Sri Lankans from countries that were affected by the virus and lack of adherence of the masses to the restrictions imposed by the government. Similar to other countries, the disease continued to spread despite many efforts of containment and a high fatality rate was recorded in August 2021 due to the onset of the Delta variant. Consequently, Sri Lanka recorded the fourth largest number of daily deaths in the world by population after Georgia, Tunisia and Malaysia in August 2021. This was a confirmation of the impact of the disease in Sri Lanka. As per the ‘National Epidemiology Report-Sri Lanka’, published by the Epidemiology Unit of the Ministry of Health, Sri Lanka (2023) there have been more than 671,903 cases, 655,063 recoveries and more than 16,817 deaths due to Covid-19 as of January 2023.

2.3 MEASURES TAKEN BY THE GOVERNMENT TO CONTROL THE PANDEMIC

Given the situation that arose due to the pandemic, the government of Sri Lanka adopted several measures to address the novel crisis that had affected the country. Attempts were made to control the virus by disinfection in the early stages of the pandemic and gradually preventive efforts were revised to include ways of minimizing human contact and interaction which was known to be a major factor that caused its spread. Strict measures of case detection, contact tracing, quarantine, travel restrictions, isolation of small villages and imposition of island-wide and district-level lockdowns were carried out accordingly.

At the administrative level, the government of Sri Lanka established the Task Force on Prevention of Coronavirus on February 26, 2020, as one of the steps taken in the battle against the pandemic. This task force was responsible for the implementation of preventive and management measures by the proper coordination of public health and other relevant services.

Consequently, at the ground level, two stern measures were undertaken during the initial stages of the pandemic: imposition of an island-wide curfew from March 20 to 23, 2020, and suspension of all forms of gatherings such as picnics, pilgrimages and leisure activities. Further, the government also utilized the efforts of the military as part of its preventive strategy as forty-five quarantine centers were built by the Sri Lanka Army by 23rd March 2020. The government imposed the second, ten-day lock down on 20th August the same year as a measure to limit the spread of the virus due to pressure imposed by the health authorities and civil society with the surpassing of 1,000 deaths due to the pandemic.

TABLE 2: SYNOPSIS OF COVID-19 MEASURES AND WASTE MANAGEMENT IN SRI LANKA

Covid 19 related measures	<p>Strict curfews</p> <p>National wide: 20th March –June 28th</p> <p>Regional: 30th October- 9th November</p> <p>Local: at various times in identified pockets for two weeks or longer</p> <p>Work from home</p> <p>Vaccination</p>
MSWM related covid-19 measures	<p>MSWM declared as an essential service</p> <p>PPE for formal waste workers</p> <p>Banning of informal recyclers from streets during curfews</p>
Formal waste governance (Collection)	<p>Central guidelines, national and sub national government bodies overseeing waste management by municipalities</p>
Informal waste sector	<p>Not integrated in formal MSWM</p> <p>Mostly male waste recyclers</p> <p>Integrated in private, hierarchical recycling chains</p>
Waste disposal infrastructure	<p>Sanitary landfills, transfer stations</p>

Source: SPIRIT proposal, 2022

The government also declared a period of work from home for both public and private sectors from March 20th to 27th 2020. Relevant authorities were instructed to take steps to ensure the continuous supply of essential services including health, public administration, transportation, banking, food, water, electricity, distribution of fertilizer and buying paddy during this period while the activities of District Secretariats and Divisional Secretariats were expected to be carried out continuously.

Students in Wuhan and other cities in China were brought back to the country to ensure their safety and were sent home after a 14-day quarantine period. In the judicial sector, no case was to be heard in open court except for cases which were decided by the judge as urgent and necessary. Video technology was to be used in the process of extending detention period of inmates instead of bringing them into the courts (Presidential Secretariat, 2020).

While all such efforts were in place, the government also used vaccination as preventive measure. Although the roll-out of vaccines were delayed in Sri Lanka, an article by UNICEF (2022) details that 65% of the population has been vaccinated with both doses of a vaccine against COVID-19 and that the country was on track of achieving the next target of 70% coverage by mid-2022. The vaccination drive was supported by a ‘whole of government and whole of society’ approach, with strong community mobilization; addressing of misinformation on COVID-19 vaccines; and promotion of vaccination among adolescents and adults and the booster doses among the elderly.

2.4 COVID -19 AND WASTE MANAGEMENT IN SRI LANKA

2.5.1 TYPES OF WASTE GENERATED

Hannan (2020) quotes the Director of the Western Province Western Province Solid Waste Management Authority who states that the overall waste in the Western Province reduced by 40% during the pandemic. In discussion, the reasons for this phenomenon are the fact that single-use plastics were not brought into the city and because there was a reduction in people going outdoors and ordering takeout.

The two main materials that caused a strain to MSWM in Sri Lanka during the pandemic were medical and plastic waste. In terms of the generation and treatment of medical waste (MW) prior to the onset of the pandemic, statistics by the MOE (2018) reveal that an estimated amount of 20-23 metric tons of MW is produced in the country daily. Segregation is practiced in HCFs and are stored separately and are treated using both onsite and off-site systems. The pandemic caused an additional pressure on waste management in Sri Lanka as Kankamage et al., (2022) reveal the following statistics. Approximately 12 million facemasks were used daily, while 0.22 million gloves and 0.29 million face shields were used after the pandemic in Sri Lanka. Further, out of the 12 million facemasks, 10 million were surgical and N95 masks. The most common method of disposing of facemasks in Sri Lanka was open burning by the users at their homes (55%) and the rate of burning was comparatively low for other PPE. Although nearly 30% of people handover used facemasks to the municipal solid waste collection, there were no special precautions taken for separate collection and safe disposal. These are some of the challenges that arose due to the increase of medical waste in the country during the pandemic, causing an additional strain to waste management itself. Given the nature of medical waste, safe mechanisms of storing and handling waste would have been quintessential in the Sri Lankan context.

The use of plastic (both globally and domestically) during and after the pandemic was particularly high as it was a material used for various purposes associated with the pandemic. For an example, PPE which was formerly used by those in the medical industry was identified as a ‘protective’ measure that should be used by the common man to prevent contraction of the virus. In addition, a large quantity of protective equipment such as plastic barrier screens or sheets were used by businesses while masks (Jayasinghe et. Al, 2021), sanitizers and face shields were utilized by all individuals as per the regulations imposed by governing bodies based on medical instructions. This caused an additional burden to the waste management system in Sri Lanka as it was ill-equipped to deal with plastic waste even before the pandemic. For an example, Sri Lanka was responsible for 1.59 million tons of mismanaged plastic in 2010 and ranked fifth worldwide for inappropriate plastic waste management (ibid).

2.5.2 CHALLENGES TO MSWM

Municipal waste collection continued in Sri Lanka despite the lockdowns as the government declared it an essential service. Formal waste workers were given passes that allowed them to engage in waste collection activities during the period, but activities of informal waste workers were banned. However, social distancing restricted households from interacting with formal and

informal waste workers due to fear of contracting the disease. General issues related to waste management during the pandemic are highlighted by Jayasekare (2022). These include disruption due to shortage of workers, lack of safety at work, safe handling of household waste of affected individuals, increased quantities of healthcare waste, and lack of securing safe management of waste from collection points to recycling or treatment facilities. In that work the author concludes that developing countries and cities were challenged with preventing risks to the environment and human health including those of waste workers caused by Covid-19 related waste while simultaneously fighting against Covid-19.

Hannan (2020) notes that the Ministry of Health Sri Lanka had estimated a budget of \$ 515,000 to attend to the immediate needs of infection prevention and control (IPC). The funds were to be utilised to train staff in IPC measures, waste (clinical) management training on PPE use – how to put on (donning) and remove (doffing) (specifically removal of PPE after work) – and to provide training on logistics to improve supply chain management. Waste disposal (clinical) methods were to be strengthened with training, and the Ministry was to assess IPC measures in each hospital that treated Covid-19 patients. An IPC monitoring tool and an external assessment system as part of quality assurance was to be developed in the following months. The medium-term needs with an estimated budget of \$ 131,440,000 was to be utilized to strengthen IPC measures based on detailed assessment in each of the 107 secondary and tertiary care institutions

2.5.3 COPING AND ADAPTIVE STRATEGIES ADOPTED BY THE GOVERNMENT

2.5.3.1 TREATMENT OF MEDICAL WASTE

Due to the increased volumes of medical waste during this period, according to the due diligence report on medical waste management in Sri Lanka, the government implemented a plan to manage waste which included several guidelines, such as segregation of immunization waste at the point of generation, collection, treatment, transportation and disposal of immunization waste (treated within 24 hours from disposal) and training for staff members that handled infectious waste. Given the above guidelines, all vaccination centers were expected to conduct on-site waste segregation. The segregated waste was then transported to the nearest secondary Health Care Facility (HCF). The waste collected in Western, Central and Southern Provinces were taken by the company Sisili Hanaro Encare (Pvt.) Ltd for incineration while they were incinerated or shredded through MetaMizer units or burned in concrete pits in other provinces. This waste is usually treated (incinerated or shredded) on the same day, but all these facilities had adequate storage capacities in case immediate treatment was impossible.

2.5.3.2 THE INTERIM GUIDELINE FOR MANAGEMENT OF COVID-19 INFECTIOUS WASTE (2020)

The interim Guideline for Management of COVID-19 Infectious Waste (2020) was an official measure implemented by the government to manage waste that was generated from households in quarantine. It was formulated by incorporating certain protective measures recommended by the WHO and was in line with the current solid waste management policy in the country, its regulations and standards but provisions were made to accommodate the specific needs of the health emergency that prevailed during the period. Some of the main guidelines are as follows. The Local Authority was to be in charge of the execution of operations including management of medical waste under the patronage of the Ministry of Public Administration, Home Affairs, Provincial Councils & Local Government and its affiliated institutions, facilitated by the resources of the Ministry of Health and the Ministry of Defense. The guideline consisted of five sections with instructions to Local Authorities and Stakeholders, Households/ Places Subjected to Quarantine, Waste Collection and Disposal Instructions for Local Authorities, Occupational Health and Safety of Waste Handlers and Additional Instructions for Local Authority.

2.5.3.3 CHAIN OF COMMAND

According to the waste management guideline, the first step was to identify households, places and persons subjected to self-quarantine. Thereafter, the Medical Officer of Health (MOH) was responsible to immediately inform the respective Local Authority to provide the residence or cluster with proper waste handling and disposal guidelines. In doing so, localized on-site waste handling and disposal was encouraged to reduce exposure to persons involved in collection, transport and disposal stages. The Local Authority was to continue delivering special services to such places and households and was expected to deliver regular waste collection services to all other places in the area. In addition, workers were expected to give instructions to households undergoing self-quarantine to refrain from illegal open dumping. However, assigning this task to workers is debatable as the extent to which households accept advice from waste workers is questionable.

