A CALL FOR ACTION

REPORT BY EXPERT COMMITTEE

THE BRUHAT BENGALURU MAHANAGARA PALIKE

20th May 2014

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INTRODUCTION: BACKGROUNDER & STATUS OF SWM

MANAGEMENT IN BANGALORE

April 2014

Since the Expert Committee is responding to the Prayer and the status of compliance of Orders passed by the Hon'ble Court, it is necessary to sum up the case very briefly.

The Hon'ble High Court of Karnataka In WP no. 24739-40/2012 between Ms. Kavita Shankar, In WP no. 30450/2012 between G.R.Mohan and the State of Karnataka and others.

Compilation of orders issued by the High Court

Date of Filing: 19 July 2012, Heard till 10 Dec 2012 by CJI Hon'ble Justice Vikramjit Sen.

On-going hearings by Hon'ble Justice N. Kumar and B.V. Nagarathana.

Last Hearing date 25th April, 2014

Visits to Bangalore City requested by Hon'ble Judges to assess ground reality and understand issues deeper are organized by Expert Committee on November 1, 2013 and December 22 , 2013.

This Writ Petition filed praying to:

- **Declare that the 'Right to Life' under Article 21 of the Constitution of India includes the 'Right to Life' of the future generation also and therefore it is incumbent on the Respondents State to protect the natural environment and safe guard the same for not only the present generation but also for the future generation of the City of Bangalore.**
- **Direct that the Respondents 1 to 4 enforce Segregation of the solid waste at source by each resident of Bangalore by separating organic waste from recyclable waste and to only hand over the residual waste to the Respondent BBMP, Bruhat Bengaluru Mahanagara Palike.**
- **Direct the Respondent BBMP to only store the Residual waste in the Landfill sites so that they will not pollute the underground or the surface water, or the ambient air quality.**
- **Direct the Respondent BBMP to levy 'Penalty' in addition to Cess under the Municipal Solid Waste Management Rules from each and every occupant of a house or premises or**

establishment in Bangalore who does not segregate waste at source by following the 'Polluters Pay Principle' policy.

- **Direct the Respondent State and the Respondent BDA , Bangalore Development Authority, to ensure that in every formation in a development of a layout there are designated areas for dry waste collection Centres and also to provide areas ear marked in the Comprehensive Development Plan for the said purposes, along with compost plants in every area.**
- **Direct that Respondent 5 to telecast a 1 minute show on the benefits of Solid waste Management at source at the start of every film in the cinema theatres so as to educate people in this regard.**

Grant interim order to direct the Respondent BBMP and BDA to appoint Executive Magistrates or Special magistrates under Sections 20 and 21 of the code of criminal procedure by recruiting retired Government officials, Retired civil servants, ex defence personnel, who may be nominated by Respondents 7 to 20 to oversee implementation and enforcement of segregation of waste at source in every ward of the BBMP.

Highlights of the Introduction and Concluding Summary Remarks

Hearing date: 10 Dec 2012 (last hearing by the CJI Hon'ble Justice Vikramjit Sen)

There are several issues to be thrashed out in this petition. Some long time measures and short time measures had to be taken. But one thing that matters most is the immediate removal of garbage from the City. A consensus is arrived at wherein this removal of garbage should be done on a war footing. This is not a problem, which has crept in today. It is the responsibility of the Corporation which has been discharging its duties from the date of its inception. How the garbage has to be removed, where it is to be dumped, how to keep the City clean is the total responsibility of the Corporation.

The State submits that the State will stand solidly behind the Corporation and extend its full support to discharge their statutory duties for keeping Bangalore City clean.

It is in this scenario we think it proper to give an opportunity to the Corporation to mobilize all its resources, tune its machinery and with a single-minded devotion take such lawful steps to remove the garbage forthwith. If any person causes any obstruction, the law should take its own course. In public interest such obstruction should be put down with a firm hand.

Therefore we propose to give them a week's time to report compliance of the various directions issued earlier in particular regarding removal of garbage and its disposal in a scientific manner.

Hearing date : 13 Dec 2012 (first hearing by Judge N Kumar and Judge B V Nagarathna)

What emerges from the submissions is that the problem is two fold. One is collection and transportation of the garbage every day and the second is the garbage that is already transported and dumped in various landfills, its treatment and disposal.

It appears that one of the main reasons for the problem in collecting and transporting garbage is the fight between the contractors. The notification issued calling for bids from various contractors for collection and removal of garbage is under challenge before this Court . That matter is listed on Jan 3, 2013 for final hearing. Probably once that issue is sorted out, it would be easy for the Court to fix the responsibility of this collection and transportation of garbage on contractors vis a vis the BBMP and pass appropriate orders. Therefore for the time being that is deferred.

Insofar as the garbage already transported out of the City and lying in the landfills is concerned, that is causing great problem to the villagers around those landfills and unless that garbage is duly treated and processed the problem cannot be solved.

Directions

Waste Legislation

Hearing date : 10 Sept 2012

Every Citizen needs to be reminded that he/she has Fundamental Duties as contained in Part IV-A of the Constitution of India and in this regard , to keep the Environment clean by ensuring that waste is segregated in each household so as to enable the Corporation to collect the same for further treatment or disposal as the case may be.

Appointment of Executive Magistrates invested with powers under Sec 20 and 21 of the Cr. P.C. w.r.t powers under Sec 431 of the Karnataka Municipal Corporations Act, 1976 for imposition of fines on households which are failing to segregate garbage into dry and wet garbage

Decentralised Waste Management

Hearing date: 22 Nov 2012

It is agreed by all concerned, that merely receiving MSW is not a permanent solution and that the ideal situation would be for processing the MSW by establishing plants for receiving and processing the MSW. So

steps shall be taken in right earnest so that the Waste management Units could be set up at the earliest.

We think that Decentralization in the system of MSW management would lend efficacy and prevent bottlenecks impacting the entire City at a given point in time.

Landfill

Hearing date: 10 Sept 2012

There can be no gainsaying that the Landfills are not a permanent solution. The Corporation has already initiated steps for the award of contracts to commercial entities desirous of converting the garbage / waste into energy/ composting plants, so that the requirement of landfill areas will eventually be made superfluous

Extended Producers Responsibility -EPR

Hearing date: 13 Dec 2012

It is necessary to note the Plastic Waste (Management and Handling) Rules , 2011 Rule 6 provides for plastic waste management.

A perusal of the aforesaid provision makes it very clear that it is the Municipal Authority which is responsible for setting up , operationalizing and complete coordination of the waste management system and for performing the associated functions as set out in clause (c) . In discharging the said responsibility, clause (d)(i) provides for their seeking the

assistance of manufacturers of plastic carry bags, multilayered plastic pouches or sachets or of brand owners using such products. Further, the Municipal authority has to work out the modalities of a mechanism based on Extended Producers responsibility involving such manufacturers and brand owners either individually or collectively, as feasible or set up such collection systems through its own agencies. The Municipal authority shall also encourage the use of plastic waste by adopting suitable technology such as road construction, co incineration etc.

Therefore, a statutory obligation is cast on the BBMP under the Rules. However it appears the authorities have not given proper attention to these statutory obligations, which are cast upon them. The Corporation submits by the next date of hearing they will place on record the steps that are taken as contemplated in Rule 6 of the aforesaid Rules, so that a satisfactory remedy could be found for this plastic waste management.

Ward Committees

Hearing date: 10 Jan 2013 Order on ' For being spoken to

By an order dated 8 Jan 2013 after hearing the learned counsel for the parties , an order was passed directing the Government to constitute Ward Committees in terms of Sec 13 A of the Act. Before the said order was signed it was brought to the notice of the Court that Sec 13A of the Act is substituted by Chapter IIIA by way of the Karnataka Municipal Corporations (Amendment) Act, 2011, which has come into force from Aug

1, 2011. Therefore, as the power to constitute the Ward Committees by virtue of the said amended provision vests with the Corporation, the order dated Jan 8, 2013 requires modification.

The Karnataka Legislature has passed the Karnataka Municipal Corporations (Amendment) Act, 2011, providing for the constitution of the Area Sabhas and Ward Committees in the state of Karnataka to institutionalize community participation in municipal functioning and to provide for matters connected therewith or incidental thereto. It is in the absence of this committee functioning in each ward, that probably the task of removal of garbage, which was not a problem for the last 5 decades, has assumed gigantic proportions in the last couple of years.

Therefore, in order to fix the responsibility on the persons who should ensure proper solid waste management it is necessary to constitute a Ward Committee forthwith. That may ease the problem of this garbage, which is haunting the city of Bangalore.

For the aforesaid purpose, the Council Secretary shall convene the meeting of the Corporation in consultation with the Mayor and the Commissioner, to consider the agenda of nominating the members of the Ward committee by the Corporation in terms of clause (b)of sub sec(2)of Sec 13 H of the Act, within 3 days from today.

Hearing Date: 27 May 2013

Submissions:

- Recommendations of the BBMP Expert Committee of Municipal Waste Management
- Technical Committee recommendations of EOI application

Directions:

- The Hon'ble Court directed that both the Expert Committee and Technical Committee recommendations be web-hosted and extensively shared by the BBMP so that they could be reviewed for the purpose of identifying objections by SWM practitioners, civil society and opinion makers.
- It was also directed that former BBMP Commissioner Siddaiah to file a report on matters which may not have been included in the other two reports that in his opinion could help identify sustainable waste solutions for Bangalore.

Hearing Date: 30 August 2013

Submissions:

- Report by Sri Siddaiah, former Commissioner of the BBMP, as per the order passed on 27.05.2013

Directions:

- The Court directed that the government issue an order to the corporation to spread awareness about the KMC Amendment Act 2013, and that prompt action be taken on giving effect to the rules.

- Objections were invited for the Karnataka Municipal Corporations (Ward) Committees Rules, 2013.
- The Court directed that given the number of allegations against M/S Ramky Infrastructures India Pvt Ltd and M/S Clean and Green Solutions Pvt Ltd, the corporation not make any payments to them without further orders from the Court.
- The Corporation was directed to fix a tenure for the existing contractors and take permission from the court for the further extension of any existing contractors in 41 packages (who were continued to work because the packages/tenders were not finalized)
- The corporation commissioner was also directed to bring to the notice of the Expert Committee the objections filed against the report, so that they could have a say in the matter.

Hearing Date: 20 September 2013

Directions

- It was decided to go ahead with the recommendations of the Expert Committee recommendations, Technical Committee recommendations and the report filed by Shri Siddaiah (Former BBMP Commissioner) as after consideration, the Expert Committee felt that there in substance, there were no serious objections to the report.

- A compilation of all feedback was submitted, along with a Note on the disadvantages of BURN technologies.

Hearing Date: 24 October 2013

Submissions

- Order dated 11.10.2011 passed by the National Green Tribunal, New Delhi
- Record of the discussion of the meeting held on 5.3.2012 to finalize the draft of the MSW (Management and Handling) Rules.

FIELD VISIT BY HON'BLE JUDGES with EXPERT COMMITTEE

NOV 1, 2103

Hearing Date: 13 November 2013

- Post the visit by the judges on 1st November 2013 to a Dry WasteCollection Center (DWCC), large and medium apartments managing their waste in-situ using an OWC, a large scrap-dealer, Karnataka Compost Development Corporation for large centralized management of segregated waste, and a college deploying a small bio-meth unit.

Directions

- The Pollution Control Board was instructed to state what action has been taken against individual/bulk offenders so that they're role in the matter of SWM could be assessed.
- Corporation to handle 41 packages directly that were previously under a contractor. Costs and effectiveness of the arrangement be determined
- The Court directed the Corporation to take immediate steps to empanel vendors for wet and dry waste to offer Bulk Generators authorized service provider options
- The Court suggested installing waste processing plants in Assembly Constituencies to manage smaller quantities of waste
- Commissioner to file report on the places where DWCCs are to be set up, as well as details on how many are completed/functional.

SECOND FIELD VISIT BY THE HON'BLE JUDGES WITH EXPER COMMITTEE MEMBERS ON DECEMBER 22 TO VISIT MAAVALIPURA LANDFILL, TERRA FIRMA FOR CENTRALIZED PROCESSING AND RECYCLING OF PLASTIC AND WARD-LEVEL BIO-METHANIZATION

PLANT OF 5 TPD AT YELAHANKA.

