Public Private Partnerships in Municipal Solid Waste Management

Potential and Strategies

Athena Infonomics
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METHODOLOGY

The methodology adopted to assess Municipal Solid Waste Management (SWM) practices in the urban sector constitutes a well-balanced mix of theory and practice. The theory underlying the key conclusions/findings was developed by undertaking an extensive review of extant literature. In addition to the inferences drawn from secondary research, insights were gathered from practitioners of Public Private Partnerships in Solid Waste Management, through a number of primary interviews and focused group discussions. Here four solid waste management projects undertaken via the PPP mode were chosen and the issues faced by stakeholders in each of the chosen cases were documented and lessons were drawn.

A workshop on "Potential and Strategies for Public Private Partnerships in the Municipal Solid Waste Management Sector" was organized on 26th March, 2012 in Chennai, to discuss the issues and challenges faced by stakeholders in adopting PPPs. The workshop brought together a distinguished group of professionals comprising of private waste management companies, academics, environmental organizations and citizen representatives. A quick perusal of PPP practices in MSW and inferences gathered from our primary and secondary research, display the presence of two broad contending PPP approaches in the SWM sector namely centralized (technology driven) and decentralized (community driven) models. The specific pre-requisites and conditions that support one system/practice over the other has been analyzed in greater detail in the report and the merits and the demerits of centralized waste management approaches vis-a-vis decentralized community based waste management practices and their potential to co-exist in varying urban contexts has been explored.

ABBREVIATIONS

3R	Reduce, Reuse, Recycle
ADB	Asian Development Bank
AUDA	Ahmedabad Urban Development Authority
BBMP	Bruhat Bengaluru Mahanagara Palike
BOO	Build Own Operate
BOOT	Build Own Operate Transfer
BOT	Build Operate Transfer
BMC	Berhampur Municipal Corporation
CAGR	Compounded Annual Growth Rate
C/N	Carbon-Nitrogen Ratio
C&T	Collection & Transportation
CDP	City Development Plan
CDM	Clean Development Mechanism
CPCB	Central Pollution Control Board
CPHEEO	Central Public Health Engineering and Environmental Organization
CPP	Community Public Private Participation
DDA	Delhi Development Authority
DEA	Department of Economic Affairs
EOI	Expression of Interest
GDP	Gross Domestic Product
GHMC	Greater Hyderabad Municipal Corporation
GMMC	Greater Mumbai Municipal Corporation
GOAP	Government of Andhra Pradesh
GOTN	Government of Tamil Nadu
HPEC	High Powered Expert Committee
HUDA	Hyderabad Urban Development Authority
IEC	Information, Education, Communication
ISWM	Integrated Solid Waste Management
INCAP	Infrastructure Corporation of Andhra Pradesh
J&K	Jammu & Kashmir
JnNURM	Jawahar Lal Nehru National Urban Renewal Mission
JUIL	Jindal Urban Infrastructure Limited
Kcal	Kilo Calorie
Kg	Kilogram
KIIT	Kalinga Institute of Information Technology
KMC	Kanpur Municipal Corporation
Kwh	Kilowatt Hour
LOI	Letter of Intent
MA&UD	Municipal Administration and Urban Development
M&H	Management and Handling
MCD	Municipal Corporation of Delhi
MDG	Millennium Development Goals

MOEF	Ministry of Environment & Forest
MoU	Memorandum of Understanding
MOUD	Ministry of Urban Development
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
MTD	Metric Tonnes per Day
MT	Million Tonnes
NA	Not Available
NDMC	New Delhi Municipal Corporation
NGOs	Non-Governmental Organization
NIMBY	Not in My Backyard Syndrome
NOC	No Objection Certificate
O&M	Operations and Maintenance/Management
PIL	Public Interest Litigation
PMC	Pune Municipal Corporation
PPP	Public Private Partnerships
PSP	Private Sector Participation
RDF	Refuse Derived Fuel
REEL	Ramky Enviro Engineering Ltd.
RMC	Rajkot municipal Corporation
RRC	Resource recovery Centers
RWAs	Resident Welfare Associations
SHGs	Self-Help Groups
SPCBs	State Pollution Control Boards
SWaCHS	Solid Waste Collection and Handling
SWM	Solid Waste Management
TOWMPCL	Timarpur Okhla Waste Management Project
TNPCB	Tamil Nadu Pollution Control Board
TMC	Tirupur Municipal Corporation
TNUDF	Tamil Nadu Urban Development Fund
TPD	Tonnes per Day
UDHR	United Nations Declaration of Human Rights
UIDSSMT	Urban Infrastructure Development Scheme for Small and Medium Towns
ULBs	Urban Local Bodies
UNDP	United Nations Development Programme
UNICEF	United Nations International Children's Education Fund
UNESC	United Nations Economic and Social Council
VNV	Vijayanagara Nagarika Vedike
WtE	Waste to Energy

PREFACE

This report is part of a broader research exercise that aims to provide implementation guidelines and policy recommendations for catalyzing Public-Private Partnerships (PPPs) in the social sectors viz., urban water supply, municipal solid waste management and skill development.

This report attempts to describe the status of municipal waste management (MSW) system in India, highlight key issues & challenges faced by various stakeholders in the MSW management space and gauge the potential for private sector participation in managing and delivering Municipal Solid Waste. The report also describes strategies that can be pursued by ULBs while planning for management of municipal solid waste. Other forms of waste like hazardous waste and e-waste etc. are not included in the scope of this report.

The rest of the report is structured as follows:

Chapter I describes the definition and related concepts of MSW – waste quantity and characteristic in India, maps the institutional framework for management of municipal waste in the country and discusses the existing waste management practices.

In Chapter II, the current status of MSW management and the associated factors for poor service delivery has been discussed for each segment of the MSW value-chain.

Chapter III gauges the potential for public private partnerships (PPPs) in municipal waste management sector and discusses the strategic framework to enhance PPPs for improving efficiency and leveraging private capital wherever required

Finally Chapter IV concludes with next steps and the way forward.

Public Private Partnerships in Solid Waste Management

Potential and Strategies

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EXECUTIVE SUMMARY

BACKGROUND

Waste is a major health hazard that undermines people's right to a safe life.[1] All forms of waste — municipal, bio-medical, e-waste, or industrial, if not treated and disposed carefully are a threat to the health of people as well as the environment. Anaerobic degradation of waste at landfill sites produces methane — a greenhouse gas that is 20 times more harmful than carbon dioxide. Filth and garbage on streets facilitate spread of diseases like malaria, plague; making a significant dent on a country's prospects of achieving the Millennium Development Goals (MDG).[2]

With waste generation rates set to more than double over the next twenty years in low and middle income countries, the costs of managing the waste is also expected to witness a steep rise, with cost increases being most severe in low income countries (more than 5-fold increases) followed by middle income countries (more than 4-fold increases).