2.5.3.4 MANAGEMENT AND PREVENTIVE MEASURES

As per this directive which was focused on households in quarantine, houses with adequate garden space were recommended to construct a waste disposal pit (two feet deep with bunds) to dispose all kitchen waste with adequate disinfection. Handing over of non-degradable waste was resumed after the period of isolation, based on the clearance of the MOH. A number of resources (separate waste collection vehicle with protective equipment, abled waste handling crew, detergents, colour coded waste collection bags, loading and unloading with minimal involvement, etc.) were to be allocated for this process. Waste was to be segregated into three categories namely, Kitchen and food waste: (waste generated from food processing, leftover after consumption, and spoiled/ discarded foods. Non-biodegradable waste: (paper, cardboards, polythene, plastics, discarded cloths, and other consumables) and Special waste: (waste and potentially contaminated items such as face masks, masks, gloves, handkerchiefs, tissues, sanitary pads, diapers and other materials contaminated by body fluids of residents while minimization of waste was encouraged. Separate vehicles were to be allocated to collect waste from infected households while guidelines were formulated for occupational health and safety of waste handlers, such as the use of PPE and other protective equipment, appropriate methods of handling waste, maintenance of social distance and disinfection of all equipment used in the process of handling waste. Additional instructions for local authorities included using a closed vehicle to collect waste from households undergoing self-quarantine and disinfecting the ordinary waste collection vehicle. Workers were requested to temporarily stop accepting waste for recycling centers or shops until the pandemic ceased. Further, training programs, site visits and study tours to waste management sites which were maintained by the respective Local Authority were to be halted. Each Local Authority was to strictly prohibit the entry of people and animals to dumpsites and scavenging on waste while a responsible officer was appointed to implement waste management activities with the assistance of other stakeholders.

This guideline is commendable as it dictates a special mechanism of handling waste, (including infectious waste) of households which were in quarantine during the pandemic in Sri Lanka and as it contains important preventive measures from the generation of waste to disposal such as onsite handling, segregation by abiding to quarantine measures. However, as Kankamage et. al, (2022) rightly point out, issuing guidelines to households in quarantine only leaves the general public with many questions regarding waste management during a pandemic. Therefore, a general guideline to both infected and non-infected households would have been more useful to the people. Further, though the usage of PPE is recommended, it is questionable as to how many waste workers abided by this rule given the nature of work such as the difficulty in collecting waste using gloves and being clothed with long, additional attire. It is questionable therefore whether such protective measures were practical or gender sensitive. The guideline does not offer any solutions or alternate options to informal waste workers except for the restriction of waste related activities. This directive would have had a negative impact on those involved in recycling. Thus, such individuals whose livelihood depended on waste related activities would

have experienced an unexpected setback. In addition, though formal waste workers were prohibited from collecting waste for recycling etc. the practicality of this instruction is questionable as economic pressures and difficulties would have caused workers to act otherwise. The guideline has less emphasis on waste disposal, especially with waste workers having to deal with increased volumes of medical waste and sharp materials like syringes. It would have been ideal if disposal and storage were further emphasized.

2.6 THE ROLE OF NON-GOVERNMENT AND INTERGOVERNMENTAL ORGANIZATIONS

It is also evident that intergovernmental organizations such as UNICEF (under the UNICEF Covid-19 WASH response program, 2021) have contributed towards waste management activities during the pandemic. It is mentioned that UNICEF supported the Environmental and Occupational Health Directorate of the MoH to develop a training module on health care waste management for health care staff and that 240 medical health staff were trained as part of the program. In addition, waste bins and carts were provided for four base hospitals, which functioned as COVID-19 treatment centers. It also supported in training more than 600 waste handling staff in local authorities of four districts and developed a guideline on safe handling waste at local authorities and information poster with key IPC measures.

2.7 LACK OF INTEGRATION OF LA WITH THE NATIONAL DISASTER MANAGEMENT MECHANISMS

Findings also revealed the lack of communication and coordination among state actors that were expected to play an active role when faced with a disaster; for an example, state institutions that were expected to combine their efforts and resources to address the challenges associated with Covid-19 lacked proper coordination among them. A respondent explained how the Disaster Management Center together with the Ministry of Disaster Management and the Local Government Authority were not interconnected and did not liaise in their activities- while the funds were channeled from the DMC or the Ministry to the DS, equipment and other resources were with the LA.

“Immediately after the Tsunami this DMC and the ministry was set up. They chose a different line of communication i.e. from national ministry to the Grama Sevaka. There are two parallel lines but unfortunately there is no interconnection between these two units- so the issue is-all the funds are been channeled from the DMC or ministry to the DS and equipment and other resources are with the LA. So since there is no connection between these two, there is no coordination in the efforts what they do. What has happened is, LA always works on response, whereas they should have worked on from the planning itself they should have incorporated DM into their mandate.” (KII interviews, 2023)

The allocation and possession of funds and resources to two different bodies may have led to unnecessary delays and shortcomings in addressing the emergencies that arose during the pandemic.

An expert revealed a fundamental flaw in the existing policy framework associated with responding to a disaster, revealing that Disaster Management was not an area that came under the purview of the local government (according to the ordinance of 1948).

“In 2018 a new policy was introduced for LGs which was endorsed by the parliament where DM has been recognized by the policy. LAs should now implement new areas under their purview based on this policy. The devolvement of power to provinces is very important because there are provincial differences..... It is submitted and endorsed by the parliament. The problem is transforming policy to action.” (KII interviews, 2023)

Activities of LAs are limited to 'response' during a disaster instead of been active from the initial, planning stages. In addition, the respondent stated that the two of the main state actors namely, the National Ministry of LG and National Ministry of Disaster Management should have a common agreement of how disaster management should be carried out at the ground level. The data also reveals the passive involvement of the DMC during Covid-19 while the Ministry of Health played a significant role in managing the situation.

3 THE COVID-19 IMPACT IN TWO SELECTED LOCAL COUNCILS

3.1 INTRODUCTION

This chapter of the report expounds on the impacts of the COVID-19 pandemic on the municipal solid waste management architecture and waste value chain of the selected local councils. Accordingly, section two of the chapter briefly introduces the Dehiwala-Mt. Lavinia Municipal Council and the Boralesgamuwa Urban Council and the impacts of COVID-19 on the waste management architecture and waste chain of the selected local councils.

3.2 DEHIWALA – MT. LAVINIA MUNICIPAL COUNCIL

The Dehiwala-Mt. Lavinia Municipal Council (DMMC) is a local administrative body located in the suburbs of the Colombo city. It consists of 29 wards that spread across 20.19Km². The local council area is a densely populated urban area located in the outskirts of the Colombo city. DMMC is the second largest municipal council in Sri Lanka after the Colombo Municipal Council. According to the national statistics of the municipal council, DMMC is populated by 889,000 individuals (SOSLC, 2012).

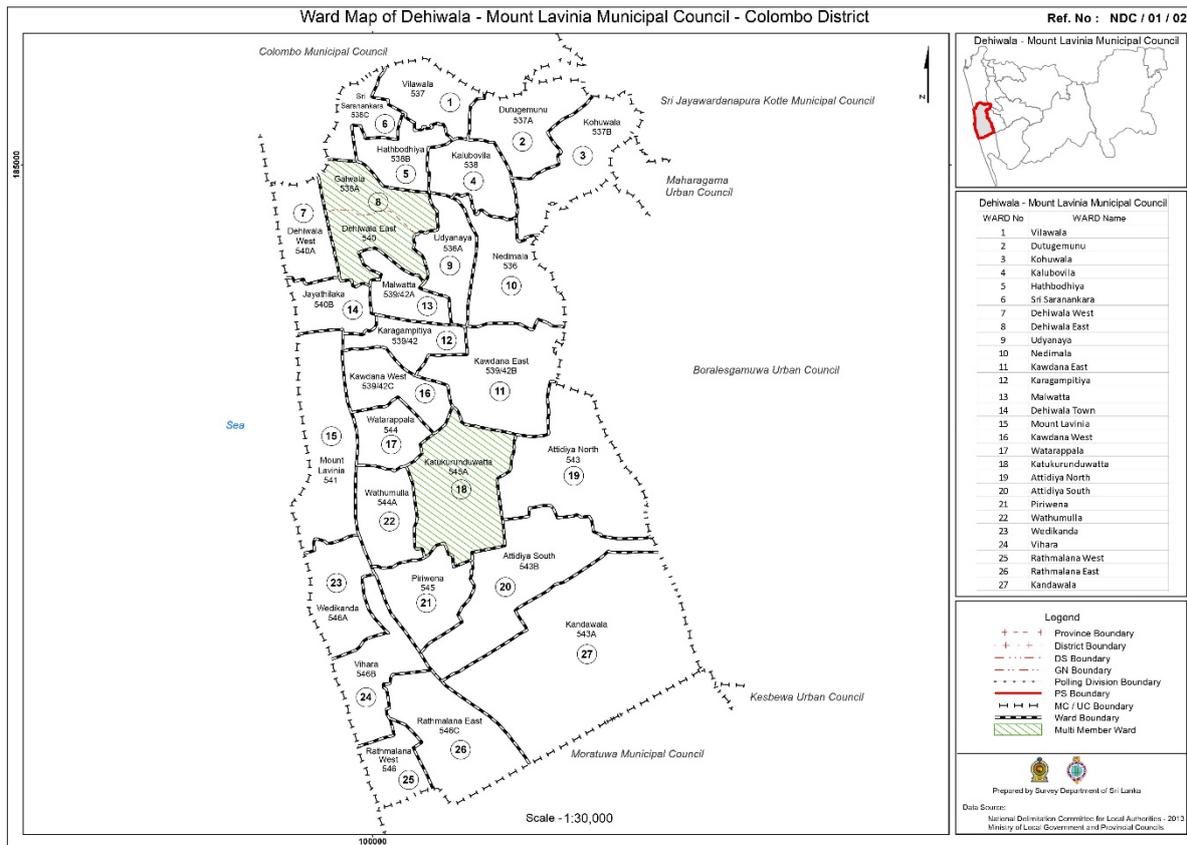
3.2.1 MUNICIPAL SOLID WASTE MANAGEMENT OF DMMC

According to the findings of the r4d working paper series, the monthly waste production in the DMMC area is 4,800 Metric Tons of municipal solid waste (Fernando and De Silva, 2020). Over 40% of the generated waste is food waste, while the remainder is other types of waste of which 35% are recyclable waste (Fernando and De Silva, 2020).

