

**Beyond hard interventions:  
(Co)managing COVID wastes in urban peripheries**

Amit Kumar Das<sup>1</sup>, Jenia Mukherjee<sup>2</sup>

**Abstract**

*Solid Waste Management (SWM) is one of the most important public health services which is provided by the Urban Local Bodies (ULBs) across the globe. The key focus of this service is to manage the generated wastes from different sources. With the onset of the Severe Acute Respiratory Syndrome (SARS)-COVID-19 in late December (2019), there is a sudden upsurge in the quantity and quality of waste generation. Most people around the world were locked down in order to prevent the transmission of the virus and have also started to use facemasks, sanitizers, and gloves to remain safe from the COVID-19 virus as per the World Health Organization (WHO) guidelines. With this lockdown scenario, there is a huge increase in the quantity of municipal solid wastes (MSWs) across the planet. With its initial wave, COVID-19 had struck several metropolitan cities. But with the introduction of the second wave, the infection rate affected the peri-urban areas, starting to impose serious challenges to the existing waste management infrastructures.*

*In this study, by using the empirical research processes mainly the key informant interviews (KIIs) and focus group discussions (FGDs), the key perspectives and performance mechanisms of different stakeholders especially the ULB officials and local community members of three sub-divisional towns of the Hooghly District, West Bengal, namely Chandannagar, Hooghly-Chinsurah and Serampore, have been traced respectively. This study further argues that from those challenges and potentials of those stakeholders, a (co)management framework can be (co)designed and (co)implemented to cope with the COVID waste management problems in the peri-urban areas across India.*

**Keywords:** COVID-19; Hooghly; West Bengal; COVID wastes; (co) management

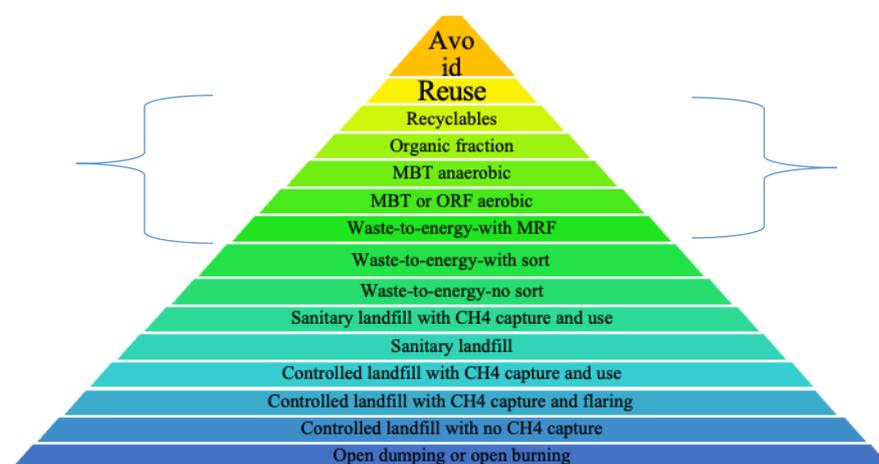
<sup>1</sup> UGC Senior Research Fellow, Department of Humanities and Social Sciences, Indian Institute of Technology Kharagpur, India.

<sup>2</sup> Assistant Professor, Department of Humanities and Social Sciences, Indian Institute of Technology Kharagpur, India. E-mail: [jeniamukherjee@gmail.com](mailto:jeniamukherjee@gmail.com)

## 1. Introduction

Solid waste management (SWM) is a public health service provided by urban local bodies (ULBs) whose importance often becomes more apparent following widespread service deficits (Moore, 2009). It is generated on a daily basis which is required to be administered daily and an essential practice adopted by the local authorities to maintain hygienic surroundings in residential areas (Hoorweg and Bhada-Tata, 2012). Urban SWM has long been recognized as a serious environmental issue in developing countries. As we know, municipal solid waste management (MSWM) is one of pivotal ULB services and it represents an inevitable by-product of human activity and a major crisis for communities across the globe. The management includes steps and strategies through which solid wastes are handled by any municipal authority (Fig. 1).

