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New Practices of Waste Management - Case of Mumbai

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1. Background

Mumbai is the largest metropolis of India, with a population of 16.37 million in 2001 within its urban agglomeration area (Mumbai Urban Agglomeration – MUA). In the Municipal Corporation of Greater Mumbai (MCGB - or in the Marathi form, Brihanmumbai Mahanagar Palika, or BMC) area, the population is 11.92 millions in 2001. In 2004, the city's population is expected to have increased to about 18 million, it becoming the third largest mega city in the world. The city (the MUA) has however observed a deceleration in its population growth rate in the decade of 1990s, the growth rate coming down to 2.65 per cent p.a. from 4.34 per cent p.a. in the previous decade of 1980s. MUA's population growth in the decade of 1990s has been lower than all India urbanisation rates of 2.75 per cent. Further, the BMC's population growth rate has been 1.83 per cent p.a., indicating an out migration from the BMC area to the urban agglomeration areas.

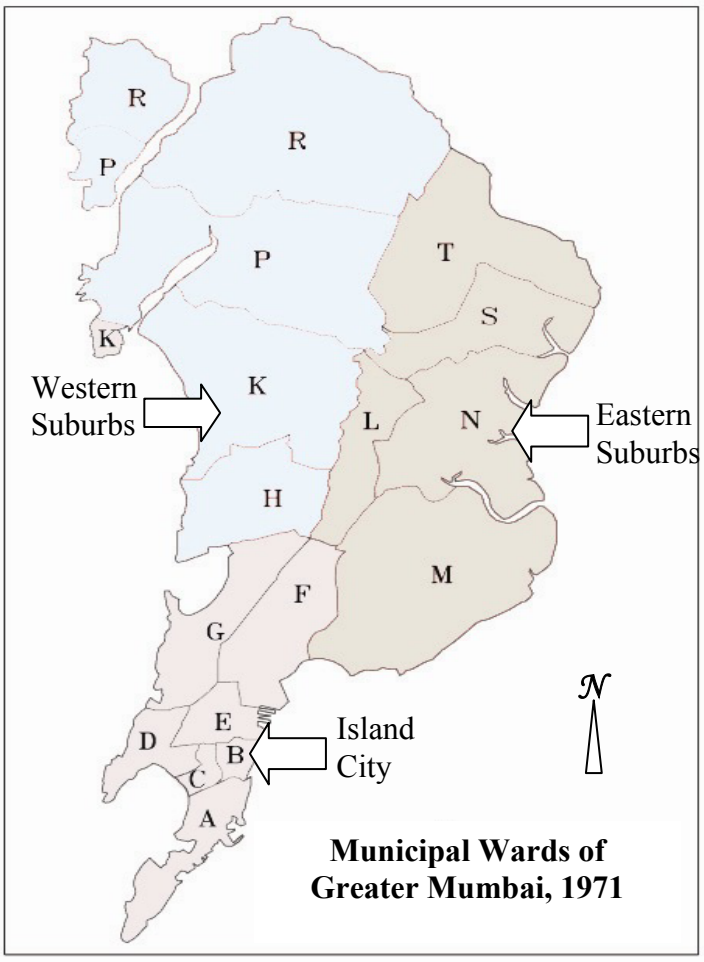
Mumbai is the capital of Maharashtra State and the financial capital of the country. The city, once a leading industrial centre has now become a tertiary economy, with just one-third of the male workers and one-fifth of the female workers employed in the secondary sector (manufacturing and construction) in 1999-00 as per the data from National Sample Survey (NSS) (from Mahadevia 2005). The rest of the workers are in the tertiary sector. But, less than 20 per cent of the male workers in this year are employed in higher end tertiary sector (based on Mahadevia 2005), indicating a predominance of low-end jobs in the tertiary sector in the city, indicating poor income levels.

BMC area is divided into two major geographic divisions. One is the island city, which is a strip of 24 sq km and the other is the suburban area, north of the island city. Mahim creek separates the two, a creek that is getting gradually filled up because of indiscriminate land developments by the builders as well as planning agencies. River Mithi running north-south in the suburbs is discharging its waters in this creek, whose path has been also blocked by such development activities.

The island city and suburbs together form the Greater Mumbai (or Brihan Mumbai) with an area of 437.71 sq km. The islands are in the form of a peninsula with the former Central Business District (CBD) at the southern extremity. The new CBD, the Bandra-Kurla complex is at the centre of the city, just north of the Mahim creek on the land developed through reclamation by Mumbai Metropolitan Regional Development Authority (MMRDA). Greater Mumbai is considered as one district and has been divided

into six zones and 24 wards to facilitate the administration of the Municipal Corporation (Figure.1).

Figure 1: Municipal Wards of Greater Mumbai



The 24 wards of Greater Mumbai are administratively grouped under three zones, the City Zone covering wards A, B, C, D, E, F (South), F (North), G (South) and G (North); the Eastern Suburban Zone covering wards L, M, (East), M (West), N, S, and T and the Western Suburban Zone covering wards H (East) and H (West), K (East), K (West), P (South) and P (North), R (South), R (Central) and R (North). Each of the wards has a ward committee through which ward level development activities and maintenance of the facilities is carried out. Ward level budgets are also available in the city (Mukhopadhyay 2005). The SWM is a ward level activity, undertaken through the ward office.

Historically, the city district has one of the highest concentrations of people in the country, its densities as high as 46,000 persons per km^2 in Mumbai and 20,000 persons per sq km in suburban Mumbai (SWM Dept. 2004). This can be comparable to that of Kolkata, which is 24,760 persons per sq km, but much higher than that of New Delhi (4,909 persons per sq km) and that of Bangalore (2,979 persons per sq km) (Based on population census, 2001).

It is commonly stated that more than half of the Mumbai's population lives in slums. The population census of 2001 puts 48.5 per cent in BMC (Municipal Corporation) area (Population Census 2001) to be living in slums. Mukhija (2000) gives 1993 estimate of the BMC as 55 per cent of the total population, living in slums. In 2001, the population in BMC area was 11.9 million; indicating that between 5.8 million to 6.5 million population of the city was living in slums then. If other industrial workers' housing (called *chawls* – one room housing units laid out in a row along a corridor in a three to four storey

building) is included then close to 70 per cent (or 8.3 million population) of Mumbai's population lives in either slums or *chawls* (Mukhija 2000).

Recent estimates claim that about 40 per cent of the city's population living in slums occupies just 3.5 per cent of cities area, alluding to high population densities in the slum areas. The population density in some of the slum enclaves can reach as high as 400,000 persons per sq km (Mumbai pages, 1997).

The slums are considered as vulnerable settlements because of their location. They are located on the hilltops, slopes, *nallahs*, low-lying areas (with tendency to flood during high tides), coastal locations, under high tension wires, along highways, along railway lines, within industrial zones, pavements, along water mains, along open drainage. In slum areas therefore, garbage clearance emerges as a major problem. Further, the municipal SWM is only in slums that are notified and not ones considered illegal by the BMC. Thus, the coverage of slums in the SWM system of the BMC is quite low and as per an estimate by YUVA (Youth for Voluntary Action), just 12 per cent of the total SWM budget is utilised in the slum areas (Davis n. d).

Status of Solid Wastes Management in Mumbai

Under the Mumbai Municipal Corporation Act of 1988, it is the mandatory duty of the Corporation to maintain the area falling under its jurisdiction in clean and hygienic conditions in order to ensure a good and healthy environment.

Following are the obligatory duties of the Municipal Corporation under section 61 (A), 61(C) and 61 (N) of the Mumbai Municipal Corporation Act of 1988:

- Cleaning of public streets
- Collection of solid wastes including temporary storage
- Removal and transportation of solid wastes
- Disposal of solid wastes
- Disposal of dead bodies of animals
- Construction, maintenance and cleansing of urinals and public sanitary conveniences.

The Municipal Solid Waste Rules, 2000 framed by the Government of India (GoI) makes it mandatory for the storage of garbage at the source and its synchronized collection at the doorstep. The MCGM has already declared the segregation and storage of garbage at source mandatory.

The per capita generation of wastes in Mumbai is about 630 gm. per person per day (MCGM 2004). The quantity of municipal solid waste generated within Greater Mumbai is 7,800 MT per day[5]. Of this, the waste generation in the island city is 48 per cent, when its population is just 27.92 per cent of Greater Mumbai's population (Table 1).

There is higher share of the island city in the total garbage generated than its proportionate share in total population because, the island city, being major employment centre, gets a large proportion of floating population, in the day time. The solid waste is

in the form of regular garbage from households, debris, silt removed from the drains, *nallas*, cow dung and waste matter removed from gullies between the houses.

On the whole, 4,500 MT (57.68 per cent) of waste in the whole of the city is biodegradable in nature; another 500 MT (6.41 per cent) is the dry waste consisting of paper and cardboards, plastics, metals, glass, etc. another 2,500 MT (32 per cent) is the debris and silt and 25 MT is biomedical waste (MCGM 2004).

Table 1: Garbage Generation by Geographic Locations, Mumbai

Division			Garbage Generation#		Garbage Density (MT/ sq.Km)
	Density (persons per sq km)*	Population (%)	MT per day	%	
Island City	49,163	27.92	3700	48.00	53.85
Western Suburbs	24,605	42.77	2500	32.00	12.07
Eastern Suburbs	10,410	29.31	1600	20.00	10.17
Total	26,722	100.00	7800	100.00	16.80

Source: TERI data as in MCGM website: http://www.demographia.com/db-mumbaiward91.htm

Table 2: Physical Characteristics of Municipal Solid Wastes by Region (% weight)

Category	Island City	Eastern Suburb	Western Suburb
Biodegradable	42.29	35.72	39.52
Paper and cardboard	6.16	10.93	6.61
Plastics	4.23	4.87	5.47
Metals (ferrous)	0.85	0.65	1.42
Glass	1.28	0.87	3.48
Sand and fine earth (Inert)	18.09	26.76	23.46
Bio resistant	4.15	11.81	11.07
Others	23.00	20.25	20.04

Source: Modi et al (2002: 35).

The composition of wastes generated in different geographic locations is different. For example, in the island city, 42.3 per cent of the waste generated is biodegradable in nature, whereas in eastern suburbs, this figure is 35.7 per cent and in the western suburbs it is 39.5 per cent (Table 2).

The data in Table 2 is from a different source (Modi et al 2002) as compared to the MCGM data that puts biodegradable waste generation at about 58 per cent in the whole city. The range available for biodegradable waste generation therefore is quite large 40 per cent to 60 per cent. It is more likely that the data presented by Modi et al (2002) in Table 2 is underestimation of biodegradable waste.

