



MUNICIPAL SOLID WASTE – THE CHALLENGES IT POSES

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ABSTRACT

According to the 2011 census, population of India was 1,217 million out of which 32% live in cities and it is projected that by 2050 half of the Indians will live in cities. Urban India is facing a huge challenge to cope with the infrastructural requirements of its ever-increasing population. Municipal Solid Waste Management (MSWM) despite being the primary responsibility of the urban local bodies still remains as a major obligation that has to be improved. To improve the urban infrastructure and basic services for the poor, with an estimated provision of 500 Billion Indian Rupees, the Government of India launched the single largest Central Government initiative in the urban sector in 2005, the “Jawaharlal Nehru National Urban Renewal Mission (JNNURM)”. The primary objective of the JNNURM is to create economically productive, efficient, equitable and responsive cities. As improvement in MSWM is one of the major issues, many cities in India for the first time have sufficient funding possibilities for shaping comprehensive MSWM systems.

Keywords: Urbanization, Environment pollution, Municipal solid waste, Solid waste management, Clean development mechanism, Bio-methanisation units



Introduction:

Solid waste in developed and least developed countries in the context of development

The last three decades witnessed the development in urban areas over rural ones in a process called urbanization. Growth of urbanization is much more in developing countries than the developed countries to the extent that it became a trend characterizing several developed and even least developed countries. Growth in urbanization is coupled with the growth of population living in urban areas. In figure 1, China, urbanization led to increase in urban population to about 35% percent of its total population with annual growth in urban population of about 4%. Similarly, it is anticipated that by 2025 Asian urban population will reach 50% of the total population; and probably more. This expected increase will cause major shift in the distribution of the countries' populations and will lead to the expansion of urban boundaries (World Bank, 2014).

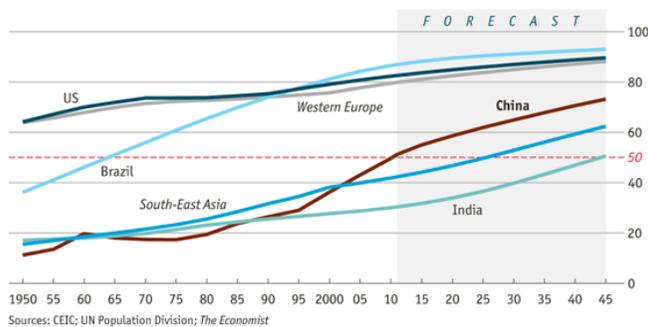


Figure 1 Urbanization Population living in urban areas, % of total

The reality is that the growth in urbanization does not always mean improving situations, including sectors developments. In the recently published 2013 human development report (UNDP, 2013), indicators that describe the accessibility to water and sanitations in developing and least developed countries are not encouraging at all. It is found that an average of about 45% of countries' populations are lacking proper sanitation infrastructures, and an average of 20% are lacking proper accessibility to water. In addition, the report showed that the percentage of populations living on degraded land is increasing to an average that exceeds 15%. The growth will result in increase in the quantity and complexity of the generated wastes and overburdens, including solid wastes, and in particular municipal solid waste (MSW). Low income countries with yearly per capita GDP that does not exceed 5000 Euro have the lowest MSW generation rates, which are in the range 0.3 – 0.9 kg/capita/day. The increase in per capita daily



generated waste is found linearly proportion to the per capita GDP. In high income countries it reaches a range of 1.4 – 2.0 kg/capita/day. Another element that characterizes differences between the generated MSW in low and high income countries (developed and most developing countries) is the percentage composition of MSW constituents. There, the lifestyle of peoples decisively characterizes the percentage composition where organic waste stream and overburden form more than 50% of the total generated MSW. This is the opposite in high income countries, where lifestyle favors fewer homes cooking, relying mainly on the readymade backed food. This is reflected in the figure 2 that represent the percentage of organic waste stream which does not exceed an average of 30% of the total generated waste and that more packing material characterizes the MSW.