Fig. 1: Conventional MSWM hierarchy



Source: Author (Das), compiled from Alhassan et al., 2018

In late December 2019, the first severe acute respiratory syndrome (SARS)-COVID-19 infected case was recorded in the Wuhan city, China. In mid-March 2020, the World Health Organization (WHO) declared it as a global pandemic. As the pandemic was declared, the countries with identified COVID-19 cases adopted actions recommended by the WHO to slow down person-to-person transmission, such as locking down the educational institutions, stopping non-essential activities, restricting circulation of people, and in more extreme cases, the total isolation of people in their homes. These actions helped in saving lives by breaking the virus transmission chain. (WHO, 2020). In order to treat the COVID-19 affected persons, personal protective equipment (PPE), gloves, masks, sanitizers are imperative. The facemasks became essential and mandatory to remain safe from the SARS-COVID-19. Additionally, the increase in COVID-19 cases raised worries worldwide about the contamination risks associated with SWM mainly focused on bio-medical and household waste, since many diagnosed patients do not need hospitalization, and remain in home isolation. In this latest scenario, the risk of increasing the spread

of the virus through household waste from contaminated individuals cannot be disregarded, since the municipal waste collection systems may not be able to handle a sudden increase in infectious waste. With the use of millions of PPE kits, gloves, face masks, etc. which are being discarded every day around the world, the municipal solid wastes (MSWs) handling is under immense pressure (Torkashvand et al., 2021).

Indian cities and ULBs found it difficult to manage COVID wastes along with conventional MSWs without proper infrastructural equipment. With the initial wave of COVID-19 (March 2020), the metropolitan cities like Delhi experienced severe challenges in managing MSWs including COVID wastes (Randhawa et al., 2020). With the explosion of the second wave of COVID-19 during mid-March (2021), the challenge has been amplified in a faster way than expectations.

This paper is an exploratory study capturing perceptions and practices pursued by different stakeholders, especially the ULB officials (the sanitation officers, engineers, on-site sanitation supervisors and workers) and local communities in the three sub-divisional towns of Hooghly corridor namely Chandannagar, Hooghly-Chinsurah and Serampore from June to August 2021. By drawing insights from their perspectives of COVID waste management through the deployment of qualitative research methods such as: key informant interviews (KIIs) with the ULB officials and focus group discussions (FGDs) with local communities, we finally argue that co-managing solid wastes along awareness, participation and cooperation among multiple actors is an option for urban peripheries of the global south lacking sophisticated hard infrastructures to tackle MSW, especially during the COVID scenario.

## 2. Review of Literature

The intensity of effectiveness and transmission of the pandemic is much higher in metropolitan towns like Kolkata as they are characterized with more dense human population and are dotted with inadequacies in SWM. Different MSWM strategies, specific challenges, and possible solutions are required for better understanding of those involved in waste management and also providing a possible management strategy during and post-COVID-19 pandemic. A set of recommendations regarding handling household medical wastes in addition to health education about disinfection and management of MSWs with scientific background is mandatory under the pandemic circumstance (Das et al., 2021). To facilitate sustainable plastic waste management under pandemic circumstances, the residents' active participation and engagement may provide higher resilience in the entire waste management chain for the developing world (You et al., 2020; Silva et al., 2020).

Considering the need of COVID waste management, the most effective disinfection technologies during the outbreak like high/low heat technologies and chemical disinfection, and PPE reusing processes, including dry heat, vaporized hydrogen peroxide, and ozone can be very useful. People also should revise their viewpoints on plastic consumption by enriching sustainable behaviors, abandoning

old habits, and adjusting to novel ones (Teymourian et al., 2021). Haque et al. (2020) have illustrated the diversification in generation of waste during the COVID-19 pandemic lockdown period in Bangladesh, where alongside the hazardous waste volume, single-use plastic items and PPE have induced a new type of PPE pollution in the land and aquatic environment. In Peru, in order to manage and handle the surging facemask, the operational efforts such as beach clean-ups carried out by citizens, along with educational workshops seems to be a plausible solution to promote cleaner environments (Torres and Torre, 2021). According to Ouhsine et al. (2020), the local inhabitants should put the preventive equipment (gloves, mask, alcohol gel, coveralls) in a special, uniform bag before throwing it in the bin to protect the garbage collectors and rag pickers. Apart from these guidelines, the ULBs should also organize systematic awareness campaigns to ensure sustainable management of COVID-19 wastes.