April / May: short hearings and case posted for June 2014 post submission of Final Recommendations of the Expert Committee

In addition, the Court has passed several orders re the following:

- Old Landfills to be bio-mined and tenders to recover resources and reclaim land. Present dumping to be scientifically done to minimize damage to the environment while processing infrastructure is enhanced
- KCDC to increase capacity on war footing and accept new segregated waste for processing
- The Karnataka Municipal Corporations (Amendment) Act, which received the assent of the Governor on 19.8.2013, allow for penalties to be levied for 'littering' and to empower the Health Inspector upwards to levy and collect fines. Amount collected and impact assessment
- A dedicated Cell to be created in BBMP dedicated to SWM to be set up on priority
- Weighment of waste transported to landfills to be done and records maintained

It is extremely encouraging to note, that in addition to the Hon'ble High Court of Karnataka and Supreme Court of India, the Planning Commission has also released a report on May 12, 2014 called "Report of the Task Force on Waste to Energy" Volume 1, and the highlights are:

<u>Status of MSW in India</u>

1. **Quantification of 2012-13 by PCB = 1,33,760 TPD**
    - **Only 19% =25,414 TPD processed**
2. **Approximately in 8000 total cities and small towns in India 279 compost plants, 172 bio-meth plants, 29 RDF plants and 8 W2E units established. Of these, large number are dysfunctional due to vary basic reasons like**
    - **Lack of supply of committed quality/quantity of waste (read as segregated waste)**
    - **Inadequate market for sale of end product**
    - **Lack of financial viability & due diligence**

- **Public outcry on location**

RECOMMENDATIONS:

1. Integrated Approach – based on
    - Participation of Civil Society,
    - IEC to promote segregation at source
    - Informal sector engagement
    - Residual disposal in sanitary landfills
    - Professionalizing the sector
2. PPP models for investment in centralized processing of recyclables for up cycling and decentralized for bio-degradable using composting and bio-methanization
3. Appropriate technology selection to be basis size, waste quantity and reliability and extent of segregation
4. Viability gap funding and inclusion of market forces and opening up the economy
5. Projected estimates for costs done basis size of population and costs divided into Capital and O&M..
6. Bio remediation and Capping of Dumpsites declared priority
7. Sanitary landfill sites for 25-30 year to be set up with possible clusters and sharing of a 50 km radius of facilities
8. Tipping fee or Support fee as gap funding in process of

converting waste to usable product

9. Institutional strengthening at national and State level. Each ULB recommended to have a MSW department and focus
10. Focus on R&D, on setting standards and benchmarks and monitoring and audit mechanisms

As is evident from the highlights that the basic philosophy and principles of the Expert Committee have been upheld again and the Government of India too is recommending segregation at source, decentralized processing, upcycling of recyclables, PPP and investments and opening of the market, Bio remediation of dumpsites and selection of appropriate technologies. A huge thrust and importance has been placed on strengthening of Institutional capacity and investment of adequate research and setting of standards as presently few, if any norms exist.

The BBMP has responded to these Directives and submitted Action Taken Reports (ATR's) basis the Orders that Commissioner BBMP has passed on specific aspects. The visits of the Hon'ble Judges along with Members of the Expert Committee were planned to give the Judges a sampling of decentralized management at Apartment level, at Zonal level, a visit to the

Landfill at Maavalipura, visits to Dry Waste Collection Centre, a rag picker colony, scrap dealers, and meeting with citizens etc so they could see the efforts of the BBMP and the state of infrastructure in the City.

The Hon'ble Chief Minister Shri Siddaramaiah, launched the segregation at source pilot initiative, Kasa Muktha, for 22 wards on July 24, 2013.
The first bio-meth decentralized unit was commissioned in Yellahanka ward in November 2013.

As a brief summation, it is necessary to put on record that despite many efforts of BBMP to establish facilities to process segregated waste, to make functional and operational over 150 DWCCs, to sign MOU's for units for processing segregated waste and to address the garbage crisis and follow the orders of the Hon'be High Court by setting up systems to manage waste, there has not been much success in increasing the quantum of segregated waste and percentage of waste being processed.

Despite all these efforts, the status quo in terms of solid waste management continues

Efficient and functional DWCC

Non-performing DWCC

Citizens segregating waste

Mixed waste during transportation

Citizens helping to clean up litter

Black spots due to negligence during collection

l in Indian media	
MANDUR 2014 May	**MANDUR 2012 Sep**
	Citizens helping to 

New Indian Express, May 14: 'Mandur Threatens to Stop Garbage Trucks'

The Expert Committee feels in the interest of a Clean Healthy City that is garbage free a firmer and more focused approach is required which allows for an Integrated Model of Sustainable Management for SWM to be accepted which is systemic and rooted institutionally with all agreed guiding principles enshrined as pillars for a long-term policy. Ad hoc programs and frequent changes in leadership, the lack of accountability of the

Zonal administration and no defined policy direction, huge nexus and vested interest and ample confusion across the board result in huge sums being spent with little or no visible difference being felt by the citizen. There have been many initiatives like Kasa Mukhta launched by Hon'ble CM in July 2013, and various other endeavours directly by BBMP or in partnership with other NGOs, private organizations, many new projects that are under review, many have gotten approval, yet, on the ground there is little visible improvement. Even anonymous groups have worked and shown a difference and in a few days its life as usual.

We need to understand deeply and as requested by the Hon'ble Justices, look at basic core reasons and find systemic solutions and raise a call for action so the city moves towards a sustainable and integrated system for the management of waste as per the Rules of the Land.

CALL FOR ACTION

GOVERNANCE & POLICY

A number of measures and programs have been initiated both by BBMP and civil society intensively over the past 18 months as directed by the Hon HC and driven by the crisis impacting Bangalore, but few have had the impact desired to demonstrate definite visual cleanliness in public places and a move towards a Clean and Garbage free City. Projects and programs undertaken with great planning and enthusiasm and financial investment are not executed with rigor. Scale is difficult as performance from contractors and data reliability is low. The willingness for change and time bound focused endeavor is sporadic and in few pockets. Driving systemic change is a challenge. The lack of institutional mechanisms to implement and ensure consistency of performance and provide data for corrective interjections, or a means to transparently assess the specific situation is amply clear and expressed by the ULB on several occasions.

Recommendations

a. Institutionalizing the SWM Cell with single and dedicated manpower, and environmental specialists who build subject knowledge and

capacity within the organization. Dual accountability is a reason for the complete lack of follow up and focus within BBMP of getting any scheme or program implemented.

1. Apex body at City Level for continuity and sharing of learning's. Plan and budgets for SWM to be approved by the Body consisting of experts and administrators, practitioners, NGOs etc.

2. Creation of an SWM Board for Monitoring and if BBMP believe that they cannot fix the system in a time bound manner with milestones for accountability, empower the BOARD to manage MSW and set up a company like structure

3. Monitoring Parameters and Metrics to be evolved for planning and evaluation and on-going assessments.

4. SWM Policy to be declared for 10-15 years with review and milestones every 2-3 years

5. Planning to be a Central SWM Cell function and execution a zonal responsibility

6. Accountability at the zonal level re the Execution and implementation of Orders issued by the SWM Cell and the Expert Committee decisions as per the Directives of the Hon'ble High Court

7. Penal provision for offenders – Systemic procedures and transparent forms and collection mechanisms

8. Expert committee to be an empowered committee appointed for a minimum of 3-5 years reporting to the HC and GOK with regular quarterly reviews

9. GOI and UDD, KSPCB roles and responsibilities to be defined especially re inter-stake holder aspects

10. 3rd party audit mechanisms to be instituted through professional third party agency selected through tender floated with a professional job description as defined by the Expert Committee. Qualified chartered accountants and other consultants to be considered.

11. Mandatory for Corporation to put key Policy decisions before the Expert Committee.

SWM POLICY

At present there is no stated direction or BBMP SWM Policy which articulates the plan of the Corporation and states its Guiding principles, sets targets or articulates the roles and responsibilities of the generators / the BBMP / the Council and Councilors etc. The Annual Budget of the BBMP for SWM is not an exercise that has a long-term plan allocating funds on an annual basis with some visibility into the projected costs etc.

In the absence of a stated and accepted policy there is random fire fighting measures that shape the action at Ward level. Combined with no internal capacity, the programs and projects that are approved for implementation have no continuity and no officer accountable.

Milestones and targets and programs are not planned for execution. Hence all bodies, groups, individuals who are proactive step in to help and act and this often further creates confusion.

Every new Officer in charge starts from a clean slate with no institutional memory and continuity. Hence BBMP carries a large financial burden and no visible impact to justify its operations, plans, principles or philosophy.

Recommendations

Basis the SWM Expert Committee Report on Future with NO Landfills and the feedback and extensive socialization of the same and the HC Directives to use this as a basis, a SWM Policy needs to be articulated and a comprehensive Integrated SWM Plan made with 15 year plus milestones and targets outlined.

The GOI, Planning Commission report has also set out parameters and direction, and this report and the XC report are in conformance and committed to by and large similar outcomes.

A lot needs to be done, but the first step is to outline a direction and then get its citizens to collaborate and come together to discuss and accept the direction and set out plans for implementation.

FINANCE COMMITMENTS AND LEGAL STRUCTURES

Planning and Financial Parameters

Existing contracts and terms of reference are often the baggage that disables change. Hence unless some of the following financial arrangements governing the BBMP and its contracts and contractors change, there is little scope, if any, of dramatic shift in focus.

A few key points:

a. Review of existing contracts: The present contracts reflect a system built on mixed waste, and hence are collection and transport contracts. These need to be amended to become contracts based on collecting and transporting segregated waste for destination bound processing.

   Unless we build a plan for embedding the new philosophy and principles to govern the City we are comparing apples and oranges and running behind a lost cause.

   Current lacuna in system and relevant contracts have to be reviewed by a neutral third-party legal cell, and we request the Hon'ble High Court to mandate a time bound review. Where BBMP needs to pay the vendors to change the clauses that investment is a small price to be paid for correcting the legal frame to base the financial model on a firm legal footing.

b. Presently the Garbage contracts are weight led, and hence we are dis-incentivisng segregation. This needs to be amended and NO weight commitment need be made, especially since we moving towards a Polluter Pay economy and wanting to drive PPP and encourage decentralized capacity to increase.

c. New tender conditions need to be set out for collection and transportation tender for households, markets and slums and generators less than 10kg.

d. Tipping fee to be abolished and replaced with a support fee for processing. Tipping fee to be the gap funding to support processing and upcycling of waste into products for the market place, especially alternate energy.

e. Data and financials to be compared and an analysis to support the recommendation done by a team of technology and urban experts to ensure financial viability of solutions is considered, along with environmental conditions which the MoEF Laws define.

f. Pending contracts/projects that have been stalled to be studied and a closure defined as they put on hold approved lands for SWM and there

is conflict of interest and doubling of expenses

g. Performance review of current projects – brings the existing base line on the same page and start the baseline afresh. Establish a transit Plan for the City moving from mixed dumping to segregated processing of MSW

h. Set up a joint inter-stake-holder cell with the KSPCB – UDD – Expert Committee and BBMP to review quarterly.

i. A financial analysis of the savings accrued to BBMP due to Polluter pay removing Bulk generators from being the primary responsibility for collection of the BBMP to be tabled and recorded.

j. These funds to be allocated for investments in infrastructure and IEC and training of the informal sector

k. SWM Cess, a nominal amount for the BBMP, needs to be abolished in the light of the shift in focus for user fee to be for private service providers or self-management

l. Benchmarks like MNRE to be set up to support and incentivize investment in this sector for a fixed period of 10 years.

SEGREGATION AT SOURCE TO ENABLE DECENTRALIZED DESTINATION-BOUND PROCESSING: THE ONLY WAY FORWARD

The recommendation of the Expert Committee on segregation at source, endorsed by the Ruling of the SC and the Hon'ble High Court Order mandating Segregation and the BBMP Notification announcing segregation and handling of Bulk generator waste separately are a strong legal framework on which to pursue this first and basic step. NO recommendation of this committee can be measured or evaluated without first accepting the premise of segregation. It is the law of the land and the primary responsibility of every citizen.

It has also been repeatedly demonstrated by the citizen of Bangalore that he is willing to segregate, and is frustrated when the Corporation mixes the waste at the primary collection spot or in the truck, nullifying all his efforts.

It is critical here to point out that non-performance of the BBMP to execute a directive, cannot be read as irrelevance of the principle. (Study done of the Kasa Muktha wards also ratified the same. 50-70% citizen segregation and 5-10% destination bound transportation indicating that the balance is re mixed)

IIM –Bangalore Survey done in 2014 has assessed the citizen willingness to segregate and to pay user fee and found a very high willingness for both. (Survey report to be tabled to Hon'ble HC)

The BBMP has invested close to Rs 22 crore in investing in DWCC to enable ward level segregation at source, so as to have a local, accessible space to hold this waste and aggregate it to ensure maximum resource recovery and processing.

Several Apartments are segregating and more keen to take on the onus of managing their own waste, and need some clarity of role both of the Developer and the BBMP.

Some associations have worked with their members, like CII to enable them to move towards Zero Waste Campuses. There is traction for the same, but expect Corporation to clearly spell out the expectation and provide umbrella services and certification standards to be followed.

Recommendations

A transit plan to enable the shift from mixed to segregated needs to be worked Citywide with targets and milestones. The plan assumes that segregation at source is to be applied to ALL generators of waste,

irrespective of who manages the waste.

Time-bound implementation of segregation at source with reducing targets of mixed waste to landfill is the aim. Time bound is a key need, since as long as there is mixed waste BBMP have to collect and transport it to avoid black spots. The costs escalate for dual systems to operate, providing citizens have an option. Only rigorous non-acceptance, with penal action will ensure the rise in the % of segregated waste. In addition to adequate infrastructure and authorized service providers are essential elements for a successful implementation of the same.

At a City level, the ask is to open the market and provide options for management and set systems for rejects and buy-back of compost generated. Special waste categories and authorized vendors are to be empanelled and monitoring and certification systems set in place.
In addition the recommendation includes specific aspects:

- A clear citywide uniform coding system for waste segregation.
  2 bin systems, with 1 bag.
- Standard colors for wet organic waste – for recyclables or Dry waste and for Rejects and inerts. This is a base minimum. Adding sanitary, green waste and all other special categories required and

must be implemented through a service provider network where the processing and resource recovery of those streams is enabled.

- Separation of HH and Bulk generator waste collection infrastructure, timings etc
- Deployment of Penal Provisions
- Continuous education and Training
- Contractor norms and terms to be corrected

Household Collection and Waste Management System

This section details the components required to make D2D or Household collection system effective:

1. Segregation at source is mandatory for all residential premises. While different procedures may be adopted for handling of waste in different types of areas, and different categories may be established for various types of establishments, nonetheless all of the waste shall be segregated at source in every case. Pourakarmikas will refuse collection of mixed waste.