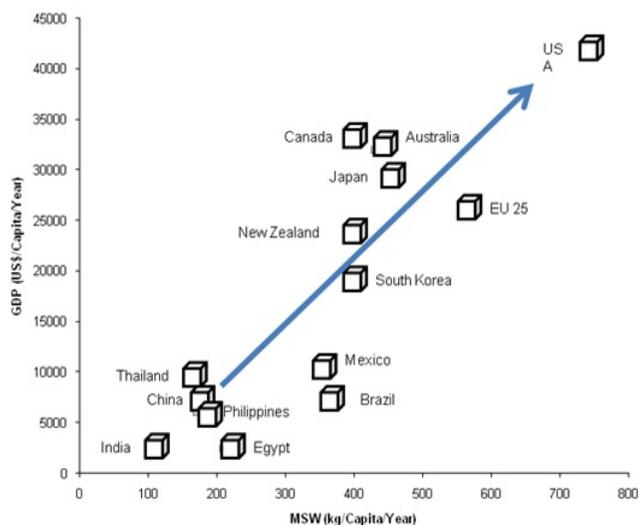


Figure 2 Municipal Solid Waste vs GDP in various countries

In urban areas of most developing and least developed countries generated MSW is at best collected and dumped in arbitrary dump sites that mostly lack the appropriate norms. Such disposal requires collecting, transport and dumping into the nearest open space area. In other countries MSW is dumped into water bodies and wetland and part of the waste is burned to reduce its volume. Such practices have their adverse environmental impacts ranging from polluting the natural resources and the ecology to the creation of health problems which might turn into long-term public health problems. Studies conducted in the last decade in several developing countries showed that same old non environmental sound practice are still used. Although lots of significant efforts have been done in the last few decades in many developing countries supported technically and financially



by developed countries and international organizations, substantial reforms in the management of MSW are still not attained. This is due to the fact that frameworks recommended were mostly similar to that adopted in developed countries but without seriously addressing the socio-economic differences between the developed and developing countries.

Solid waste in the context of development in India

India's economy is growing at a faster pace than ever before in the history of the country. With an average growth rate of more than 7% since the year 1997, the country is ranked as the 10th largest GDP in the world. Urban India is the major driving force of the country's economic growth contributing to more than 60% of the GDP. It is estimated that by 2030, urban India could generate 70% of net new jobs and contribute to more than 70% of the Indian GDP. India has experienced rapid increase in urban population in the past few decades. According to Census of India, the urban population of India has increased from 25 million in 1901 to 368 million in 2014. This growth has been more pronounced after the 80's and it is estimated that by 2050 half the Indian population will live in cities.

One of the key challenges in urban India is to cater to the infrastructure needs such as solid waste management, transportation, water supply and sewerage of the ever-increasing population which calls for huge investments in this sector. The XII Five Year Plan of India (2013-2017), foresees that the total fund requirements for implementation of the Plan target in respect to transportation, urban water supply, sewerage and sanitation, drainage and solid waste management is about 3.3 Mio INR (~43,000 Euro). On the other hand till today Urban Local Bodies (ULBs) in India, which can be divided on the basis of population, into Municipal Corporations, Municipalities, Municipal Committees or Nagar Panchayats, usually do not have financial and technical abilities to plan for, implement, operate and maintain improved infrastructure facilities.

Jawaharlal Nehru National Urban Renewal Mission (JNNURM)

As a response to the increasing stress on urban infrastructure and basic services for poor, the Government of India launched a massive investment and reform programme in December 2005. The Jawaharlal Nehru National Urban Renewal Mission (JNNURM) provides infrastructure improvements in 65 Indian cities including seven mega cities, all the state capitals and other cities of outstanding religious and touristic importance. The primary objective of the JNNURM is to create economically productive, efficient, equitable and responsive cities. The reform programme has two



major components. Ref. figure 3., The first component is substantial investment in urban infrastructure wherein 50% of the investment is contributed by the Central Government and the remaining 50% is jointly contributed by the respective State Governments and the Urban Local Bodies (ULBs) depending on their population. The second component comprises of mandatory reforms to be undertaken at the respective State and ULB level to ensure good governance and financial sustainability of the proposed interventions. Municipal Solid Waste Management is one of the key issues being addressed under the JNNURM reform programme.

Municipal Solid Waste Management in India:

Municipal Solid Waste Management (MSWM) is one among basic essential services provided by Urban Local Bodies in the country to keep urban centres clean. However, it is one of the most poorly rendered services in the basket. The total waste production in urban India is estimated to be 115,000 MT/d (metric tonnes/day). Per capita generation of waste in Indian cities ranges from 0.2kg -0.6 kg per day. As in Table 1, An assessment states that the per capita waste generation is increasing by about 1.3% per year. With an urban growth rate of 3-3.5% per annum, the annual increase in waste quantities has been estimated at 5 % per annum.