Emerging literature on COVID wastes within the Indian context is overtly technical and metropolitan-centric (Ganguly and Chakraborty 2021; Goswami et al., 2021; Randhawa et al., 2020; Thomas and Leon 2020). While Ganguly and Chakraborty (2021) highlight how government should implement more robust mechanisms to deal with COVID wastes from source to mouth, Goswami et al. (2021) have emphasized on capacity building of healthcare workers and waste-handlers towards safe collection, treatment, and disposal of bio-medical wastes (BMW) as well as a well-equipped system for safe disposal in the post-COVID-19 scenario. Randhawa et al. (2020) illustrated how to involve local residents, waste pickers associations, non-governmental organizations (NGOs), and government officials to manage wastes under the pandemic scenario in Delhi.

There is dearth of literature on urban peripheries. As the second wave of the pandemic struck the peri-urban and rural areas in India, which also lag behind than their metropolitan counterparts in terms of better SWM options, we argue that there has to be alternative framings and innovative (soft) measures through which COVID wastes can be tackled. This article provides first-hand field insights from the three sub-divisional towns of the Hooghly district: Chandannagar, Hooghly-Chinsurah and Serampore to finally emphasize on how and why (co)managing COVID wastes as part of MSW through overlapping priorities and collaborations among bureaucratic, technical actors and local communities can be a viable and resilient solution.

### **3. Study area and Rationale**

#### **3.1 The sites**

In general, these three sub-divisional towns of Hooghly district are the peri-urban towns of Kolkata metropolis. They are located along the stretch of the Hooghly Corridor. Chandannagar, Hooghly-Chinsurah and Serampore comprise our empirical frame of analysis. Chandannagar Municipal Corporation (CMC) (22°50'12" N to 22°53'12" N and 88°19'15" E to 88°23'06" E) and Hooghly-Chinsurah Municipality

(HCM) (22°52'08" N to 22°56'19" N and 88°22'01" E to 88°24'15" E) are the two adjacent class-I cities surrounded by the Bansberia Municipality in the North, the Bhadreswar Municipality in the South, the River Ganga in the East and different rural mouzas<sup>3</sup> in the West. The Serampore Municipality (SM) (22°43'43"N to 22°46'09"N and 88°19'01"E to 88°21'30"E) lies 20 km south of the CMC along the western bank of the River Hooghly (Fig. 2). In terms of physiography, the present study area is influenced by the lower Gangetic plain and climate-wise these areas belong to the tropical monsoonal climate (*Am*- short dry season, according to Wladimir Koppen, 1900 & 1940)<sup>4</sup>. On the other side, Chandannagar, Hooghly-Chinsurah and Serampore have population over one lakh i.e., 166867, 179931 and 181842 respectively as per 2011 census of India.<sup>5</sup> In addition to that, these three towns serve their respective rural areas as service nodal point as they are entitled as sub-divisional towns and equipped with different types of socio-economic infrastructures like health, education, market, courts etc.

### 3.2 Rationale of the study

COVID-19 is generally regarded as an urbanocentric disease. With its introductory wave of infection, it has created severe impacts in the different dimensions of livelihood (health, sanitation, waste generation and its management etc.) of metropolitan cities like Kolkata, Mumbai, and Chennai in India. But with the arrival of second wave of COVID-19 in early March 2021, the rate of infection has increased enormously in no time in the peri-urban areas of these metropolitan urban areas. Eventually, it has created several challenges on the existing MSWM infrastructures of each area with the additional waste generation namely the COVID wastes. Being district sub-divisions, Chandannagar, Hooghly-Chinsurah and Serampore towns offer socio-economic opportunities to attract a considerable chunk of (floating) population from surrounding rural areas. As a result of which, there is a huge accumulation of conventional solid wastes in the study area. Due to the daily influx of floating population in the post initial wave of the COVID-19 pandemic (since late November, 2020), these three cities have experienced an upsurge (Table. 1) in case of per capita waste generation as well as in overall solid waste generation, also determining an increase in COVID wastes, especially during the outbreak of the third wave.