2. Wet organic waste shall be collected daily and put directly into the collecting receptacle. Dry waste shall be collected by a separate vehicle twice weekly and delivered to the DWCC in the ward.

3. BBMP has invested close to Rs 2 crore to establish DWCCs and the following are now ready and to be made operational.

Zone	No. of DWCCs	Complet-ed	Roof Level	Plinth Level	Yet to start/Site under litigation	Functional DWCC centres	MOU with NGOs	Equipment
South	44	37	2	4	1	24	24	15
West	44	36	1	-	7	24	31	15
East	44	41	-	-	3	41	24	24
Yelahanka	11	11	-	-	-	11	11	11
Dasarahalli	8	8	-	-	-	6	6	8
RR Nagar	14	6	-	-	8	6	3	2
Mahadevapura	17	2	1	1	13	2	1	-
Bomannahalli	16	10	2	1	3	8	5	5
Total	198	151	6	6	35	122	105	80

(As on 18.1.2014)

The Functioning and operational rules and roles and obligations of the Contractor, citizen and BBMP reference to the DWCC have to be streamlined and one set of parameters to bring in transparency established. Informal sector participation, and inclusion of existing scrap dealers and kabadiwallas is imperative to the success of the program.

4. All primary collection vehicles (autos, tippers, pushcarts, trucks, etc) shall have either compartment for segregated waste, or separate

bins/barrels. Where large quantities of waste are to be transported, contractors may use separate transport vehicles for each type of category of segregated waste. In either case, only segregated waste shall be transported. Waste generators shall be liable for punishment if they fail to segregate waste at source. (The details of penalties to be imposed shall be included along with the Corporation circulars issued.)

5. Health Inspectors and Environmental Engineers in each ward shall be responsible for ensuring that all premises give only segregated waste to BBMP. This responsibility will be reinforced by departmental action and penalties against errant officials. (The details of penalties to be imposed shall be included along with the circular, when it is issued.)

6. The duties of Praharis shall be fully detailed, and the HIs and EEs shall ensure their full utilization for monitoring and on spot supervision.

7. EEs and HI's shall be responsible for ensuring that contractors have all the equipment and manpower as agreed in the contracts. All transport vehicles used in the SWM program shall be registered with the BBMP and the KPSCB, and may not be used for any other purpose. This responsibility of EEs will be reinforced by departmental action and penalties against errant officials. (The details of penalties to be imposed shall be included along with the circular, when it is issued.)

8. In slums and other unorganized housing areas, BBMP shall create systems by interacting with the people and provide either large bins/drums for segregated waste to be placed within easy access, or 2 collection cycles.

9. In certain areas where black spots dominate and behavioral attitudes need to be addressed, an interim manned kiosk to be provided.

10. Segregated waste from primary collection vehicles shall be taken either to local Dry Waste Collection Centers, or to secondary vehicles for transport. Vehicle-to-vehicle transport shall take place without spillage, and contractors are responsible for ensuring this. EE/ HI to ensure and supervise.

11. Black-spots to be monitored and appropriate solutions and techniques deployed depending on the local conditions and source of the problem. Severe punishment for regular offenders to be

12. Hawkers and street vendors: All hawkers to have a 2 bin system and their waste to be put into a defined space in each ward. It was discussed that coconut vendor waste will be studied and a proposal for collecting and handling will be presented to the Expert Committee. This waste forms

a stream to be recycled.

13. Small shops and Traders: The 2 bins system applies to all shops and they shall place the bins safely outside the door for clearance by the PK. The ward EE will ensure that a timely collection happens and ensure that timings are synchronized on a case by case basis in different neighborhoods.

14. Collection of domestic medical and sanitary waste to be done on pilot basis for estimation of quantities to enable systemic planning and tenders to be defined.

Bulk Generator System

The BBMP has passed a Notification pertaining to Bulk Generators categorized as Commercial & Domestic. A commercial bulk generator must on a polluter pay basis manage his own waste. These entities which generate large quantities of waste as a by-product of their commercial interests, broadly termed 'bulk generators'. The following measures are recommended:

1. All systems, procedures to be as per the National MSW Policy as prevalent from time to time. Programs and initiatives will be guided by

principles enshrined by BBMP in its Long-term SWM Policy.

2. BBMP will not collect waste from commercial bulk generators. BBMP will professionalize the market and authorize service providers who will have dedicated infrastructure and processing facilities to manage this waste. It is also essential to set up a process of monitoring the safe and scientific disposal of the waste generated by these establishments, namely hotels, *kalyana mantaps*, malls, restaurants, *darshinis*. All these establishments will segregate waste at source. All establishments will follow the same uniform color code as advised for the City and maintain a 2 Bin system. All these establishments are expected to process their waste in-situ as far as possible. Where space and quantities justifies collaboration, the bulk generators are to establish shared facilities. BBMP will be responsible for handling inerts+rejects. BBMP will establish criteria, including certification of the processes used, method of disposal and management of dry waste. A proposed system of monitoring and supervision with stringent penal action for offenders will follow as a circular.

3. The penalty for a bulk generator must be linked finally to the renewal of his Trade License, issued by the BBMP as right to operate in that trade,

4. It is recommended that there be a coding system for all bulk generators,

so identity of the generator is available to measure against the norms of generation. Many cities have done this successfully and it brings in greater transparency.

5. Large National Government establishments like Defence, Railways , having multiple establishments and properties and whose consumers generate waste must establish their own systems and facilities to manage and handle this waste. All these bodies to apprise BBMP of the systems set up and ensure that NO littering or dumping of their waste is done.

6. The Government of Karnataka to instruct ALL Government buildings, Offices, PSU's, Public Spaces like LalBagh, Cubbon Park, BMTC Bus Depots etc to set up appropriate systems to manage their own waste. All systems to be in compliance with the BBMP Notifications and as per the Directives of the MSW Rules and the Directives of the High Court.

7. All utilities like Bescom Transformers, and other such conveniences in Public Spaces are to be made responsible for their cleanliness and to keep them such that no dumping and gathering of litter is encouraged.

8. Apartments, as domestic bulk generators, will be mandated to segregate their waste as all other residences. Apartments will follow the same 2 Bin + 1 bag system as Households. BBMP will set up a transparent system of

service providers where user fee range and norms are defined. BBMP is obliged to collect segregated waste from a central accessible point at apartment communities and housing colonies, similar to the manner identified above for residences in layouts till service providers have been authorized.

9. Consultative Process: In the next three months, in consultation with representatives of apartment communities, BBMP will explore whether some of the responsibility for SWM in large residential complexes can be borne by the residents themselves, and which portions must be continued by BBMP. Where communities are already processing and managing their waste in-situ, BBMP will collect the rejects.

Systemic and Institutional Recommendations Involving Key Stakeholders

1. CREDAI: If all builders provide this 100/- segregation kit to residents in newly built apartments, from day one segregation will take place. Also Chute system should be abandoned in all apartments.

2. House Owners: should be made responsible. Garbage vendor has to give defaulters list to health inspector official. Penalty should be added on their property tax.

3. Apartment/ Layout associations: SWM responsibilities should be added to Karnataka Resident Owner Association laws and ROA should be made accountable in managing waste as per the Supreme Court directive.

4. Apartment Management services and Hotel management companies should be play a key role and understand the colour coded process.

5. The BBMP Town Planning Department must not give Occupation Certificate unless management systems for waste are provided and access for collection of rejects and other special categories is enabled. A cut –off date must be announced, after which all Developers to be penalized for dereliction of duty. The same has been done for STP and laws passed to push Rain Water Harvesting in Karnataka and other states very successfully and these mechanisms of consultation and follow up to be Directed.

Specific Categories Waste Generators

Specific Special situations applicable to certain categories of waste generators need special handling : The following measures are recommended :

1. Markets and Santhes - All systems to enable segregation of waste at source will be set in place. In vegetable markets empty trolleys will be placed in different locations in the market, and vegetable waste shall be

deposited only within these. A system to be set in place to send the clean green vegetable waste to the cow-sheds for cattle feeding to be set in place. Records will be maintained for the quantity and the destination it is sent to. Dry and recyclable waste will be taken to centers for aggregation and then baling and recycling. There will be a second cycle of collection, clearance and transport of waste, if the quantities generated daily cannot be held in the trolleys and holding receptacles provided to enable segregation.

2. Slaughter Houses and Chicken and meat stalls : A separate system shall be put in place for animal waste, chicken shops and from the meat and poultry industries, which shall not be mixed with any other category of waste under any circumstances. BBMP shall identify and provide the necessary land for handling of animal waste. The Joint Director (Animal Husbandry) will provide a first draft of the proposed scheme for scientific management of this category as per the Rules and Regulations that govern it.

3. Slums and economically weaker sections where access to reaching the points of generation is limited, will have special and individual systems set up conducive to the need. Segregation at source will be adhered to there as well, and different prevalent successful models to be deployed in consultation with the dwellers. NO littering and dumping and black spot creation is acceptable.

4. Hopcoms shall maintain their vegetable wastes separately, and not mix it with the municipal waste collection. This will be collected and managed by Hopcom.

5. Parks generate a lot of leaf litter and Leaf waste in parks shall be composted within the parks. For very small parks, this may be carried out in nearby larger parks also. Under no circumstances shall leaf waste be mixed with any other part of BBMP's SWM program. Under NO circumstances will leaf litter be burnt on road corners. Leaves from trees in streets surrounding the park shall also in due course be added to the processing within the park. BBMP vehicles along with the municipal dry waste collection in each area shall collect dry waste left behind by visitors to the parks. Shredders shall be installed, along with staff to manage and run it in parks where the tree cover in the neighborhood is high, and the quantum of waste to be composted is large.

6. New Construction sites or repair and maintenance of existing homes. A separate process shall be evolved for building debris, and for sweepings. For debris, the feasibility of using abandoned quarries, as well as recycling of debris into building materials, shall be explored. This waste stream will merge into the special waste category of C&D waste as soon as sytems and service providers are in place.

On a time to time basis these categories are to be evaluated and amended.

CONCLUSION & HIGHLIGHTS

to enable S2S at ground level for BBMP Managed areas

Problems faced for segregation at source as also tabled in the Kasa Muktha report and in reviews and discussions with BBMP Officers need to be addressed on a war footing and correctives taken, in addition to the measures and recommendations listed.

Lack of contractor incentive: At present, private contractors in the city are paid according to the volume of waste they transport and the distance they are transporting it. Because of this, it is more profitable for them to carry larger quantities of waste to landfills on the outskirts of the city. Segregation can reduce the quantity of waste sent to the landfill to a mere 20 percent of the original quantum. Because of this, several contractor employees mix waste post collection.

It is necessary to create mechanisms to monitor waste collection and transportation implement penal provisions for non-segregation as mandated by the Hon'ble High Court. This would involve identifying specific structures and appointing officials to implement penal provisions

as mandated by the High Court. Penal provisions for the Bulk Generators must be severe and linked to cancellation of Trade License.

It must be ensured that adequate training is provided to the BBMP collection staff and that officials to ensure the same are appointed.

It is necessary to ensure that there is adequate infrastructure in terms of vehicles and bins in each ward to store and transport waste in the segregated form.

Enlisting the help of citizens through various forums and Resident Welfare Associations to create a continuous engagement will help the BBMP to better monitor waste collection/transportation systems. The Ward Committee is an existing Constitutional structure which also engages the Councillor in the process and obligation of a clean ward.

IEC and Awareness : Continuous education through a media campaign, neighborhood training, workshops and multi-media efforts are key. It is necessary to create a dedicated campaign for easy recall, and identity and ensure that partnerships with schools, colleges, NGOs etc is done to disseminate the information about the program and roles and responsibilities of the different generator categories. Not all citizens are fully aware of what constitutes wet and dry waste. For instance, many of them are unsure of which category soiled paper and plastic come under. Because of this also, a lot of waste is actually handed over in the mixed form.

A clear allocation of destinations, even if interim, needs to be done. It is evident that the City is in transition, and hence finding ideal solutions will not be possible. The teams of Contractor / BBMP/ citizens and generators need to be instructed about the appropriate destinations and where to store and transfer the waste from small to larger vehicles.

Absence of dedicated vehicle for wet waste is a critical issue for destination bound processing without which segregation cannot work. Not all wards have sufficient dedicated vehicles, but bins can easily be put into place in vehicles to store the categories of waste. Because of this, the segregated waste is mixed during transfer from small to larger vehicle for destination transportation. These interim measures will encourage and give faith to the citizen and while the City moves from one system to the other, time for procuring appropriate infrastructure is built in.

Action Points

- Incentivizing the contractor by paying according to collection/transportation for segregated waste, rather than weight of mixed waste
- Creation of monitoring mechanism and appointing of officials to keep a check on waste management
- Penal provisions to be linked with cancellation of trade license
- Allocation of category-specific destinations in a prompt manner
- Provision for separate vehicles and collection cycles for wet and dry waste

QUANTIFICATION

It is quite evident that for a successful segregation at source system with specific policies by generator of waste type, it is essential that there be good estimates and quantification to ensure that a robust system of monitoring be set in place ensuring all waste generated is being managed and processed as required.

Since there is no comprehensive study that quantifies the waste generated differentially by the different generator categories, (eg large apartments, eateries like darshinis and luxury hotels, slums, markets and campuses,) and also assesses the quantums of different categories of waste by each generator type, the City is compromised and all infrastructure requirements are hence reflected with a range of 3500 -5000 TPD and often beyond.

No planning or policy recommending investments and capacity can be sure unless some of these numbers are ratified. The business models also depend on accuracy of these projections.