In Modi et al's (2002) estimates (Table 2), there is much higher proportion of dry wastes such as paper and cardboard, plastics, metals and glass, ranging from 12 per cent to 16 per cent, whereas the MCGM data puts this figure at just 6.41 per cent, as mentioned before (MCGM 2004). These are all recyclables, which have their own markets.

As per MCGM data (MCGM 2004), the debris constituted about 32 per cent of the total solid waste. But, data in Table 2 puts the proportion of these wastes between 18 per cent

and 27 per cent. There is much higher generation of debris in the eastern suburbs, followed by the western suburbs and then in the island city. High rate of new constructions in the suburbs, both eastern and western could be resulting in high level of debris generation in these areas. There is therefore a wide variation in the solid waste composition, as given by the MCGM and an independent source. The former source shows that about three-fifths of the waste generated in Mumbai is biodegradable in nature, putting large onus on the municipal corporation to organise the same.

A part of the recyclable waste generated, is sold by the households themselves and part of it is picked up by the rag-pickers and waste-pickers to earn their own living. The ones that is sold by the households themselves do not account in the figures of solid waste generated given by the city government. But, the ones that are picked up by the waste/rag pickers do account in the figures of total waste generated. Hence, before the waste reaches the dumping (disposal site), part of it is already recycled by the recyclers. There is therefore a gap between the percentage of recyclable waste generated and percentage of recyclable wastes that reach the disposal site. For example, in the island city, 6.16 per cent of the total waste generated is paper, but, at the disposal site for the island city waste, 5.38 per cent of the waste is paper (Table 3).

Similarly, for plastics and glass, part of the waste generated is picked up for recycling by the recyclers. This is happening in all the three regions of Mumbai, the island city, the eastern suburbs and the western suburbs.

Table 3: Constituents of Recyclable Wastes at Source and Disposal Sites

Zone	Paper		Plastics		Glass	
	Source	DS	Source	DS	Source	DS
Island City	6.16	5.38	4.23	4.10	1.48	1.30
Eastern Suburb	10.93	7.08	4.87	3.54	2.07	1.02
Western Suburb	6.61	3.98	5.47	3.85	4.23	3.64

Note: DS= Disposal Site

Source: SWM Department, MCGM (1994).

Also, it is the paper that is the most sought after item among the recyclable materials. For example, 10.93 per cent of the solid waste generated in the eastern suburbs is paper, but, just 7.08 per cent of the waste disposed from the eastern suburbs is paper. Similar situation is in the western suburbs. To remember is the fact that households themselves would be recycling other paper wastes such as the newspapers and magazines and other good quality used paper.

2. Present Waste Management System

2.1. Street Sweeping and Collection of Wastes

In Mumbai, there is manual sweeping of all the public roads on a day-to-day basis. In selected areas such as the arterial roads and the main station roads, sweeping is carried out during the night hours. The total length of streets in Mumbai is 1,800 km. To successfully cover the entire length, the area is divided into ‘beats’. The beat area is about

4,000-5,000 sq. m. for the city area and 8,000-10,000 sq. m. for the suburban areas. A pair of sweepers is assigned a single beat.

The activity is carried out from 6:30 a.m. to 1:30 p.m. The pair uses one handcart and 2 containers and brooms. There are around 4,200 beats for entire Greater Mumbai and about 8,400 staff for this activity alone. Wastes thus collected are deposited in nearby community dustbin containers, which are provided by the MCGM.

2.2. Collection and Temporary Storage of Solid Waste

In view of the MSW Rules of 2004, the MCGM has issued notices u/s 368 of MMC Act. The notice talks about public awareness programmes for understanding the importance of waste segregation at source. For effective implementation, MCGM has also proposed to charge fines. It has also proposed to propagate the concept of "Advance Locality Management" (ALM) scheme, which is at present being implemented by a population of 3.27 million throughout the city (Jain 2004). We would discuss the ALM scheme in details later on.

The MCGM, from time to time, carries out campaigns through newspapers, instructing the citizens/ institutions to collect their own garbage and store the same in bins to be kept at the gates from where the municipal vehicles would pick them up mechanically at specified time. The citizens and the institutions are also instructed that the municipal authorities would not enter individual premises for the purpose of garbage collection and lifting.

The municipal authorities have also notified the citizens that the dry and wet waste has to be stored separately, and that the wet waste would be collected daily and the dry waste would be collected once or twice a week, depending on the amount generated. Composting of wet waste on the premises would be encouraged under the ALM scheme.

Of the total population of Greater Mumbai, 83 per cent is served by the community bin collection system and 15 per cent by door-to-door collection[6]. This is being further strengthened under the implementation of the MSW Rules, 2004. Garbage collectors employed by various housing societies manually collect the waste generated at the household level and dump it in the garbage bin at specified street corners.

Collection of waste from community bins is carried out once in 24 hours. There are about 6,300 community dustbins of different designs and construction provided through out the 5,500 waste collection points in Greater Mumbai for collection and temporary storage of the all waste other than the debris, silt etc. At present, 83 per cent of the waste is collected through community bins (Jain 2004). Most of these bins are open and bottomless or are open RCC refuse bins, which require manual and multiple handling of waste. The MCGM has proposed for separate collection of waste from hotels, restaurants, office complexes and commercial areas, which at present are being partially covered. Private initiatives on tipping fees (collection charges) are also being encouraged.

2.3. Removal and Transportation of Waste

The centre or main business district of Mumbai is at the southern end of the peninsula and traffic conditions are very congested during the daytime. From many parts of the city, a refuse collection truck can make only one journey to the disposal site in one shift. Hence, for the sake of economy, vehicles making this journey carry maximum amounts of waste. Since large vehicles are not suitable for waste collection within the city, waste has to be transferred from smaller collection vehicles to bulk transport vehicles to be taken to the disposal site.

The corporation employs manual (22 per cent) and mechanical (78 per cent) means for the removal and transportation of wastes (Jain 2004). Manual handling is carried out at the collection points, where waste is collected by the municipal workers and dumped into transportation vehicles. Both Municipal and contractors' vehicles are used for removal and transportation of garbage, but only municipal labour is used in this work. For debris, silt etc. however only the contractors' vehicles and their labours are used. 45 per cent of the transportation is through municipal transport and 55 per cent is contracted out[7].

Transportation of waste is carried out by using different types of vehicles depending on the distances to be covered by them. 60 per cent of waste is transported through stationary compactors, mobile compactors and closed tempos; 10 per cent is through partially open dumpers whereas 20 per cent is through tarpaulin-covered vehicles, which includes silt and debris.

The removal and transportation of garbage is done mainly in 2 shifts i.e. morning shift from 6:30 a.m. to 2 p.m. and afternoon shift from 2 p.m. to 10 p.m. However, if the situation warrants, the vehicles are deployed in night shift also. The removal and transportation of debris, silt etc. is done in one general shift i.e. 8 a.m. to 5 p.m. only. All municipal vehicles are of hydraulic tipping type but the contractor vehicles are open body and tipping type. The contractors are appointed on 3 years term on rate per trip basis or per vehicle shift basis or per cubic metre basis.

While most of the vehicles carrying refuse dispose off the waste from the collection points to the disposal sites, a number of them discharge waste at transfer stations where the wastes are loaded into larger vehicles for transportation to the disposal sites. In case of South Mumbai, trucks collect garbage from the garbage bins and transport it to the Transfer Station (TS) at Mahalaxmi. There are at present 2 TSs, one situated at Mahalaxmi and the other in the Eastern suburbs in Kurla. Both the TSs combined handle about 600 MT of garbage everyday, remaining of which is transported directly to the dumping grounds. A separate transport is arranged for transferring the garbage from Mahalaxmi to the northern part of Mumbai where the dumping grounds are situated. From all other parts of the city, garbage is sent directly to the dumping grounds. Nearly 95 per cent of the waste generated in the city is disposed off in this manner (Coad 1997).

The transportation of garbage from the transfer stations is done using 15-20 cubic metre Trailers and Bulk Refuse Carriers. It has been observed that the TS at Mahalaxmi is capable of handling at least twice the present load and is at present poorly utilized (Coad 1997). For removal and transportation of the garbage, 6 municipal workers and 1 *Mukadam* (labour contractor) are deployed with each refuse vehicle, Municipal Corporation's or contractor's, whatever the case may be. The worker uses 2 baskets and 2 iron rakes per vehicle.

For primary collection, transportation and disposal, MCGM deploys 141 refuse vehicles for the city region and 120 for the suburbs. The Corporation does the operation and maintenance of these refuse-vehicles through a network of transport garages. A total of 13 garages are provided at different locations within Greater Mumbai area (Coad 1997). The maximum trips made by the municipal vehicles in a day are 425 and that by the Contractor vehicles are 660 and the minimum number is 395 and 651 respectively (MCGM 2004).

2.4. Disposal of Municipal Solid Wastes

Disposal through Dumping

The Corporation disposes waste through landfill or land dumping method. At present there are 4 dumping sites in operation. Waste is brought here from various locations throughout the city as well as from the TSs at Mahalaxmi and Kurla. Refuse and debris are levelled at these sites by means of bulldozers and landfill compactors. The land filling carried out here is open dump tipping. At present there are 3 landfill sites in Mumbai. These are: Deonar, Mulund and Gorai (Figure 2).