As per the provisions of the Municipal Council Ordinance (1947), the DMMC collects waste from households and businesses using a door-to-door waste collection system. The municipal council employees 380 health labourers, 35 waste supervisors, 10 drainage cleaners and 11 P.H.I officers for this purpose. The council utilizes over 55 vehicles to manage waste including compactor trucks and tractors to transport waste. In 2016, in the aftermath of the Meethotamulla disaster, the DMMC made it compulsory to segregate waste into categories of biodegradables and non-biodegradables. The official segregation rate in the council was around 50% in the year 2020. However, data collected for the r4d project revealed that the (self-reported) segregation rate was over 95% (Fernando and De Silva, 2020).

The council has allocated specific weekdays to collect biodegradable and non-biodegradable waste from the council area. The collected biodegradable waste is handed over to the Karadiyana landfill and composting site. Recyclable waste, such as metal, glass and paper, is collected at waste recycling centers of the local council. Recyclable waste collected by waste workers are further segregated, categorized and stored securely to be sold to informal waste entrepreneurs and other interested parties.

FIGURE 1 WARD MAP OF DEHIWALA - MT. LAVINIA MUNICIPAL COUNCIL; SOURCE SURVEY DEPARTMENT OF SRI LANKA 2013



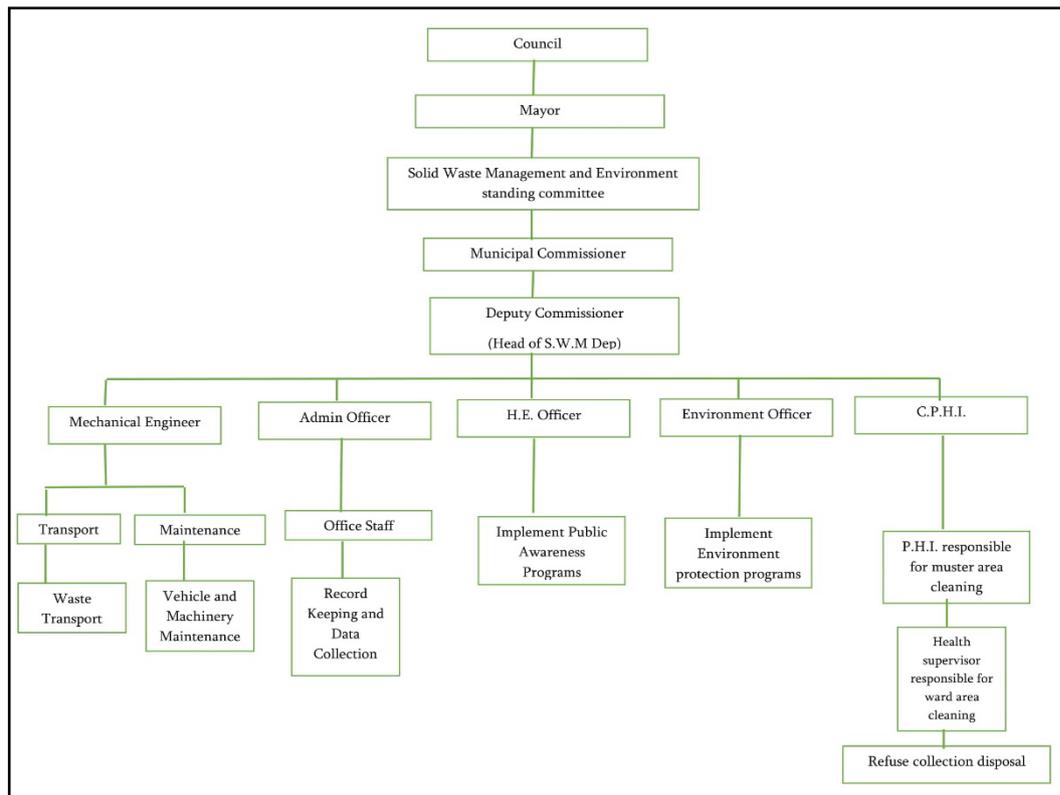
3.2.2 MUNICIPAL WASTE MANAGEMENT ARCHITECTURE OF DMMC

Municipal solid waste management activities of the local council are handled by the Health and Solid Waste Management Department (HSWMD) of the municipal council.

Waste management activities of the department are supported by the Solid Waste Management & Environment Protection Standing Committee of the municipal council. The key responsibilities of the (HSWMD) are:

- Waste collection and transportation Service
- Public health activities (Dengue)
- Road sweeping
- Public awareness on waste separation

The activities of the department are supervised by the elected members of the municipal council which is headed by the Mayor. Under the supervision of the Council and the Mayor, the Municipal Commissioner and the Deputy Commissioner oversee waste management activities. Municipal solid waste related activities of the council are executed through four divisions, namely the transport and maintenance, central management, health education, and environment divisions.

FIGURE 2 MUNICIPAL WASTE MANAGEMENT ARCHITECTURE OF DMMC; SOURCE: AUTHORS' NOTES

As suggested by the title, the transport and maintenance division of the department is responsible for transportation of the solid waste starting from door-to-door waste collection, transportation of formal workers and officials, transportation of collected solid waste from intermediate management centers such as recyclable waste collection points and also disposal of waste at sanitary landfill sites. The division is also responsible for the maintenance of waste collection vehicles and machinery, such as bailing machines, grass cutters, push carts, etc. This division of the department is headed by the chief engineer of the municipal council and the technical officers.

The central management division of the local council is responsible for managing administrative activities of waste management activities. The chief administrative officer leads the division with the support of other staff members of the local council. This division is responsible for managing finances related to the waste management process such as purchasing fuel, releasing petty cash for daily activities, releasing salaries of health laborers (formal waste collectors), keeping records of daily collection and disposal activities, etc.

The third division of the department is the health education department which is managed by the health education officer under the supervision of the deputy commissioner. This division of the department is responsible for increasing awareness among the community regarding sustainable solid waste management practices at household and institutional level. The division organizes awareness raising programmes in government institutions, private companies, schools, etc. The division also prints posters, leaflets and booklets regarding environment friendly waste management activities, sustainable household practices, recycling, etc.

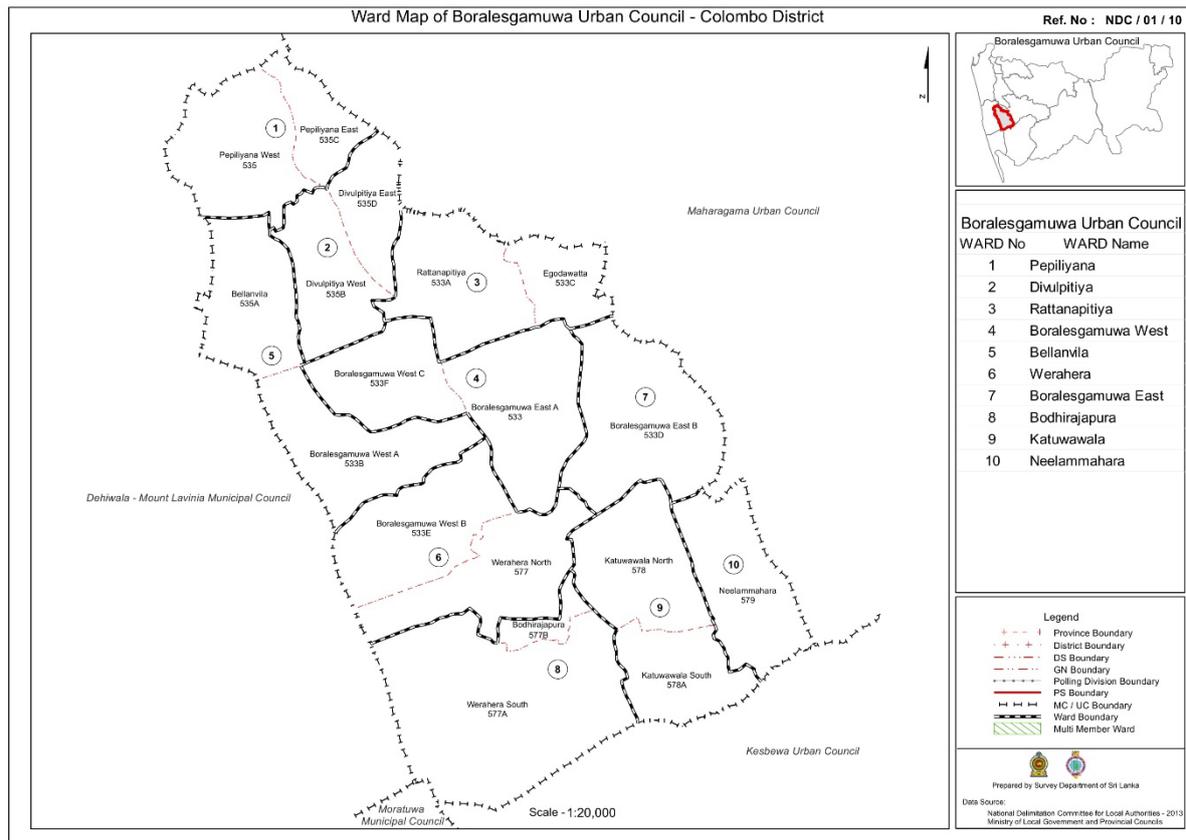
The fourth division is the environment protection division which undertakes the responsibility of executing environmental protection activities in collaboration with the Environmental Police. Accordingly, the division enforces law against individuals that dispose waste in public spaces by issuing warnings and filing cases against polluters. This division plays a key role in inspecting

houses, commercial and institutional premises for violations of dengue related environmental codes. This division is managed by the environment assistant officer.

3.3 THE BORALESGAMUWA URBAN COUNCIL

The Boralesgamuwa Urban Council (UC) is a relatively new urban council which originally was part of the Kesbewa municipal council. The council expands across 13.5 square kilometers and consists of 18 Grama Niladhari (GN) divisions . According to the 2011 Census report, there are 37,260 permanent residents in the Boralesgamuwa Urban Council area.

FIGURE 3 WARD MAP OF THE BORALESGAMUWA URBAN COUNCIL; SOURCE: SURVEY DEPARTMENT OF SRI LANKA 2013



3.3.1 MUNICIPAL SOLID WASTE MANAGEMENT OF BUC

As per the provisions of the Municipal Council Ordinance (1947), the Boralesganuwa Urban Council is responsible for management of solid waste within the council area. The BUC area produces over 35 tons of solid waste on a daily basis (in-depth interview, 2020). Accordingly, the BUC carries out door-to-door waste collection activities within the local council area by using 16 vehicles including tractors, compactor trucks and crew cabs. The municipal council employs over 35 formal waste collectors to engage in waste collection activities.