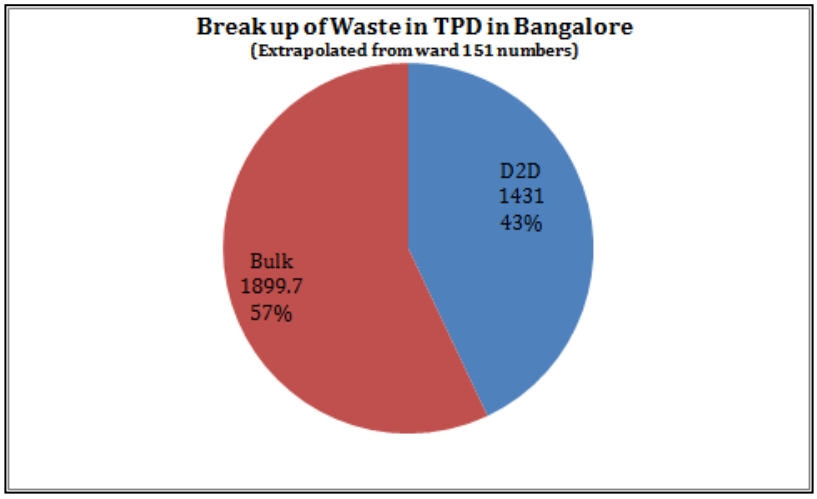
Some norms for generation by classification by waste stream have been taken up by different groups and these to be rationalized. For the time

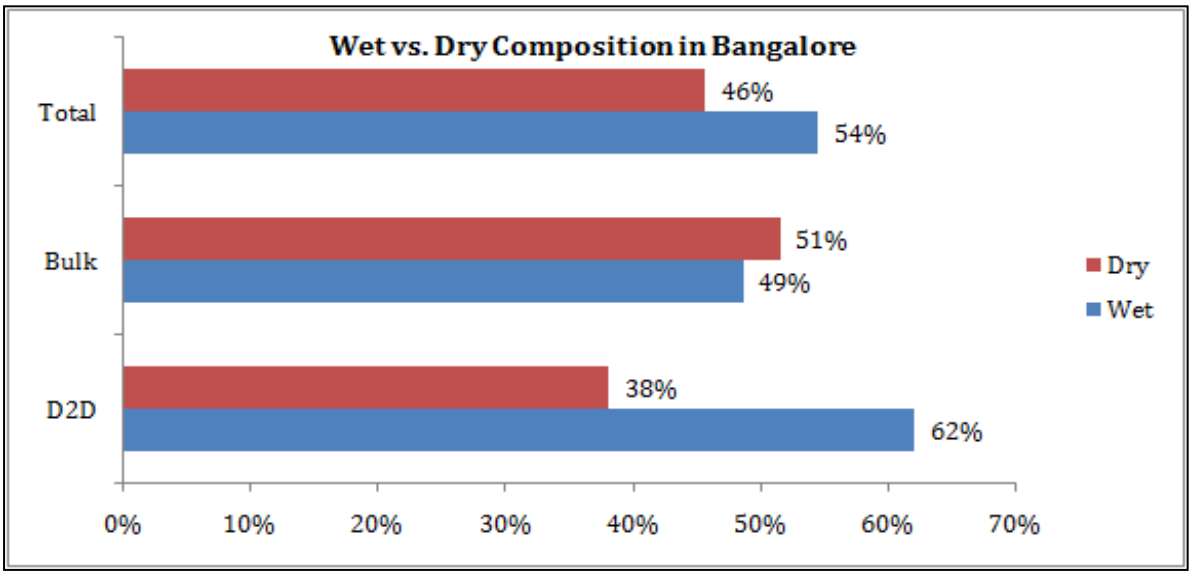
being let us assume these figures basis norms of generation by population as per the GOI standard and norms for wet and dry as per earlier studies.

The figures are as below:

Bulk generator waste: 1899 or 2000 TPD

HH or Domestic waste: 1431 or 1500 TPD





The table above does a divide between bulk dry and wet and D2D. This understanding is essential to put in place systems and policies that encourage and support the informal sector, up cycling and some EPR for resource recovery.

Recommendations

There are a few studies done by different groups for different waste streams and also on per capita generation norms for SEC classifications. These to be compared and a standard accepted for planning purposes.

A limited self-assessment exercise can be taken up for waste to confirm the norms by generator type and by category of waste stream.

This exercise to be time bound, and done by a professional group of experts, including SWM experts. Normative standards to be generated for evaluation basis the categories in the GOI, UDD Baseline norms to set one national comparative benchmark and set acceptable standards to form basis for planning, payments etc Eg standard of waste for 250 student school in a 20 acre campus, vs 250 student is a 1 acre campus?

Norms largely exist for wet organic west generation and few for other special categories eg for domestic sanitary waste there is no study or norm available.

Volumetric weighing of segregated quantities, for different waste streams and GPS tracking for all transport to ensure weighment of all categories must be set up.

There is grave uncertainty around the actual quantum of waste generated in the City, but the only certainty is that over the last six years, there has been a gradual increase in the expenditure incurred by the BBMP on solid waste management. According to the CAG Report, the BBMP's budget allocation for SWM has risen from 193.41 crores in 2008-2009 to 1305.6 crores in 2012-2012. In 2008-2009, the amount being spent on door-to-door collection, transportation and street sweeping was 10870 lakhs across all zones, which has increased to 28754 lakhs in 2013-2014. It is evident from these rapidly escalating figures that the city can't afford to continue on this path – this is especially the case since we are currently paying a tipping fee as high 130 Rs/ton whereas only 28 percent of waste is being processed.

In 2004-5 the cost per ton of collection of MSW was Rs 781 per ton, which has now risen to Rs 2440 per ton in 2013, with no visible difference in the

visual cleanliness, the collection mechanisms, or the actual waste being processed

DECENTRALIZED PROCESSING

Along with implementing 100 percent segregation at source, setting up decentralized processing facilities is one of the fundamental principles around which the BBMP's approach to solid waste management has been shaped post the waste crisis in 2012.

Creating options for processing different categories of waste at the ward or zone level has been not only cuts down on the cost of transporting waste across long distances, but also creates clusters of self-sustaining

wards, encouraging the idea that waste needs to be taken care of in the area that it is generated. The benefits of a model of decentralized processing have been listed below:

- Waste managed near to the source of production in an efficient way
- Ease of MSW management
- Transportation costs are greatly reduced
- Useful product can be obtained
- Reduced carbon footprint

The Principle of Decentralized management and handling of waste, and moving away from centralized infrastructure is a necessary premise of integrated management of SWM and taking responsibility for the geographic boundaries of administration for cities and panchayats. It is also extended to ensure that neighboring villages and panchayats do not bear the brunt of other cities waste, without consent. Hence Reduction and Recycling become essential to the success. Any study of smaller towns and experiments clearly points to the fact that over 250 TPD becomes difficult to manage, and has a different set of problems. Hence if the 8-20 TPD generation per ward and up to 250 TPD at Constituency level, or Zonal levels are the baseline, setting systems to manage them will be easier.

Keeping this in mind, the BBMP has been setting up processing options at the ward and zone level by encouraging private participation and

supporting private entities who are looking to do business in the field of waste. In terms of infrastructure, this includes the setting up of Dry Waste Collection Centers at the ward-level, as well as 16 bio-methanization plants that can serve as a destination for wet food waste.

Levels of decentralization

There are various levels at which facilities for waste treatment have been set up. These include:

At the household level: In many cases, households compost their own wet waste on a daily basis, with the help of equipment such as composting pots and kambhas.

At the community level: There are several examples of community-based shared services for processing waste. Here, facilities for in-situ management of wet waste, and secondary sorting of dry waste are set up for a group of households or generators, to ensure that as much waste as possible is processed in-house. Two of the most common instances of community-level processing are:

a) Apartments and gated colonies: Since the BBMP does not supply waste collection services to bulk generators, and private contractors are unreliable and often charge exorbitant sums on a monthly basis, the management of several apartment complexes and gated colonies in the city have taken matters into their own hands and set up facilities for in-situ processing. While pushing up the levels of source segregation among residents remains an on-going effort, many of them have arranged for the space and staff to handle wet waste in-situ. This includes purchasing OWCs and equipment to compost wet waste on a daily basis, as well as employing trained staff to handle the same.

   In terms of dry waste, some residential bulk generators have invested in space, equipment and manpower to carry out secondary sorting of dry waste – ie, sorting it into different categories of paper, plastic, metal etc. The sorted dry waste is then sold to local kabadiwallahs. Wet waste, on the other hand, is composted in bins and the resultant manure is distributed among the residents of the colony. In this way, the total quantum of mixed waste that has to be transported from the locality has reduced from 500 kg to a mere 25 kg per day.

b) Companies: Various corporate organizations have also undertaken to set up in-situ processing facilities within their campus. The measures undertaken to them are very similar to those taken up by residential bulk generators.

At the ward level: Most processing facilities that have been set up at the ward level have been funded and supported by the BBMP. These include options for both wet and dry waste. The most common examples of ward-level processing options have been listed below:

a) Dry Waste Collection Centres: Dry Waste Collection Centres, or DWCCs, are centres set up by the BBMP as destinations for ward-level dry waste. The DWCCs are equipped with appropriate infrastructure capable of purchasing, collecting, aggregating and processing both high-value and low-value dry waste. Waste that is brought here is further sorted, baled and sent either to wholesalers to secondary processors.

b) Bio-Methanization units are running in 2 wards and 5 others are near completion.

Landfill reduction with a target of maximum of 15% of City waste into

Landfills as the eventual goals over a period of time. The logic of this is today other than recyclables and organic, all mixed waste streams are going to landfill, and once mixed the recovery is minimized. Hence once the streams are collected and transported separately, debris or C&D, Sanitary, Hazardous, e-waste, Garden waste they all have ready markets and the % of silt, and inerts left by international standards is less than 15%. Hence the sanitary landfill capacity required comes down, and with proper management and supervision the duration and effectiveness of a landfill is over 35 years thereby reducing the quantum of land to be allocated for the purpose. The reason for the landfills to be out of developed areas is the size of land required. Unfortunately, it adds a tremendous burden of transport costs with no investment and recovery, unless the waste is segregated and transported to specific processing facilities set up to utilize the resource by category. Eg C&D , laminates, tetra pak etc.

Recommendations

1. The concept of decentralization has many advantages and also some challenges that need to be addressed to maximize this opportunity of destination bound processing for wet waste, and having aggregator infrastructure in the form of DWCC to sift, sort and ensure maximum up cycling. Even the Kasturirangan report of the Planning Commission Task

Force recommends PPP for processing in both centralized and decentralized processing options both for organic waste for bio-meth, composting and for appropriate technologies for dry waste.

2. Political will is essential in finding appropriate land in the wards, and having uniform applicability to reduce the NIMBY syndrome. These can go a long way.

3. In addition Transition from dumping to processing with focus on decentralization will ensure the fastest visual cleanliness results and bring in citizen accountability and pride.

4. SWM cess to be returned or abolished for those processing and managing waste in-situ.

5. Opening the market to get private people who have land, professional vendors and practitioners to participate through PPP mechanisms and grants like MNRE gave to incentivise the alternate energy sector.

6. No cess for those entities that manage and process their waste.

7. Rejects and inerts to be the responsibility of BBMP to collect and transport, or empanel and authorize for scientific disposal in landfills.

8. Incentives to get new people into the business of investing in infrastructure:

9. Tipping fee to be converted into support fee for processing. This fee should be made available to any party, a RWA, or a private party who manages waste and convert and process it.

10. For RWA and individuals who compost waste, BBMP to be supported by GOK to buy back the compost.

11. Standards for compost to be defined and normative standards for resource recovery to be established by the Pollution control Board and other academic institutions.

12. There is an absence of norms, standards and any kind of evaluation or assessment parameters and we seek the HC to direct the creation of a dedicated regulatory agency .

13. Ward/constituency level: Need a norm for size and processing capacity correlation – according to KCDC standard, norm would be 10 tons per acre. If 250 tons is smallest capacity for decentralized processing, then average size is 2.5 acres+buffer area.

14. Decentralization should be implemented at zonal level , and for this a pilot in a time bound manner to be initiated with immediate effect. A team consisting of local residents, Councillor, representatives of the Expert Committee and other Govt bodies as required to be set up.

15. Roles and responsibilities of Ward-level committee to be defined clearly.

Conclusion

Decentralization is a phenomenon that needs to be implemented and it is preferable to do it in the outer lying areas first as land will be easier to get and allocate. Zones can combine with CBD zones on a fee basis to share responsibilities and shared processing capacities of private parties, and BBMP infrastructure will create sufficient options and market dynamics.

PPP is as per the Report of Planning Commission recommendation through Venture funding the only way to build processing capacity, bring in new technologies for up cycling and maximize resource recovery through segregated collection of different categories of waste.

TECHNOLOGY OPTIONS

AND BIO-REMEDIATION to be added from XC NO burn note and Spcl wastes as per the stipulating law.

Landfills management

1. Special categories of waste
    a. EPR and the policy requirements for special categories. Building a role for an aggregated waste plan to enable maximum processing.
    b. Special categories include
        i. C&D
        ii. Sanitary
        iii. E Waste
        iv. Bio-medical
        v. Hazardous
        vi. Slaughter house

vii. Green

c. Materials like Paper, laminates, plastics to be aggregated and enabled for upcycled conversions

d. Responsibility for special wastes will be as per market forces and vendor empanelment

e. Sanitary waste: special category, the generator should keep it separate. BBMP: office medical wards should make provision for people to drop it off. BBMP should either establish incinerators to incinerate the biomedical waste or they should tie up with various agencies to manage it – that is BBMP's responsibility. Handling of special waste: centralized facility but sorting will be decentralized. Aggregator type economy will be set.

f. Dry: centralized, standardized procedure from DWCC, irrespective of who operates them.