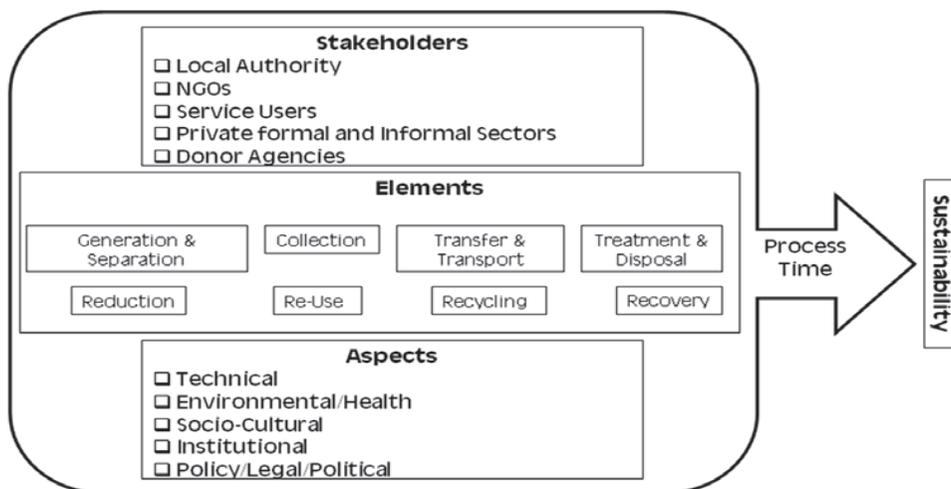


Figure 3 Components of Reform Programme



Population range (in million)	Average per capita waste generation gms/capita/day
0.1 to 0.5	210
0.5 to 1.0	250
1.0 to 2.0	270
2.0 to 5.0	350
5.0 plus	500

Table 1 Population range and Waste Generation

Municipal Solid Waste Management (MSWM) being the statutory responsibility of the Urban Local Bodies (ULBs), it is usually looked after by the Public Health and Sanitation Department, as one of its many fold duties. However, on a pan India scale till about a decade ago, most ULB's did not have the adequate infrastructure or funds to cater to the various systems needed to manage a good municipal waste management system including collection, transportation, storage, processing and disposal. Technological options for proper treatment and scientific disposal of municipal waste were also largely unknown till about a decade ago. All Indian households segregate and sell dry waste to the informal recyclers (kabariwala). Thus most waste that has a perceived market value like newspapers, magazines, metal, glass bottles, plastic bottles/material, etc. is sold and does not enter the municipal waste stream ref table 2. Door to door collection systems are only recently emerging and waste is often littered or dumped into community bins or on road side dumps.

Once the waste leaves the house, the rag-pickers come into action. The waste is shifted through by the rag-pickers and most recyclables are collected from the community bins, the road sides or the city dumps and sold to the local vendor for recycling. This sector takes care of a large part of the waste stream but there is a growing concern with regards to the adverse impacts on the health of these recyclers, as a large number of women and children are involved and the use of protective gear is largely unknown. In the end large quantities of waste including plastic are dumped and littered which is severely disturbing the urban environment including the cities aesthetics'.



City	Paper	Metals	Glass	Textiles	Plastic ¹	Ash, dust	Organics	Others ²
Chennai	5.90	0.70	-	7.07	-	16.35	56.24	13.74
Delhi	5.88	0.59	0.31	3.56	1.46	22.95	57.71	7.52
Kolkata	0.14	0.66	0.24	0.28	1.54	33.58	46.58	16.98
Bangalore	1.50	0.10	0.20	3.10	0.90	12.00	75.00	7.20
Ahmedabad	5.15	0.80	0.93	4.08	0.69	29.01	48.95	10.39
Mumbai	3.20	0.13	0.52	3.26	-	15.45	59.37	18.07

Table 2 Wastes based on materials in cities

According to Ministry of Urban Development, Government of India (MoUD), 72.5 percent of the total solid waste generated in the country is generated in cities with a population of more than 0.1 million, of this the 35 million plus cities account for approximately 35 percent of the total garbage generation. The remaining 3,955 urban centres produce only 17.5 percent of the waste. The collection efficiency ranges between 70 to 90% in major metro cities as in figure 4. In smaller cities, it is often below 50%. It has been estimated that the ULBs spend about INR 500 to 1500 per tonne on solid waste collection, transportation, treatment and disposal (8 to 25 Euros per tonne). About 60-70% of this amount is spent on street sweeping, 20-30% on transportation, and less than 5% on final disposal of waste, which shows that hardly any attention is given to scientific disposal of waste. In practice, this means that the final disposal of MSW is mainly uncontrolled. The launch of the JNNURM programme of the Ministry of Urban Development (MoUD), Government of India, brought considerable change in the status of the ULBs. Suddenly there were funds available for all infrastructural projects with a special emphasis on MSWM.