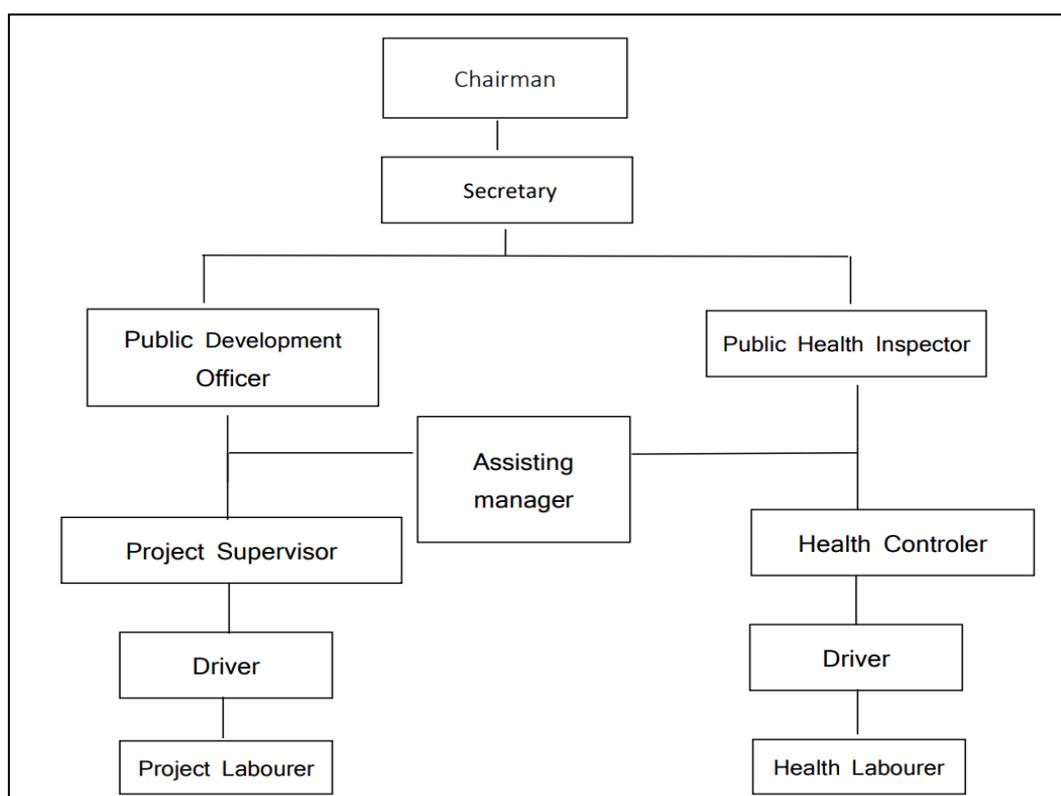
The BUC collects garbage which is segregated as degradable and non-biodegradable waste from households and commercial premises. The council has assigned specific weekdays to such waste. The biodegradable waste collected by the local council is disposed at the Karadiyana waste management center located in the BUC area. At Karadiyana, the biodegradable waste is utilized to produce organic fertilizer. The non-biodegradable waste is further segregated, and economically viable waste items are handed over to the waste recycling center “Sampath

Piyasa”. After further processing, the recyclable waste is sold as raw material to the private sector.

3.3.2 MUNICIPAL WASTE MANAGEMENT ARCHITECTURE OF BUC

The Boralesgamuwa UC has a Solid Waste Management & Environment Protection Standing Committee (SWMEPSC). The Chairman serves as the head of the SWMEPSC. Waste collection and transportation services, public health activities (dengue awareness programmes), road sweeping and promoting public awareness on waste segregation are some responsibilities of the SWMEPSC. In addition, the SWMEPSC consists of the Refuse Collection & Disposal Division where the Chief Public Health Inspector (CPHI), PHI, and Health Supervisor are employed.

FIGURE 4 MUNICIPAL WASTE MANAGEMENT ARCHITECTURE OF BUC; SOURCE AUTHORS’ NOTES



3.4 IMPACT OF COVID-19 ON THE WASTE MANAGEMENT ARCHITECTURE

For the purpose of this particular report the authors define municipal solid waste management architecture “as a formally organized hierarchical structure that has been established to collect, treat and dispose municipal solid waste. The structure encompasses mobile and immobile assets, individuals involved in waste management activities (including workers) and services offered by the infrastructure”.

Accordingly, the following section of the chapter will elaborate on the impacts of COVID-19 on the key components of the solid waste management systems, specifically to:

1. The organizational hierarchy
2. Waste management services
3. Individuals involved in waste management activities, formal waste workers and residents.

3.4.1 IMPACT OF COVID-19 ON THE ORGANIZATIONAL HIERARCHY

It was revealed that the organizational hierarchy of the waste management system was not severely affected by the onset of the COVID-19 virus. Findings of the study suggested that the organizational hierarchy of municipal solid waste management mechanism in the BUC and DMMC were not changed due to the onset of the COVID-19 virus. During interviews with officials of local councils it was revealed that the existing solid waste management mechanisms were altered as required to counter the challenges posed by the COVID-19 virus instead of making any changes in the hierarchy. An official of DMMC had the following to say when questioned about why the organizational hierarchy of the municipal council was not changed due to the onset of COVID-19.

“As you are aware, the municipal solid waste management mechanism in the municipal council is quite comprehensive. As we are equipped with five divisions and enough numbers of waste workers, all we had to do was to change waste collection and management activities according to the requirements. Accordingly, we increased the number of meetings we had regarding solid waste management at the municipal council in order to identify the most pressing concerns and issues we experienced each week. We allocated the resources we had in the most sustainable way and often obtained the support of the Ministry of Health to manage infectious waste.” (In-depth Interview, 2022)

Findings revealed that the municipal councils had obtained the support of the Ministry of Health when collecting, managing, and disposing of infectious waste. Moreover, the municipal council had obtained the support of the army and police to obtain curfew passes for formal waste collectors and government officials.

When asked about the involvement of the police and the military in solid waste management activities, an official of BUC stated the following-

“As you know, we have always worked very closely with the Police and the Army. This was the case even before the spread of COVID-19. Our P.H.I officers obtained the support of Police when prosecuting and warning individuals who had disobeyed the orders of the council and also when taking legal action against violators of waste management regulations. Moreover, the Environmental Police division of the Sri Lanka Police has always worked with us to enforce laws related to waste management and environmental protection. So, this was nothing new; they are not new actors. The pandemic period was a challenging time but still I have to say that waste management remained in the full control of the municipal Council.” (In-depth Interview, 2022)

As it was revealed in the findings of the r4d project, the Ministry of Health had already played a significant role in waste management activities prior to the onset of the COVID-19 virus. PHI officers of municipal councils are appointed by the Ministry of Health and they are responsible for managing community health in the local council areas. In the case of DMMC, as solid waste management activities are managed by the Committee for Solid Waste Management and Health, the Ministry of Health has always been a major actor in solid waste management activities of the council. As a result, it was easy for the Ministry of Health to introduce infectious waste management mechanisms to the local council's solid waste management initiatives.

3.4.2 IMPACT OF COVID-19 ON THE WASTE MANAGEMENT SERVICES

Findings of the study revealed that the onset of COVID-19 virus impacted waste management services offered by the councils. Majority of the impacts were negative in nature while some were positive. The negative impacts of COVID-19 virus on the waste management services will be described below.

3.4.2.1 REDUCTION OF COLLECTION DAYS

Waste management activities of local councils were disrupted due to the onset of COVID-19 virus as a significant number of officials and formal waste workers, especially, were infected with the virus. Findings revealed that nearly 10% of formal waste collectors in DMMC and BUC were infected with the virus in different instances. This in turn forced the local councils to limit the number of days on which waste collection was carried out due to the shortage in labour. Accordingly, the DMMC allocated two days to collect non-biodegradable waste and another two days to collect biodegradable waste. The municipal councils managed to carry out waste management activities without a disruption though the number of days were reduced.

An official of DMMC explained this as follows:

“This was our biggest challenge. Due to the limited budget, we were not in a position to recruit new waste workers on a temporary basis. Also, we experienced difficulties when it came to obtaining curfew passes for the other waste workers. Therefore, we had no other option but to limit the days of waste collection to four instead of seven days.” (In-depth Interview, 2022)

Findings of the r4d project revealed that waste collection activities were not carried out for nearly two weeks during the COVID-19 period in some areas of the DMMC and BUC. A survey carried out with the residents living in the municipal council area revealed that formal waste workers did not collect waste for a period of two to three weeks. The respondents of the survey had stated that the disruption of waste management was a result of waste workers being infected. However, it must be noted that municipal council officials were reluctant to acknowledge this disruption during the COVID-19 period.

When questioned about the long-term disruption of waste collection activities during the COVID-19 period, one of the officials stated the following:

“I don't think such a long-term disruption would have taken place in any of our areas. We did our very best to make sure that we provided a good service to our residents. However, due to the situation that we were facing at the time, there could have been a disruption of waste collection activities. Yet it is difficult to believe that such a long disruption of waste collection could have happened. If such a disruption has had happened, we would have gotten to know about it through the elected members. It is a surprise that we did not get to hear about this situation.” (In-depth Interview, 2022)

As mentioned by the official, it is true that elected members are extremely concerned about waste management activities carried out within their particular ward. However, due to the onset of the COVID-19 virus, the priorities of elected members had changed from maintaining cleanliness of the area to maintaining the health of the residents. This could be one of the reasons why complaints regarding the disruption of solid waste management activities had not reached officials of the municipal council.

3.4.2.2 COLLECTION OF MIXED WASTE

Another negative impact on waste management activities of local councils was the obligation to collect mixed waste from households and commercial buildings. According to the findings, the elected members of the municipal council had persuaded the officials to consider the possibility of collecting mixed waste from households stating that the municipal council should be able to reduce the number of days the waste is collected if mixed waste is collected. Nevertheless, during the in-depth interviews conducted with the officials it was revealed that they were not happy with this decision of the elected members. The officials were concerned that collection of mixed waste could negatively impact segregation efforts the municipal council.

An official of the DMMC stated the following during an in-depth interview:

“It was a great difficulty to convince the elected members and the public to segregate waste at the source in 2015. The collapse of the Meethotamulla garbage dumping site also aided us to further improve the waste segregation rates. Segregation at source brought down the expenses of the municipal council (to manage waste) by a significant percentage and also through increased recycling we managed to earn a good income. We pointed out to the elected members that it will be difficult for us to convince the public to segregate waste again. Unfortunately, according to the Municipal Council the final decision regarding any of the activities carried out in the municipal council lies with the members of the elected council. Therefore, we had no option but to agree to collect mixed waste from the residents.” (In-depth Interview, 2022)

It was also revealed that this initiative to collect mixed waste faced significant resistance and criticism from certain residents. Some residents had contacted the Secretary of the BUC and had complained regarding this practice and had urged with him to continue with the segregation. The commissioner stated the following during an in-depth interview;

“I got many calls. I got many calls from residents living in different areas of our municipal council questioning this practice. They asked why we are resorting to collect mixed waste again. I had to explain to them that due to the shortage of labour we have no other option but to collect mixed waste. Most of these individuals were well educated and some of them have lived overseas for a long while. They truly care about waste management activities. One person told me to check whether such a change in waste collection have been done in any other country. Personally, I don't know whether such changes have taken place in other countries. Unfortunately, as I told you before the final decision always rests with the elected members of the municipal council.” (In-depth Interview, 2022)

It was also revealed that the local councils are experiencing difficulties convincing residents to resume waste segregation activities at their households. An official of DMMC stated that they are experiencing resistance to segregate waste at source as a result of collecting mixed waste during the COVID-19 period.