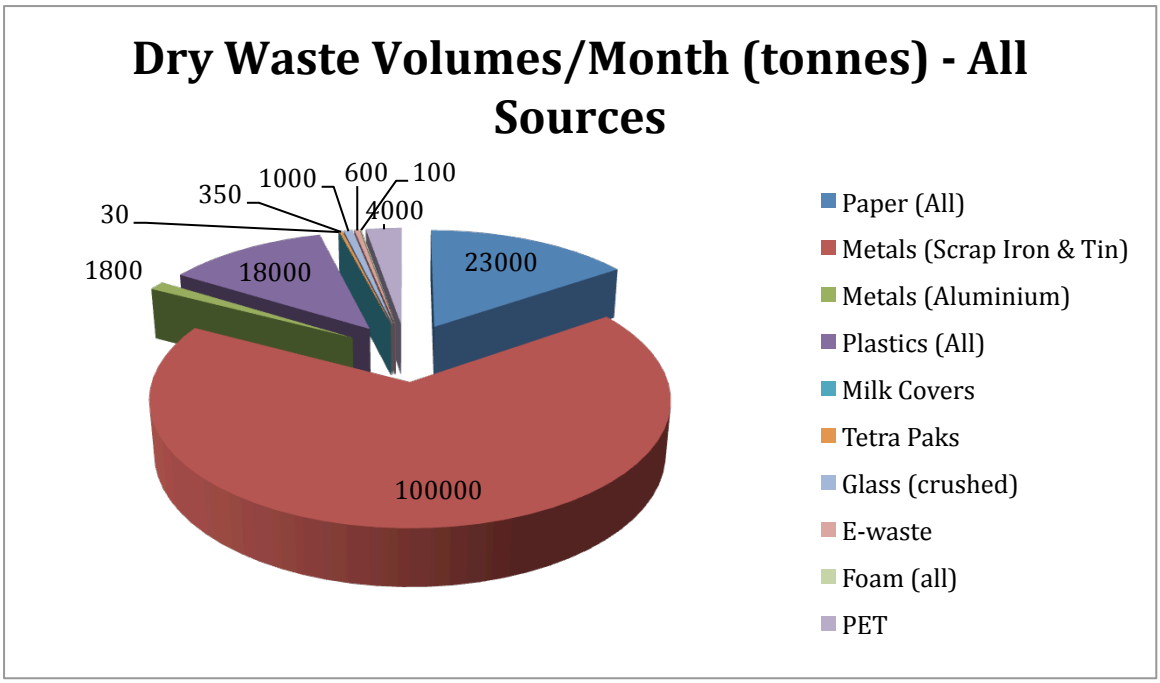
(market for processing to be brought in)

THE MARKET SIZE AND POTENTIAL FOR PROCESSING OF RECYCLABLES

(NEED FOR A POLICY ON EXTENDED PRODUCER RESPONSIBILITY)

Dry Waste Collection Centres or DWCCs, are centers set up by the BBMP as destinations for ward-level dry waste. The DWCCs are equipped with appropriate infrastructure capable of receiving /purchasing, collecting, aggregating and processing both high-value and low-value dry waste. Waste that is brought here is further sorted, baled and sent either to wholesalers to secondary processors.

Recent dialog and assessments from practitioners which took a deeper look into the functioning of the city's Dry Waste Collection Centres (DWCCs), waste processors as well as dealers in Jolly Mohalla, a wholesale market for waste, has demonstrated an extremely vibrant and robust dry waste market. This market comprises a range of goods of extremely high value. For instance, in the case of newspaper, it is estimated that around 9000 tons are generated every month, which comprises a market of ₹ 13.5 crores. Similarly, 6000 tons of carton boxes are generated in the city per month, amounting to a market of ₹ 5.1 crores. In terms of plastic, estimates indicate that around a monthly generation of 18,000 tons is worth around ₹ 81 crores. Broken glass, of which around 1000 tons are generated monthly, has a market of ₹ 4.5 crores.



By this estimate, the total quantity of dry waste that is generated in Bangalore per month is around 148,880 tons.

Bangalore's total capacity to process dry waste is around 62,000 tons per month. However, for some categories, there is either limited or no processing capacity in the city. For instance, while around 100,000 tons of scrap metal is generated per month in Bangalore, the city only has the capacity to process around 35,000 tons. In the case of Tetrapak, there is a processing gap of around 250 tons. The estimated market and processing gap for different categories of waste has been studied.

Thus, there is huge market opportunity here to invest in processing facilities and maximise resource recovery; if waste is segregated at source, we can look at realizing this full capacity by routing the appropriate categories of waste to the appropriate destinations. However, failing to do

so will result in a loss of potential revenue. In the case of Tetrapak, for instance, around 330 tons are generated per month, whereas only 100 tons are collected and recycled in the city. Given that the value of Tetrapak is Rs 8/kg, the revenue loss for DWCCs and aggregators because of this ₹ 18.4 lakh.

For those categories for which there are so far no known processing technologies for post-consumer reuse, it is necessary to define a strategy by including producers as the west has done, and ensuring that active participation to create a formally defined EPR (Extended Producer Responsibility) policy.

Back-end tie-ups: Back-end linkages to aggregators have been set up for most categories of waste. Direct tie-ups with processors is very rare because of the following:

- Volumes accumulated (eg, PET, paper, metals) is too little to be sent to processors directly.
- Plastics have to be segregated into at least 25-30 categories before being sent to processors. DWCC staff are not trained to differentiate all the different categories of waste.

VENDOR EMPANELMENT

The BBMP has adopted the policy of separating domestic and bulk generator collection systems, with the view of reducing the burden on its own waste management capacity.

The BBMP is also aware that despite not providing waste management services to bulk generators, it cannot ignore its responsibility of implementing a responsible solid waste management system in the city. Thus, in its capacity as an enabler, it is setting up a regulatory framework within which these private contractors are expected to operate. Through this framework, the BBMP intends to ensure that segregation at source is implemented; waste is handled responsibly and transported to the appropriate destinations.

BBMP has to authorize and empanel service providers and determine service level criteria and conditions which reflect the MSW Policy and also the KMC act. In September 2012 BBMP issued a notification to all bulk generators in the city, mandating that they manage their own waste. This is following the 'polluter pay' principle, wherein generators who produce waste as by-product of commercial activity are expected to manage this waste as well. In this case, since the generator is not using the services of the BBMP, the SWM cess should be cancelled.

Several bulk generators have experimented with systems for handling wet waste within their premises, including composting and bio-methanization techniques. However, not all can manage waste in –situ and hence shared services are required which are run by these empaneled service providers.

Also external support is required to handle dry waste as well as special categories such as sanitary waste and construction/demolition debris. Bulk generators are thus hiring private contractors to collect and transport these categories of waste. With no framework in place these 'responsible generators; are being presently exploited in terms of varying rates and no guarantee of destination and responsible handling of their waste.

At present, there has been very little effort to quantify the number of bulk generators in each ward of the city, as well as the amount of wet and dry waste generated by them.

There are currently around 30 lakh commercial entities in Bangalore. There are also many bulk generator groups such as CREDAI and CII who are willing to take on the responsibility of self-management of waste. It is however, necessary to provide them with a framework within to operate as well as options in terms of service providers. At the same time, it is critical to keep focus on destination-bound processing to ensure that illegal dumping of bulk waste does not become the norm.

Accordingly, the BBMP is required to initiate a program of service provider enlistment as per category of waste. Apart from approving service providers, decentralized destinations for different categories of waste need to be identified for a responsible system. Currently, there is a lack of processing capacity in the city. Hence, it is necessary to incentivise processors and transporters to invest in waste treatment opportunities and bring more professionals into the field of solid waste management.

Through the system of enlisting vendors, the nexus between existing SWM contractors as well as the new service providers needs to be broken in such a manner that all waste contractors professionalize their practices and offer generators more efficient service.

There also needs to be more accountability of both the service provider and bulk generator in the case of mismanagement of waste. Hence, a transparent online system for tracking waste flow and keeping a check on contractor services is an important aspect of the program. Moreover, certification norms for third-party approval are also required.

- There is a Processing capacity Gap which we hope will get addressed within this framework.
- Corporation will mandate the use of compost generated by citizens for use in public parks and for procurement by the Horticulture Department.

Vendor Responsibilities for Bulk Generators:

- Vendors should be registered with BBMP and his details, vehicles numbers, waste disposal destination details and customer review should be available on a BBMP Ward SWM web page. Vendors also should upload monthly reports on processing and destination delivery of waste of all categories from the different generators they are contracted with.

- Bulk generator codes will ensure no duplication and also create generator accountability and vendor responsibility
- Any vendor found burning waste should amount to cancellation of the license to operate.
- BBMP to Accept reject waste at the collection point from all vendors for a fixed fee. So by accepting reject from all vendors at for a fixed fee will ensure a fair market for all. This is very important to avoid any contractor mafia.
- Any vendor, if found to be either accepting mixed waste or mixing the waste, the license should be cancelled immediately.

Recommendations

The Kasturirangan report also strongly recommends the deployment of PPP and inviting capital investment in setting up infrastructure for management and processing and to look at Gap funding for O&M costs till the new system stabilizes.

INSTITUTIONAL/ORGANIZATIONAL

1. Institutional Mechanism

   Having a cell

   No dual responsibility

TECHNICAL/OPERATIONAL

2. Infrastructure at City level and illustrative examples
   a. DWCC investment made – Performance status – Renewed role
   b. Rag-picker community and numbers – Status n inclusion
   c. Apartment and gated community initiatives: Citizen engagement and responsibility
   d. Corporate companies and the initiatives taken – in-situ management
3. Bio-remediation and handling Historical waste
   a. Handling of landfills and identification of alternate landfill site
   b. Historical waste and bio-remediation plan and timelines

(Reviewed professionally with central parameters to be executed zonally – define process of bio-mining versus

4. Processing & Approved Technologies

Technologies for Processing and metrics for handling of waste by TPD. The technology by-products environmental impact as per the MSW rules and the Draft Bye laws stipulated from time to time.

As per the SC rulings, the technology need to be compliant with conditions set – as new technologies emerge, as long as they are economically-viable and environmentally sustainable, should be reviewed from time to time. We do not recommend waste-to-energy, bioremediation is the only one.

HUMAN RESOURCES

1. Ongoing Continuous Communication and Training

Training and IEC for BBMP staff, Processing facilities, Citizens and vendors. On going and continuous training and workshops to build messages

Skill for maintenance as well.

PUBLIC AWARENESS/STAKEHOLDERS

2. Citizen engagement
    a. Citizen engagement as a structured voluntary role – Scope and advantages – Shuchi Mitras
    b. Competitions and pride in neighborhoods – Building Community ownership for visual cleanliness
    c. Empowerment of the citizen for parallel mustering

BEST PRACTICE: INDIAN CITIES

As per the CPCB Report (2012-13), urban municipalities in India generate 1,33,760 metric tons of waste. However, the report of the Planning Commission Task Force (May 2014) indicates that only 19 percent is actually processed, and the rest of the mixed waste is dumped in landfills. There is a lot of debate amongst the activists in Indian Towns and with the Hon'ble Supreme Court setting strict guidelines and timelines, the municipalities are all attempting different strategies.

In order to analyze these with meaning and relevance to Bangalore, we have attempted to analyze these with a comment on the Front-End and Back-End systems.

The Front end refers to the means and methods that are citizen facing. What the resident experiences and sees and how these efforts are organized. Back-end refers to the processing and technologies and the type of infrastructure, vendors where information was available and state of affairs.

A process flow table outlined in the Planning Commission Task Force report, which highlights the front-end and back-end processes as described above, has been included below.