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<sup>3</sup> *Mouza* or *mauza* is a Bengali word used in Bangladesh and West Bengal to imply an administrative district corresponding to a specific land area within which there may be one or more settlements.

<sup>4</sup> <https://www.nationalgeographic.org/encyclopedia/koppen-climate-classification-system>

<sup>5</sup> [https://censusindia.gov.in/2011census/dchb/DCHB\\_A/19/1912\\_PART\\_A\\_DCHB\\_HUGLI.pdf](https://censusindia.gov.in/2011census/dchb/DCHB_A/19/1912_PART_A_DCHB_HUGLI.pdf) (pp. 45)

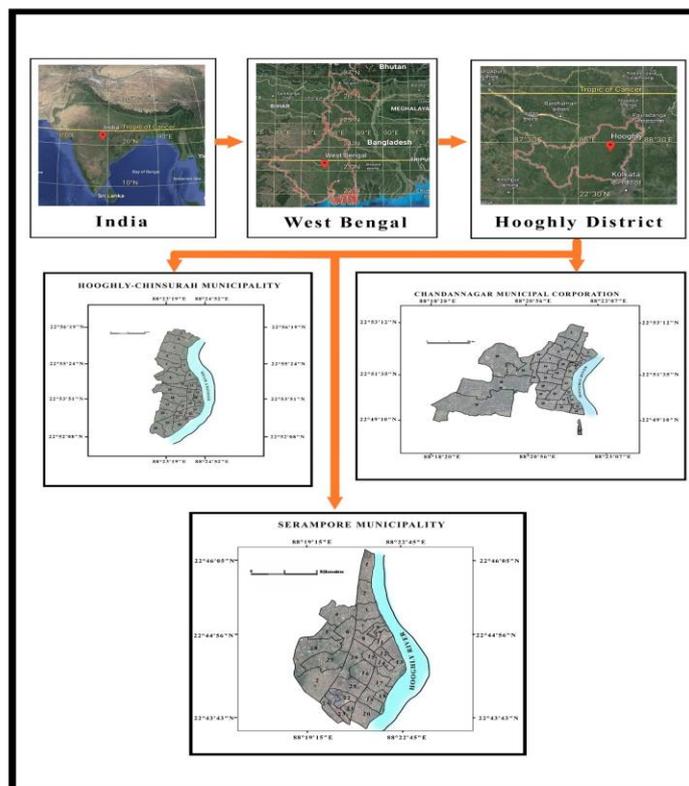
Table. 1: Changing Trends of Waste Generation in the Study Area

Towns	Waste generation in a municipality (MT-Metric Tons/day)			Per capita waste generation (gms/day)		
	1993	2011	2020	1993	2011	2020
Hooghly- Chinsurah	15.36	80.21	85.10	145.23	470.6	472.40
Chandannagar	14.96	68.34	76.53	142.35	419.32	458.62
Serampore	9.36	50.00	90.00	110.23	277.85	494.93

Source: Compiled from interviews conducted with sanitation officers (HCM, CMC and SM) (April-May, 2021)

Inadequate financial arrangements and inappropriate technical apparatuses i.e., the "hard interventions" are major impediments for ULBs to run successful SWM program in the study area under the global pandemic scenario. There arises an important question as to how with limited infrastructural equipment and funding, this extra load of waste can be negotiated? It is within this context, that capacitating local communities' perception and involving them in MSWM system in the COVID-19 pandemic situation to assist ULBs can be a significant intervention. In order to capacitate and activate communities, first and foremost step will be to trace the perception and performance stature of the local community stakeholders regarding the SWM in the pandemic scenario through extensive empirical research process. These peri-urban sub-divisional towns lack hard infrastructural resources (lack of proper dumping ground, lack of transport vehicles) to tackle the COVID wastes. Here, the "soft interventions" like the perceptions and performance tracking of the local community members and perspectives of ULB officials can be carried forward for the alternative arrangements of the COVID waste. In this article, we have conducted KIIs with the ULB officials and FGDs with local inhabitants to map their perception and performance levels. We also tried to understand the COVID waste management challenge and opportunity scenario as laid out by the interviewed. We finally argue that these qualitative insights can make way to develop more robust quantitative design through which awareness-induced and cost-effective (co) management options can be mapped and implemented.