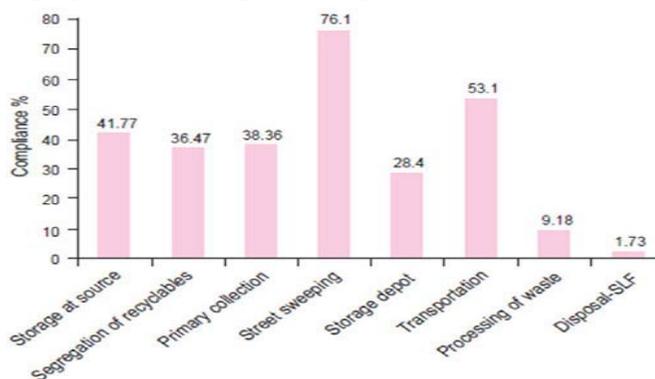


Figure 4 Collection Efficiency

The JNNURM has also encouraged private sector involvement for innovative financing and technical up-gradation. As on March 2014, a total



of 51,064 million INR (735 million Euros) have been sanctioned for 67 Indian cities to improve their solid waste management. Despite huge investments and the encouragement of the Central Government to invest in and adapt to the MSW (M&H) Rules 2000, improvement in this sector is very slow. To further encourage the ULBs, the 13th Finance Commission of the Government of India, has sanctioned 25,104 Million INR (343 million Euros) to the MoUD for strengthening the SWM schemes in ULBs and the 14th Finance Commission of the Government of India, recommends that of all grants to be given to the ULBs, 50% should be for SWM (2016-2020).

Main reasons for weak implementation by Indian ULBs:

Institutional weakness: The administrative structure of Municipal Corporations in India has traditionally not been designed to manage the enormous change processes necessary in the urban sector. Quantity and often more important, lack of qualification of staff is hindering adequate institutional development. Top municipal managers, though often qualified, get frequently transferred. Generally, citizens' trust in public sector performance is very limited.

Lack of financial sustainability: Till today only very few Municipal Corporations have been able to achieve transparency in their MSW budgets. Dependence on (irregular) funding from the state level has led to lack of accountability towards the citizens. Regular funding for SWM usually derives from property tax, the collection efficiency for which is widely inefficient, keeping many municipal budgets on the minimum.

Lack of experience in private sector involvement: The enormous amount of investment needed for infrastructure development in SWM needs private investments. Moreover, it is felt in India, that the private sector will be more efficient in dealing with municipal services like waste management.

Need for capacity building of elected local representatives: Although the involvement of local elected representatives in day to day city administration is usually not very strong. In absence of a clear understanding of an integrated MSWM system local elected representatives are often reluctant to approve necessary user charges needed for financial sustainability, creating political drawbacks for necessary change processes.

Inadequate land use planning and its enforcement: Urban areas are also expanding rapidly and the local authorities are not able to keep pace with an



ever expanding urban sprawl. This lack of enforcement on the part of the authorities also aggravates the problem and results in considerable delays in the construction of treatment facilities and scientifically engineered landfills in many places. Public Interest Litigations (PILs) in some cases have also resulted into the closure of functioning facilities.

Lack of environmental awareness and weak enforcement: Although, according to Indian laws, Environmental Impact Assessment (EIA) is mandatory for common MSW treatment facilities, the practical procedure is often inadequate or simply ignored, leading to critical site selections in some cases. The extreme scarcity of land is often dragging decision makers into unsuitable land for infrastructure development. Once operation starts, operation and compliance to the consent conditions is not always properly monitored by the responsible authorities.

Agents of change: Despite all these problems, issues related to MSWM have come on the political and administrative agenda in urban India. SWM is increasingly becoming a prime subject in local elections. Growing concern in the society about the urban sector in general and SWM especially have resulted into many fold activities, promising a much faster progress to come in the near future. Some of the key activities and approaches are listed below. **Government Initiatives:** The JNNURM reform programme is currently under revision and is likely to be extended beyond 2012. The MoUD is evaluating the impact and will readjust policies wherever needed.