SOLID WASTE PROCESS FLOW DIAGRAM

(Source: Planning Commission Task Force report, May 2014)

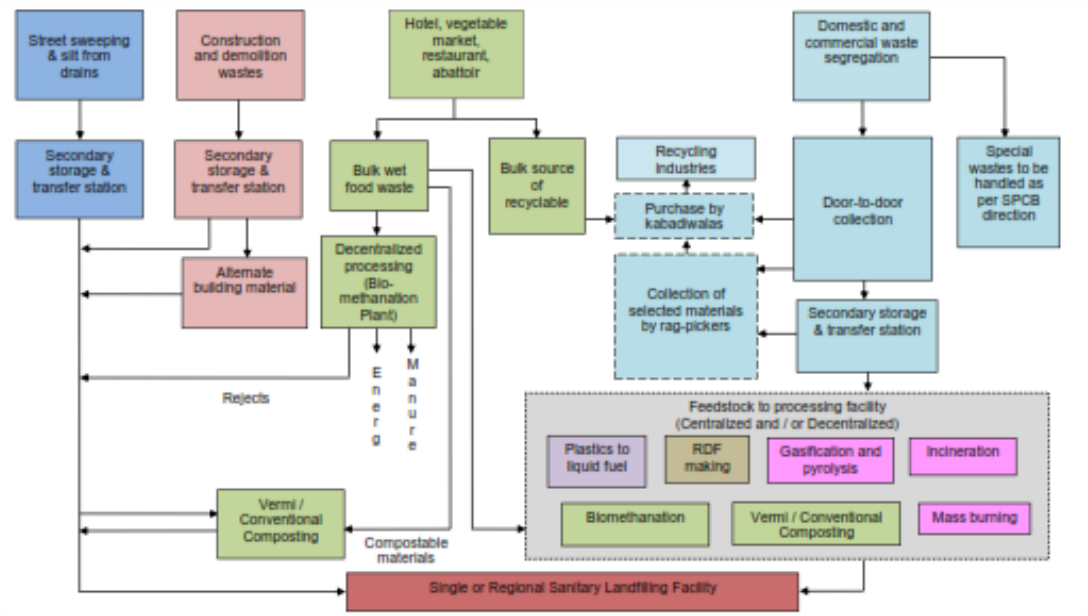


Figure A: Integrated MSW Management System for the Population of more than 2 Million

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FUNCTIONS OF MUNICIPALITY: Front/Back-End Systems

(Source: Planning Commission Task Force Report, May 2014)

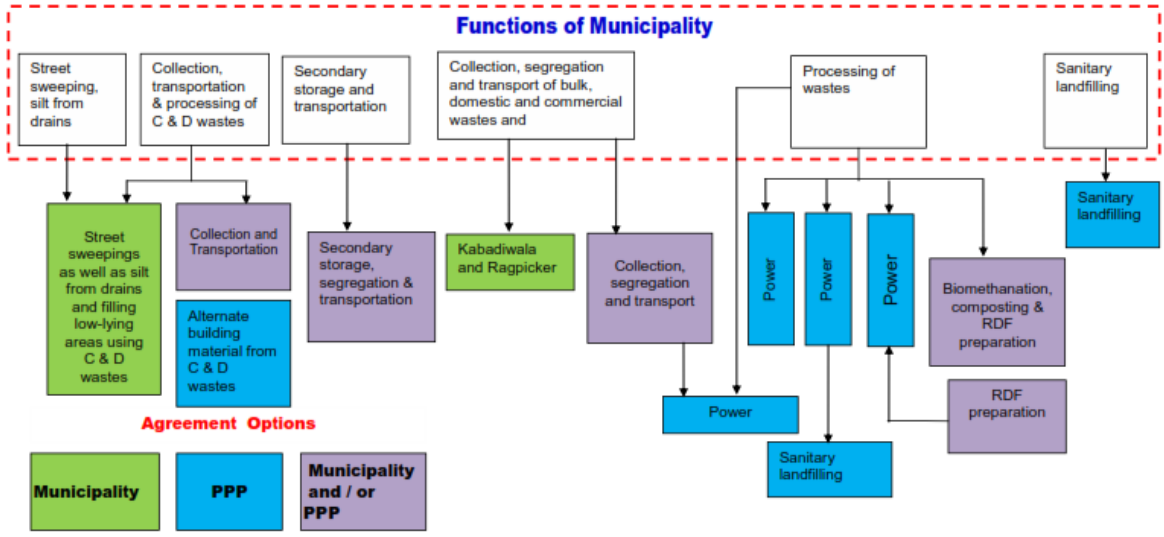

Figure B: PPP Agreement options for Integrated MSW management available to municipal authority

The section has been divided into population-related categories based on the division in the Planning Commission report. A lot of the smaller town learning's are relevant for Bangalore in a decentralized way where the size of population and waste generation can be compared to that of a zone, or a Constituency.

General Statistics

City	Area	Population	Waste generated/day	Per capita generation/day
Mumbai	603	18,414,288	6,500	0.352
Delhi	431	16,314,838	7,500	0.459
Kolkata	186	14,112,536	4,000	0.283
Chennai	174	8,696,010	4,500	0.517
Hyderabad	172	7,749,334	3,000	0.387
Ahmedabad	281	6,352,254	3,500	0.550
Pune	243.84	5,049,968	900-1400	0.178-0.277
Surat	212	4,585,367	1,565	0.341
Nagpur	217.65	2,497,777	700	0.280
Trivandrum	177	1,687,406	171	0.101
Nashik	259	1,562,769	300	0.191

Rajkot	163	1,390,933	500	0.359
Salem	124	831,038	315	0.379
Waranagal	68	620,116	146	0.235
Panaji	36	99,677	150	1.50

	Population: 2 million and above
	Population: 1 to 2 million
	Population: 1 lakh to 1 million

Population statistics according to 2011 census.

The purpose of including smaller towns with a population of less than 2 million in this report is to illustrate how a decentralized model can be implemented in Bangalore by focusing on smaller sections of the city. In the case of the larger towns, key learning is in methods and practices of investment, infrastructure and resource recovery.

MUMBAI

Population: 18,414,288
Waste Generation: 6,500 TPD
Per Capita Waste Generation: 0.352 kg/day
Area: 603 square km

Front End

The Municipal Corporation of Greater Mumbai operates a huge fleet of 983 municipal and private vehicles for collection of waste, making 1396 number of trips each day. These include small and large compactors, tippers and dumper placers.

The waste is taken to one of three transfer stations at Mahalaxmi, Kurla and Versova. Most of the emphasis is on the front-end part of the process, including collection and street sweepings as well as transportation. The other two areas on which the Corporation is focusing includes bringing in the private sector and introducing new technology. There are strict rules for apartment complexes and against dumping of waste.

Back End

Mumbai's municipal corporation has experimented with different area plans for the processing of waste. Currently, the city is functioning on a landfill-based model of waste management although experiments and trials in the field of waste to energy are taking place. Mumbai also had a centralized composting unit on the same lines as the KCDC; however, it has been shut down. The city is also experimenting with decentralized processing models in suburban neighbourhoods.

Problem Areas

- Very little segregation at source
- Huge transport cost because of size of city

DELHI

INSPIRATION FOR BANGALORE

👍 **Private sector participation**
👍👍 **Guidelines for Bulk Generators**

Population: 16,314,838
Waste Generation: 7500 tons/day
Per Capita Waste Generation: 0.459 kg/day
Area: 431 square km

Front End

There are three agencies responsible for Municipal Solid Waste (MSW) management in Delhi namely the Municipal Corporation of Delhi (MCD, which was recently subdivided into three autonomous entities), the New Delhi Municipal Council (NDMC) and the Delhi Cantonment Board (DCB).

The operation of street cleaning, waste transportation and waste disposal is done by the MCD. The secondary collection and transportation of MSW is done through private concessionaires in six zones. In four zones the secondary collection and transportation of garbage is done by the Corporation involving a large number of staff, mobile equipment and plant. Waste holding centres were installed in most neighbourhoods. An organization called Chintan also did national-level work on creating an inclusive system that incorporated the informal sector.

Back End

An initiative of the Corporation in two Zones from July 2009 takes care of the primary and secondary collection and transportation of garbage to so-called Sanitary Landfill Sites, which are actually open dumps of untreated waste that are sometimes covered with soil.

Twenty landfill sites have been developed since 1975 of which 15 have already been closed and two have been suspended. There are at present three landfill sites in operation: Bhalaswa, Ghazipur and Okhla.

There are three composting plants at the sites, which have a total capacity of 600 tons/day.

Problem Areas

There is no emphasis on segregation at source or

processing of different categories of waste. The model is based on transport and is centred around the landfill.

- The waste-to-energy plant at Okhla is creating enormous neighbourhood pollution by smoke, soot and dioxin emissions. It is likely to be shut down anytime.
- The waste-to-energy plant at Gazipur is seriously delayed and yet to commence operations.

INSPIRATION FOR BANGALORE

👍 Composting

👍 Neighbourhood waste holding centres

👍👍 Inclusive approach towards rag-pickers

KOLKATA

Population: 14,112,536
Waste Generation: 4000 tons/day
Per Capita Waste Generation: 0.283 kg/day
Area: 186 square km

Front End

The solid waste management system in practice in Kolkata comes under four heads: sweeping, collection, transportation and disposal. It is handled by the Kolkata Municipal Corporation.

Waste that is generated by domestic and bulk generators in Kolkata is rarely segregated at source. Mixed waste is stored in common bins and this collection, as well as waste from street sweepings, is transported from source to one of the city's 664 collection points.

Back End

Kolkata's 'Dhapa One Mile' is famous for vegetable-growing on city waste, which also supports nearby fisheries.

A compost plant functioning there is to be dismantled to install a proposed waste-to-energy incinerator.

Problem Areas

- Limited segregation at source
- No investment in infrastructure to promote segregation

CHENNAI

Waste Generation: 4500 tons/day

Per Capita Waste Generation: 1.003 kg/day

Front End

Every day, an alleged 4,500 tons of waste is collected and removed from Chennai city. In addition to this, around 700 tons of building debris is also generated in the city on a daily basis.

Segregation at source is promoted but not mandatory in Chennai. At present, 95 percent door-to-door collection has been implemented in the.

Collection efficiency has been promoted with the introduction of a fleet of 2,800 tricycles. Each worker has been assigned a work schedule, and provided with equipment like brooms, baskets, brushes, iron plates, containerized push carts, tricycles and wheeled bins.

Back End

Segregated waste is taken to a transfer station, according to routes schedules that are drawn up for all vehicles. Heavy vehicles make two trips a day while light vehicles make 4 trips a day. There are 11 transfer stations that are currently operational.

At present, untreated mixed waste is dumped and partially covered with debris. There are two disposal sites:

- Kodungaiyur: The size of this site is 200 acres and it has been operational for around 30 years. It is estimated that the site cannot be used post 2016. Daily, between 2100 and 2300 tons of waste is dumped here.
- Perungudi: This site has been in use for 25 years and is also expected to become saturated by 2015. 2200 to 2400 tons of waste is brought here everyday. The
- size of the site is 200 acres.

Investments have been made to promote efficiency of waste dumping, including constructing transfer stations, patching up roads that lead to the dumping

ground and replacing collection lorries with compactor vehicles. 15 shredding machines in 15 zones have been procured at a total cost of Rs 23.2 lakhs for shredding thin plastics below 40 microns, which is then being used to lay roads.

INSPIRATION FOR BANGALORE

- **Investment in infrastructure**
- **Decentralized collection**
- **Experimented with PPP model for collection/transportation**

HYDERABAD

sweepers employed by the

they are also entrusted with the duty of collection. They are given carts and tricycles and collect waste from the households, charging a small amount each month. Around 5000 waste collection containers and distributed across the city and waste is brought there either by the sweepers or residents themselves.

Back End

The collection containers are transported to transfer stations, where waste is loaded on to trucks and taken to the dumpsite in Jawaharnagar, which is around 40 to 50 km outside Hyderabad. Ramky's existing composting facility at Jawaharnagar is grossly inadequate to process the waste received, for which a tipping fee is charged. A waste-to-energy plant has been planned but delayed by several years.

There is also a robust informal sector in Hyderabad, which does its part to recover recyclables from the MSW. This is brought to aggregators and wholesalers who route them to recycling factories.

Problem Areas

- No segregation at source
- The emphasis of the system is on transport and dumping, rather than resource recovery

AHMEDABAD

INSPIRATION FOR BANGALORE

👍 Sufficient infrastructure for D2D collection

👍👍 Aggregation of recyclables in the waste chain

Population: 6,352,254
Waste Generation: 3500 tons/day
Per Capita Waste Generation: 0.550 kg/day
Area: 281 square km

Front End

The Ahmedabad Municipal Corporation provides basic solid waste management services to its citizens. Waste is collected,

transported, treated and disposed of according to the MSW Rules.
The AMC has outsourced some of the work to private contractors. Almost 61 percent of the MSW is collected from municipal bins and street sweeping. Street sweeping is carried out by more than 11,000 workers in two shifts. The AMC has also appointed contractors to collect waste from residential units in the morning and commercial units in the evening. This is done in closed Hydraulic Euro III vehicles, to make the process more hygienic. More than 600 vehicles have been deployed for this collection.
The AMC has identified 1,100 locations as waste collection points. 725 closed storage bins have been provided at 597 sites for waste collection. The collection and transportation of bio-medical waste from 5 municipal hospitals, referral hospitals and 59 urban health centres to an incineration plant has been contracted to Semb Ramky Environmental Pvt Ltd and Bio Medical Waste Management Pvt Ltd.
It has also launched a Sanitation Mobile Court, which is dedicated to disciplining those who litter and help keep the city clean.

Back End

The AMC has entered into contracts with a variety of agencies to treat MSW. Six transfer stations of 400 tons capacity each are being set up in five zones, and at each station there will be 2 stationary compactors and 10 large containers (of a capacity of 10-12 tons).
Kitchen waste from hotels and restaurants is transported to a composting plant run by Excel Industries Ltd. Currently, more than 1,000 units are covered through this system. The AMC also entered into an agreement with Excel Industries Limited in 1997 to convert 500 tons of MSW per day into compost. 25 acres of land have been provided for this

purpose. The contract was for 15 years and has now expired.

The UPL Djai Power Ltd processes 250 tons of MSW per day into RDF, pellets and fluff. RDF is used as fuel in boilers as a substitute for wood, coal and furnace oil in industries. 15 acres of land have been provided for this purpose.

Creative Eco Recycle Port Pvt Ltd has been contracted to process around 800 tons of MSW per day into refuse, paper, plastic, wood and fuel, which is also used as substitute for fuel in boilers. 12.5 acres of land have been provided for the plant, which is still under construction.

The AMC has also signed an agreement with Hanjer Biotech Energies Pvt Ltd for processing 500 tons of MSW per day into multiple products like compost, fuel pellets and RDF. 50,000 square meters of land have been provided for the plant, which is also still under construction.

A scientific landfill of 12.88 hectares has been constructed at Gyaspur. It has a capacity of 11.5 lakh tons. 68 hectares of land has also been earmarked for future need of 30 years in 5 stages.

Steps have also been taken to promote the processing of green waste. Citizens can register with the AMC and send their green waste to the OWC at Excel Industries Ltd.