Observations made from secondary research also show that developing nations lag behind the developed countries when it comes to the efficient delivery of waste management services, despite the magnitude of expenditure remaining similar /comparable.[3]

This can be traced back to the differences in waste management practices observed across low, middle and high income countries. Low-income countries continue to spend most of their SWM budgets on waste collection, with only a fraction going toward disposal. In developing and transitional countries, while large investments are being made to improve the delivery of solid waste management services, lack of sufficient emphasis on reduction and segregation at source, insufficient allocation of funds for processing and disposal, poor accountability owing to weak regulatory frameworks, presence of a large informal sector and unregulated markets for recyclables, have led to sub optimal utilization of capacities and poor service delivery systems.

On the contrary during the last two decades, high-income countries have taken up recycling as an integral part of their waste (and resource) management systems, and have invested heavily in both physical infrastructures and communication strategies to improve their processing and disposal capabilities. This has proven to be an efficient

1 India is a party to United Nation's Universal Declaration of Human Rights (UDHR) which states that everyone has a right to life, liberty and security of person. Rights that relate specifically to the ability to live in good health are embedded in the declaration. See, Introduction: Safety as a Human Right in 'People's Right to Safety' Health & Human Rights, Mohan D., (2003).

2 India has the highest incidence of TB in the world accounting for 20% of the total cases and the incidence of malaria being 1.51%. Source: MDG - Status of India Report 2010, MOSPI, GOI.

3 MacFarlane in his study on expenditure pattern on urban waste management by ULBs in major cities of the world found that cities in both developing and industrialized countries did v not spend more than 0.5 % of the per capita GDP. Please refer to 'What a Waste: Solid Waste Management in Asia,' World Bank (1999), for further details.

alternative to expensive landfills, incineration and other treatment and disposal options.

Municipal Solid Waste Management in India – Current Status

In India, the responsibility of waste management lies with Urban Local Bodies (ULBs) due to the public and local nature of the service.

Since MSW is inextricably linked to urbanization and economic development, the nature and constitution of MSW in India differs greatly, when compared to MSW in other high-income countries. [4] The composition of MSW at generation sources and collection points in India is observed to mainly consist of a large organic fraction (40–60%), ash and fine earth (30–40%), paper (3–6%) and plastic, glass and metals (each less than 1%).[5]

However, with most cities/towns urbanizing rapidly there has been a marked shift in the quantities and quality of waste generated across the country, in turn contributing to a rising deficit between the demand for MSW services and the current capacities among ULBs to service the same.

In India, segregation and storage of MSW at source is lacking and the decomposable and non-decomposable wastes are often disposed off at a common communal dustbin/disposal centre. The collection efficiencies are also seen to be poor, at around 70% in most Indian cities and continue to be predominantly manual in nature.[6] Transfer stations are rarely used and the same vehicle that collects refuse from the individual communal bins is also responsible for taking it to the processing or the disposal site. Collection and transportation activities constitute approximately 80–95% of the total budget of MSWM; hence, it forms a key component in determining the economics of the entire MSWM system. On the contrary, disposal and treatment of waste is an underinvested area and open, uncontrolled and poorly managed landfills are a common feature across most Indian cities and town.[7]

Institutional Initiatives

The overarching framework for management of MSW in the urban areas was created by the Ministry of Environment & Forest in 2000 with the enactment of MSW (Management & Handling) Rules, 2000 under the Environment Protection Act, 1986 that entrusted the ULBs with the responsibility of managing MSW.

4 Please refer to (Gupta et al., 1998; Shannigrahi et al., 1997; Jalan and Srivastava, 1995) for further details

5 For details, please see, http://www.unc.edu/courses/2009spring/envr/890/002/readings/SolidWasteIndiaReview2008.pdf

6 A key trend in collection of MSW that is unique to low to middle income countries like India is the presence of a large informal sector that plays an active role in collection. The rag pickers work day and night to collect the recyclable materials from the streets, bins and disposal sites for their livelihood, thereby significantly reducing the role of the Government in recovering secondary materials form the waste.

7 A recent pilot study by Ministry of Urban Development to assess the performance of the ULBs relative to certain benchmarks in select cities and towns in the country showed that only 8 % of the total MSW generated actually underwent scientific disposal.

These rules, along with other legislations pertaining to plastic, bio-medical, hazardous and other wastes, aimed at instilling waste management practices that are safe and environmentally sound. Further, the 13th Finance Commission has enhanced the share of ULBs in the divisible tax pool and state governments and external funding agencies have enhanced budgets to support ULBs improve their waste management systems.

Also, since the launch of JnNURM in 2005, Central Government grants are being channelized through the Urban Infrastructure Governance (UIG), and Urban Infrastructure Development Scheme for Small & Medium Towns (UIDSSMT) under JnNURM and the Finance Commission Grants.

Private Sector Participation

Despite the increasing focus on MSW management by state and central governments, providing affordable and sustainable waste management services is among the largest municipal challenges in India. The presence of a large informal sector that remains un-integrated into the formal waste management system coupled by inadequate mechanization owing to the poor financial health of the ULBs has made the management and delivery of a well structured MSW system a herculean task.

In order to overcome the technical and financial deficiencies associated with the current system, state and local governments in India are increasingly resorting to the use of private contractors for collection, transportation and disposal and private capital to supplement the mechanization/improvisation process.

In fact, private participation in the provision of MSW services is not new to India and several corporation/municipalities have employed private contractors for secondary transportation from the communal bins or collection points to the disposal sites since 1985. However, the services provided for by the private sector then were contractual in nature and were confined to one or two segments of the MSW value chain.

In recent times, the engagement of private sector participation has increased from short-term contracts to long-term partnerships. Close to 31 long-term Build-Operate-Transfer concessions have been awarded to the private sector till March, 2011 to manage solid waste in the country.

However, despite the rising popularity of Public Private Partnerships in the management and delivery of MSW services, the institutional setting, governance and regulatory structures and market linkages (for recyclables/compost) are at a nascent stage, making the successful implementation of PPPs a challenging task. This is further complicated by the presence of a large informal sector (mainly consisting of rag pickers) that pre-dominantly remains outside the PPP framework.

Thus the evolution of the MSW sector in India and the potential role that PPPs could play, given the local institutional and market dynamics, demands closer attention.

Strategic Framework

A quick perusal of the various PPP practices in waste management in India display the presence of two broad contending approaches namely centralized (technology driven) and decentralized (community based) systems of waste management.[8] At one end of the spectrum, private players are engaged for either a segment or the entire value chain of solid waste management for handling of bulk waste with little or no community participation, while at the other end there are cases where Self-Help Groups (SHGs) or Resident-Welfare Associations (RWAs) partner with ULBs to manage waste in their own localities with or without assistance from other private entities. The choice of a decentralized model vis-à-vis a centralized system of management depends on location (size, density), economic and socio-political-cultural aspects of cities/towns.

The quantity of waste generated, availability of external funds, current financial and human resource capacity and the potential internal resource generation capacity of the ULBs differ as per city size. For instance, the per capita waste generation in large cities is greater than that produced in relatively smaller cities and town but the ULBs in the latter category are eligible for a greater percentage of central government assistance in terms of overall project cost. On the contrary, large ULBs conventionally have higher potential to generate tax and non-tax revenue to become financially self-sufficient to management waste in the long-run. Therefore, these factors should be considered by the ULBs to determine the waste management model for the city or the town.