“One resident told me that they used to segregate waste during the COVID-19 period and that the municipal council had taken a decision to collect mixed waste later. Again after two months you are asking us to segregate again. Is this a joke? What's the point of this?” (In-depth Interview, 2022)

It was also revealed that officials had to struggle to persuade the elected members to reintroduce segregation activities. According to the accounts of the Deputy Commissioner of DMMC, they were persuaded to adopt segregating at the source after the Western Province Waste Management Authority made an enquiry regarding the collection of mixed waste in the municipal council area.

“We initially tried to convince the elected members that we have to return to segregating waste if we are to continue sustainable waste management activities. However, it was difficult for us to convince them. It was a blessing that the Western Province Waste Management Authority took an interest to inform the council that collecting mixed waste is against the waste management policy of the Western Province. As a result, the council had to return to segregating waste at the source. However, as you pointed out, we are experiencing some difficulties in convincing residents that there won't be any changes in the future”. (In-depth Interview, 2022)

3.4.2.3 REDUCED INVOLVEMENT OF P.H.I OFFICERS

Another negative impact that local councils experienced as a result of the onset of the virus is the reduced participation of PHI officers in solid waste management activities. As discussed

earlier, PHI officers are appointed by the Ministry of Health of Sri Lanka to manage public health and community wellbeing in respective local councils. However, in addition to providing health related services, PHI officers are also a key pillar of waste management activities. They engage in community awareness development programs, train formal and informal waste collectors on sustainable practices, supervise waste collection, treatment and disposal activities and prosecute violators of the municipal council's waste related regulations and policies.

The significance of a PHI officer's role in solid waste management was revealed during an interview conducted with an official of the BUC.

“Public Health Inspectors are an important part of solid waste management activities of our council. They are responsible for supervising waste collection and intermediate treatment and disposal of waste. They also play a significant role in supervising the activities of waste workers and attending to their social and economic wellbeing. PHI officers also play an important role in enforcing the law of the municipal council as they are in-charge of prosecuting individuals who dispose waste to public spaces and those who do not abide by the eradication regulations of dengue fever.” (In-depth Interview, 2022)

However, the PHI officers were tasked with the responsibility of attending to the individuals infected with the virus with the onset of the COVID-19 virus. Accordingly, PHI officers were responsible for identifying individuals infected with the COVID-19 virus, isolation of infected families, attending to the socio-economic needs of families in isolation, vaccination of residents living in the municipal council areas, producing daily reports to be submitted to the Ministry of Health on COVID-19 virus, etc. As a result, PHI officers had to prioritize activities related to COVID-19 prevention and management over municipal solid waste management activities. Therefore, PHI officers were unable to provide their inputs and guidance to solid waste management activities as they used to do prior to the onset of the virus.

An in-depth interview with an elected member of DMMC revealed the difficulties that the municipal council experienced when engaging in waste management activities with the reduced participation of PHI officers.

“With the onset of the COVID-19 virus, PHI officers became preoccupied with activities related to controlling and preventing the spread of the virus. Therefore, it was difficult for them to be involved in solid waste management activities. As a result, we experienced difficulties in attending to complaints of individuals regarding waste management related misconduct and issuing warnings. As a result, the amount of waste dumped in public spaces illegally increased significantly. Even during lockdown periods some individuals had disposed of waste in public spaces. However, I must mention here that even during such a difficult time our PHI officers still managed to find time once in a while to look in to waste related matters. We are grateful to them for that.” (In-depth Interview, 2022)

These findings revealed that reduced participation of PHI officers in the solid waste management activities had contributed to reducing the quality of the waste management services provided by the local councils.

3.4.2.4 DIFFICULTIES IN MANAGING MEDICAL WASTE AND USING MASKS AND SANITIZERS

The onset of the COVID-19 virus also contributed to the expansion of waste management services provided by local councils. As discussed extensively in the working paper series of the r4d project, municipal solid waste activities provided by BUC and DMMC were strictly limited to the management of non-medical waste. However, with regulations which made the usage of face masks compulsory, the local councils were forced to manage medical waste. Moreover, the use of hand sanitizer also increased with the spread of the pandemic, further complicating waste

management. Neither the local councils nor the Waste Management Authority of the Western Province had previous experience in managing medical waste as the Ministry of Health was the authority that attended to the management of medical waste. As a practice the government hospitals of Sri Lanka utilized small scale incinerators to manage medical waste produced in their respective institutions. However, these incinerators could not be utilized to manage the large number of medical waste produced due to the increasing use of face masks and hand sanitizers.

An official of the DMMC stated that they were faced with a dilemma and it was quite difficult for them find a safe and practical solution to manage used masks and sanitizer bottles.

“Having to manage used masks and sanitizer bottles was a challenge for us. First of all, used masks posed a health threat to our waste collectors as handling of masks used by infected individuals would expose them to the virus. Secondly, we did not have a proper method of disposal. However, after having a few discussions with the health authorities we came to realize that the most appropriate way of handling used masks and sanitized bottles was to request the residents to manage it themselves by securely burying or burning them. As a result, at first we informed the residents through our staff that used facemasks and sanitizer bottles will not be collected by the council and that the residents should manage them.” (In-depth Interview, 2022)

However, this waste management initiative led to a major issue. This issue was revealed during an interview with the waste supervisor of BUC.

“Even though we asked the residents to manage masks and sanitizer bottles on their own, many were reluctant to collect used face masks at home. So instead, a large number of residents made it a practice to discard used masks at their offices and public spaces. On the other hand, everyone does not have enough space to bury or burn face masks. Most of the residents in our council area live in small pieces of land. Often they build their houses on two thirds of the land leaving them only a small piece of land as a garden. Sometimes this empty space also doubles as a parking space. So often they would burn these medical waste items on the roadsides. And the other method they used to manage waste was mixing masks with the waste collected by the municipal council. As a precaution we advised waste workers to refrain from checking the contents of the waste bags and containers collected from households and commercial premises during this period. So we only got to know if a resident had given mixed medical waste when we empty the truck or the compactor at Karadiyana.” (In-depth Interview, 2022)

It was also revealed that some waste management workers were aware of this practice but turned a blind eye as they understood that the residents did not have any other way of managing waste and sometimes the residents would give the waste workers some cash to dispose masks and sanitizers.

One waste collector stated the following when asked about the practice of the disposing masks and sanitizers with municipal waste.

“What can we tell them sir? Can we tell them to take the masks out? We all are humans you know. We understood that residents do this because they have no other option. These are good people who were stuck at home and couldn't go out. They live in small houses - everyone doesn't have big gardens to burn them. So we took the bags. We had to be sensible. It was a difficult time for all. It is still a difficult time. Of course some houses would give us some money when we collected the waste but I don't think they did it because they wanted to grease our palms. I would like to believe that they wanted to appreciate the work we do during a difficult time. It was never about the masks.” (In-depth Interview, 2022)

Adding to this conversation an official of the DMMC stated the following,

“We also knew that people are mixing medical waste with municipal waste. Also we were aware of the fact that waste workers accept money from residents to collect municipal waste mixed with medical waste. But we also did not want to enforce the law strictly at the time because we were already finding it difficult to keep the waste collection system afloat due to the labour shortage. If we were to punish the people who were reporting to work things could have gotten much worse”. (In-depth Interview, 2022)

Therefore, it is evident that the officials and waste workers allowed residents to dispose of medical waste to the Karadiyana dumping site using the municipal solid waste management system of the local councils. This practice must have significantly impacted waste management activities at the Karadiyana waste management center during the COVID-19 period. Accordingly, the authors wish to collect data from the officials working in the waste management site regarding the nature of the waste composition of municipal waste disposed at the site during the COVID-19 period and how mixed waste (medical and municipal) impacted waste management activities at the site.

3.4.2.5 INCREASE IN WASTE MANAGEMENT EXPENSES

The municipal councils have experienced a significant increase in expenses relevant to the waste management activities. These additional expenses are results of

1. Having to purchase sanitizer for waste workers and for cleaning of waste collection vehicles,
2. Having to spend on transportation of waste collectors from their houses due to the lack of public transport facilities,
3. Having to provide accommodation and meals to some waste workers who were willing to stay in the municipality instead of coming to work from home
4. Providing financial and other types of support to waste workers and their families that were infected with the virus.

As the DMMC and BUC had not anticipated additional expenses for the period in which the COVID-19 virus spread within Sri Lanka, the councils had to find additional funds and depended on donations provided by the Western Province Waste Management Authority and private donors to provide waste workers with masks, sanitizer and anti-bacterial soap.

The difficulties experienced by the local council in obtaining sanitizer was disclosed in the following manner during an interview with an official of the Boralesgamuwa Urban Council.

“Initially we did not have a clear idea how we should proceed to collect waste amidst the spread of the virus. However, as the health authorities had advocated the use of face masks and hand sanitizer our Mayor instructed all workers of the council to use facemasks and hand sanitizer, and also to maintain social distancing regulation at all costs. Accordingly, we asked waste workers to use face masks at the beginning. However, when the virus started to spread aggressively the PHI officers recommended that we should provide masks and anti-bacterial soap to workers using our own funds as most waste workers did not wear masks due to the high price of masks. Also we received instructions from the Waste Management Authority of the Western Province regarding the management of infectious waste. These instructions had made it compulsory for waste collectors to wear masks and PPE protective gear when collecting infectious waste and to use a large quantity of disinfectants to clean themselves and waste collection vehicles. Accordingly, we had to finance the purchasing of facemasks and sanitizer using the funds available in other budget lines

and also urge the businessman in our area to donate funds or masks and sanitizer for the use of waste workers.” (In-depth Interview, 2022)

This account discloses that having to spend on sanitary equipment exerted a significant financial burden on the local council. It is important to note during spending on sanitary equipment was not the only additional expense that the local council had to bear in this period. In addition to the expenses related to solid waste management mentioned above the local council was pressured to look into the wellbeing of the residents of the council that were infected with COVID-19 virus. The elected members of the council took it upon themselves to provide dry rations and other necessary goods to families that were isolated in their households on a weekly basis. Due to the patron-client relationship that exists between the elected members and residents, elected members had pressurized officials of the councils to allocate funds to provide aid to affected families. As a result, officials had an extremely difficult time to obtain funds to provide waste workers with necessary sanitary equipment. An officer of the DMMC explained the measures that officials adopted to provide masks, sanitary liquid and soap to waste workers.