As part of the National Urban Sanitation Mission, which was launched in December 2008, SWM is addressed through a set of instruments on state and city level (state and city sanitation plans). Therefore liquid and solid waste management are getting strategically connected.

The National Action Plan on Climate Change (NAPCC), which was launched in 2008, formulates the Indian strategy towards climate change. It consists of 8 missions. One of the missions is the “National Mission on Sustainable Habitat” addresses SWM as one of the relevant issues to be improved in urban India.

Government of India has started to generate competition through service level benchmarks amongst cities and states. The MoUD has formulated Service Level Benchmarks for the basic urban services of SWM, water supply, sewerage and storm water drainage with an aim to improve

performance of the ULBs and therefore the service delivery to the community. The SWM benchmarks include 8 aspects:

1. Household level coverage of SWM services
2. Collection efficiency
3. Extent of source segregation at consumer level
4. Extent of waste reused/ recovered/recycled
5. Extent of scientific disposal
6. Extent of cost recovery
7. Efficiency in redressal of customer complaints and
8. Efficiency in collection of user charges.

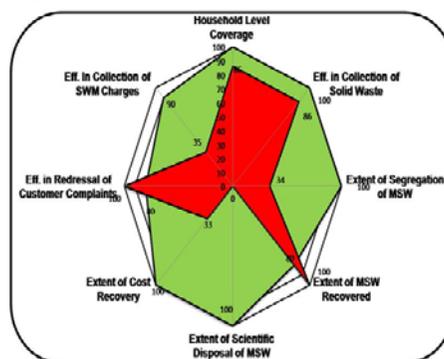


Figure 5 Aspects of Benchmarks

CDM potential in MSW in India is being used; 12 CDM (Clean Development Mechanism) projects have been registered from India in MSW which have a potential of generating approximately 3.28 million CERs (Certified Emission Reductions) by the end of the first commitment period (2012). Majority of these projects are composting projects. GTZ conducts an annual event viz. 'Carbon Bazaar' in collaboration with German Federal Ministry for the Environment, Nature Conservation & Nuclear Safety (BMU) and Ministry of Environment & Forests (MoEF), Government of India to strengthen Indian Carbon Market and provide a common platform for different market players.

SWM has become a major focus for service level improvement and provision of investment from the public side. It is increasingly becoming a business opportunity for private sector in India. This will lead to increased competition and improved services by the private sector while the national institutions face the challenge of providing the rules and a level playing field. At the same time Municipal Corporations will gain experience in shaping and monitoring sensible PPP projects.

Waste to Energy: Though highly promoted in India there are so far only few examples for successful waste to energy projects in the urban sector. After a



few prominent failures in large scale biomethanisation plants (Lucknow, Vijayawada) due to various technical, Institutional and financial reasons, organic waste gets mainly processed in compost plants. Considering the growing energy demand in urban India, biomethanisation offers a large potential for energy production, methane avoidance and recovery of nutrients in an integrated waste management system. GTZ under the International Climate Change Initiative (IKI) of the German Ministry for Environment, Nature Protection and Nuclear Safety (BMU) is currently carrying out a pilot project for treatment of black water from community toilet complexes and segregated organic waste through co-fermentation. The project only recently started and so far, first results are being awaited.

Co-processing of fractions of MSW: Co-processing of the high caloric fraction of MSW could be a cost effective and environmentally sound alternative to landfilling, in many cases. On the basis of already ongoing pilots and internationally accepted principles, as elaborated during a PPP project between the cement company Holcim and GTZ, the concerned Ministries in India are currently considering a suitable regulatory framework for the promotion of co-processing of certain fractions of MSW in cement kilns as well as in other industries (thermal, steel).

Conclusion and outreach: Developing and least developed countries have no alternative but to plan for a sustainable development processes acknowledging the importance of encountering the problems in persistence and facing the development challenges with an active participation of stakeholders including the public. With the growth in urbanization MSW services is becoming one of the most challenges which if not properly and sustainably dealt with will adversely impact all other development sectors. The best approach for dealing with solidwaste sector is by implementing an integrated and sustainable management approach that ensures the good health of the society and the environment and the active participation of the society.

Looking into the huge infrastructure requirements for liquid (waste water) and solid waste management processes, innovative decentralized solutions, which make use of the energy and nutrient content of wastes will be most appropriate and cost effective. Therefore technology cooperation is a key success factor for sustainable waste management in urban India.



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Exchange rate

1 Euro = 70.20 INR, as on February 07, 2015