Table 4: Amount of Waste Disposed at Dumping Sites

Location	Area (hectares)	Quantity of MSW received (Maximum) (TPD)
Deonar	111.00	6,826
Mulund	25.30	598
Gorai	14.50	2,200
Total	**150.80**	**9,624**

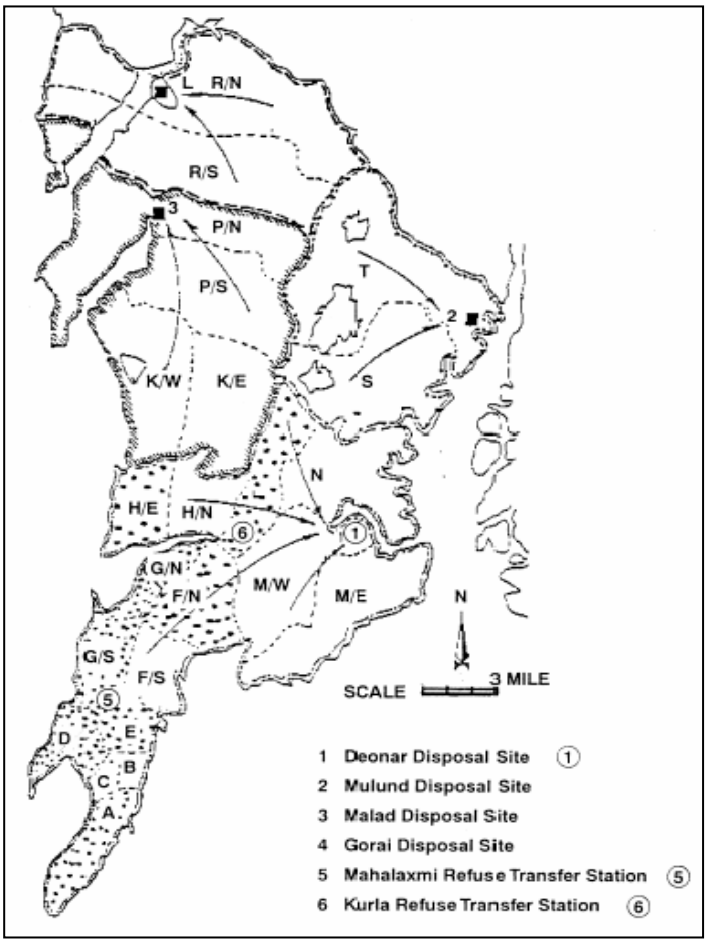
Source: MCGM, Dec. 2004

Two more landfill sites have been proposed: at Kanjurmarg of 82 Ha and at Mulund of 40 Ha (SWM Cell, AIILSG, 2003). Of all the four waste disposal sites, Deonar receives 70 per cent of the total waste generated (Table 4), as this is the largest of all the three dumping sites with an area of 111 ha. All the dumping grounds are nearly 30-40 km north of South Mumbai, which is generating 48 per cent of the total waste of the city. As a result, transportation costs of waste are quite high and approximate to about Rs. 16 lakhs per day[8] Costs for maintenance of dumping ground, waste transportation and hire charges come to Rs. 126 crores per annum and constitute nearly 28 per cent of the total budget allocated for SWM (Davis n.d.). These sites need to be upgraded and the waste appropriately treated as it has been estimated that they will last for only another 5 years (SWM Cell, AIILSG 2004).

Increasing population of the city has forced people to settle near the dumping grounds. Densely inhabited areas now surround the landfill sites. This has led to a situation where the residents have starting making complaints of environmental pollution caused due to burning of garbage and foul odour.

Land being scarce in Mumbai, the Corporation is looking for means for disposal of garbage through manufacture of organic manure and electric power. The various methods adopted for the disposal of municipal solid wastes in Mumbai are composting, bio-methanation of wet garbage, vermi-composting and recycling of dry waste, done by rag pickers. These methods are being now adopted by a number of decentralized units under various organizations working in coordination with MCGM, thus forming an effective public-private partnership.

Figure 2: Transfer and Disposal sites in Greater Mumbai



Source: Coad (1997).

Decentralised Methods for Waste Disposal

The Corporation has recently issued a work order for establishing a centralized treatment facility on Built-Own-Operate-Transfer (BOOT) basis. This treatment facility will be equipped with imported autoclave and shredder machines to deal with different categories of bio-medical waste (MCGM website, Jul. 2005). A Waste to Energy and Compost Plant for 3600 TPD has also been proposed, although no date for commissioning has been indicated (SWM Cell, AIILSG, 2003).

Wet or biodegradable waste is disposed through the process of composting by adopting the method of vermi-culture and dry or recyclable waste is disposed by direct sale to the recycling unit by rag-pickers. At some places for example, for example at the Bhabha Atomic Research Centre (BARC) plant and at the Shatabdi Hospital plant, wet i.e. biodegradable waste - specifically waste from the canteen in the case of the BARC plants and waste from nearby hotels in case of the Shatabdi Hospital plant - is converted to bio-gas through the process of bio-methanation. Wet waste from markets is converted to high

quality compost manure called "Vermigold" at the vermi composting plant located in Dadar. Waste disposed in this way throughout the different waste management units under various organisations adds up to 370 MT per day.

Of the total waste generated in the city, this amounts to 5 per cent. Thus the need for encouraging waste disposal through such decentralized units becomes evident. The list of decentralized facilities existing now in Mumbai is in Table 5.

Table 5: Decentralised Waste Disposal Centres, Mumbai

No	Organisation	Method of Disposal	Quantity of waste disposed (TPD)
1.	M/S Excel Industries Ltd at Chincholi Dumping Ground*	Converting to organic manure	240.0
2.	200 active ALMs through out the city#	Vermi-composting (Individual or Community based)	50.0
3.	5 T plants at Dadar (market waste), Versova and Colaba#	Vermi-culture	15.0
4.	Stree Mukti Sangathan's (SMS) composting units+	Composting	21.0
5.	Waste collected by Parisar Bhaginis of SMS+	Recyclable dry waste	1.0
6.	Approx. 30- 40 Municipal Gardens#	Composting	1.5
7.	Hotel Orchid#	Vermi-Composting	0.15
8.	Composting units under Force Foundation#	Vermi-Composting	20.0
9.	Churchgate Plaza#	Composting	0.6
10.	Units belonging to Force Foundation#	Composting/ Vermi-culture	20.0
	Total		**369.25**

Source:
* *MCGM, 2004*
\# *Discussion with personals from Dept.*
\+ *Data from Stree Mukti Sangathan*

Recycled Waste in the Informal Sector

As in all Indian Cities, even in Mumbai, there are door-to-door waste collectors, street and dumpsite rag pickers, the middlemen or the roaming waste dealers and the waste recycling workers involved in recycling part of the solid waste generated. But, a significant part of this waste is disposed off for recycling at the household level itself. This recycling material reaches the middlemen involved in the recycling trade from where it reaches the processing and manufacturing units - small to large-scale. Middlemen accept every type of waste as long as it has market value in the waste recycling sector.

Those employed in collection of such recycling materials are uneducated and unskilled labour (Modi et al 2002). Those engaged in particularly rag picking and sorting of waste at the garbage collection points are the most unskilled and the poorest and many among them are women and children. A survey of 2000 women conducted by Stree Mukti Sangathan (SMS), an organisation that has organised and trained the rag picker women, in 1998, found that, in Mumbai, rag picking is a caste and gender based activity, with 85 per cent of them being women, 5 per cent being children and 10 per cent being men, and most of them were from dalit landless labour families coming from drought-prone areas of Maharashtra. The age groups of rag-picking women vary from 7 years to 70 years. They are forced into rag picking because of their poverty, illiteracy (98% being illiterate)

and because they have no alternative skills. Rag pickers suffer serious health hazards resulting from unhygienic work conditions. They carry heavy loads and have no form of transportation. Rag pickers are unaware of their rights as citizens; hence the society as well as the middlemen in garbage management take advantage of their helplessness and exploit them, further de-generating their position.

According to MCGM, there is about 50,000 to 60,000 street and dump site rag pickers in Mumbai city, of which 60 per cent are women, 20 per cent are men and 20 per cent are children (Modi et al 2002). Further, door-to-door waste collectors and recycling workers total 80,000 to 100,000 in the whole city (Modi et al 2002). Therefore, there is already a large section of workforce in the entire recycling sector in Mumbai, part of whom could be trained to collect SWM. This is what SMS has done, as we would see later on.

3. Governance Structure for Waste Management

3.1. Organizational Structure

The organizational set-up of the department is well-structured with the Chief Engineer (SWM) as head of the department. He works under the Dy. Municipal Commissioner and Additional Municipal Commissioner/ Municipal Commissioner. A team of 3 Deputy Chief Engineers and 4 Executive Engineers assist the Chief Engineer (SWM).

The three zones under which Greater Mumbai is grouped are the City Zone, the Eastern Suburban Zone and the Western Suburban Zone. The work at the zonal level is managed by a Deputy Head Supervisor (DHS). Below the zonal offices are the ward offices.

The Solid Waste Management Department is divided into two wings, namely, the Conservancy Wing and the Transport Wing. The staff for these divisions consists of 13 Asst. Engineers, 25 Sub-Engineers, 23 Jr. Engineers etc. who work on the transport side and a Head Supervisor along with 6 Dy. Head Supervisors, 28 Asst. Head Supervisors, 53 Supervisors, 433 Jr. Overseers, 1772 *Mukadams* and Labour Staff, who work on the Conservancy side.

At the ward level, Assistant Head Supervisor (AHS) heads the SWM works. At the lowest rung in the department are the sweepers. For technical guidance and control, the AHS reports to the Deputy Head Supervisor (at zonal level) who in turn is guided by the Head Supervisor, the Deputy Chief Engineers (SWM) and the Chief Engineers (SWM). A total of 38,000 staff belonging to this department works for 24 hours in 3 shifts with the help of 7,900 refuse vehicles. Sweepers alone cover an area of approximately 1,800 km on a daily basis (area excluding slum pockets).

The day to day functions are organized at the ward level in each of Mumbai's 24 wards. These functions encompass general cleaning of roads, waterways and drains and the collection of garbage and debris and its transfer to disposal sites.

The Chief Engineers (SWM) working under one of the Additional and Deputy Municipal Commissioner of the same department are in charge of the collection and disposal of solid waste within Municipal limits. The Deputy Municipal Chief Engineer (Projects) handles special projects related to solid waste management. Street sweeping and primary garbage collection are managed by the Head Supervisor who is assisted by three Deputy Head Supervisors and their staff.

The AHS who is the head at the ward is responsible for day to day sweeping of the streets within the wards as well as collection and transportation of garbage from residential areas in the ward area. He is responsible for all activities of the SWM in the ward under the direction and control of the Assistant Municipal Commissioner (formerly Ward Officer).

The Conservancy Wing and the Transport Wing are involved in the secondary stage of garbage collection. The responsibilities of the supervisory staff of the Conservancy Wing is to ensure the provision of adequate number of community bins at the collection points and to plan its transportation without allowing any backlog including sweeping of streets to maintain overall cleanliness and hygiene. The basic duty of the officers of the Transport Wing is to provide optimum number of refuse vehicles for safe, timely collection of garbage and its disposal to the land fill site.