“It was extremely difficult for us to find masks at first because vendors of masks and sanitizer had hidden stocks with the hope of inflating the prices. Even though we could find masks the quoted prices were as high as 200 per mask. These are not KN95 masks; jut ordinary masks. So our commissioner called for a meeting with a few entrepreneurs living in our local council area and urged them to donate some masks to continue our work without disruption. As a result, we got a large quantity of sanitary masks, sanitizer liquid and carbolic soap within few days. But as we had to use new masks everyday this stockpile depleted right before our eyes within a few days. We then purchased some more masks from stock traders and also commissioned the production of cloth masks from a local entrepreneur. Fortunately, after a month or so the local market was flooded with cheap, Chinese face masks and the price of masks began to go down quickly. This helped us to acquire some sanitary equipment.” (In-depth Interview, 2022)

Moreover, the municipal councils also have had to spend on providing transport facilities to waste workers who live in locations far away from the municipal councils. DMMC is the municipal council that have had to spend on the transportation of formal waste workers. An official of the DMMC elaborated on this particular expense in the following manner.

“Some of our experienced waste workers live in areas away from the municipal area. Under usual circumstances they use public transport to travel to work. However, with the declaration of lockdowns during the COVID-19 period they faced significant difficulties in finding transport options as public transport activities came to a halt. We had no option but to offer them transportation services to sure that the waste management activities were not disrupted. So we used about four vehicles to pick and drop off some of the waste workers from areas such as Horana, Homagama and etc. Though it was an additional expense we had to bear it for the sake of keeping the council area clean.” (In-depth Interview, 2022)

Moreover, DMMC and BUC had spent additional expenses on providing accommodation and meals to the waste workers. In the case of DMMC waste workers were offered accommodation in community centers located in the local council area as a solution to transportation issues experienced by waste workers. However, only male waste workers had taken up the offer to use accommodation and the council had provided accommodation to over 10 waste workers.

An officer of the DMMC local council elaborated on the expenses that the council had to bear for providing accommodation to waste workers.

“We provided them accommodation in some of the community centers owned by the local councils and we also permitted them to temporarily sleep in the musters of the council. Providing them with accommodation was the easy part. Providing them with meals on a daily basis was the biggest challenge as all the hotels and food outlets were closed due to the lock downs. We ultimately had to obtain the services of a third party to provide the workers with meals.” (In-depth Interview, 2022)

BUC also had borne expenses to provide meals to waste workers as they too had experienced difficulties in finding meals. The council had provided them with tea and savory items in the morning and lunch when required. The mayor of the local council had obtained the support of his supporters to finance these activities.

As mentioned previously, a significant percentage of workers from local councils had fallen ill. The local council had spent a significant amount to take care of economic and other requirements of infected waste workers and their families. Both DMMC and BUC had provided infected waste workers a full salary for the period in which they could not report to service. An officer of DMMC justified this action taken by the local council in the following manner.

“As you know, these waste workers are innocent and when they are ill they do not have any other means of surviving other than the salary we provide from the municipal council. If we were to deduct the salary when they are sick, not just due to COVID-19 but for any other reason, that would be unfair by them. This is because they do a job that most of us would not like to do even if we were paid a million. The elected members and the officers all stood behind this decision.” (In-depth Interview, 2022)

The Mayor of BUC justified the decision to pay the waste workers in the following manner

“We are very well aware of the lives of these waste workers. Most of them are poor and engage in different daily paid labor activities even after working at the municipal council. They have taken many loans and barely manage to pay them. They can't even spend on their children's education. Therefore, we couldn't cut their salaries with a clear consciousness.” (In-depth Interview, 2022)

Moreover, the local councils had provided a free bag of dry rations on a weekly basis to infected waste workers. This bag of essential goods included rice, lentils, coconuts, cooking oil, canned tuna, dry fish, salt, sugar, milk powder packets, vegetables and etc. The government of Sri Lanka had taken measures to provide low-income families with a cash advance of LKR. 10,000.00 to purchase essentials and to bare their monthly bills. The government also took measures to provide low-income families with a bag of dry rations with all essentials on a weekly basis. DMMC and BUC had taken action to ensure that the waste workers of the local councils were added to the lists of the above-mentioned relief measures even though most of them would not have made it to these lists as they earn a significant income.

An officer of DMMC stated:

“We made sure that infected waste workers received all the relevant relief services provided by the government to poor households. Even though our waste workers have a government job they still earn a minimum income. On top of that they are stuck in day loans and other types of informal loans. We also made sure to provide them with additional bags of dry rations and in necessary situations officers of the local councils gathered money personally from the staff and handed them over to the waste workers. We wanted to show them that they are not alone in their darkest hour and that we care for them.” (In-depth Interview, 2022)

These findings of in-depth interviews suggest that the onset of the COVID-19 virus had negatively impacted waste management services provided by the local councils in a significant

way. Nevertheless, the onset of the COVID-19 virus has also had positive impacts on waste management activities of the local councils.

According to the accounts of the Deputy Commissioner of DMMC, the onset of the COVID-19 had revealed the shortcomings of waste management activities of the DMMC. According to her, the onset of the virus had revealed that the council had collected waste on too many days. As mentioned previously DMMC had to reduce the number of waste collection days to four from collecting waste on all seven days. However, the Deputy Commissioner was of the opinion that the pandemic situation revealed how they can increase the efficiency of waste collection activities and thereby reduce the expenses related to waste collection and disposal. She further explained how the pandemic helped her to convince the elected members that waste can be collected efficiently on a smaller number of days.

“Earlier also I had proposed to the local council to reduce the number of days that waste is collected to five. However, the elected members were totally against it and pushed us to continue with the seven-day waste collection. But COVID showed every one that waste management can be carried out on four days thereby reducing the amount we spend on fuel and overtime payments of waste workers. Now we have an example to base our activities. Unfortunately, I will be transferred to a new location soon but still the individual who will replace me should be able to use this example to change waste management activities in the future.” (In-depth Interview, 2022)

Moreover, the authors observed that the onset of the virus had revealed a key fault in waste management activities carried out by the local councils. This fault is the lack of disaster preparedness in waste management activities. The local councils and even provincial and national level organizations involved in waste management activities had failed to foresee that the waste management activities of the local councils are vulnerable to external stresses and risks. If not for the COVID-19 virus a different disaster scenario could have had a similar negative impact on waste management activities. However, unfortunately none of the elected members or government officials interviewed in the study touched on this gap in waste management activities. Therefore, the authors intend to further study the nature of this gap in the MSWM system of the local councils with the hope of enlightening the officers and elected members regarding their lack of disaster preparedness.

3.4.3 IMPACT OF COVID-19 ON WASTE WORKERS

Findings of the study revealed that formal waste workers involved in municipal solid waste management activities have experienced multiple negative impacts due to the onset COVID-19 virus. In-depth interviews conducted with elected members, officials and waste workers of municipal councils revealed that these impacts have had a negative influence on the health, income earning activities and social status of waste workers.

The key impacts that waste workers experienced as a result of the onset of the COVID-19 virus are:

1. Increased exposure to COVID-19 virus
2. Significant reduction of income
3. Increased workload due to the reduction of waste collection days
4. Experiencing an increase in discriminatory treatment

Prior to elaborating on these key impacts it is important to note that majority of the formal waste management force consists of males while female waste workers of the selected local councils amounts to an extremely small percentage. Findings of the r4d project suggested that local councils give priority to males when recruiting waste collection workers. Officials and elected

members of the local councils presented the reasons that justify the phenomenon of giving priority to males when recruiting waste collectors.

An official of the BUC stated that male waste workers are given prominence as they agree to work at any hour and are capable of carrying out heavy work such as loading, unloading, lifting and transporting waste.

“Unlike female waste workers we don’t have to worry about recruiting male waste workers as they are always ready to work- at any hour and under any circumstances. But when you recruit a female waste collector we cannot send them in the tractor to collect waste from households as it is difficult for them to hang on to tractors or compressors. Usually female workers are recruited to sweep road sides and pedestrian walks.” (In-depth Interview, 2022)

An official of the DMMC stated that it is difficult to retain female waste workers in the job as a formal waste worker as once they are employed by the local council they tend to make requests to the political leadership for transfers to different sections of the local council such as to engage in office work, secretarial work and etc.

“Most of the female waste workers we had recruited to collect waste have swept roadsides and have been engaged in waste collection for a limited time. Once they get the confirmation letter from the council they demand us to transfer them to another division other than the waste management division. Majority of females recruited for the position of female waste collectors were close acquaintances of elected members. As a result, they easily get a transfer to a different division and we have to recruit waste workers again.” (In-depth Interview, 2022)

As a result, majority of the municipal waste workers engaged in waste management activities are males. This statement is applicable to DMMC and BUC and every other local council in Sri Lanka. The gender bias seen in the composition of waste management labour also relates closely with the type of work that female and male workers have to engage in. According to the primary data collected for the study it was revealed that male workers are responsible for managing heavy work such as collection of waste from neighbourhoods, loading waste to vehicles and etc. while female waste workers are expected to engage in comparatively less heavy activities such as cleaning roadsides, pavements, sweeping, mopping etc which were discontinued in the COVID-19 period. As a result, it must be understood that all the negative impacts of COVID-19 virus have been experienced by male waste workers.

3.4.3.1 INCREASED EXPOSURE TO COVID-19

One of the key negative impacts experienced by waste workers is the increased exposure to the COVID-19 virus when compared to other professions. The responsibility of waste workers is to collect municipal waste and to transport the collected waste to management and disposal facilities. Accordingly, none of the respondents who were interviewed in the study had received training on managing infectious waste. Nevertheless, waste workers of the local councils had collected and managed infectious waste from houses of individuals who were infected with the virus. Even though the local councils had provided waste workers with PPE kits, sanitizer and boots all these equipment do not guarantee complete protection from the virus.

According to an account of a waster worker of DMMC, the risk of been infected is further increased by the fact that waste workers were also exposed to mixed waste generated from other households in addition to being exposed to waste generated from households of infected individuals. Unfortunately, waste workers and officials of the local council had no means of comprehending whether waste collected from households carry the virus.