Fig. 2: The Study Area



Source: Author (Das), with assistance from Google Earth

#### 4. Lessons from the field

The first part of the primary study that was conducted places key insights manifested from interviews conducted with the officials of the ULBs and the second part is a compilation of reflections from local communities or residents of the study area.

##### 4.1. Understandings of ULB officials

###### CMC

CMC officials stated that in order to cope with COVID wastes along with MSWM, they undertook extensive efforts like complete ban on the plastics and instead mandated carrying of cotton carry bags. They also put in place a fine of minimum ₹500 on the vendors and consumers found using the plastic bags.

According to Mr. Suman Das (chief sanitation officer of CMC) (July, 2021),

*"Lockdown has intensified online shopping and its related wastes like cardboards, plastic wrappings have led to an upsurge of plastic accumulation."* While discussing segregation at the source, he further

mentioned, *“We have already started to distribute two separate bins (from January 2021) to every household of the city. As, we are expecting that the local community stakeholders’ contributions will be helpful in this ‘segregation at the source’ mission. ‘Mission Nirmal Bangla’ (Mission Clean Bengal) scheme for the biodegradable (green color bin) and non-biodegradable wastes (blue color bin) segregation.”*

He further added,

*“We are trying to ban all the micro plastic bags by imposing finest of minimum ₹500 for both the vendors and consumers. Instead of micro plastics, we are encouraging the local community members to use bags made of cotton and jute for daily purchase of vegetables, flesh type foods and other type of stuffs from the market. Apart from that, we have adopted newer techniques like bio-mining<sup>6</sup> to compose the bio-degradable wastes along with the plastic wastes.”*

According to Ram Chakraborty (previous mayor-in-charge) (May 2021),

*“We are installing a new machine (Fig. 3b) which will segregate biodegradable, non-biodegradable and COVID wastes (especially facemasks, sanitizer bottles, and gloves) in our Kolupukur Dhar dumping ground. The non-biodegradable plastic wastes will be taken care of by the Ambuja cement company. On the other side, we are now using the bio-mining process<sup>7</sup> (spreading earthworms to decompose the biodegradable wastes early). We are expecting that with this process, within 2 to 3 years, 80% of the biodegradable wastes will be decomposed. We will also able to manage COVID wastes by reducing the biodegradable wastes. We will be able to dump and incinerate the wastes in future.”*

He also stated that *“we are trying to collaborate with neighboring ULBs to find out an alternative disposal ground to tackle the COVID wastes.”*

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<sup>6</sup> Bio-mining is the process of using micro-organisms (microbes) to extract metals of economic interest from rock ores or mine waste.



3(a)



3(b)

**Fig. 3(a): Involvement of women in waste transportation and**

**Fig. 3(b) Installation of new machine for COVID waste and municipal wastes**

Source: Author (Das), field visit in June 2021

While asking about the local community stakeholders' participation issue, the previous mayor of CMC also added, *"We have recruited the local women (Fig. 3a) in their respective residential area based on their respective educational qualifications in order to collect wastes from the households to the community bins across 33 wards. Each ward has five to six women for that collection of waste process. Their monthly salary is ₹3000."*

## HCM

HCM area is the district headquarters of the Hooghly district. Having that socio-economic status, this area experiences a significant amount of population pressure on a daily basis, which has ultimately impacted the waste generation and management scenario. While discussing about the COVID waste management strategies with Himanshu Chakraborty (sanitation officer of HCM), some issues become very clear that they are not satisfied about the local community members' practice mechanisms under this global pandemic scenario.