Figure 3: Organisation Chart of SWM Department of MCGM

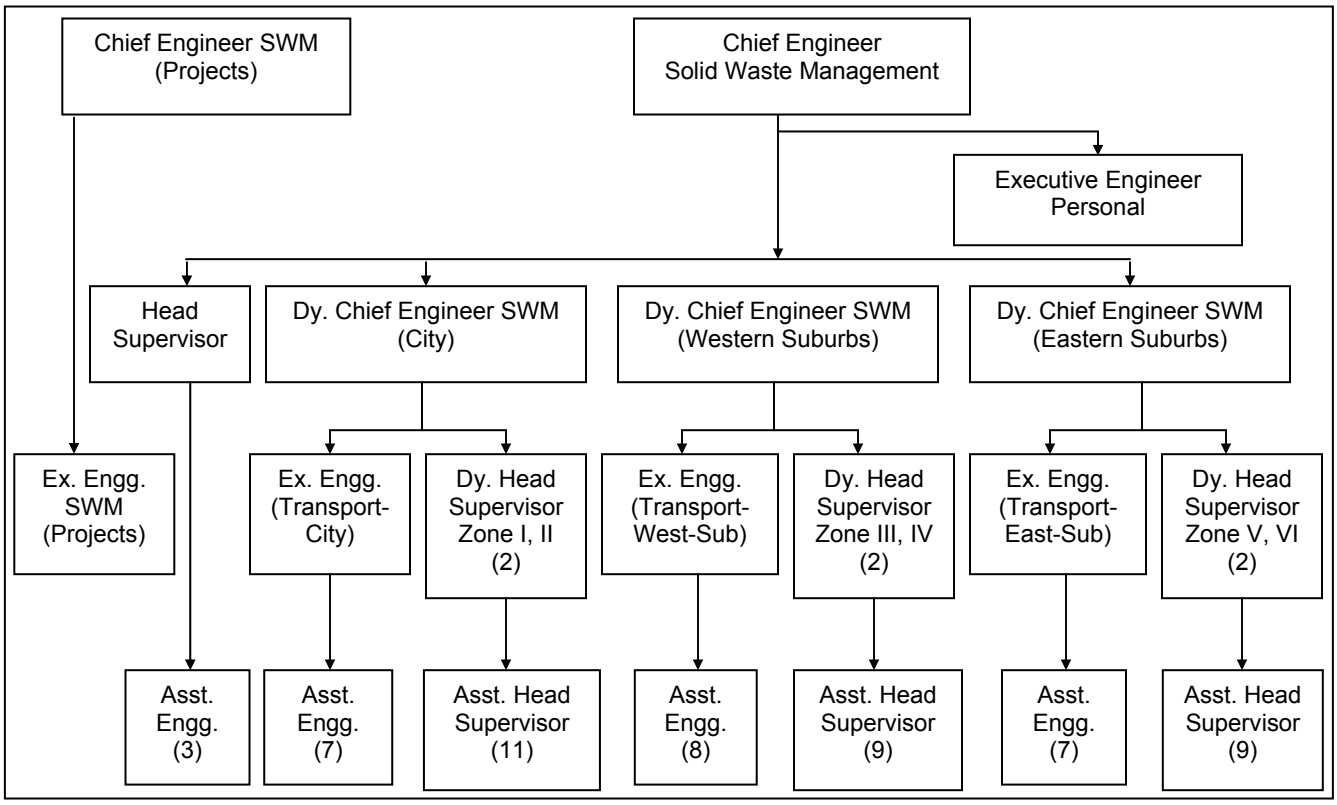
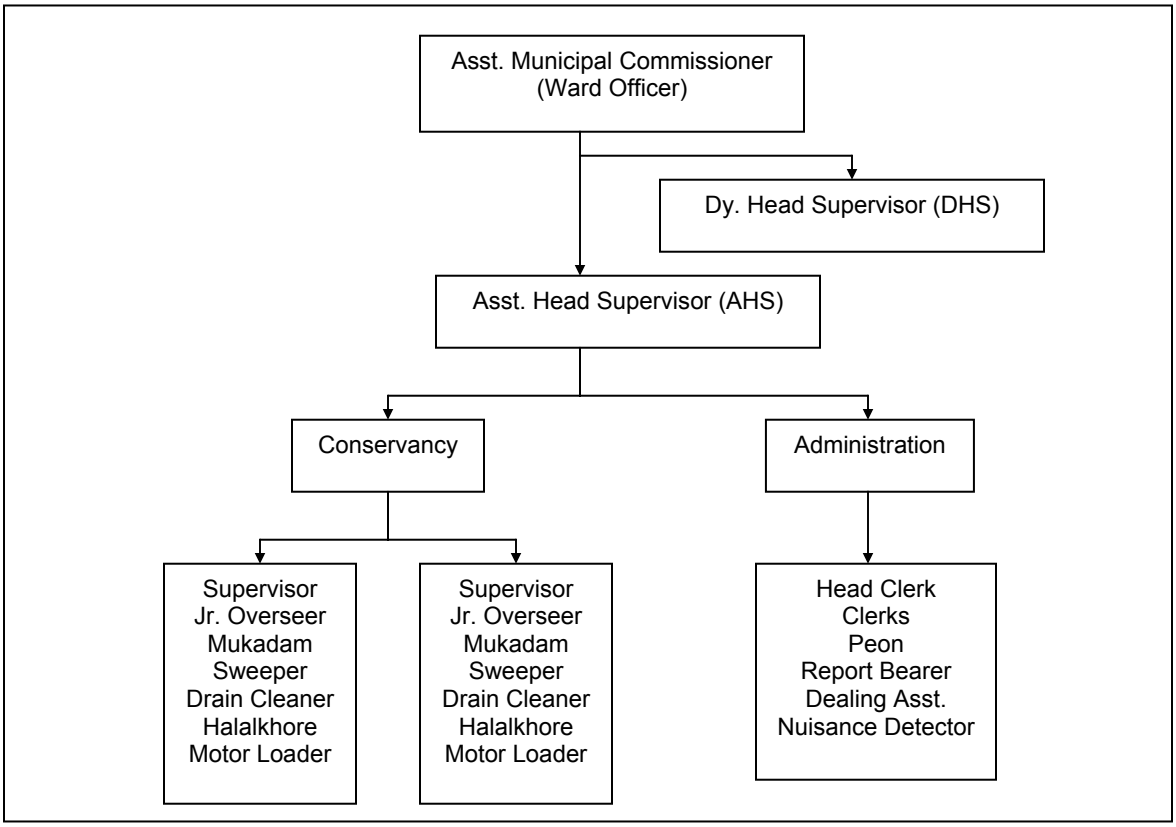


Figure 4: Organisation Chart of SWM Department of MCGM at Ward Level



Budget Allocation for Solid Waste Management

The Municipal Corporation of Greater Mumbai (MCGM) had spent Rs. 400 crores in 2000-01 and Rs. 385 crores in 2001-02 on SWM (Table 6). Of this, as per Jain (2004), more than Rs. 250 crores, that is 62.5 per cent, are spent on just wages total of 25,000 employees are deployed largely for sweeping of the streets and collection of waste. According to Jain (200s4), the number of sweepers is disproportionately high in number in the island city area.

Table 6: Annual Budgetary Expenditures for Solid Waste Management

Year	Cost (crore Rs)
1996-97	250
1997-98	247
1998-99	314
1999-2000	350
2000-01	400
2001-02	385

Source: MCGM, Jan 2003

As per calculations done by the SWM Cell at All India Institute of Local Self Government, by 2003 prices, cost of SWM per MT of waste generated came to Rs. 1,500 and per capita, it came to Rs. 265 per year in the same year. Of the total expenditure on the SWM incurred by the MCGM, in the same year, 38 per cent is on sweeping activities,

57 per cent is on collection and transportation and remaining 5 per cent is on disposal activities (SWM Cell 2003).

4. Issues in Solid Waste Management in Mumbai

4.1. Primary Collection

A very high volume of floating population and daily commuters, with almost 65 lakh people travelling daily is a cause for road littering (Jain 2004). In many areas of the city, streets are in ill-maintained conditions due to lack of timely street sweeping and there is clogging of surface water drains due to solid waste dumped into it. The percentage of roads cleaned 6 days a week is 77 per cent and only major roads are cleaned 7 days a week (SWM Cell 2003). At present, the door-to-door collection of waste is limited to just 15 per cent of the waste generated and remaining waste remains un-segregated. Because of non-segregation, part of the waste that gets dumped on the disposal sites is recyclable in nature. This has led to increase in quantity of waste required to be disposed.

The problem in Mumbai is further aggravated due to a high density and large proportion of slum population. The slum and pavement dwellers do not have access to proper services and hence dispose their waste in the public spaces like roads, drains or railway tracks. Hawkers contribute to littering of roads.

4.2. Disposal of wastes

With increasing urbanization, land available for dumping and creation of landfill sites for disposal of waste is becoming unavailable. There are only 4 landfill sites in the MCGM area, whose expected lifespan remains only 5 years. MCGM is going to find it difficult to find new waste disposal sites in the near future to take care of present level of waste generations and that generated by the new population.

4.3. Incompetency in Enforcement of MSW Rules

The MCGM has not yet been able to enforce MSW Rules 2000. Although it is mandatory to segregate waste at the household level, notices to this effect have not been given for the implementation of the rules. Rules require that community waste storage bins are put up. Further, the bins have to be closed with prescribed colour code and of a size that is compatible to transport vehicle to avoid manual handling. But, in Mumbai, the bins placed are open and without base, which cannot be lifted by mechanically. Hence, the garbage has to be handled manually.

4.4. Lack of Participation/ Communication

It has been proven through research that in the case of Mumbai, there has been an absence of communication between local government and the communities[9]. This is due to the diverse backgrounds of communities and the difficulties of everyday life of citizens due to the city morphology. Besides this, since the wards of the city are as big as any Class I city, the ward offices have very large responsibilities. People are totally

dependent on MCGM for cleanliness of their locality and there is no citizen's participation or decentralized mechanism to keep the locality clean.

5. New Efforts in Waste Management

Looking into the drawbacks relating to the solid waste management that the city is facing at present and also anticipating the future problems, local NGOs along with the MCGM have taken up certain new initiatives in order to control the waste management problem. Three new initiatives (i) The Advance Locality Management, (ii) the Slum Adoption Programme and (iii) the Parisar Vikas programme by the Stree Mukti Sanghatana (SMS) are discussed in this article.

5.1. Advanced Locality Management (ALM) Programme

Genesis and Background

In Mumbai, the Advanced Locality Management (ALM) Programme came into being in 1997. The scheme has been initiated by MCGM with the main objective of mobilizing citizens in a participative approach in setting up a system for dealing with the problem of solid waste management in an environmental friendly manner. The focus of the initiative was decided as 'waste minimization' and 'segregation of waste at source'.