INSPIRATION FOR BANGALORE

- **Sanitation mobile court**
- **Arrangements for bio-medical waste**
- **Destination-bound processing**

PUNE

Population: 5,049,968
Waste Generated/Day: 900-1400 tons/day
Per Capita Waste Generation/Day: 0.178-0.277 kg/day

Front End

For administrative purposes, Pune has been divided into 4 zones. Pune's solid waste mechanism too emphasizes the importance of segregation at source and decentralized processing. A part of the collection, resource recovery and processing has been outsourced to SWaCH (Solid Waste Collection and Handling), a cooperative of waste-pickers. A number of PMC rag-pickers have been assigned

collection duties as well.

The PMC has carried out awareness campaigns to promote segregation at source. However, 100 percent segregation is still not a reality. Waste is collected from the doorstep on a daily basis and after the recovery of recyclables; it is transported to a designated PMC collection point with closed containers. A total of 5,500 rag-pickers are registered with the Pune Municipal Corporation and of these, 1836 are engaged in door-to-door collection. They are provided with identity cards, uniforms, equipment like wheelbarrows and safety gear. Citizens have to pay Rs 10 per month as a user fee to the PMC rag-pickers.

Back End

Solid waste that is collected from the city is either transported to a compost plant or dumped at Devachi Urali, which is 20 km from Pune. The Hanjer compost plant also open-dumps waste that it cannot process, because of which it was briefly shut down. During this time, wet waste was handed over to farmers for composting. However, the plant has since reopened.

The duty of monitoring has been assigned to five parties: The Pune Municipal Corporation staff, SWaCH coordinators and ward supervisors, concerned residents, local NGOs and the ward councilors.

Problem Areas

- Segregation at source is still not a reality, and mixed waste continues to be routed to the landfill.
- Open dumping is still amply prevalent

SURAT

Population: 4,585,367
Waste Generated/Day: 1565 tons/day
Per Capita Waste Generation/Day: 0.341 kg/day
Area: 212 square km

INSPIRATION FOR BANGALORE

- **Empowerment of self-help groups and rag-pickers**
- **Monitoring mechanisms**

Front End

The Surat Municipal Corporation has implemented a series of strategies that primarily aim at bettering the waste collection system in the city. Attention is also being paid to cutting down on the waste sent to the landfill by adopting suitable technology. At present, waste is being collected, sent to a transfer zone and from there routed to a disposal site. It is ensured that the transport vehicles and transfer zone are covered and hygienic. The SMC is also investing in a more efficient collection system,

as well as combining manual and mechanical labour for day-to-day cleaning. This involves synchronizing systems of waste transportation to the transfer site to prevent rubbish heaps on the streets. Only covered vehicles are used to transport waste. Involving the citizens in creating a clean urban space is an important part of the agenda.

Back End

The SMC is looking to construct four more semi-close body transfer stations to strengthen the existing collection, transportation and secondary transportation system. Attempts are also being made to invest in processing facilities for waste (including safe handling of bio-medical waste), and the SMC intends to generate revenue through the same.

INSPIRATION FOR BANGALORE

👍 👍 **Integrated approach towards solid waste management**

NAGPUR

Waste generation: 700 tons/day

Per capita waste generation: 0.291 kg/day

Front End

SWM in Nagpur is controlled both by the Nagpur Municipal Corporation and the CDC (Centre for Development Communication), which is hired on a contractual basis.

The Nagpur Municipal Corporation is attempting to enforce 100 percent coverage of the city. It has implemented various strategic decisions such as appointing private companies for garbage collection, creating a supply-chain road map, dividing the city into clusters of zones and using technology like GPS to ensure that proper garbage collection is taken place.

Although the NMC has the final

responsibility in terms of waste management, the CDC is providing collection services to most of the households. Door-to-door collection is carried out on a daily basis and it is estimated that at present, there is approximately 75 percent coverage. The CDC is also creating awareness about segregation by distributing literature and holding interactive events.

Collection is carried out by Swachata Doots, rag-pickers who have been brought into the organized sector by the CDC. They are trained in handling the waste in a proper and hygienic manner and wear uniforms so that they can be easily recognized. Waste is collected from households in a cycle rickshaw, which is then emptied into a community bin where further sorting takes place. Mechanical tricycles and wheelbarrows are provided for slum areas and narrow roads, and multiple bins are used to ensure waste remains segregated.

The Corporation has also established a Garbage Collection Complaint Centre, where citizens can lodge complaints

Back End

Waste that is collected from community bins is transported to transfer stations in containers. These are then brought to open dumping sites outside the city by the Municipal Corporation workforce. It is ensured that waste is not stored for longer than necessary in residential areas.

Since monitoring and supervision are critical to the success of this model, supervisors and zonal in-charges inspect the field everyday. They regularly get in touch with households and shops to check for feedback, complaints and suggestions. The CDC also has a customer care service to address complaints and problems.

Problem Areas

Population: 1,687,406
Waste generation: 170 tons/day
Per capita waste generation: 0.101 kg/day

- Not much attention is being paid to processing of waste.
- 100 percent segregation at source is still not a reality.
- Better communication between the NMC and CDC is required, in terms of maximizing the efficiency of equipment.
- The system is based on infrastructure and equipment that is expensive and in some cases, inefficient, such as the open containers that are used to transport waste.

INSPIRATION FOR BANGALORE

👍 👍 **Incorporation of rag-pickers**

👍 **Investment in front-end infrastructure**

THIRUVANANTHAPURAM

Front End

The Thiruvananthapuram Corporation is launching a campaign to clean up public places in the city and streamline solid waste management. The standing committee on health and sanitation discussed methods to ease the pressure on the garbage

plant which is at the centre of many environmental problems .

Back End

Thiruvananthapuram follows a centralized waste management model and till recently, waste was transported to Vilappilsala. The garbage transported to Vilappilsala would be restricted to a maximum of 100 tonnes daily and strict measures would be taken to ensure this. A decentralized environmentally-sustainable system of garbage disposal using alternative technology is also under consideration. The city is subsidising and promoting domestic treatment of solid waste.

Problem Areas

- This model is largely landfill-oriented. Efforts towards a processing-based system are still in progress.

NASHIK

Population: 1,562,769
Waste generation: 300 tons/day
Per capita waste generation: 0.191 kg/day

Front End

Segregation, collection and transportation of MSW in Nashik is the responsibility of the Health Department, while processing and landfill-related duties are assigned to the Mechanical Division of the Nashik Municipal Corporation.

The contract for door-to-door collection and transportation of solid waste in the 6 divisions of the city have been given to 2

contractors. Solid waste is collected from 2.9 lakh households of 108 wards in the city through 124 Ghanta Gadis (small trucks), under the ownership of the NMC. This model combines primary and secondary transportation stages by using the same vehicle from the point of generation to the destination. Sorting of waste is carried out in the vehicle. In this way, black spots are prevented. The door-to-door collection also covers hotels and restaurants (1,806) and commercial establishments (300).

The NMP has also put in place a complaint redressal system by appointing 6 Divisional Sanitary Inspectors to whom complaints can be sent. A 24-hour toll free number is also operational, and all complaints will be addressed within 72 hours. In addition to this, citizens can file their complaints either with the divisional office or NMC headquarters.

Back End

Waste collected from the city is routed to the NMC's Treatment Facility, which includes the following facilities:

- Aerobic Composting Unit: this employs the windrow composting method, for which sheds have been constructed. Out of the total MSW, 3-5 percent is converted into compost, which is sold to farmers within a 100-km radius of the city. If segregation at source is pushed to 100 percent, around 10-15 percent of MSW can be composted.
- Inert Processing Unit: this has a capacity of 50 tons per day. It comprises of a mechanical sieve and air density separator and recovers construction material from the waste. This is then recycled and either sold or used for in-house construction activities.

- Leachate Treatment Plant: this has a capacity of 10,000 litres per day and has been installed for the treatment of leachate from the windrows, solid waste dumps and the sanitary landfill site. It generates 40 KW of power, which is used to operate pumps at the facility.
- Refuse Derived Fuel: this handles the high-calorific material, which is handled separately during collection. The plant has a capacity of 150 tons per day and generates fuel pellets from high-calorific waste material.
- Animal Carcass Incinerator: this has a capacity of 250 kg per hour and is used to incinerate carcasses such as dogs, cattle etc.

Rejects are transported to a plastic-lined sanitary landfill site. This has an area of 2 hectares and proper arrangements for leachate have been provided to ensure that it complies with all the aspects of scientific land-filling.

HIGHLIGHTS

Synchronized transport

Problem Areas

- No 100 percent segregation

RAJKOT

Population: 1,390,933
Waste generation: 500 tons/day
Per capita waste generation: 0.359 kg/day
Area: 163 square km

Front End

The responsibility of solid waste management in the city lies with health department of Rajkot Municipal Corporation under the supervision of Medical Officer of Health and attempt is also made to start a separate solid waste management department under the supervision of Environment Engineer. The total waste generated in the city is approximately 500 tons per day. Privatisation has been introduced in the primary collection (sweeping) and secondary collection activities in 12 out of 23 wards. The work involves collection of solid waste from all

the collection sites and transporting it to the waste disposal site.

Back End

A combination of large trucks (contractor-run) and smaller vehicles (municipality run) is used. Waste is transferred from smaller vehicles to larger ones. One transfer station has been constructed for this purpose and will soon be operation. Another is still being constructed.

The RMC does not have any facility for processing solid waste. It has two landfill sites,. Sokhada (11 acres), 12 km away from the city and Manda Dungar, (2.5 acres) and 7 km away from the city. Both the landfill sites will soon be full and the RMC has already put forward a proposal for new landfill site of 40 acres near Nakrawadi, 15 km away from the city.

Problem Areas

- Non-emphasis on segregation at source
- No facilities for processing of waste, with emphasis instead on an unsustainable model of dumping.

HIGHLIGHTS

👍 **Investment in collection/transportation infrastructure**

SALEM

Population: 831,038
Waste generation: 315 tons/day
Per capita waste generation: 0.379 kg/day
Area: 124

Front End

Segregation at source is an important part of Salem's solid waste management system and waste is collected door-to-door on a daily basis (in 9 divisions, this is done by self-help groups for women). At the collection point, separate containers are used to transport waste in the segregated form. In order to ensure that this is possible, 242 pushcarts, 72 containers, 44 tractor trailers, 12 lorries and 2 excavator-cum-loaders are being used.

The Salem City Municipal Corporation has taken the decision to privatize 20 of the city's divisions (one-third of the total number) for primary and secondary collection with

segregation at source and transportation to the modern scientific solid waste processing yard. The tender process is in progress.

Back End

A 150-acre site in Chettichavadi Village was identified to be converted into a modern scientific solid waste management facility. Gujarat-based Integrated Waste Management is a private partner in the project.

Area: 68 square km

HIGHLIGHTS

- **Private investment in processing**
- **Investment in infrastructure**

WARANGAL

Population: 620,116
Waste generation: 360 (measured 146 tpd) tons/day
Per capita waste generation: 0.500 (measured 0.209) kg/day

Front End

In October 2012, the Warangal Municipal Corporation hosted a

program to promote segregation at source and decentralized management of waste, called the Clean Cities Championship Campaign. With a month's effort, it successfully promoted segregation total of 150 teams from Hyderabad and Warangal were invited to take part in the event, which was sponsored by the AP Pollution Control Board. The model is based on segregation at source and different categories of waste are collected door-to-door in specially designed pushcarts and bins. Before the kick-off of the program in October 2012, intensive IEC campaigns were held to spread awareness and train citizens as well as volunteers. This was targeted towards NCC cadres (who supervised and audited the performance of teams), school teachers (who were trained in performance ratings), nursing students (who were trained in IEC), builders and market associations, municipal staff and religious leaders.

Back End

Dry waste is sent for sorting and packing to a Resource Recovery Centre, while wet waste is processed with the help of windrow composting at Madikonda. Vegetable market and slaughter waste is processed for gas generation and vermi-composting.

Duties of supervision and monitoring have been distributed among WMC officials. This includes monitoring the attendance of filed staff, pushcarts, door-to-door collection, segregation, weight and transport of dry resource and preventive maintenance of transport, as well as documentation of quantities, cost efficiency, infrastructure, management and entrustment of drivers and collecting information from designated offices. Daily weighing of different fractions of waste are posed online; this transparency reduced claimed

quantities of transported waste to about one-third.

Problem Areas

Change in the leadership and hence a change in the policy for handling waste and the focus and strategy.

HIGHLIGHTS

👍👍 **Category-specific collection infrastructure**
👍👍 **Intensive training**
👍👍 **Destination-bound processing**

PANAJI

Population: 99,677
Waste generation: 150 tons/day
Per capita waste generation: 0.150 kg/day
Area: 36 square km

Front End

Through intensive promotion and penalty, Panaji has achieved an astounding figure of 100 %

segregation at source as well as smoothly-functioning processes that ensure that the segregated waste is appropriately transported and processed.

This has been done on a budget of between Rs 20 and 30 crore and a staff of 500 to 550 *safai karamcharis* (who manage all waste in-house) and 150 workers who handle all the other aspects of the system.

Officially, the city is divided into 23 wards. However, for the purpose of solid waste management, it has been carved into 6 waste zones, based on the kind of waste generated in each area; for instance, beaches have been classified as one zone while areas in the hills comprise another. Large bulk generators and domestic residential areas have been categorized separately. Thus, it has been possible to provide infrastructure and implement methods that are appropriate to the type of waste generated in each area.

All bulk generators have been coded and route maps drawn up for the waste streams to enhance the efficiency of this system.

If any waste is found mixed at the recycling yard, it is promptly sent back to the bulk generator (identified via the code) with a fine of Rs 10,000.