According to Chakraborty (July 2021),

*"People throw the facemasks, sanitizer bottles, gloves and other COVID wastes along the roads despite various awareness advertisements across the town. We are providing two separate bins to segregate biodegradable and non-biodegradable wastes, but they use those bins as their domestic water containing bins. When we question them on such practice, they response elicits lack of time to segregate the wastes."*

In case of disposal of wastes, he also added,

*"Just like the CMC, we have deployed the bio-mining process to decompose and reduce the biodegradable wastes, to create more spaces for the COVID*

*waste management. The SIGMA group (2020) has already surveyed our dumping ground near Sukantanagor (Rabindranagar bazar area) and suggested for a newer dumping site along with the Sukantanagor one for the COVID waste management."*

In order to reduce the impact of COVID waste and its management loopholes, the HCM sanitation officer pointed out,

*"We are trying to collaborate with the neighboring municipalities like Bansberia Municipality and CMC for a common waste dumping ground and treatment plant" as the HCM officials think that the pressure and challenge of COVID waste management will escalate in coming years."*

From these reflections, it is evident that HCM is in the preparatory stage to manage COVID wastes along with conventional solid wastes. The ULB is looking forward to a better dumping and recycling process to lift the urban environmental status of the town.

## **SM**

The Serampore town is recognized as the most eco-friendly town of the Hooghly district. However, with the arrival of the COVID-19 pandemic, the situation is grim so far as SWM in SM is concerned. The introduction of COVID wastes has burdened MSWM practices of SM.

While pursuing KII with the chief sanitation officer of SM, Anuj Banerjee (July, 2021), he stated that

*"We are now trying to segregate the conventional MSW from the COVID wastes. We have already launched some campaigns to advertise the side effects of COVID wastes across the town during the early August, 2020. Most of the people have responded in a sound way. But in some areas like Dakhin Rajyadharpur, Mahesh, Sideshsoritola, people are still mixing all the solid wastes with the COVID wastes. We have already provided two separate bins for the biodegradable and non-biodegradable wastes under 'Mission Nirmal Bangla Scheme'. But people are still not aware about the dangers from COVID waste."*

On the dumping ground scenario, he mentioned,

*"We have two dumping grounds. One is our own which is located along the Rayland circular road (south Serampore, Mahesh Colony along the Eastern railway track) and the other one is collaborated with the Uttarpara-Kotrung, Konnagore, Rishra, Baidyabati and Champdani Municipality near*

*Rishra station. We are planning to ban the plastics just like other neighboring ULBs."*

From this interview, it can be interpreted that the Serampore municipal authority is very keen to segregate and dumping the wastes in a sustainable way. The scheme of collaboration with other municipalities is directed by the Kolkata Metropolitan Development Authority (KMDA). SM is prioritizing the COVID waste segregation at the source and recycling of the same in a much healthier and safer way.

## 4.2. Viewpoints of local communities

### CMC

Chandannagar is very popular for its cultural and colonial history. The COVID-19 pandemic has struck its local tourism and economic growth. Moreover, KII with one of the ULB officials confirmed that while during pre-pandemic times the daily per capita waste generation was about 419.32 gms/day, recently, i.e., since mid-2020, it has increased to 458.62 gms/day. This shows that the uses of different waste producing materials have risen. Local residents have a huge role to play from waste emitters and disposers to coping actors and adaptive managers. Thus, their key perspectives and practice mechanisms become essential and must be incorporated into the COVID waste management framework.

In general, people are dissatisfied with the performance of the CMC. Regarding waste segregation at the source, according to some local inhabitants (Ward no. 14 near Hatkhola Monosatola), *"We segregate the biodegradable and non-biodegradable wastes into different bins and also the COVID wastes in a plastic bag. But, at the time of collection, the waste collectors mix all the type of wastes and put them into their respective waste bins for transportation. The waste collectors often argue that they do not have enough time to segregate the wastes."* Residents further added that *"We are not satisfied even about the cleaning process of the community bins. Those bins are cleared by the municipal corporation in every fortnight ultimately creating severe odor and pollution. We have frequently complained about the situation to the local ward coordinators (previously ward counselors), but do not receive any proper response."*

Inhabitants from ward no. 2 and 3 (Fig. 4a) added, *"When we complain about the waste collectors' non-cooperative behaviors to the on-site supervisors, they use to say that it will be taken care of. But the reality remains the same. Often the masks, gloves sanitizer bottles are left in the community bins for over a week. But the corporation does not take care about it. They are very happy about the inclusion of local women in the waste management practice. Plenty of people think that this is very good move by the corporation to provide some empowerment to some needy families. In future, this move should be encouraged more."*

The CMC officials appeared to be very confident about their ground planning to cope with swelling COVID wastes. But, the above mentioned FGD results of the CMC localities are clearly depicting the loopholes of the CMC's existing COVID waste management system, when it comes to execution. The frustration among the community members across the CMC town about the non-co-operative behaviors of the waste handlers and collectors during the lockdown period demonstrated the persisting lack of knowledge about the danger of waste mixing among the waste handlers during door-to-door collection. Apart from that, it was underscored that with the inclusion of women waste collectors since January-2021, the community members have found it easier to communicate while handing the wastes over to them for further transportation.