The operational model of the MSW Management project can be centralized or decentralized waste management system depending upon the profile of the locality in terms of composition of waste, availability of land for processing waste, market linkages, health risks and extent of informalization of the waste management system.

Centralized PPP models are suitable for urban areas where significant economies of scale are possible and the composition of waste allows for greater extraction of value from the waste through technological solutions. Health hazards due to inefficient waste disposal and non-availability of land in close proximity of localities are other two important factors to be considered while choosing a centralized waste management system. Depending upon the maturity of the private sector to manage different segments of the MSW value chain, the ULBs can partner with waste management companies.

Decentralized PPP models are appropriate if the organic composition of waste is high, land for composting is available at appropriate locations, market for compost is accessible, risk for poor self-governance is low and possibility of integrating informal health workers into the system is high. This allows PPPs at the unit level where micro-entrepreneurs can work with the ULBs to

8 A centralized waste management system involves management of bulk waste by one or two entities. The processing of waste is done at a centralized facility and involves application of modern technologies like pellatization, mechanical composting, etc. A decentralized waste management system envisages management of waste within the vicinity of waste generation i.e., a ward or zone and involves community participation in all segments of the MSW value chain namely, collection & transportation, processing and disposal of waste. We elaborate the concepts in detail later in chapter I.

produce compost or other value added products from the waste and the ULBs either on its own or through a bigger private partner manages the collection of refuse and maintenance of landfill sites.

With adequate planning and inclusive stakeholder consultation it is even possible for both the centralized and decentralized waste management systems to co-exist. Thus the need of the hour is to think out of the box and diligently explore suitable mechanisms to address the issue of poor municipal waste management in the country.

Chapter I

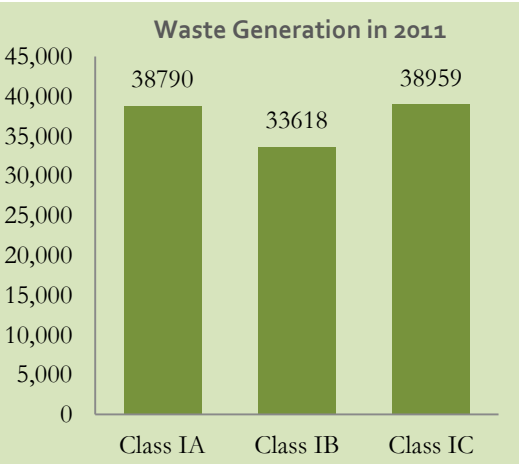
DEFINING MUNICIPAL SOLID WASTE

Municipal Solid Waste (MSW) in India includes commercial and residential wastes generated in municipal or notified areas in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes.[9] Management of MSW consists of seven important steps, namely — segregation and storage of waste at source, primary collection, street sweeping, secondary storage, transportation, treatment & recycling and finally disposal of waste. The scope of this report is confined to municipal waste and excludes other forms of wastes like e-wastes, untreated bio-medical wastes and industrial wastes.

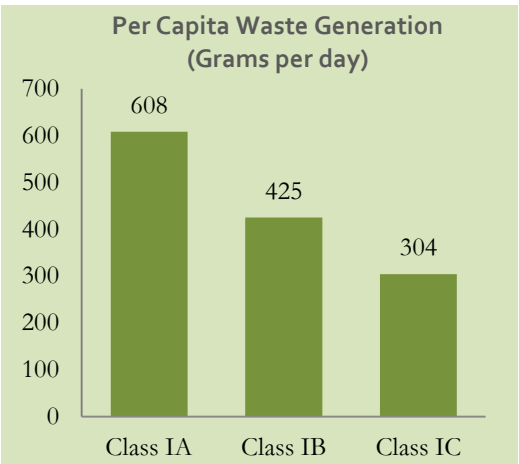
I.1 MSW — Quantity & Characteristics

India generates over 1,15,000 metric tons of municipal waste per day. Fig. 1.1 displays the waste generated in Class I cities in India.[10] It also shows the per capita waste generation in these cities. Class IA and IB alone account for over 40% of the total waste generated in the country.[11] The per capita waste generation is highest in Class IA cities followed by Class IB and IC cities.

Figure 1.1: Total and Per Capita Waste Generation



Source: Estimated from 'Status of Water Supply, Sanitation and SWM in Urban India,' Statistical Volume III, SWM 1999, NIUA (2005).



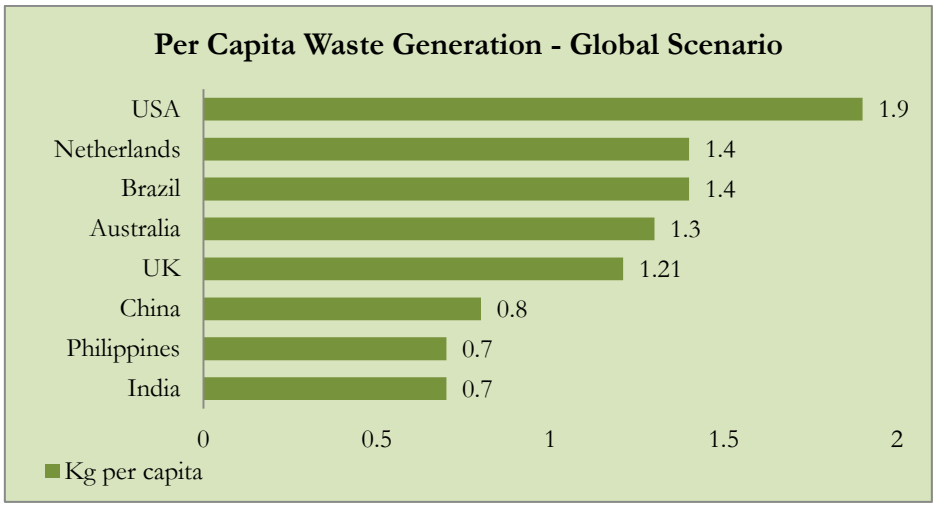
Source: HPEC Report, GOI (2011)

9 Please refer to MSW (Management & Handling) Rules, Ministry of Environment & Forest, GOI (2000).
10 Cities with population over 5 million are classified as Class IA; cities with population between 1 and 5 million as Class IB; and cities with population between 0.1 and 1 million persons as Class IC. Source: High Powered Expert Committee Report, GOI (2011).
11 The waste generated by six megacities is almost equal to the waste generated by 228 Class IC cities.