The ALM scheme was started in Joshi Lane, Ghatkopar, which lies in the North Eastern Suburb of Mumbai. The citizens of Joshi Lane were facing the problem of solid waste which gathered on the streets, blocking vehicular traffic and causing a stench. The MCGM officials were of the opinion that the problem was due to lack of support from the citizens, which led them to hold discussions and meetings with representatives of different societies of Joshi Lane. On the basis of these discussions, it was felt that in order to improve the delivery of services, people's participation was of utmost importance. Understanding the issue, the residents decided to collectively apply the principle of thre 'R's, 'reduce-reuse-recycle' along with segregation of waste at the source. Citizens formed a 'Street Committee' and maintained vigilance to prevent littering. Rag pickers were engaged in this scheme, for door-to-door waste collection and speedy removal of segregated waste. The Street Committee approached the MCGM and formalized the partnership wherein the 'Street Committee' would ensure the three 'R's and waste segregation, whereas the MCGM would carry out street cleaning, regular pick-uo of the garbage collection, and disposal. The scheme was then adopted by surrounding lanes voluntarily. In November 1997, the ALM scheme was formalized by the six Street Committees of Ghatkopar and was accepted by the Additional Municipal Commissioner, MCGM for implementation in Mumbai city.

Process of formation of an ALM

One ALM was formed either with members of one housing society or a group of housing societies in a locality - depending on the size of a housing society - the residents and non-resident population of which were committed to improving the quality of life with close cooperation with the MCGM. The two parties in the ALM were: (i) the residents and shopkeepers of the locality and (ii) the administration of the MCGM.

Following were the conditions for residents and shopkeepers to form an ALM:

- The residents form a 'Local Committee' (LC) with one representative from each *chawl* or building and selected office bearers for interaction with the Municipal Corporation.
- The LC meets once a week and maintain a register to note the problems of the society. The Ward Office to be then notified about the problem and the residents' intention to form an ALM through a formal letter (Figure 5).
- The residents to maintain two components of waste separate, wet-waste (bio-degradable waste) and dry-waste (recyclable waste).
- Dry-waste to be disposed off directly through rag-pickers and wet-waste to be converted to compost through vermi-composting either individually or at community level. The excess waste to be handed over to the MCGM. The debris to be disposed off by the generator at the MCGM designated areas.

The following process was set up for the administration of the MCGM:

- An ALM Society is registered with the local Municipal Ward Office, which appoints a Nodal Officer to collaborate with the ALM and attend to citizen complaints. This Nodal officer follows up all the actions required at the MCGM level, based on the requirements and complaints of the ALM. In essence, the Nodal officer co-ordinates the actions required with regards to different departments of the MCGM, at the ward level. This is the essential aspect of this partnership that ensures success of the ALM. In case the complaints are not addressed then the Nodal officer passes them on to the Deputy Municipal Commissioner or the Additional Municipal Commissioner of the same zone.
- A representative of the Ward Office addresses the first ALM meeting. During this meeting, major and minor problems of the locality are identified and the problems mentioned in the register are attended to by the Ward Officer.
- MCGM also takes help of local voluntary organizations to speed up the work.
- A common fund is set up at the rate of Re 1 per apartment per day, collected on a quarterly basis. Contributions are received from the residents of the lane and are treated as contribution towards the 'Maintenance Fund'. All expenses are to be incurred from the Maintenance Fund.
- An ALM representative attends the monthly meeting with the Assistant Municipal Commissioner (AMC) at the Ward Office where locality registers and/or unresolved problems are screened by the AMC. General meetings for the whole area are held on monthly or quarterly basis, whose minutes are recorded and then circulated in an ALM Newsletter. During this meeting, all the problems concerning MCGM with respect to the ALM area are discussed among the ALM Committee and other citizens of the neighbourhood.

Scale of project

The scheme started in July 1997 with only one locality as its participant. Later the number of societies registered in ALM scheme crossed 1000 (Modi et al 2002). Presently

there are almost 375 societies (Jain 2000) registered in different areas in Mumbai catering to 3.27 million population. But, according to another source (Table 7), there are 578 ALMs in the whole city, with the highest numbers in two wards in western suburbs, wards H and K, which has high income groups. These two wards have the highest vermin-composting units. The main target of the ALM system is the individual households and most of these are middle to high income households.

Table 7: Distribution of ALM Groups

Zone	Wards	ALMs present	Vermi-composting Units
1	A-E	88	33
2	F/North, F/South, B/North, B/South	72	38
3	H/ West, H/East, K/West, K/East	181	86
4	P/South, P/North, R/South, R/North, R/Central	67	42
5	L, M/East, M/West	80	31
6	N, S, T	90	31

Source: Bhagwat (2000).

Institutional Framework

The ALM scheme began to spread and as its success was being felt by the MCGM, the MCGM appointed an Officer on Special Duty (OSD) for the purpose of educating people and creating awareness about the scheme. The OSD coordinated with the overall performance of the ALMs which was reviewed by the Additional Municipal Commissioner. On demand by the ALM citizens, the Ward Officer also allocated a specific day and time to the citizens where different issues like solid waste could be discussed at the Ward Office in the presence of all other heads of the department. The MCGM also allocated areas (usually per councilor ward) to a Nodal Officer to attend to complaints and to actually visit the ALMs.

Various NGOs who were already involved in work relating to local governance and groups of senior citizens involved in civic issues became a part of the ALM process. With the involvement of NGOs, corporates also joined the process.

The role of rag pickers in the overall solid waste management in keeping the city clean emerged as a result of ALM movement and hence MCGM took a decision to support the activities of rag pickers by providing them with sheds, vehicles for dry transportation, open spaces and also helped them in linking with ALM and Co-operatives Housing, Corporate and Ward Office. The rag pickers were involved in the collection of dry recyclable waste directly from individual houses. MCGM started supporting NGOs like Stree Mukti Sangathana (SMS), Force and Akkar Mumbai to organize and train the rag pickers. As a result rag pickers became more organized, received fairer prices to their collection, and better health and insurance services, along with work provided by the NGOs.

The private contractors in turn played a role in the collection, segregation and disposal of solid waste. The role of the beneficiaries is to segregate the waste at source and maintain vigilance on the spot to prevent littering. Besides this, they are also involved in creating

awareness among the community for the propagation of the concept of source segregation along with importance of disposal of waste in the bins to avoid littering of roads and other public places.

It can be observed that the institutional mechanism in the present case was formal with specific roles assigned to specific people. Since the initiative for the ALM movement came from the public who compelled the local authority i.e. MCGM to take necessary actions, there was no definite hierarchy in the management framework.

Financing mechanism

Each housing society registered under the ALM scheme contributes Re.1/- per day, to raise funds to support segregation of garbage at household level, sweeping and disposal of biodegradable waste through composting or vermi-composting. Accounts related to people's contribution are maintained by the housing societies themselves. It is estimated by the residents of Joshi Lane that the cost of Integrated Solid Waste Management by the residents is Rs. 8 per capita per month or Rs. 96 per annum (Jain 2004).

System of waste collection

The residents of the locality are the major players in waste management, being assisted by ragpickers, MCGM workers and the private operators together, depending on the area delineated to each service provider.

Technology Used

Under the scheme, it is mandatory for waste segregation is carried out by the household itself. The wet waste is processed through vermi-culture to form compost at individual or community vermi-composting units. Dry waste is collected by the rag-pickers and directly sold by them to the recycling units.

Innovation in Practice

An innovative approach in the management is the residents' initiative to RRR, i.e. Reduce-Reuse-Recycle. The waste is segregated at the source and recyclables are removed at the source itself to be taken away by the rag-pickers, which gives the rag-pickers some income. The wet waste is taken directly for composting. This led to 'Zero Garbage' situation. This has eliminated the need for community dustbins. This scheme has considerably reduced the burden of primary collection, transportation and disposal of waste which in turn has reduced the MCGM's expense on the waste disposal process amounting to Rs. 1.5 per kg of waste (Jain 2000). Thus, while the doorstep collection has added to the collection cost, it has been counterbalanced by reduction in waste quantity.

Figure 5: Format of ALM Registration Letter

Format of ALM Registration Letter

Date
To,
The Assistant Municipal Commissioner,
(Full address of the ward)

Dear Sir,
Sub: Formation of an ALM in our area--ALM Name
We, the members of the above mentioned association have adopted 'Advanced Locality Management' concept in our area. The name of our ALM is _____.
Our area comprises of a total of _____ families/flats and covers the following buildings/dwellings from _____ to _____. (give the exact location of your area).
Please inform us the name and telephone number of the Nodal Officer who is appointed for our area , the registration number of the garbage truck, the route and the timings for the route. Also let us know the timing and day of the Ward level monthly ALM meeting.
We are also pleased to inform you that we have initiated steps for segregation of garbage.
Hoping to hear from you soon.
Yours truly,
Sd!Convenor
For (Name of the ALM)

Source: www.agnimumbai.org

The other feature of the scheme is that the housing societies/ communities are asked to register themselves with the MCGM, as prerequisite to the ALM scheme. Weekly meetings and focus group discussions are held between the residents of an ALM society and the Ward Officer of MCGM, through which problems at local level are identified and then addressed. Awareness programs have also been conducted in the localities and in schools with the help of local NGOs and CBOs. Another special feature of this scheme is the appointment of an Officer on Special Duty (OSD) for educating and spreading awareness among people of other wards about the scheme.

Results achieved

The success of the ALM scheme in one community led to its widespread replication in other areas of the metro city. This has been possible because of the concerted efforts by the municipal authorities. MCGM through the appointment of the OSD has assisted in building awareness among the residents of different wards.

With the success of the ALMs in SWM, the Municipal Commissioner delegated additional functions to them. These included beautification of the localities and maintenance of gardens, parks and roads. The ALM movement has been so successful that the citizen groups have not just taken up the responsibility of their immediate neighbourhoods but also have organized maintenance of open spaces like the Juhu Beach etc. at the ward level (Kundu 2005). Wherever the ALM societies are functioning successfully, their scope of work has increased to take up other activities such as tree plantation, prevention of encroachment on pavement and beautification of streets.

The corporate houses have undertaken the responsibility of managing their road, sanitation and solid waste. Today there are a total of ten Corporates that are part of the

ALM movement; one of them has even registered a trust called 'ALM Trust' which encourages vermi-composting. 261 vermi-composting units spread over six zones reduce approximately 20-25 MT of garbage per day from reaching the disposal site. It is estimated that about 25 per cent of the ALM are managing solid waste at the local level through vermi-composting and recycling of dry waste (Redkar 2005).

People's habit of throwing garbage on the roads has reduced with increase in segregation of wastes at household level. Dustbins from the main roads were removed, providing a cleaner look to the streets. The system has developed a platform where the urban local body and the citizens can work in consultation rather than confrontation with each other. Such interaction helped in developing people's faith in the city's governance.