4(a)



4(b)



4(c)

Fig. 4 (a), (b) and (c): FGDs across three different towns

Source: Author (Das), field visit in June-July 2021

## HCM

As per the on-site supervisor (Almas Hussain),

*“There is a certain amount of unrest among the local residents near the HCM’s dumping yard (close to the Sukantanagor area), as during the transportation of the wastes especially the COVID wastes (facemasks, gloves) and other municipal wastes (Fig. 5).”* According to one of the local inhabitants, *“While the tractors use to litter everywhere outside the main dumping yard. We have already written some complaints about the littering across the roads to the municipality, but they never came here to see the conditions.”*



**Fig. 5: Littering during waste transportation**

Source: Author (Das), field visit in July 2021

While discussing about the frequency of the waste collection (near Tolafotok area), communities argued that

*"The waste collectors come to collect the wastes twice a week. Sometimes, once a week they come. But before the pandemic, every day the municipal waste collectors came to collect the wastes. During the pandemic, we use to carry and dump the wastes in the local community bins and often the bins are over saturated with the wastes. The pandemic scenario reduces the frequency of the waste collection."* According to them, *"The municipal authority often dumps the wastes along the Ganga River (Fig. 6a) and Kumorpara (Fig. 6b) area mixed with sanitizer bottles, facemasks etc. The wastes have been dumping since December 2020 along the banks of Hooghly River to fill the lands there for municipality future development projects like children's park."*



**6 (a)**



**6 (b)**

**Fig. 6(a): Disposal of wastes along the Ganga River**

**Fig. 6(b): Unhealthy deposition of waste in Chinsurah Kumorpara area**

Source: Author (Das), field visit in June-July 2021

It can be noticed that the local community stakeholders are not satisfied with the frequency of waste collection during the pandemic scenario, and they are also appealing about the non-landfilling along the Ganga River which ultimately creates lots of problem for them like odor, unhealthy living conditions.

**SM**

FGDs in the Serampore reveal varying levels of satisfaction among local communities about the ULB's role in SWM. People from the Sideshsoritola remain satisfied. To them, *"The municipal authority has been provided couple of waste bins since December 2020 to promote the waste segregation at the source and we are maintaining the same across our areas. Previously, before pandemic, we used to dump all the wastes in our households within a particular bucket and throw them into the community waste bins provided in our locality."*

FGDs near the south Rajyadharpur area (in front of the Serampore ESI hospital) showed one of the severe drawbacks of the city governing authority. According to a mobile shop owner, *"Due to extensive dumping of wastes from the Serampore ESI hospital (especially the COVID wastes) (Fig. 7a and 7b), one blacksmith person died due to extreme odor in November, 2020. Another threat is often found due to extreme and irregular cleaning of community bins, arrival of snakes. We often use carbolic acid to stay away from the snakes. The municipal authority clears these areas once in every fortnight and this ultimately creates a bad environment for marketing. Personally, I have complained several times but they don't response in a proper way."*

From the above dialogues of different community stakeholders across the SM areas, it is very much recognizable that they are very much exasperated with the ongoing community bin clearance routines of the local ULB authority. Their appeals for immediate actions against such practices, especially during the pandemic, needs urgent attention, else it may cause severe disruption of the town's environmental and health scenario.



7 (a)



7 (b)

**Fig. 7(a)** PPE kits (Mark-1 with red color) and Surgical Facemasks (Marking 2 with red color) with other municipal solid wastes in front of ESI hospital Serampore Rajyadharpur

**Fig. 7(b)** KII with a mobile shop owner (Raju Shrivastava) in Serampore Rajyadharpur area (June-July, 2021)

**Source:** Author (Das), field visit in June-July 2021

The overall priorities of each town's community stakeholders have been tabulated in to find out the area of improvement in COVID waste management.