“We always took extreme precaution when we collected waste from houses of infected people. We wore the PPE kit, boots, gloves and used sanitizer but we could not use all

these precautions when we collected waste from houses that did not have an infected person. So we were always exposed to the virus. In some instances, residents of isolated houses had removed the identification tags and announcements that PHI officers paste on gates and doors of infected households. So some of our workers had direct interaction with households in isolation unknowingly. When something of this sort happened all individuals that were in touch with him had to isolate themselves. This happened all the time.” (In-depth Interview, 2022)

Another factor that had contributed to the increased exposure of waste workers to the virus was having to manage mixed waste disposed from households that disposed used masks, gloves and sanitary liquid bottles. As discussed in a previous section of the report, residents of both local councils had resorted to dispose used medical waste by mixing these items with municipal waste. As a result, the waste workers were in constant threat of being exposed to the COVID - 19 virus. A waste worker of BUC explained during an interview how waste mixed with medical waste exposed them to the virus.

“Almost all the waste bags we collected from Bodhirajapura had masks, gloves and sanitizers. The usual practice was to hide the masks in the middle of the bag between food and other waste. As we were instructed by the PHI officers to refrain from checking the content of bags we had no means of knowing whether a bag contained medical waste. On the other hand, some individuals had made it a practice to discard used masks and other sanitary equipment near bus halts, shop fronts, under trees located in common areas, under bridges and etc. We had to collect that waste also as the city has to be cleaned in the morning by seven a clock.” (In-depth Interview, 2022)

Moreover, it was also revealed during interviews with elected members and officials that the reluctance of waste workers to use protective gear provided by the local council at all times was another factor that contributed to the increased exposure to the virus. As explained by an official of DMMC, waste workers found it difficult to use protective gear at all times.

“Even though we had provided waste workers with masks, gloves, sanitizer and carbolic soap most of the waste workers did not use these items at all times. After a while a false sense of security had seeped into the minds of waste workers that somehow they are immune to the virus. They used to only wear the protective gear when we asked them to use it or when they were collecting waste from a household with infected individuals” (In-depth Interview, 2022)

These findings reveal that waste workers have been exposed to the COVID-19 virus more than other professionals due to their constant interactions with infectious waste and medical waste.

3.4.3.2 REDUCTION IN INCOME OF WASTE WORKERS

Secondly, the onset of the COVID-19 virus had significantly reduced the income of waste workers. As it was revealed during the interviews with the elected members and officials, waste workers engage in multiple income earning activities. Waste worker had obtained loans from government banks for their personal use and in addition they had also obtained loans from informal lenders. As a result, the income earned from the municipal council is barely enough for them to provide for their families. Therefore, waste workers utilize various means to earn an additional income. These additional means of earning an income includes engaging in daily paid labour activities such as cleaning gardens, aiding residents with petty work and selling economically viable waste to informal waste workers.

Findings revealed that the onset of the COVID-19 virus had negatively impacted these income earning sources of waste workers. Firstly, due to the intermittent lockdowns implemented by the government of Sri Lanka, formal waste workers of selected councils could not find work after completing the duties of local councils. According to the accounts of waste workers, this was

the most lucrative among the many income earning sources as they did not have to share the income they earned from activities with other members of the team. One of the respondents revealed how he found it difficult to provide for his family due to the lack of outside work.

“Prior to the onset of COVID-19 I used to provide labour for gents and females I had gotten to know from collecting waste from their households sometimes they wanted me to help them with cleaning the gutters, drains, or cutting tree branches, transporting LP gas canisters to the shop and etc. If the work is less they usually give me around LKR. 500.00 and well to do families would give a thousand rupees. If it was a day’s work, I take leave on the day they want help and if I work for a day I can easily earn close to LKR. 3,500.00 rupees.... But COVID-19 lockdowns changed everything; even though we could go to their houses they were reluctant to take us in! This was a huge problem for me as almost my whole salary goes to paying off many loans I have taken to build my house.” (In-depth Interview, 2022)

The onset of the virus had also negatively impacted the income that waste workers made from selling economically viable waste to informal waste collectors. According to the waste collectors formal waste workers get an opportunity to sell selected economically viable waste items such as beer cans, metal pipes, paper, etc. to informal waste collectors on days in which non-biodegradable waste is collected. The income earned from selling these waste items is then divided among waste workers equally. According to the accounts of the formal waste workers on average an income of around LKR. 2000.00 can be earned on a daily basis. This amount is then equally divided among waste workers that travelled in the tractor or the compactor on that day. Even though this is not a substantial amount, waste workers stated that they use this income to spend for tea, lunch and snacks. The accounts of waste workers revealed how the onset of COVID-19 changed this situation.

“When the lockdowns were declared by the government, the local councils banned informal waste collectors from collecting waste from the local council area. I thought that this would be a good opportunity for us to sell more waste to the vendors. But with the lock downs the amount of economically viable waste that people threw out from houses reduced significantly. Instead, food waste increased in our area; which couldn’t be sold to anyone.” (In-depth Interview, 2022)

As a result of the significant reduction of additional income sources they had to obtain loans from informal lenders to provide for their families. According to them, they are now struggling to payback the loans and reobtaining loans to pay back the loans they have obtained. This difficult financial situation was explained by a waste worker of DMMC in the following manner.

“That time was so difficult for me. I had obtained a loan from a money lender to pay for the treatment of my son’s illnesses. He has a hole in his heart and because of that he is always sick. I had obtained many loans to pay for his treatment and even now he is sick. Before COVID-19 I somehow managed to pay for his treatment by doing additional work after my shift. But as the income dried up I had no other option but to borrow more and more money.” (In-depth Interview, 2022)

3.4.3.3 INCREASED WORKLOAD

Another challenge experienced by formal waste workers of the local councils is the increase in the workload due to the reduction of waste collection dates. As mentioned previously, both local councils had reduced the number of days on which solid waste is collected within the local council area in the COVID-19 period due to labour shortage. As a result, the workload of formal waste workers had increased significantly. A waste worker of DMMC shared his experiences in the following manner.

“Before COVID-19 waste collection was carried out on all seven days of the week. I usually started my shift at around 5.00 a.m. and ended around 1.30 p.m. I worked in city cleaning activities and in the route vehicle; we had to collect one load of waste and dump it at the Karadiyana waste management center. However, with the onset of the virus many of my colleagues were infected with the virus. This changed the way we collected waste. We had to collect more than two truckloads of waste on a day and we were always in a rush as we had to finish collecting one truckload, dispose it at Karadiyana and then start collecting the next one.” (In-depth Interview, 2022)

An official of the BUC confirmed this finding stating:

“[We] had to manage everything with the small number of waste workers we had. So on some days workers had to collect more than one truck load of waste. However, waste workers did not have to collect a large amount of waste as the amount of degradable and non-biodegradable waste reduced significantly.” (In-depth Interview, 2022)

Findings also suggest that the increased workload had become a severe burden to most waste workers as they were also unable to take paid leave during the COVID-19 period due to the shortage of workers. This has been difficult especially for individuals that had stayed in the accommodation provided by the local councils. These workers stated that they had to support officers of the municipal council for other activities such as distribution dry ration bags and other relief material provided by the local council. This had exerted an added pressure on waste workers both physically and mentally. A waste worker of the DMMC stated the following, expounding on the difficulties he experienced due to being unable take paid leave and having to support activities other than waste collection.

“I stayed in the community center as I found it extremely difficult to come to work from my home as public transport services had completely collapsed during the lock downs declared by the government. I thought that it will be easy for me to stay there as I didn't have to travel and also as the council provided us with meals and tea. However, as some waste workers got infected with the virus the number of routes we had to cover in a day increased. Also we had to clean the vehicles and disinfect the equipment after completing daily activities. Because of this, even though our shifts ended around 1.30 p.m. we had to carry out cleaning of vehicles and equipment till about 2.30 p.m. After that I was also often asked to help officials of the council in various ways such as loading and unloading dry rations, making dry ration bags, helping P.H.I officers to distribute dry rations and etc. It was such a hectic period.” (In-depth Interview, 2022)

3.4.3.4 DISCRIMINATORY TREATMENT

Findings also revealed that waste workers of both municipal councils had experienced discriminatory treatment at the hands of some officials of local councils and residents. The most common form of discriminatory treatment was residents refusing to interact with waste workers and asking them to not to come to their houses. Waste workers of the local councils revealed that they had maintained an amicable relationship with residents prior to the onset of the COVID-19 virus. Residents had given cash, gifts such as dry rations, old clothes and old furniture to waste workers in appreciation of the services provided by the waste workers. However, this amicable relationship had changed during the COVID-19 period.

A waste worker of the DMMC shared his experiences of discriminatory treatment and probable causes for mistreatment.

“In the first week of the very first lock down we were collecting waste down station road and I went to a house that I have been to for many years and opened the gate of the house as usual. I always go in and pick up trash from the house. But this time when

went in to collect kitchen waste the owner of the house screamed at me saying not to touch anything and asked get out. The response surprised me a lot because he was nice to us always and he used to give hundred rupees or so to have tea. He then told me not to open the gate anymore as he had heard that some of our waste workers had been infected with the virus. He said that he would make sure that I lost my job if I opened the gate again. Thinking back, I am actually not upset about it. He was afraid for his life. This was a time where people died like flies.” (In-depth Interview, 2022)

An official of the DMMC stated that it was sad to see how the treatment of waste workers quickly changed during the COVID-19 period. He stated that a rumor had spread among residents of his neighbourhood that COVID-19 is spreading the waste workers as they visit houses and interact with residents.

“It was my wife who told me that our neighbours had heard that many residents in Dehiwala had got the virus from the waste workers of the municipal council. I was so sad to hear about such a rumor. Unfortunately, people believed it. In many instances when waste workers had gone to collect waste residents from different areas called the council and had asked to stop waste collection activities fearing the spread of the virus.” (In-depth Interview, 2022)

However, some respondents stated that even officials of local councils had treated them differently during the COVID-19 period. A waste worker who requested to remain anonymous stated that he and his colleagues experienced discriminatory treatment at the hand of officials of the local council they worked at.

“All are the same. When we come to the office to inquire about something they would ask us to not to come in, instead they would come out and speak to us. They would not touch us for any reason and if they touched us even by mistake they would quickly wash their hands. But when the elected members have meetings with us they pretend to praise us and say that we have “Golden hands”. I think only the PHI officers treated us in the same way as before.” (In-depth Interview, 2022)

These accounts of respondents revealed that waste workers of the municipal councils had experienced different negative impacts as a result of the onset of COVID-19 virus.

3.5 IMPACT OF COVID-19 VIRUS ON THE WASTE VALUE CHAIN

The study also focused on comprehending the impact that the onset of COVID 19 virus had on the waste value chain of the municipal councils. Findings revealed that the COVID-19 virus had negatively impacted the waste value chains of the local council’s area. The impact caused by COVID-19 virus can be categorized in the following manner.