India's per capita waste generation is relatively low compared to other developed nations. An average Indian generates 0.3 to 0.6 kg of waste per day whereas an average American generates 2 kg of waste per day.[12] In Hong Kong, the situation is even grimmer as the per capita waste generation is 5.07 kg per person per day. Fig. 1.2 shows the per capita waste generation in select developed and developing countries of the world. One reason for the low level of waste generation in India is that much of the recyclable items are sold to the recycling units at the household level itself through a network of *kabadiwalas*.[13] India has a good waste recycling system and the informal sector plays a significant role in it. For example, in Pune 22 % of the total waste generated in the city is recovered by the informal sector.[14]

> *"Studies have indicated that for every Indian ₹ 1,000 increase in income the solid waste generation increases by one kilogram per month" – Visvanathan et al., (2003)*

Figure 1.2: Per Capita Waste Generation (2011): A Few Select Countries



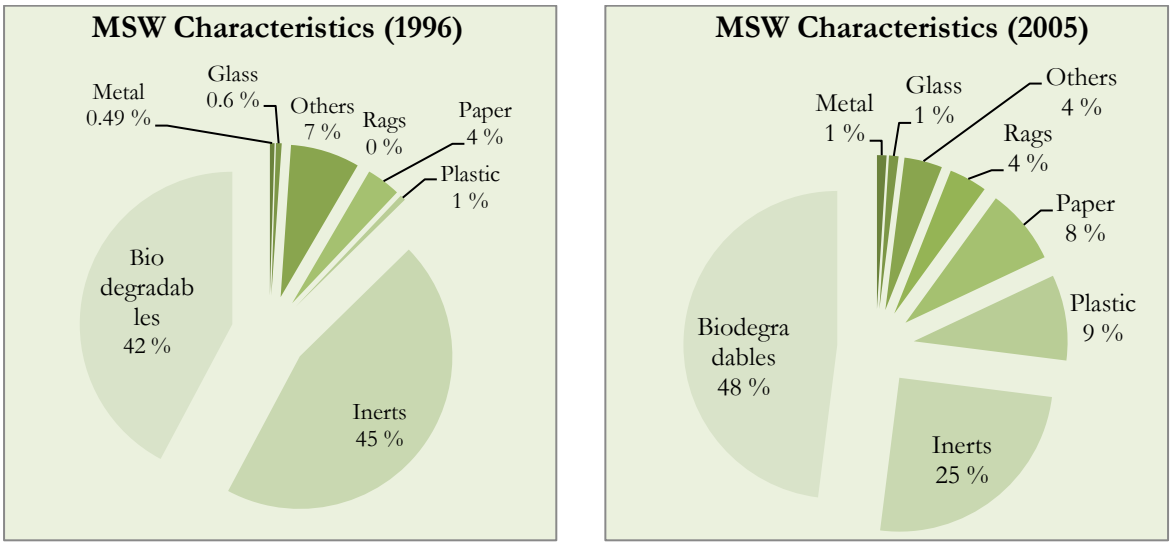
Source: Compiled from various sources

The nature of the waste generated in Indian cities is also different from those of the industrialized, high income countries. Studies have found a direct negative relationship between a country's income level and the quantity of bio-degradable waste in the total waste generated. Compared to countries in the high income group, waste generated in India has a higher share of bio-degradable and inert items. However, the composition of municipal waste is India has seen a marked change over the last two decades, as is evident from Fig. 1.3. The proportion of non-bio-degradable

12Please refer to 'What a Waste: Solid Waste Management in Asia,' World Bank (1999), for further details.
13 Informal workers engaged in buying of waste from households and other commercial establishments e.g., hotels, shops, etc are colloquially referred to as 'kabadiwalas' in India.
14 Please refer to "The Economics of the Informal Sector in Solid Waste Management," CWG (2011), for further information on the role played by the informal sector in waste management in 6 cities across the world.

material, metals, glass and plastic has increased significantly. Inert items that comprised around 45% of the total wastes in 1996 reduced to 25% by 2005. Changing lifestyles, increased industrial and construction activity combined with increasing levels of income has resulted in the changing composition of waste over the years.

Figure 1.3: MSW Characteristics (1996 and 2005)



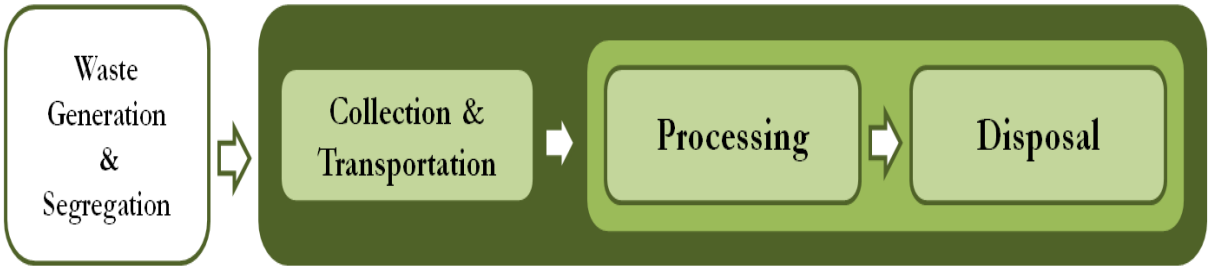
Source: Based on data available in 'Improving Solid Waste Management in India,' D. Zhu, *et al.*, (2008)

I.2 MSW Value Chain

The MSW value chain conventionally consists of three broad aspects, namely, collection & transportation (C&T), processing and finally, disposal of wastes. A holistic approach to waste management includes efforts to reduce the quantity of waste generated at all points i.e., waste reduction at source to reduction at disposal. The C&T system includes door-to-door collection of *segregated* waste from households followed by transportation to waste processing plants in covered vehicles. The processing of waste involves the application of appropriate technology, depending upon the quantity and quality of wastes, so as to reduce the overall quantity of waste reaching the landfill sites and to derive value from the wastes to the extent possible.[15] Lastly, the refuse from the processing plant is collected from the waste processing plants and disposed in scientifically engineered landfills. Every segment of MSW management entails cost and hence there is a need to manage all three segments of the MSW value chain in the most efficient manner. The cost nodes of the MSW chain are depicted in Fig. 1.4 provided below.

15 Several technological alternatives have been available in recent times like incineration, pellatization, bio-methanation that allow conversion of waste in to useful products like electricity that have commercially saleable value.

Figure 1.4: MSW Value Chain



In India, the state of MSW however deviates from the above prescribed process. In India, segregation and storage of MSW at source is lacking and the decomposable and non-decomposable wastes are often disposed off at common communal dustbin/disposal centre. The collection efficiencies are also seen to be poor, at around 70% in most Indian cities and continue to be predominantly manual in nature.[16] Transfer stations are rarely used and the same vehicle that collects refuse form the individual communal bins is also responsible for taking it to the processing or the disposal site. Collection and transportation activities constitute approximately 80–95% of the total budget of MSWM; hence, it forms a key component in determining the economics of the entire MSWM system. On the contrary, disposal and treatment of waste is an underinvested area and open, uncontrolled and poorly managed landfills are a common feature across most Indian cities and town.[17]

16 A key trend in collection of MSW that is unique to low to middle income countries like India is the presence of a large informal sector that plays an active role in collection. The rag pickers work day and night to collect the recyclable materials from the streets, bins and disposal sites for their livelihood, thereby significantly reducing scope of recovering secondary materials form the waste.