Along with the priorities of ULB officials, the community stakeholders' priorities can be incorporated to frame a suitable and sustainable COVID waste management framework for these three sub-divisional towns of Hooghly district and make SWM truly participatory.

## 5. Conclusion

Our qualitative reflections from the three towns demonstrate that each ULB has its own specific COVID waste story. For CMC, the most prioritized element is the segregation of COVID wastes from the conventional municipal solid wastes; while for HCM the key concern is less frequent waste collection during the pandemic scenario, which ideally, should be regular in nature. In case of SM, lack of proper and irregular community bin clearance is the pivotal concern in this crunch.

The CMC governing body has planned to come up with an awareness mobilization program by reaching out to every locality so that people become conscious of hazards and dangers relating to COVID wastes. The CMC authority has deployed bio-mining processes to find out more places within their stipulated dumping yard for the treatment of COVID wastes. Adding to that, in order to create a common dumping yard policy, they are also trying to collaborate with HCM and Bansberia municipality. Just like the CMC authority, HCM is also implementing the bio-mining process for the better space availability of COVID waste management and trying to collaborate with CMC for better waste management policy under COVID pandemic scenario. On the other hand, the SM is already involved in the common dumping yard policy and it is recommended that rest of the two towns take some inputs on that. SM authority has also prioritized regular sanitization and clearance of the local community bins to stop the unwanted transmission of COVID-19 virus.

The community members of the three different towns were not satisfied enough with the planning and execution of their respective ULB authorities. Their main concern was the mixing of wastes and lack of regular local waste bin clearance in this crunch time. As per their suggestions, ULBs should invest and strategize in separating wastes through uses of differently-marked bins. Three differently colored big waste bins should be placed in every ward for smooth waste collection and disposal activities. The bio-degradable and non-biodegradable wastes should be taken care of by the ULBs and dedicated staff within or beyond ULBs should be trained to tackle COVID wastes.

We argue that qualitative or descriptive insights from different stakeholders are important to capture the ground scenario in small towns within the COVID context. These remain important not only to understand the conflicting perspectives among stakeholders but also map cross-cutting, converging possibilities through which solid wastes can be (co)managed along soft measures

such as awareness, participation, involvement and engagement in tackling COVID-induced solid wastes.

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### Conflict of interest

We the authors hereby declare that we have followed the accepted principles of ethics of study. We also confirm that there is no way our manuscript is in possible conflict with the ethical standards required by the Journal.

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## **Annexure**

### **Open-ended questions used for Key Informant Interviews (KIIs)**

1. Name and affiliation of the Key Informant, affiliated to \_\_\_\_\_ Urban Local Body (ULB):
3. What are the existing SWM practices in this particular ULB under your jurisdiction?
4. Do you see (dis)similarities in the generation of solid wastes during the pre-COVID-19 and COVID-19 scenarios?
5. Has this difference impacted upon the SWM practice system here?
5. What are the roles and responsibilities being played by multiple stakeholders including ULB personnel and local communities in tackling the solid waste situation during the pandemic?
6. Kindly elaborate on people's perceptions, performance and practices.
7. Can you kindly share if the ULB is sincerely planning effective strategies to more effectively cope with the COVID situation, for example more efficient mechanisms to segregate the COVID-19 wastes from conventional municipal solid wastes?
8. What would be your final comment on how ULB and community awareness and participation can be activated in collaboratively planning and executing appropriate SWM practices.

### **Open-ended questions used for Focus Group Discussions (FGDs)**

1. Number of FGD members:
2. Location and Municipality:
3. Do you notice any significant change in the generation of solid wastes during the pre-COVID-19 and COVID-19 scenarios, particularly in your locality/ULB?
4. Are you satisfied with the current SWM practices prevalent in your area?
5. What are your reflections on the performance of ULBs in terms of dealing with the present SWM scenario? What are the major complaints and notes of appreciation?
6. What is the role played by local community to deal with the situation?
7. What are your responses relating how community awareness and participation can be activated in collaboratively planning and executing appropriate SWM practices in collaboration with the ULB officials and actors?