Figure 6: Street Sweepers working in pairs at Joshi Lane

Figure 7: Parisar Bhagini picking up collected waste at Pestom Sagar ALM, Mumbai

Figure 8: Street side plantations and clean drains at Joshi Lane

The ALM movement that started with the objective of cleanliness (Zero Garbage') has gradually spread to other areas of people's grievance regarding civic services like maintenance of road in the locality, improvement in water supply, check on unauthorized construction, and monitoring unauthorized hawking. It has provided a forum to the citizens for participating in SWM and in improving the city's environment. To note is the fact that the ALMs are largely middle and high income based groups, whose interest is 'Clean City', at the exclusion of the poor. Hence, although many of the initiatives of the ALMs are recommendable, these have become organised forums for the support for evictions of slum dwellers and the pavement dwellers from public space.

Probable Conflicts and Sustainability Issues

Initially, citizens had expressed their doubts on the formation of ALM societies of their own community members. Opinion was also expressed that why they should undertake these activities which is the responsibility of the MCGM. Many did not find any problem with littering on the streets and roads, as they were used to it and were themselves engaging in. Lastly, many were not ready to contribute money for the maintenance fund.

The MCGM expected ALMs to segregate waste at source and create in-house system for recycling biodegradable waste, whereas the ALMs expected MCGM to provide separate carriers for dry and wet waste. The ALMs did not want to do vermi-composting at the neighbourhood level as these units produce foul odour. The ALMs thus wanted the MCGM to pick up the wet waste as well. This conflict has not yet been resolved. Hence, many of the ALMs are failing to perform. The MCGM's support to ALMs still remains provisional and has not been institutionalized into regular municipal functions.

Transparency and accountability, along with the relationship that developed between the people and the Municipal Corporation after the implementation of the project assured that the results achieved by the initiatives have a spiralling and long lasting effect. The ALM societies generated their own resources to undertake SWM, this being an indication that the concept of ALM was moving towards financial self-sustainability at society level.

5.2. Slum Adoption Scheme

Genesis and Background

A study done by the Youth for Unity and Voluntary Action (YUVA) in 1998, which covered 100 communities in the slum pocket of Jogeshwari (East), found that while the residents were aware of the problems related to inadequate practices of household disposal of waste and systems of collection and transportation of garbage in the community, there was very little community involvement in solving the problem. It was also experienced by the MCGM that because of the heterogeneous population in the slums there was no sense of belongingness in the slums, which led to piling up of garbage and deteriorating health conditions of the dwellers.

As a result of the survey, it was realised that an attempt to motivate and involve the slum population in keeping the slums clean had to be made through offering some incentives for the purpose. It is in this background that the Slum Adoption Scheme (SAS) through community-based organizations and public participation was started by the MCGM. Called the *Dattak Vasti Yojana*, which means Slum Adoption Scheme, this programme is meant to financially support slum communities to form garbage committees that would then hire workers to clean their areas.

Description of the Initiative

A Community Based Organisation (CBO) has been involved in work related to SWM in the Prem Nagar Slum Community since last one and a half years. The MCGM has provided necessary equipments for the purpose to the CBO and it also takes care of the salaries of the slum cleaners. The project has turned out to be successful. This scheme is being put forward as an example to motivate other slums, to participate in the scheme. However, SAS is only meant for authorised slums. After the successful implementation of Prem Nagar Pilot Project, in 1999, the MCGM formed 'Slum Adoption Policy' (Jain 2000). A circular followed this in 2001 for appointing an Officer on Special Duty to educate slum dwellers about SWM. The circular was reached out to slum population of about 3.27 million (Redkar 2005).

Box 1 Advance Locality Management: A Case of Pestom Sagar ALM

Pestom Sagar is located in the M (West) Ward of MCGM. The total population in the area is about 20,000 people. Before the initiation of the scheme, the locality was facing numerous problems with waste management. 6 community bins located in the area were not being cleared regularly. Slum and hawkers' encroachments were resulting in littering of waste on the streets. A municipal garden within the locality was neglected and it was being misused by anti-social element.

The locality consists of 6 roads. The scheme was first initiated only on road number 1 and 2. After its successful implementation, the scheme was replicated on roads 4, 5 and 6.

A Committee has been formed for effective management and which is headed by a Chief Convener. For each street, a committee member has been appointed who is in charge of 6 sweepers each. Besides these, a Joint Coordinator has also been appointed. The 6 sweepers have been trained and are deployed on permanent basis with all the equipment necessary for road cleaning. These sweepers are also engaged in waste segregation at the household level.

Figure 9: Waste collection bin at Nani Nani- Munna Munni Park maintained by Pestom Sagar ALM

Fig. 10 View of Compost pit along the edge of the park

The current membership of the scheme is a total of 2,295 people that includes people from slums, hospitals, clinics, shops and vegetable vendors. Beautified frontages of the residential buildings can now be seen in the area. Members attend the monthly meeting of the ALM at the Ward Office. The Kangra Garden leased to the ALM for maintenance has been turned into one of the finest gardens in the city. A pit of 440 cu. ft. surrounding the garden is used for vermi-composting (Refer Fig. 10). In one year, during Ganesh festival, a total of 100 MT of 'Nirmalya' (flowers and other bio-degradable material offered during worship) from 500 *mandals* was processed in this garden. The security cabin of the Garden has been converted to an office, as the need for vigilance was not felt after the citizens took over the maintenance of the Garden. This has saved the municipal body the monthly salary of the security guard.

The contribution made by persons from the residential area is Rs. 0.33 per day per family member, whereas for commercial areas a contribution of Re. 1 was made on a daily basis.

Institutional Framework

The CBOs involved in the scheme require recommendation from their ward councillor and a registration with the charity commissioner office, to become eligible for SAS. This process formalises the CBO. The selection of the CBO is based on certain norms and it is appointed as an agency on behalf of the MCGM to keep the slum area clean. The CBO represents the people and implements primary services of the municipal authorities at the slum level.

The MCGM generally provides services to the slums located on its lands. In case where the slum in not located on land belonging to the MCGM and where the latter is not providing any services, an NGO is appointed to keep the slum clean. The NGO employs labour for the cleaning task. The MCGM gives grants and logistical support to the NGO for the purpose. Performance of these NGOs is evaluated on certain specified indicators. In essence, the NGOs are treated as contractors. Now, efforts are being made to form Community Development Societies of the slum dwellers and motivate them to maintain cleanliness.

System

The waste is collected from door-to-door. But, because the slums have narrow pathways and alleys, it is difficult to take in large vehicles inside the slum for collection of waste from a pocket. Hence, waste is collected through handcarts, tricycles, auto-rickshaws or other smaller modes that can move on the narrow paths, and then transferred to community bins.

The community bins in turn are lifted by a dumper-placer / skip-loader vehicles or compactors, and carted away to the landfill. A system of keeping plastic containers in the passages for short periods for doorstep collection of the waste has been also introduced in place of waste bin at household level, given that in many slums individual housing units are located cheek-by-jowl. The waste pickers employed to do the task in the adopted slums remove waste from such common containers thus placed.

Financing mechanism

The initial source of finance for the scheme is from the MCGM, who provides some annual amount for first three years, but the amount reducing gradually over the period. Then, the CBO is expected to raise Rs. 10/ per household for collection of segregated waste from house to house and for the maintenance of toilet blocks. The scheme has been so designed that by the end of the third year, the CBO would be self- sufficient in managing services related to waste management and sanitation at the primary level.

In the later stage though, the CBOs started limiting their services to only a small section of the slums, where the beneficiary's contribution to them was as low as 8 per cent to 10 per cent of the total budget. Due to this, the CBOs found it difficult to sustain themselves in managing the project financially. They have therefore begun taking up other activities.

Results achieved

Through his programme, MCGM is reaching out to 253 slum pockets of a total of 1,959 recognized slums in the city of Mumbai. However, the CBOs service only small sections of the slum pockets handed to them. Hence, their efforts are not felt strongly in the overall scenario. Nonetheless, they are known and respected within the communities as supporters of a healthy and clean environment. The exposure of the CBOs to the ward system has made them formal organizations with registration and audited accounts. They have become more aware about the functioning of the ward system and hence are prepared to take on many more complicated and larger contracts of solid waste, mid-day meal and slum sanitation programmes.

The project has also resulted in creating opportunities for the slum youth, women and rag pickers by giving them employment. The CBOs headed by women are more than 35 per cent of the total CBOs (Redkar 2005) and this has enabled women to participate in development processes that would eventually lead to their empowerment in the society.

Probable Conflicts and Sustainability Issues

The SAS is not without its own concerns and problems. One of the most glaring drawbacks of this programme is that the Slum Adoption Programme is meant only for the authorized slums. Due to this, the non-authorized slums of the city and pavement communities do not have any means for effectively dealing with their waste management and cleanliness issues. This is one more mechanism of creation of rift between the authorized and unauthorized slums.

On the economic front, it can be seen that as the CBOs serve only a small section of the areas allocated to them. Thus, the beneficiaries' contribution does not add up to any great amount. In fact, the total contribution adds up to just 8 per cent to 10 per cent of their total costs of keeping the slum clean. Hence the CBOs face a great difficulty in the operation and management of the cleanliness drive.

The CBOs therefore have begun to engage themselves in other kinds of activities to make themselves financially sustainable. One of the method resorted to is to sub-contract the cleaning job to smaller groups at low wages and in the process become agents in the system of service provision. To overcome this problem there has been no guidance and supervision from the MCGM.

The amounts of money to be paid to the CBOs being meagre and without any formal arrangement with the community, payments tend to become irregular and often not forthcoming. This has created a major problem for the CBO's sustainability. In places where the SAS has worked, local politics has entered; the local councillors have gradually started to promote their own party youth groups for the latter to get financial benefits and the former to draw political mileage.

In cases where the local councillors have interfered with the programme, it has come under the control of the councillor and no longer remains a programme in the control of

the CBO. Some instances of corruption have also been found. In some slums, MCGM has provided the grants for the wage of workers at the rate of one labour for 1000 households. Instead of hiring the required number of workers to clean the slum, lesser Numbers are hired. The balance amount remaining is pocketed between the local officials and a few slum dwellers in leadership position. This has happened because the slum dwellers are not yet aware of this programme and only those few who are aware have tended to make private gains out of the programme.

In essence, SAS was designed to be a sustainable programme to implement SWM scheme in the slums, but, in reality, it has not succeeded much, unless, there has been an NGO working with the community for a long time, and which has been able to put up a functioning and sustainable CBO for the task.

Box 2 Slum Adoption Scheme by NSDF

In 2003, the National Slum Development Foundation (NSDF) decided to take up the Slum Adoption Programme in the transit camps of Mankhurd and Wadala Kokri Agar, which house a total of about 30,000 people who had been resettled here as part of the Mumbai Urban Transport Project. Garbage committees comprising local boys and girls had already been organised and had been regularly cleaning the area since the resettlement occurred in 2000 and all residents contributed towards their salaries and equipment (Citywatch, 2003-2004).