17 A recent pilot study by Ministry of Urban Development to assess the performance of the ULBs relative to certain benchmarks in select cities and towns in the country showed that only 8% of the total MSW generated actually underwent scientific disposal.

I.3 Institutional Framework for MSW Management

The overarching framework for management of MSW in the urban areas was created by the Ministry of Environment & Forest in 2000 with the enactment of MSW (Management & Handling) Rules, 2000 under the Environment Protection Act, 1986 that entrusted the ULBs with the responsibility of managing MSW. Box 1.1 summarizes the key features of the MSW rules. These rules, along with other legislations pertaining to plastic, bio-medical, hazardous and other wastes, aimed at instilling waste management practices that are safe and environmentally sound. Fig. 1.5 presents an overview of the institutional framework that governs MSW practice in the country. The Ministry of Urban Development (MoUD) issues policy guidelines from time to time and administers the 'Sub-Mission for Urban Infrastructure and Governance," which has MSW as one of its thrust areas. Pollution control boards at the central and state level monitor the compliance with service delivery benchmarks as set by MoUD.

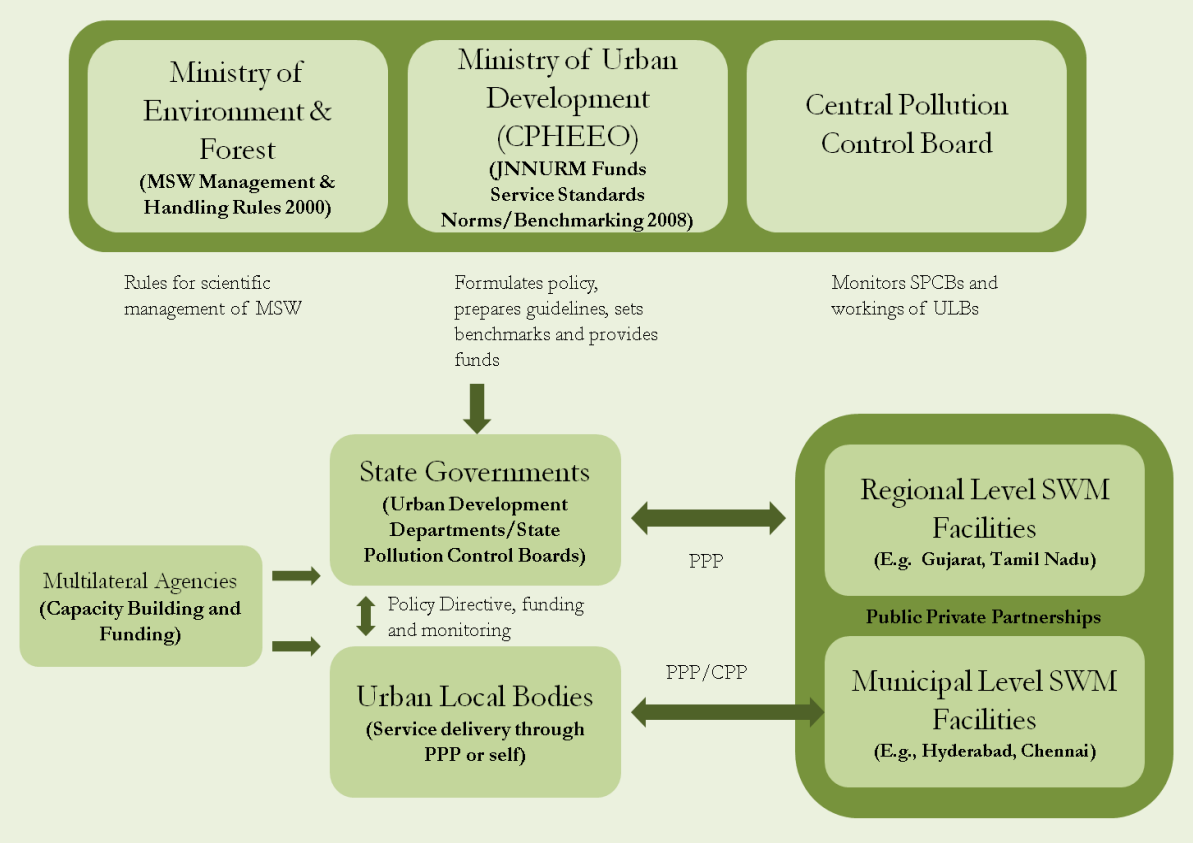
Box 1.1: Salient Features of MSW (Management & Handling) Rules, 2000

- Municipal Solid Waste (MSW) includes commercial and residential wastes generated in municipal or notified areas in either solid or semi-solid form **excluding industrial hazardous** wastes but including treated bio-medical wastes.
- **Prohibition** on littering of MSW in cities, town, notified urban areas.
- Bio-Medical and Industrial waste **not to be mixed** with MSW.
- **Responsibility** of waste generators to avoid littering and ensure delivery of waste in accordance with the collection and segregation notified by municipal authorities
- Municipal Corporations shall undertake **awareness campaigns** for source segregation of MSW.
- **Prohibition** on manual handling of wastes.
- The storage facilities set up by municipal authorities shall be **daily** attended for clearing of wastes.
- Municipal authorities shall adopt **suitable technology** or combination of such technologies to make use of wastes so as to minimize burden on landfill. (Compositing, incineration, etc.)
- Land filling shall be **restricted** to non-biodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing.
- The municipal authority shall undertake phased programme to ensure **community participation** in waste segregation.

The MSW Rules have set responsibilities for ULBs, State governments and Central & State pollution control boards for different aspects of MSW management. While the rules make ULBs responsible for their implementation and for any infrastructure development relating to collection, storage, segregation, transportation, processing and disposal of municipal solid wastes, they entrust waste generators with the responsibility to avoid littering. The ULBs are required to organize awareness programs for segregation of wastes and promotion of recycling or reuse of segregated materials. The municipal authorities need to undertake a phased program to ensure community participation in waste segregation. For this purpose, regular meetings at quarterly intervals are arranged by the municipal authorities with representatives of local Resident Welfare Associations and Non-Governmental Organizations. In areas falling under the jurisdiction of development authorities e.g., Delhi Development Authority (DDA), Hyderabad Urban Development Authority (HUDA), it is the responsibility of such development authorities to identify landfill sites and hand them over to the

concerned municipal authority for development, operation and maintenance. Elsewhere, this responsibility rests with the concerned municipal authority.

Figure 1.5: Institutional Framework for MSW Management



Source: Athena Research

The State Board or the Committee is mandated to monitor the compliance of the standards regarding ground water, ambient air, leachate quality and the compost quality including incineration standards.[18] The responsibility of Central Pollution Control Board (CPCB) is to co-ordinate with the State Pollution Control Boards (SPCBs), and Committees with particular reference to implementation, review standards and guidelines and compile data.