1. Impact on waste generation
2. Impact on formal collection and transportation
3. Impact on informal collection and transportation

3.5.1. IMPACT ON WASTE GENERATION

The study revealed that the onset of the virus had disrupted waste production at households, commercial premises and industrial ventures. At the household level the pandemic had contributed to increase the production of food waste during the lock down periods as a significant percentage of families living in the Western Province had to stay at home. As a result, the number of meals cooked in households increased significantly and the consumption of snacks, food supplements had increased from the middle income and high-income families that produces the highest percentages of household waste. In addition, the COVID-19 virus prevention measures introduced medical waste such as different types of masks, sanitizer liquid

bottles, rubber gloves and etc. These new additions demanded careful management due to the possibility of been infectious. Moreover, infectious waste added to the waste categories at household level as a result of the COVID-19 virus. This new type of waste demanded different waste management initiatives such as management at home, disposal using food waste, disposal to private incinerator owners etc. In addition, infectious waste was generated at households by individuals infected with the virus.

The waste generation levels in commercial and industrial enterprises reduced significantly during the lockdown periods as these ventures were closed during this period. However, at the end of the lock downs medical waste items were added to the waste generated at commercial and industrial premises similar to households as the use of masks and sanitizer liquid were made compulsory.

3.5.2 IMPACT ON FORMAL COLLECTION AND TRANSPORTATION

As discussed in the previous sections of the report, formal waste collection activities carried out by the local councils were disrupted with the onset of the COVID-19. According to the accounts of residents living in the local councils waste collection had stopped for two to three weeks during the lock down periods due to waste collectors being infected with the virus, transportation difficulties experienced by waste workers, difficulties experienced by local councils in obtaining curfew passes etc. Moreover, once waste management activities resumed both local councils had decided to reduce waste collection days and collected mixed waste from waste producers. The decision to collect mixed waste had disrupted compulsory waste segregation initiatives implemented by the local councils. The impact of these decisions had significantly contributed to alterations in the waste value chain as mixed waste must have disrupted compost production at the landfill in Karadiyana waste management center.

As a result of the onset of COVID-19 virus the local councils had to devise a waste management system to manage infectious waste produced at households. Vehicles and other equipment utilized to manage infectious waste could not be used for collection of other waste and vehicles and equipment required special treatment for safe use. Thus the transportation of waste became complex and difficult.

3.5.3 IMPACT ON INFORMAL WASTE COLLECTION AND TRANSPORTATION

As a result of the onset of the virus the informal waste collection sector was highly impacted as local governments had banned informal waste collectors from collecting and transport waste as a prevention measure. Therefore, the informal waste workers were sidelined in the waste value chain. Nevertheless, informal waste workers have engaged in purchasing economically viable waste from formal waste collectors and had continued to produce raw material for recycling initiatives. This ban on waste collection had significantly reduced the income of informal waste workers, thus forcing them to reduce the number of workers and number of days that businesses operated.

3.5.4 IMPACT ON FORMAL DISPOSAL

As discussed in the previous sections of this report, the composition of waste generated in the household changed due to the onset of the COVID-19 virus. As mentioned previously, waste producers had used the formal waste management mechanism as a way of secretly getting rid of medical waste. Therefore, the waste disposal activities at the Karadiyana waste dumping site have been impacted as food waste contaminated with medical waste are hazardous to be handled.

Formal waste collection services had to utilize the services of private medical waste management services to manage medical waste items such as face masks, sanitizer liquid bottles, gloves, face shields and etc. Accordingly, a private medical waste management service

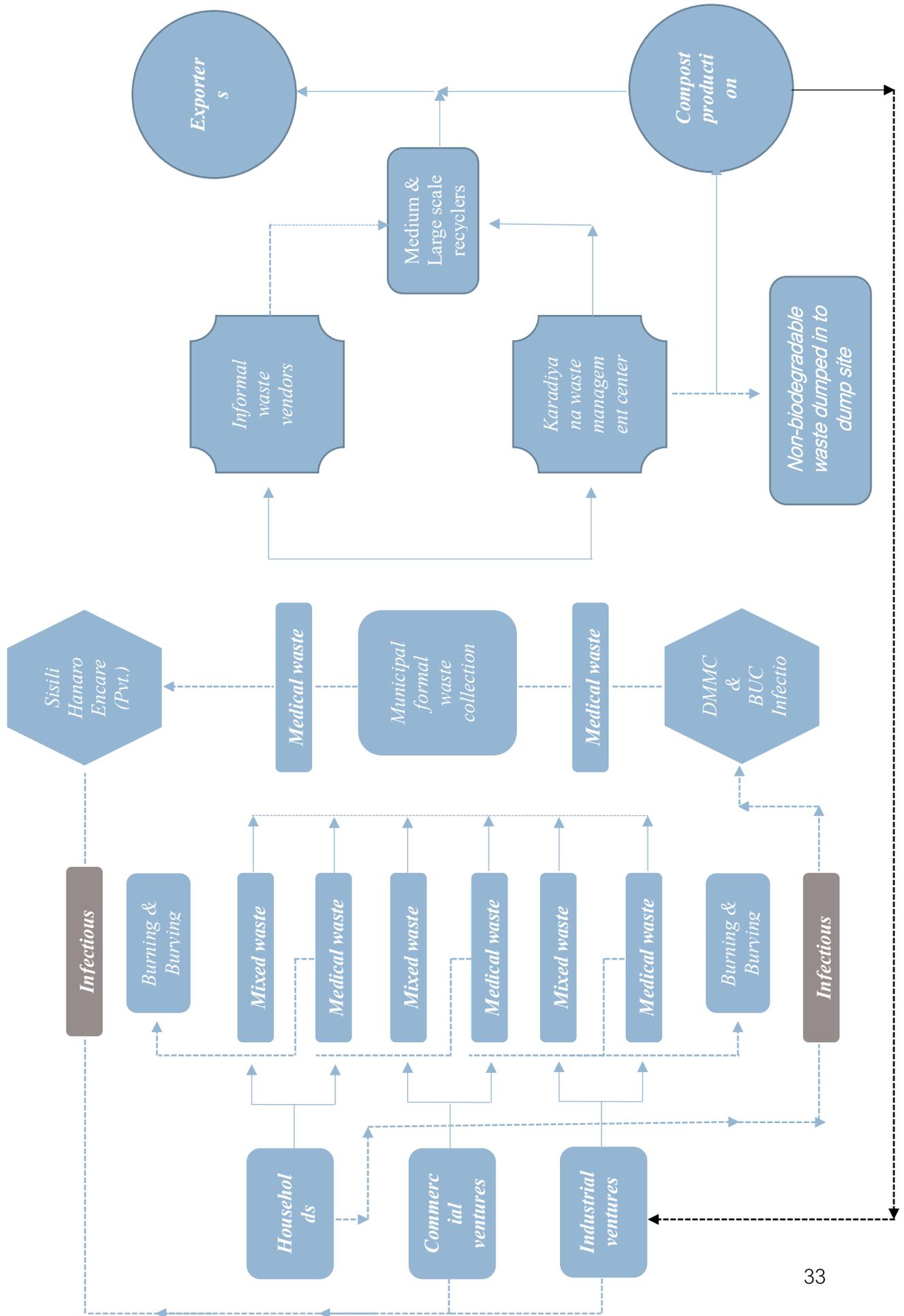
provider named Sisili Hanaro Encare (Pvt.) Ltd collected the waste. The medical waste was incinerated or shredded through MetaMizer units.

3.6 GENERAL WASTE VALUE CHAIN IN COVID -19 PERIOD

The authors wish to discuss the nature of the waste value chain that existed during the COVID-19 period in this section of the report. According to the findings of the study, households, commercial and industrial waste producers can be identified as key waste generators. These waste producers mainly generated mixed waste, non-biodegradable waste and medical waste. Some of the medical waste was managed by households on their own by burning or burying infectious waste. Formal waste workers are the only actors that had engaged in waste collection and transport activities due to the regulations imposed by the local governments prohibiting informal waste collectors from collecting and transporting waste. Accordingly, formal waste management services provided by the local councils had transported waste to the formal waste management center located in Karadiyana, economically viable waste to informal waste workers and recycling centers operated by the local councils. Further, local councils handed over medical and infectious waste to Sisili Hanaro Encare (Pvt.) Ltd. for incineration.

The informal waste workers and formal waste recycling centers have provided middle and large-scale recycling and exporting agents with raw material for their operations. Mixed waste disposed at the Karadiyana waste management center was further segregated by waste pickers working at the site where economically viable waste is separated to be sold to recycling vendors. The remaining mixed waste was further processed, and bio-degradable waste derived from mixed waste was used to produce compost fertilizer. The non-biodegradable waste derived from mixed waste was disposed to the non-biodegradable dumping site of the center. The compost produced at the Karadiyana waste management center is exported to Maldives while a portion of the compost is sold to local entrepreneurs such as CIC Agro Pvt. Ltd. and retailed at shops to individuals.

FIGURE 5 GENERAL WASTE VALUE CHAIN OF DMMC AND BUC



4. CONCLUSION

Findings of the report suggest that the onset of the COVID-19 virus has had mostly negative impacts on the waste management architecture and the waste chain of Dehiwala - Mt.Lavinia Municipal Council and the Boralesgamuwa Urban Council. It is evident that the onset of the COVID-19 had impacted the institutional architecture of the selected local councils in the following manner:

1. Organizational hierarchy
2. Waste management services
3. Individuals involved in waste management activities formal waste workers.

Findings suggest that the organizational hierarchy of the municipal solid waste management mechanism in BUC and DMMC has not changed due to the onset of the COVID-19 virus. In the interviews it was revealed that the existing solid waste management mechanisms were adopted as required to face the challenges posed by the COVID-19 pandemic. In terms of the impact that the onset of COVID-19 virus had on waste management services offered by the council, it was revealed that having to reduce the number of collection days, being forced to collect mixed waste, reduced involvement of the P.H.I officers, difficulties experienced in managing medical waste such as masks and sanitizer and increase in waste management expenses, were key impacts of the onset of the virus.

Moreover, findings of the study revealed that formal waste workers involved in municipal solid waste management activities have experienced multiple negative impacts due to the onset of the COVID-19 virus. The in-depth interviews conducted with elected members, officials and waste workers of the municipal councils revealed that these impacts have had a negative influence on the health, income earning activities and social status of waste workers. The key impacts that waste workers have experienced as a result of the onset of the COVID-19 virus are, increased exposure to COVID-19 virus, significant reduction of income, increased workload due to the reduction of waste collection days and experiencing an increase in discriminatory treatment.

Furthermore, it was also revealed that the COVID-19 virus had negatively impacted the waste value chains of the local council area. The impact generated by the COVID-19 virus can be categorized as impacts on waste generation, impact on formal collection and transportation, impact on informal collection and transportation and impact on formal waste disposal activities.

It is evident from the findings of the report that the onset of the COVID-19 virus has been a major shock to the waste management mechanism of the selected local councils and the provincial waste management architecture. This is evident as it has impacted all key components of waste management.

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