The NSDF proposed to take advantage of this scheme of the MCGM. Initially, they met with opposition from the MCGM as these slum dwellers who previously lived along railway tracks, were not thought of as slum dwellers since they were living in transit accommodation about to be moved into permanent accommodation. The proposal was later accepted by the MCGM as a special case. The federation leaders visited different communities, encouraging them to get involved. As the number of communities demanding and getting involved in this garbage-cleaning programme grew, the opportunities for corruption and moneymaking began to shrink.

5.3. Parisar Vikas Programme

Genesis and Background

The Parisar Vikas Programme has been initiated by the Stree Mukti Sanghatana (SMS) which is an NGO based in Chembur, Mumbai. SMS is a Woman's Liberation Organisation and was established in 1975. The organisation has directed its efforts towards the upliftment of women primarily by creating awareness in the society about women's issues. Since its inception, SMS has made significant contributions to the women's movement in Maharashtra through various activities.

The SWM project of the SMS is being funded by 'War on Want', a London based NGO, and the Central Government's Suvarna Jayanti Shahari Rojgar Yojna (SJSRY). The duration of the project is from 2002 upto the end of 2005.

The Parisar Vikas programme is aimed at making the underprivileged women aware of their rights. After analyzing the findings of a survey of 2000 women rag pickers (mentioned earlier), SMS initiated a meaningful dialogue with these rag-pickers, who are addressed as '*Parisar Bhaginis*' (meaning Neighbourhood Sisters). Twenty-five years of

experience of working on women's issues has helped the SMS to develop a comprehensive approach towards these problems.

Components like literacy classes, health and social awareness campaigns, setting up saving groups, and educating the children of the Parisar Bhaginis, made the programme comprehensive. SMS also sought the help of many likeminded organisations for inputs especially in health and educational activities. As work expanded, it was realised that these Parisar Bhaginis really required a better steady income and hygienic work conditions. Efforts were made to organise and develop entrepreneurship training for these women. Thus, a new dimension was added to the SMS initiative. In the process, SMS established partnership with MCGM and was able to bring out changes for the benefit of Parisar Bhagini community.

Description of the Initiative

The main strategies of the programme involved the following:

- Organisation and training of the women ragpickers.
- Improving the standard of living of women ragpickers by understanding their problems.
- Developing new techniques for treatment of waste.
- Creating zero waste situation in cities by appropriate waste recycling techniques.

Figure 11: Training Programme for Women ragpickers

Implementation Process

The rag pickers were given identity cards and provided with training in waste handling, waste collection, transportation of waste to pits and pit management. Such trained women were addressed as 'Trained Parisar Bhaginis' (TPB). The Parisar Bhaginis were also trained in alternative skills such as gardening, vermi-composting, etc. Under the programme, any rag picker or housemaid living in the nearby slums could join the programme. The training was held every Wednesday and Saturday between 10 am and 5 pm. The module was spread across 16 days. Medical camps were also conducted during this programme and the patients were treated at Municipal hospitals in case of any health problems. The women were made aware of the importance of health and personal hygiene as the nature of their work made them prone to different infections.

The 'Parisar Bhaginis' go from house to house in several localities in Mumbai and collect garbage already segregated into 'wet' and 'dry' waste. They then convert the former into compost to sell in the market and recycle the latter. The compost is used for maintaining

the plant nurseries and gardens in housing societies. Specially designed bio-composting buckets for Rs 350 each have been sold to individual households along with a detailed pamphlet describing the process of waste segregation and its importance.

At a later stage, Self Help Groups (SHGs) or micro credit societies of these women were established. With the formation of waste cooperatives, they also were able to get the right price for the sale of the dry (recyclable) waste that they collected.

Monitoring and Evaluation System

A monthly staff meeting is held among the SMS workers and the Parisar Bhaginis to evaluate the work progress and to find solutions to problems being faced by them. A six monthly report was sent to the funding organisation in UK for review of the project progress.

Institutional framework

The project partners in the scheme are the MCGM and the NGO SMS. The Parisar Bhaginis are issued identity cards, with the endorsement from MCGM and an official from the SMS. The rag pickers are given training in waste recycling practices and in the organisation of cooperatives, which would sell the collected waste materials directly to waste recycling units. In this manner, the wastes would fetch more money than if sold through interim dealers in the waste recycling market. Through this process, the informal work of waste recycling done by the rag pickers obtained legitimacy. This improved the daily earnings and also the working conditions of the rag pickers.

Financing mechanism

The project is being funded by an UK based NGO named 'War or Want', which has given Rs. 20 lakhs for a period of 4 years.

The Parisar Bhaginis collected segregated waste from every household for which a charge of Rs.10 per household was made on a monthly basis by the SMS. This money was used by the SMS for training of the Parisar Bhaginis. The Parisar Bhaginis sold the recyclable waste that they collected and made on an average Rs.10 per hour depending on the amount that they could carry.

Scale of the Project

As a trainer and facilitator, the SMS secured work opportunities for Solid Waste collection and treatment in major public and private sector housing colonies and office premises for e.g.: the Tata Power (Refer Box 1), TCS, RBI Navy, BEST, Pfizer, CIDCO, MCGM, BARC etc. About 250 trained Parisar Bhaginis brought "Zero Garbage" status in these offices and colonies and also small housing complexes spread over 13 wards in Mumbai. In 2004, their work spread to the suburban areas of Navi Mumbai, Kalyan and Dombivli.

Parisar Vikas is currently working with 2000 women rag pickers in Mumbai. It is implementing waste management schemes successfully at 40 places throughout the city. Parisar Vikas has constructed and is maintaining two *Nisargruna* plants (bio gas plants)

with Bhabha Atomic Research Centre (BARC) technology for processing 5 MT of wet waste per day for MCGM.

Results achieved

With regards to Vocational training, Access to credit, Gender roles and responsibilities:

- A training cum community centre has been constructed next to the dumping ground (the work place of the Parisar Bhaginis) on a piece of land procured from the MCGM.
- Pre-primary education has been made available to the children of the Parisar Bhaginis by starting *Balwadis* (kindergartens) in the communities with the help of Pratham, an organization working for universalisation of Primary Education. 300 girls have been given special educational assistance with the help of local donors. A crèche for the children of Parisar Bhaginis has been started in the Community Centre next to the Deonar dumping ground.
- Health camps are held for women and children with the help Family Planning Association of India.
- 200 groups, with 10 Parisar Bhaginis each, have been established. A group leader heads each group. 150 groups out of these are working as saving groups and a federation of these groups has been registered as an independent organisation called '*Parisar Bhagini Vikas Sangha (PBVS).* The saving groups together have disbursed Rs. 32 lakhs to its members till 31st March 2004.
- SMS has been given recognition of a training institute. It has conducted vocational training of 50 women. Two training centres have been established in M-ward (Chembur) for training of Parisar Bhaginis in bio-composting, vermi-composting and gardening. 300 women have been trained in manure and gardening techniques through which 250 women have gained meaningful employment. Simultaneously SMS has developed 5 to 6 composting models in available space within localities.
- Awareness and leadership development camps have been organised for group leaders. The special material developed by SMS over the years has been used for training.

Figure 13: Compost units along the roadside for garden waste

Figure 14: Biogas Unit at BARC

Box 3 SMS's spread of Parisar Vikas Activities in Mumbai City: A Case of Tata Power Colony, Chembur

Tata Power Corporation's housing colony is located in Chembur and has 540 houses. The problem of kitchen waste of the order of 600 kgs per day and at least one tonne of dry leaves from the scores of trees in the colony to be continually swept and converted into compost had begun to pose a problem.

SMS into the picture. First of all, it made extensive efforts in spreading awareness and educating the residents of the colony about the importance of waste segregation. Then, SMS facilitated setting up a SHG of 20 women, all former rag pickers and identified a supervisor for monitoring this SHG. The SHG was given the tasks of garbage collection, road and building cleaning and general upkeep of the colony premises. The rag-pickers selected were trained for sweeping and cleaning tasks as they knew nothing except collecting recyclable waste from the dumping site within the colony.

The rag-pickers then began to collect segregated waste from each household. They then worked to fill 13 pits made for the purpose of composting biodegradable waste. These women were taught to make layers of kitchen waste, dry leaves and cow manure and watering it and checking for foul smells. The wet waste converted to manure in vermi-composting pits was given back to the Tata Colony for the purpose of gardening.

For its work in the colony, Parisar Vikas earned Rs 88,000 per month, to pay salaries to its sweepers and supervisor and rent a truck for garbage collection.

The Parisar Bhaginis at times face problems due to unsegregated waste, hurting their hands while handling kitchen garbage mixed with glass pieces or sharp metal. Attempts to make the people aware about the importance of waste segregation has many a times failed, as some insensitive and indifferent residents still throw away garbage indiscriminately.

Six service cooperatives have been registered, with 50 women in each Cooperative. These cooperatives function as business enterprises.

Poverty Eradication

The initiative of the capacity building programmes for the Parisar Bhaginis has resulted in the programme getting additional support from the Urban Poverty Eradication Cell (of the MCGM). This Department has undertaken a number of initiatives and has adopted innovative concepts and strategies in the implementation of various components of this programme.

One such novel concept has been adopted in which the 'Waste Picker' community has been addressed as a special group. Thus has started a significant partnership between the *Swarna Jayanti Shehari Rojgar Yojana* (SJSRY), and the Solid Waste Management Department of MCGM. This partnership has resulted in the community in getting better access to government resources along with an assured source of employment.

With regards to Income generation and Access to Resources:

All the women working under different projects have opened their PPF (Public Provident Fund) accounts and at least 500 women are covered under Janashree Vima Yojana of the LIC (Life Insurance Corporation) of India.

Box 4: SMS's spread of Parisar Vikas Activities in Mumbai City: A case of Nisargruna Plant at Shatabdi Government Hospital, Chembur

As a part of activities carried out under Parisar Vikas by the SMS, a Biogas plant was designed for the treatment of wet waste at the Shatabdi Hospital, which was a Government Hospital located in the M/East ward at Chembur. Waste from nearby hotels amounting to a total of 1500kg is brought here daily for processing. The biogas plant works on solar energy, so that there is minimum consumption of electrical energy for its running. The biogas generated in this manner is used on the Hospital premises, thus cutting down on other energy requirements. The plant began functioning in June 2003 and has 3 Parisar Bhaginis working at the plant at present.

Figure 15 Solar Panels at the Biogas plant used for energy generation

Figure 16 Workers at the plant with SMS director Jyoti Mhapsekar

It was decided under this scheme to issue an Identity card jointly signed by the SMS president and Deputy Chief Engineer, SWM to each of the Parisar Bhagini.