I.4 MSW Management — Partnerships by ULBs

Though the MSW Rules make the ULBs responsible for management of wastes, ULBs have partnered with private waste management companies, NGOs and RWAs for various segments of the MSW value chain due to various capacity constraints. In order to comply with the MSW Rules

18 Incineration is a thermal combustion process that involves burning of organic substances contained in waste materials.

and overcome capacity constraints at the local level, some states have come up with centralized waste management systems at the city level or regional level. Centralized waste management systems at the city level are being practiced in Guwahati, Hyderabad and Chennai, among others. Regional level MSW management facilities have come up in Tamil Nadu and Gujarat. [19]

Various forms of engagement among the ULB, private sector and community have been observed at different places in the country. Exhibit 1.1 lists the various forms of partnerships undertaken by ULBs with other stakeholders for the management of MSW in India. Broadly, four kinds of engagement by ULBs can be observed in the management of MSW in India. Firstly, there are ULBs that manage the wastes on their own. Cities like Jabalpur, Bokaro and Tiruchirapalli, among others, fall into this category. It might be the case that these cities engage private contractors for some services like street sweeping but they collect, transport and dispose waste themselves. Secondly, there are cities like Hyderabad and Rajkot which have partnered with the private sector for processing of waste. In Rajkot, the collection and transportation of waste is managed by the local municipal corporation. In Hyderabad, the local authority initially entered into concession agreements with three private sector companies for only processing of waste. Lately, a separate contract was awarded to a private concessionaire for collection & transportation of waste for the entire city and processing of the remaining waste. Thirdly, municipal corporations of Chennai, Namakkal and Trivandrum, among others, have engaged SHGs and NGOs for (decentralized) management of waste. There are also cases such as the Guwahati Municipal Corporation, where ULB partners with both the private sector and the community of informal waste workers to design and implement an integrated (centralized) solid waste management model.

Lastly, in some cities, the local community has come forward to manage the waste in their own areas or nearby vicinities. In such cases, the ULBs give permission to RWAs, SHGs or NGOs to undertake waste management activities. In other cases, the ULBs actively supports community participation in management of wastes by providing financial support to the community based on the area served or quantity of waste managed. For instance, the 'Advanced Locality Management' scheme has been launched by Brihan Mumbai Municipal Corporation. Under the scheme, members of the locality participating in the scheme are provided subsidies and technical help to construct composting facilities.

19 A 'Regional MSW Facility' means a waste management facility or system of any kind (whether in relation to collection, transportation, treatment or disposal of MSW or a combination of any or all of them), which collects, manages or receives or disposes (as the case may be) MSW from more than one Authority. For further details, please refer to 'Municipal Solid Waste Management on a Regional Basis-Guidance Note, MOUD, GOI (2011).

Exhibit 1.1: Forms of Partnership by ULBs for MSWM

ULB (on their own)	ULB + Private Sector Player	ULB + Community	ULB + Private Sector Player + Community
Bokaro, Trichy, Munger, Patna	Hyderabad, Rajkot, Chennai (1995 onwards), Bengaluru, Ahmedabad	Chennai (1989-1995) Namakkal Trivandrum	Guwahati

Source: Compiled from various documents including CDPs, SWM Tool Kit (MOUD, GOI), case studies etc.

I.4.1 Centralized and Decentralized Waste Management Approaches

Municipal waste can be managed through a centralized approach, a decentralized approach or a combination of the two. Waste management services under each approach in turn can be delivered by the ULBs themselves or in association with the private sector or the local community. In India, both centralized and decentralized systems are in practice in different cities/towns. These two approaches have been briefly discussed below.

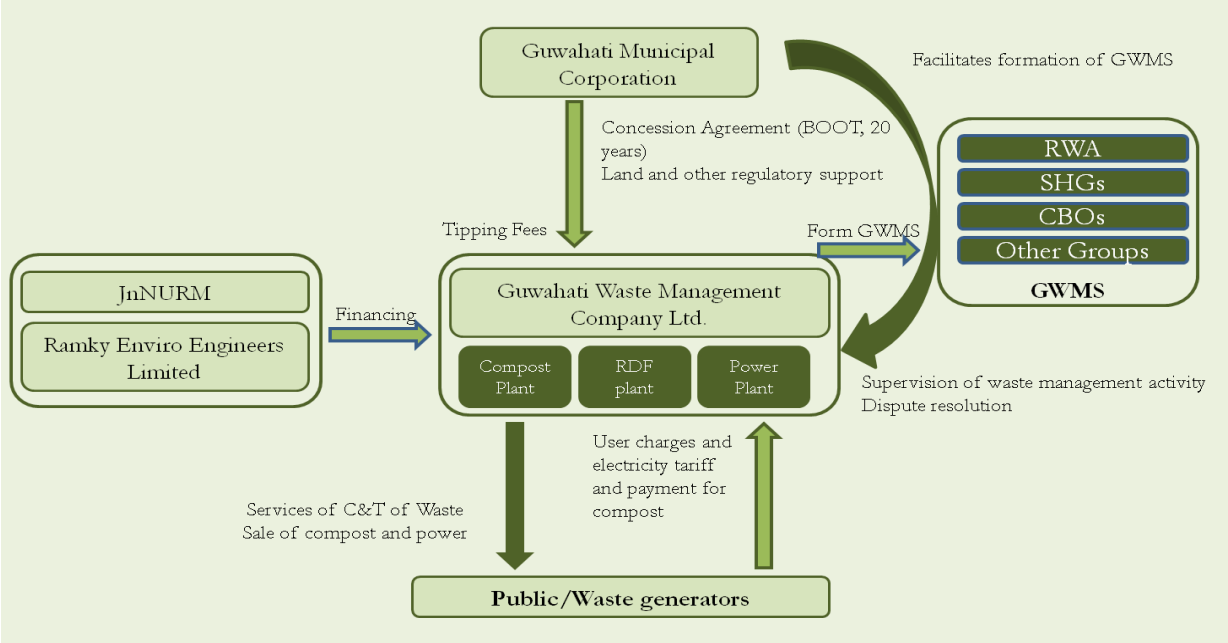
a. Centralized Approach

The centralized approach to waste management, also termed as Integrated Solid Waste Management, is a technology-driven waste management system for handling bulk wastes at a central processing facility. With respect to the MSW value chain, in a centralized waste management system, the implementing agency (either the ULB or a private entity) collects wastes from household or community bins and transports it to a processing facility. Thereafter, composting techniques and/or waste to energy technologies like incineration, pellatization[20], Refuse Derived Fuel (RDF), plasma gasification, bio-methanation are used to derive value from the wastes. These waste to energy technologies are more common in developed countries and have been applied in a few waste management projects in India. An Integrated Solid Waste Management System (ISWM) envisages provisioning of all aspects of waste management i.e., collection, transportation, processing and disposal of waste by one or two large entities. Hyderabad and Guwahati are two such cities where an ISWM system is in place. Fig. 1.6 gives a graphical representation of the ISWM project of Guwahati. Application of state-of-the-art technologies, reaping economies of scale and ensuring commercial viability of projects are the main reasons for bundling up of all segments of the waste value chain. Moreover, coordination between the ULB and

20 Pelletization is the process of segregating incoming waste into high and low calorific value materials and ripping them up separately to nearly homogenous sizes. The different heaps of shredded waste are later mixed together in appropriate proportions and then solidified to produce Refuse Derived Fuels (RDF). The RDF is used to generate electricity.

the private entity is relatively better in the ISWM framework when compared to a scenario where multiple entities are engaged in different segments of the waste management process.