In order to promote citizen awareness, extensive IEC efforts were pushed last year.

Penal provisions were also made to ensure that non-compliance would not be tolerated. The result of these continuous efforts is 100 % segregation.

Back End

All colonies and housing areas have composting pits for their wet waste, with covers to ensure visual cleanliness. Residents are expected to put their waste in the pit daily. These pits are maintained by staff that comes on alternate afternoons to manage the wet waste. Thanks to the covers, there is no smell and

residents – who are taking the effort to segregate their waste – have no reason to complain. The compost is sieved, bagged and distributed by the municipality to farmers, gardens etc.

Dry waste is accommodated in 4 or 5 wheeled bins, which each colony has been provided with. These include separate bins for glass and metal, paper and plastic, and inerts and rejects. Dry waste is collected on different days, stored in color-coded bags and the bins are then washed and put back. In areas where the bins are insufficient, the municipality collects colored plastic bags of waste on tricycles. The dry waste is taken to a recycling yard, which has one baler that works 3 shifts. The recyclables are sorted and put into larger metal mesh containers before they are baled, packed and sent for appropriate recycling. Rag-pickers also collect the waste that they need and operate in different cycles. They either bring the waste to the recycling yard or sell it to scrap-dealers. These, however, have not yet been integrated into the formal waste recycling stream of the city.

Wet waste is taken to a large processing yard for composting. As is the case at the recycling yard, any mixed waste results in the waste being returned to the generator with a fine. The compost is distributed to farmers for free.

All plastic is banned at hotels and *darshinis* and no hawker offers food in plastic or Styrofoam vessels. Temples are not allowed to give *prasad* in plastic cups either. All waste generated at temples, hawkers and the streets is also collected in color-coded bags and picked up in the afternoon collection cycle.

HIGHLIGHTS

👍👍👍 **100 percent segregation at source**

👍👍 **Town division based on waste generation patterns**

👍👍👍 **Bulk generator codification**

LEARNING FROM INDIAN CITIES

- Segregation at source: It is evident from the above comparatives that segregation at source is one of the non-negotiable principles for waste management. Most cities in India are attempting to implement segregation at source with varying degrees of success. Those cities who are practicing indiscriminate dumping are facing a variety of problems in terms of protests from local villagers and concerns about health and environmental safety.
- Investment in front-end infrastructure: Nearly all Indian cities are investing in infrastructure and equipment to create efficient front-end systems. This includes vehicles and bins to ensure that segregated waste can be transported separately.
- Front-end organization: Many cities have also created organized systems for collection and transportation that reduce dumping on the streets; these include setting up fixed timings for collection and synchronizing transportation processes to ensure that waste is not left behind in the city.
- Incorporation of the informal sector: Like Bangalore, many cities have robust informal sectors. In some cases, these rag-pickers have been incorporated into mainstream collection. In cities like Nagpur, providing them with uniforms and equipment to efficiently collect

waste has professionalized the process. Pune has also had much success with the informal sector.

- Back-end infrastructure: Most Indian urban local bodies have understood the importance of creating back-end infrastructure for waste processing and are investing in the same. These include facilities for wet, dry and sanitary waste, so that the waste sent to the landfill can be minimized. However, the success of these back-end facilities are wholly dependent on the level of segregation at source, since mixed waste is mostly dumped.
- Creating more transparency: An important part of ensuring efficient waste management systems is creating more transparency in processes, and making information easily available to citizens. In Warangal, for instance, transportation information was uploaded online so that figures and destinations were clear.

Monitoring systems: Another essential component of SWM processes is creating monitoring systems within the urban local body. In cities like Nagpur, Pune and Nashik, specific officials in charge of monitoring collection and transportation efficiency have been appointed. In some cities, forums are also provided for citizens to post complaints against improper practices or negligence, so that non-performing entities can be kept in check.

BEST PRACTICE: INTERNATIONAL

Approaches and Options

The issue of MSW and handling is a global and universal problem.

Solid waste management is a pressing concern for cities across the globe and more so for countries in the developing world. Many of them have adopted diverse approaches to the issue and we have captured some of these below. While some Cities are dependent on a landfill-based model of management, others are moving towards setting up incineration plants and other processing units. Most are attempting to segregate their waste and to maximize resource recovery through that process. A lot are struggling with adequate finances to invest in infrastructure and processing units and hence rely on grants and funds made available, and these often yield in sub-optimum solutions deploying older technologies Hence we have attempted to provide here the gist of approaches and options taken by other cities world-wide. Instead of looking at the developed world where a specific direct comparison and hence learning's are often not possible, we have selected towns from different continents where cultures and food habits etc may be similar, and also where the population and density of the Cities are comparable to Bangalore.

Suffice to also mention in passing here, that London, and NYC etc all have gone through similar challenges. In New York, for instance, despite the existence of a Sanitation Department, collection systems in the late 19th century were so appalling that people often had to walk knee-high in waste.

In London too, the build-up of waste following the Industrial Revolution was mismanaged to such an extent that the streets were choked with waste.

However, these cities grew and planned and invested in systems and infrastructure that now hold them in good stead. It may be noted by the Hon'ble Judges, that most developed nations have separate collection vehicles and days allocated for collection of segregated wastes. There may

be differences in the fractions and how they divide the waste categories, but no successful system of waste management has emerged from transporting mixed waste and dumping ad hoc into landfills.

International Comparative

City	Country	Population
Tehran	Iran	8.1 million
Dongguan	China	8.2 million
Bangkok	Thailand	8.2 million
Mexico City	Mexico	8.8 million
Dhaka	Bangladesh	8.9 million

These cities have been selected since they large urban centres in developing nations, and their population statistics and socio-economic conditions are compatible with Bangalore. Moreover, they all have a population of between 8 and 9 million people and a correspondingly high population density, implying that they face the same challenges in sustaining SWM systems as Bangalore does.

Tehran, Iran

Urban area: 730 square kilometres **Population density: 10,000/square kilometre (approximately)**

In 2005, Tehran generated around 2.5 million tons of MSW, of which around 62 percent was household waste. The municipality of Tehran is accountable for solid waste management. Most of the waste is routed to three landfills, while a small amount is recycled/composted. There is also an active informal sector in the city. In recent years, the municipality has initiated programs to mechanize solid waste management and reduce waste generation. The main challenges still faced by the municipality include:

- Proper collection and management of hospital waste
- Public education aimed at segregating household waste
- Educating municipal workers to optimize the waste collection system
- Participation of related organizations and the private sector in waste management

Dongguan, China

Area: 2465 square kilometres

Population density: 3,300 per square kilometer

Dongguan selectively collects solid waste at decentralized stations. 30 percent of household waste is delivered to trash-incinerating power plants and 70 percent is safely buried. The city established several tyre recycling factories; approximately a million tyres are treated every year. Over 30 businesses collect recyclable plastic to make Styrofoam, thus meeting the needs of other enterprises.

Most glass waste is recycled and a small portion is buried. Hazardous solid waste is burnt safely monitoring environmental pollution, and the ashes buried. These methods reduce solid waste, prevent possible harm and enable resource transfer.

Green waste, such as hayseed, twigs, leaves is either used as fish feed or to produce organic fertilizer.

Bangkok, Thailand

Area: 1568 square kilometres

Population density: 5300 per square kilometer

Prior to 1997, Bangkok practiced a very unsustainable model of waste management. Generation was increasing at an annual rate of 9 percent and waste management techniques environmentally unsustainable. The Bangkok Metropolitan Administration (BMA) provided collection services and waste was sent to unscientific landfill sites without any treatment. Under the 5th Bangkok Development Plan, BMA began to promote segregation at source. Waste was to be separated into four categories:

bio-degradable, recyclables, household hazardous waste and inerts. Engaging the community, especially school children, did this. On the front end, the BMA created vehicular capacity of almost 10,000 tons to collect and transport waste. Collection timings are fixed either everyday or on alternate days and different categories of waste are collected in different cycles and on different days.

Transfer stations were set up, where waste was quantified. The BMA also invested heavily in setting up back-end infrastructure for processing, including a sanitary landfill (capacity: 7800 tons/day), a composting unit (1000 tons/day) and an incinerator for infectious waste (capacity: 30 tons/day).

However, this system was only moderately successful. This was largely due to the inability of the BMA to implement 100 percent segregation at source, without which resource recovery is practically impossible.

Mexico City, Mexico

Area: 1485 square kilometres

Population density: 6000 per square kilometer

**Information provided below pertaining to solid waste management practices followed across Mexico (including Mexico City)*

The urban cleaning systems in Mexico consist of six elements:

1) storage in the generating source
2) manual and mechanical sweeping
3) garbage collection
4) transportation and transference
5) treatment
6) final disposal

1) Storage in the generating source: This is the first step in the SWM model followed in Mexico but unfortunately, provisions for storing

waste before collection have been unsuccessful. This is largely because most bulk generators were not constructed with this purpose in mind, and do not have the facilities to store waste.

2) Manual and mechanical sweeping: Mexican urban legislative bodies use a combination of manual and mechanical labor to sweep the streets, with adequate equipment (wheelbarrows, brooms, brushes and collecting pans) provided for manual labor. Mechanical sweeping is done with low-maintenance equipment. Public areas with large footfalls are given more priority for sweeping.
3) Collection: Collection coverage in Mexico ranges between 89 percent (in the cities) to 50-70 percent (in smaller towns). It is estimated that around 25 percent of waste remains uncollected and is dumped. Collection routes are not clearly defined, even in urban areas, showing that planning in poor. However, the participation of the private enterprise in the MSW collection systems is increasing and is using more efficient technologies and procedures.
4) Transportation and transference: Mexican cities have transfer sites to minimize transportation time and reduce operation costs. Around 75 percent of waste is routed through these sites (the rest is transported directly to the processing facility).
5) Treatment: Mexican urban local bodies attempted to set up incineration treatment processes as well as some capacity for recycling. However, incineration has been a failure. Most treatment

sites have shut down because of lack of market, high operation costs and the poor quality of the finished product. Hence more than 50 percent of waste is sent to open landfills.

6) Final disposal: This is largely carried out in controlled open air dumps or landfills. These methods do not comply with the technical requirements to achieve an adequate MSW disposal and pose health and environmental threats. The rest of the MSW collected is deposited in 40 sanitary landfills in which it is disposed of adequately.

There are also illegal dumps that have been created all over the country, created either by private waste collectors or areas where collection is deficient.

Dhaka, Bangladesh

Area: 360 square kilometres

Population density: 45,000 per square kilometer

**Dated 2005*

In Dhaka, household, commercial and industrial wastes are deposited from the source to the collection bins located on the streets. All parts of the city are not provided with these bins and there are no specific rules and criteria of placing the dustbins. In cases where there are no bins, waste is simply dumped on the ground.

In some residential areas private door-to-door collection initiatives have been organized. Rickshaw vans are used for collection of waste from houses and conveying to municipal containers. The Dhaka City Corporation owns a fleet of vehicles that collect the waste from the bins and transport it to dumping sites.

There is also an informal sector at play, which salvages valuable waste at three stages: a) delivered directly by housewives b) Salvaged by rag-pickers c) Salvaged at the disposal sites. This reclaimed material is either sold to consumers after basic processing or sent to factories for reuse.

The urban local body has also invested in some back-end infrastructure. Decentralized composting projects have been set up on land provided by public agencies and local government bodies. The first such project was set up in 1995 and in 2005, the net earning from it was Tk. 2.48 lakh. The yearly fixed and operation cost were Tk 4.75 lakh and Tk. 5.51 lakh respectively.

The rest of the waste is sent to a dumping site, where it is disposed of by crude methods.

KEY LEARNING FROM THESE CITIES

The highlights are evident through this summation and it is evident, that most growing cities are in search of models that minimize waste to landfill, minimize waste at source and maximize resource recovery. Emphasis is also being placed on making the citizen and generator as responsible and engaged in the process of Reduce, Recycle and Recover, as well as lead to investments in processing

Some of the findings from these other cities have been listed below:

1. **Segregation at source**: This is an essential step towards resource recovery. Cities that do not follow a policy of segregation are continuing to dump waste in landfills, causing environmental and health risks. Moreover, the failure to implement 100 percent segregation is a huge stumbling block in efficiently processing waste.
2. **Infrastructure and manpower**: Investing in efficient infrastructure and trained manpower is essential to ensuring

segregation, and many cities have adopted collection models that are centred on the above. In some cases, community bins are used to store waste before they are transported to processing units.

Another critical measure that has been adopted is to ensure that separate collection cycles are created for different categories of waste, to ensure that waste remains segregated.

3. **Visual cleanliness**: Most cities are investing hugely in efficient systems, equipment and labour to ensure front-end efficiency. Since this is what the citizens experience, a lot of emphasis is placed on smooth collection systems. In cities where collection is not 100 percent, dumping of waste is a huge and persistent problem.
4. **Back-end processing**: Although landfilling is still one of the most common ways to deal with waste, several urban bodies are recognizing the unsustainable nature of this model. Instead, they are investing in back-end processing facilities for different categories of waste, including composting units and in the case of Donguaan, even tyre-recycling facilities. In some cities, a decentralized model has been followed to cut down on transport cost. One of the major obstacles to this shift away from landfilling is the lack of segregation at source; with more emphasis placed on ensuring segregation through awareness campaigning and penalizing, these decentralized facilities could be made truly profitable.

5. **Failure of incineration**: While some cities do still follow an incineration waste-to-energy model, this is not universally applicable and depends on the quality of waste. In some cases, incinerators have proved unsuccessful because of high operating costs and low-quality produce