1. A household survey of these women for understanding their standard of living was conducted and accordingly, they were included under the SJSRY. A grant of Rs.10,000 has been given to each SHG as a running capital to start their micro enterprises. Of the 200 groups, 63 groups with 678 women received the revolving fund of Rs.678,000 disbursed under the 'Thrift and Credit Societies' component of SJSRY.
2. A tempo has been provided for the collection of dry waste. In 5 wards, even Parisar Bhaginis have got such tempos from the MCGM.
3. Under the infrastructure development of SJSRY, a sanction to construct sheds in seven wards for the storage of dry waste has been provided for. It was decided that these sheds would be operated on a cooperative basis under the aegis of PBVS and 5 such informal sheds are already in use by the Parisar Bhaginis. The success of this scheme facilitated the formation of neighbourhood committees (NHC).

4. Urban Development Department of Government of Maharashtra has noted the importance of this partnership and in its GR of May 2004 and it has recommended all other Municipalities of the state to adopt this approach.

Environmental Management

The design submitted by SMS for the composting of wet waste has been approved by the MCGM. MCGM has sanctioned grant to the SMS for construction and maintenance of two "Nisargruna Plants" (plants producing Bio gas and manure) at Shatabdi Hospital (Box 4) and Deonar abattoir respectively under the guidance of scientists from BARC. Today SMS is maintaining five such plants. With the introduction of environmentally sound technologies like vermi-composting for the treatment of wet waste, there has been a reduction in the total amount of waste reaching the landfill site (Table 5).

Probable Conflicts and Sustainability Issues

The approach adopted by SMS in Parisar Vikas has been found to be most sustainable as it has imparted beneficiaries with knowledge and skills, advocated their rights and helped them get organised. Getting them empowered in this manner has helped the Parisar Bhaginis to increase their bargaining power, better their social organisation, and increase their income and self-sufficiency.

For long-term sustainability of the project, SMS is trying to strengthen the self-help groups of rag pickers by involving more number of housing colonies in the waste management scheme. As an alternative means for employment, the Parisar Bhaginis can also undertake gardening activities in the housing colonies. Thus, the work of SMS with women rag pickers has challenged the traditional caste system by the simple changes brought about in the nature of their work.

6. Conclusion

The above cases are the first instances where the MCGM has involved other stakeholders such as the CBOs, Citizen's Groups and NGOs in addressing the problem of solid waste management. It already had created a partnership with the private sector in transporting the waste and disposal of the waste. These experiments have to be seen as efforts for building good governance for the city of Mumbai. After nearly five years of the implementation of these programmes, the benefits to various stakeholders are evident.

Benefits to Rag Pickers

Through these programmes, the MCGM has realised the importance of the role of the rag-picker in the management of solid waste. It has therefore brought them into the formal schemes of SWM. This has led to rag pickers getting organised. They now receive better prices for the gathered materials, have better health, are covered under insurance services and are getting more work than before. All these have legitimised the rag-pickers in the society and have increased their income and well being.

Capacity Building of Stakeholders

An active participation by the community has also increased its own capacity to perceive and participate in the management of the city's problems. With cooperation between various stakeholders there is ease in mobilisation of the community resources to solve urban problems and this has assisted in supporting and sustaining any of the activities taken up by the urban local body at minimal expenses.

Table 8: Stage-wise Partnership with MCGM for Solid Waste Management

Stage of Involvement	Name of NGO/ Govt. / Private body	Type/ Extent of work	Nature of Contract
Primary Waste Collection	ALM Society	Segregation of waste at household level	ALM Society is registered with the MCGM
	CBO working with the adopted slums	Waste collected through hand carts, tricycles, auto-rickshaws or similar modes and transferred to community bins	A recommendation from their ward councillor and registration with the charity commissioner office
	SMS	Training of women rag-pickers Area allocation for waste collection	Although no contract has been signed between MCGM and SMS, SMS has to annually report to the MCGM.
	Parisar Bhagini (belonging to SMS)	Collection of segregated waste at household level	Each Parisar Bhagini is given an I-card, signed by MCGM and SMS officials.
	AGNI	Assistance in formation of ALM	Voluntary
Collection Point	MCGM	Collection of waste from Community bins, loading it into transport vehicle	
	Rag-pickers	Waste segregation at collection points	No contract
Transportation of waste	MCGM	Provides labour and vehicles. Transports directly to dumping site or first to transfer station from where it is further transported to dumping site	
	Private Contractors	Provides labour and vehicles	Formal, renewable contract with MCGM
Waste Treatment and Disposal	MCGM	Dumping at landfill sites	
	ALM Society supported by MCGM	Biodegradable waste is disposed at independent or community vermi-culture units and recyclable waste is handed over to Parisar Bhaginis	ALM Society is registered with the MCGM
	SMS	Vermi-culture units for composting, bio gas plants for waste to energy generation	Formal contract with the waste supplying units (hotels or canteens) and with the units using the biogas produced
	Private bodies	Application of Waste treatment technologies	Contractual

Improved Waste Management

The involvement of MCGM in undertaking these experiments with citizens and Civil Society Groups has resulted in new innovations and methodologies in waste management systems. On account of the MSW Rules, 2000, the MCGM has prohibited littering and mandated storage and segregation of waste at source. But, these rules have to be enforced more effectively.

Upgradation of Governance System

The projects have also made an effort in an indirect manner to link the civil society groups to the governance system, bringing in a sense of ownership and increasing the transparency within its structure. Such kind of third party monitoring has also helped to overcome the problems of the system and of mal-practices, if any. The negotiating position of the ALM societies as well as the CBOs has strengthened and they are able to use this in bargaining for better civic service deliveries from the MCGM.

Reduction in Costs

Lastly, participatory mechanism can reduce the cost of implementation of any scheme, as it can be seen where the MCGM is able to partner with the CBOs for solid waste management either through ALM or Slum Adoption Schemes.

Long way to Go

The experience from Mumbai shows that the city has still a long way to go in SWM, inspite of the initiatives described here. The size of the city is very large and the scale of these new initiatives is not so large as to cover the whole city. Deluge of July 26, 2005 has shown that the garbage collection has to still go a long way so that it does not clog the city drains in times of heavy rains and cause severe inundation of the city areas. Nonetheless, these new practices show the way, for addressing part of the problem of waste management in Mumbai City.

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[5] Ajit Kumar Jain's presentation at All India Institute of Local Self Government (AIILSG), 2004.

[6] MCGM website: http://www.mcgm.gov.in/Departments/swmanage/wastegeneration.htm.

[7] MCGM website: http://www.mcgm.gov.in/Departments/swmanage/wastegeneration.htm.

[8] As per the SWM Department of the MCGM.

[9] "*Participation to Partnership*", Lessons from UMP City Consultations, published for the Urban Management Programme by UNCHS (Habitat), Nairobi, Kenya, pg 31

References

"*Community Participation in Solid Waste Management in Brihanmumbai Municipal Corporation*" Documentation of Best Practices from the ULB's in Maharashtra for the Ford Foundation Project on Good Governance

Bathija Raju, Sourendu Gupta and Girish Ogale (1997): *Slums: The Magnitude of the Problem*", The Mumbai Pages. (from http://theory.tifr.res.in/bombay/history/slums.html).

Citywatch (September 2003 to March 2004): "*Cleaning up the Dirt*" at http://www.citywatchnews.net/sep03mar04/sep03mar04.html#PRECE.

Coad, Adrian (ed.). (1997): *Lessons from India in Solid Waste Management*, The Water Engineering and Development Centre (WEDC) Loughborough University, UK in conjunction with the All India Institute of Local Self Government, Mumbai, India.

Davis Bejoy, (n.d.): 'Solid Waste Management and Debris Recycling' in The Bombay Community Public Trust (ed.) *Understanding our Civic Issues: SWM in Mumbai*, The Bombay Community Public Trust, Mumbai.

Jain, Ajit Kumar (2000): 'Management of solid wastes in Mumbai', *Bio Energy News* Vol 4(1) at, http://www.undp.org.in/Programme/GEF/march00/page9-11.html.

Jain, Ajit Kumar (2004): *Solid Waste Management in Mumbai*, All India Institute of Local Self Government, published in the Bombay Chamber Bulletin

Karmarkar Dilip, Jan (2005): 'Jagruti Project', compilation of reference material for Orientation Workshop on SWM, SIUD, YASHADA, Pune.

Kundu Debolina (2005): 'Elite Capture in Decentralized Governance in Metro Cities: Lessons from the Delhi Experience', paper presented at Workshop on *Inclusive Mega Cities in India? - Learning's from Mumbai*, organised by Centre for Development Alternatives (CFDA) and Institute of Social Studies, The Hague.

Mhapsekar Jyoti, (n.d.): *Environmental Entrepreneurship Program for Rag Pickers of Mumbai,* Stree Mukti Sangathan, Mumbai

Mitra Subhankar (2005): *TDR as a Tool for Slum Redevelopment – Geography and Experience in Context of Mumbai,* Unpublished Master's Thesis, School of Planning, Centre for Environmental Planning and Technology, Ahmedabad.

Modi Jatin, Ranjit Chavan and Sneha Palnitkar (2002): *Wealth of Wastes, Waste Recyclers for SWM- A Study of Mumbai*, All India Institute of Local Self Government, Mumbai.

Modi, Jatin, V., Ranjit S. Chauhan and Sneha Palnitkar (2002): "The Wealth of Waste: *Waste Recyclers for SWM (A study of Mumbai)*", All India Institute of Local Self Government, All India Institute of Local Self Government, Mumbai

Mukhopadhyay, Tapati (2005): 'Decentralization of Urban Finances: A Case Study of Mumbai', a paper presented on seminar on *New Forms of Urban Governance in Indian Mega Cities*, organised by Centre for the Study of Regional Development, Jawaharlal Nehru University, New Delhi.

Redkar, Seema (2005): 'New Management Tools for the Solid Waste of Mumbai: Some Concerns', Abstract from seminar, *New Forms of Urban Governance in Indian Mega Cities*, organised by Centre for the Study of Regional Development, Jawaharlal Nehru University, New Delhi.

Seshu, Geeta (2002): *New Eco- Warriors,* from www.Indianest.com.

Solid Waste Management Department, Municipal Corporation of Greater Mumbai at: http://www.mcgm.gov.in/Departments/swmanage.html.

SWM Cell (2003): *Status Report On Municipal Solid Waste Management, Konkan Division,* All India Institute of Local Self Government, Mumbai, March.

UNCHS (n.d.): *Participation to Partnership*, Lessons from UMP City Consultations, published for the Urban Management Programme by UNCHS (Habitat), Nairobi.

Yashda Pune, Documentation on Best Practices.