Figure 1.6: Stakeholder Map of Integrated SWM Project at Guwahati



Source: Athena Research

b. Decentralized Approach

The decentralized method of managing a city's waste involves management of municipal waste by various small waste management centers within the locality. In technical parlance, such centers are called Integrated Resource Recovery Centers (IRRC) which can be either profit-making or not-for-profit organizations engaged in collecting, transporting and processing around 2 to 20 metric tons of waste from the surrounding locality. The micro-entrepreneurs owning for-profit IRRCs generally engage informal workers for collection and transportation of wastes through hand-held carts or other small vehicles. Composting is undertaken to convert organic waste into manure whereas recyclables like metal, glass, plastics etc are either sold to the recycling industry or recycled by the organization itself. The refuse is collected by the ULBs and transported to the sanitary landfill sites. One such example is Waste Concern — a social business enterprise in Bangladesh. Fig. 1.7 provides a graphical representation of the decentralized system of the pilot project. The system is based on door-to-door waste collection and provides training to households in segregation of wastes. Resource Recovery Centers (RRC) are set up, each serving approximately 1,000 households and having a treatment capacity of two to three tons of waste per day. The RRCs are profit-making enterprises that employ informal health workers for waste collection and processing services. Each RRC provides daily door-to door collection services using cycle-carts operated by a team of two informal waste workers in uniforms and with safety equipment like hand gloves, boots and masks. The collected wastes are transported to the RRC where it is manually segregated and organic waste is composted using the aerated box method. Sieved compost is enriched with nitrogen,

phosphorous and potassium to make organic manure. The organic waste comprises around 80% of the total waste. The recyclables, which form about 15%, are sold to recycling units while the refuse constituting 5% is collected by the municipal corporation every two or three weeks and dumped in landfills.

There are also Indian examples of successful decentralized waste management systems which manage wastes in a manner that is environmentally safe and economically viable. Chennai, Bengaluru and Saharanpur are few cities which have experimented with the decentralized systems in the country. Chennai had a decentralized waste collection and transportation system as early as 1989 where EXNORA International — a non-governmental organization (NGO), set up small waste management units in different areas of the cities managed by the community. EXNORA International roped in the informal waste workers for primary collection and transportation of waste from households to the waste bins provided in street corners by the Corporation of Chennai (CoC) The community contributed a nominal amount towards the service rendered which along with revenue from sale of recyclables covered the operational expenditure (salary of the workers and other administrative expenses) of the project. The CoC supported the initiative by transporting the refuse from the street bins to the dump sites.

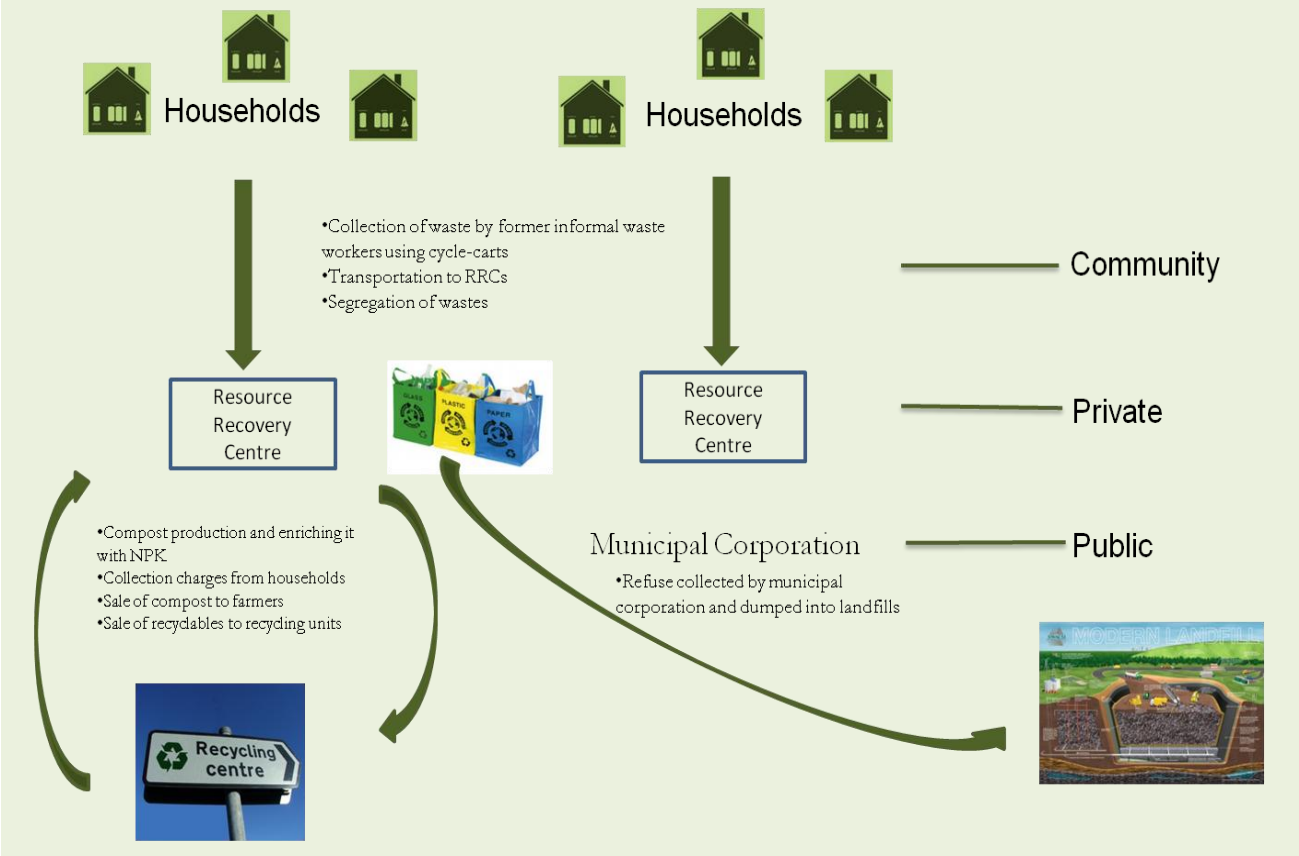
Another novel initiative is observed in Saharanpur City located in north-western Uttar Pradesh where municipal solid waste is being managed by a joint initiative of a large corporate house – ITC Ltd, an NGO – Muskan Jyoti Samiti, the local municipal corporation and the district administration in one area of the city. The NGO is engaged in the door-to-door collection, transportation and processing of waste. It has set up a small composting unit in the locality for converting organic waste into manure. The operational expenditure of the initiative is covered by sale of recyclables, manure and collection of user charges from the waste generators.

Recently, a ward in Bengaluru has initiated the process to undertake decentralized solid waste management by utilizing the JNNURM's Community Participation Fund (CDF). Vijayanagara Nagarikara Vedike (VNV) — the implementing agency of the project has been working in association with the Health Department of Bruhat Bengalore Mahanagara Palike (BBMP) on and the local community since the project planning and conceptualization phase.[21] The scope of the work includes road sweeping, collection, segregation, transportation and disposal (through bio-mechanical composting) of the waste. The BBMP would be responsible for transportation of the waste and would provide technical and financial support. It would also assist in conflict resolution and operational problems, if any along with involvement in awareness initiatives. The responsibility of the citizens includes setting up and management of the compost unit. The VNV's role would be primarily initiating community awareness programmes, project identification & report preparation, organization of training programmes for persons from the community for O&M of the composting units, marketing of compost and disposal of waste, among others.

[21] Vijayanagara Nagarikara Vedike is a Federation of the Resident Welfare Association and other institutions engaged in citizen welfare activities in different wards of Vijayanagara, Bengaluru.

Box 1.2 provides a snapshot of the key features of a small decentralized waste management facility practiced by 'Waste Concern' in Dhaka.

Figure 1.7: Community-Based For-Profit Decentralized SWM Systems



Source: Athena Research

Exhibit 1.2: Centralized & Decentralized Waste Management Systems at a Glance

	Centralized Waste Management System	Decentralized Waste Management System
Pros	▪ Suitable for high income countries/cities ▪ Reduces manual handling of waste ▪ Waste can be used for producing compost and energy	▪ Promotes source segregation ▪ Effective monitoring by community ▪ Allows integrations of informal waste workers ▪ Applicable in cities with strong social factors ▪ Savings in transport cost and landfill requirements.
Cons	▪ Not suitable for waste with high organic waste content ▪ It is not cost effective ▪ Does not allow integration of informal waste workers	▪ Does not address the issue of manual handling of waste. ▪ Requires space for each resource recovery centre in vicinity of households. ▪ Generation of electricity not feasible

Source: Athena Research; Compiled from various sources

Box 1.2: Waste Concerns Integrated Resource Recovery Centre

Waste Collection: 2 Metric Tonnes per day

Human Resource Requirement:

6 workers, 2 van drivers, 4 waste collectors and 1 plant manager

Compost Production: 500 Kg (25 % of the total waste collected)

Compost Price: 2.5-5 Tk* per Kg (Tk 7-8 per kg after enrichment)

Total Fixed Costs: Tk 5,08,200

O&M Costs: Tk 2,09,000

User Charges levied: 10-15 Tk per month per household

Land Used: 0.0022 Sq. Km

Note: The financial figures are at 2002 price level

Source: Community Based Decentralized Composting: Experience of Waste Concern in Dhaka, Urban Management Innovation.
* Tk denotes Taka (Currency of Bangladesh)

Salient Features

The integrated and the decentralized waste management systems have their own advantages and disadvantages and cannot be uniformly applied to ULBs of all sizes and locations. Both the waste

management mechanisms – centralized and decentralized – when deployed in circumstances suited to the particular mechanism, can result in efficient solid waste management. Neither has been shown to be superior to the other on all parameters in all conditions, and hence, the question that needs to be answered is under which conditions should a centralized model of waste management be adopted, and when to adopt the decentralized model.

An attempt has been made in Exhibit 1.2 to list the salient features of both the approaches so as to indicate the appropriateness of each. The choice of a particular approach depends on several factors like financial and human resource capacity of the concerned ULB, socio-economic-cultural profile of city/town, status of service delivery, quantity and quality of waste generated, availability of land, among others. In the next chapter, we discuss some key parameters that should be considered while choosing a particular approach to waste management.

Chapter II

CURRENT STATE AND GAPS

II.1 Existing Performance Standards

Proper management of waste has been a critical aspect in urban areas, especially in mega cities which are major centers of waste generation. Irregular collection or non-collection, transportation in open vehicles, and environmentally unsafe methods of processing & disposal of waste are common features of a large number of urban areas across the country. While steps for improving service delivery were initiated as early as 1963 with the Zakaria Committee setting service norms and standards in urban services, poor implementation of the committee's recommendations, owing to the presence of weak enforcement mechanisms has led to the poor management and delivery of MSW services in Indian cities. The public and the government were jolted into recognizing the deteriorating quality of waste management services by the Surat Plague disaster in 1994. After the Surat disaster, 'Clean India' campaigns highlighting the pitiable conditions of hygiene and waste management in cities and towns were made by social activists in 1994 and 1995, covering 30 cities and 60 towns. Subsequently, a Public Interest Litigation (PIL) was filed in the Supreme Court of India, Almitra H. Patel Vs. Union of India (1996), seeking adoption of hygienic waste management practices by the ULBs.

The Supreme Court of India formed an Expert Committee in 1999 to provide recommendations for improving waste management practices in Class I cities. Subsequently, the Ministry of Environment & Forest introduced the MSW (Management & Handling) Rules in 2000, incorporating key recommendations of the Supreme Court appointed 'Expert Committee'. The MSW rules contained several remarkable features, e.g., door-to-door collection, segregation of waste at source and scientific disposal of waste, among others. Further, the Supreme Court of India set 2003 as the target year for compliance with the rules set by the ULBs. Prior to the announcement of MSW (M&H) Rules, 2000 there were hardly any standards to measure the quality of MSW management services provided by the local bodies. In the absence of any law regarding the management of municipal solid waste, the ULBs were not compelled to provide regular door to door collection of waste or for its scientific disposal.

Another important landmark in the MSW space was the setting up of 'Service Benchmarks' in Urban Services by MOUD in 2008. Exhibit 2.1 lists the various benchmarks to be achieved by the ULBs.

II.1.1 Performance of ULBs – MSW Management

A glance at the existing situation of service delivery standards across the ULBs points to the poor performance of almost all cities and towns in India. Despite several policy interventions e.g., announcement of MSW (Management & Handling) Rules, setting up of service benchmarks, provision of central and state government grants through JnNURM under UIG/UIDSSMT etc, the outcomes have been largely unsatisfactory barring a few cities.

The MOUD undertook a pilot study in 2009 to assess the performance of 28 select ULBs representing different tiers of cities across different states. The study found that none of the ULBs performed at par with the service level benchmarks.[22] The exhibit below summarizes the performance of the surveyed ULBs and highlights the poor service delivery in terms of C&T, poor segregation efficiency and unscientific disposal of wastes.

Exhibit 2.1: MSWM Service Level Benchmarks and Average ULB Performance

S/N	Performance Indicator	Service Level Benchmark (in percent)	Current Average Performance (in percent)
1	Household Coverage	100	47.7
2	Collection Efficiency	100	75.3
3	MSW Segregation	100	19.5
4	MSW Recovery	100	31.73
5	Scientific Disposal;	100	8.0
6	Cost Recovery	100	17.3
7	User Charges Collection Efficiency	90	31.4
8	Complaint Redressal	80	89.1

Source: Service Level Benchmarking Data book: Improving Service Outcomes 2008 – 09, Ministry of Urban Development, Government of India.

Legend

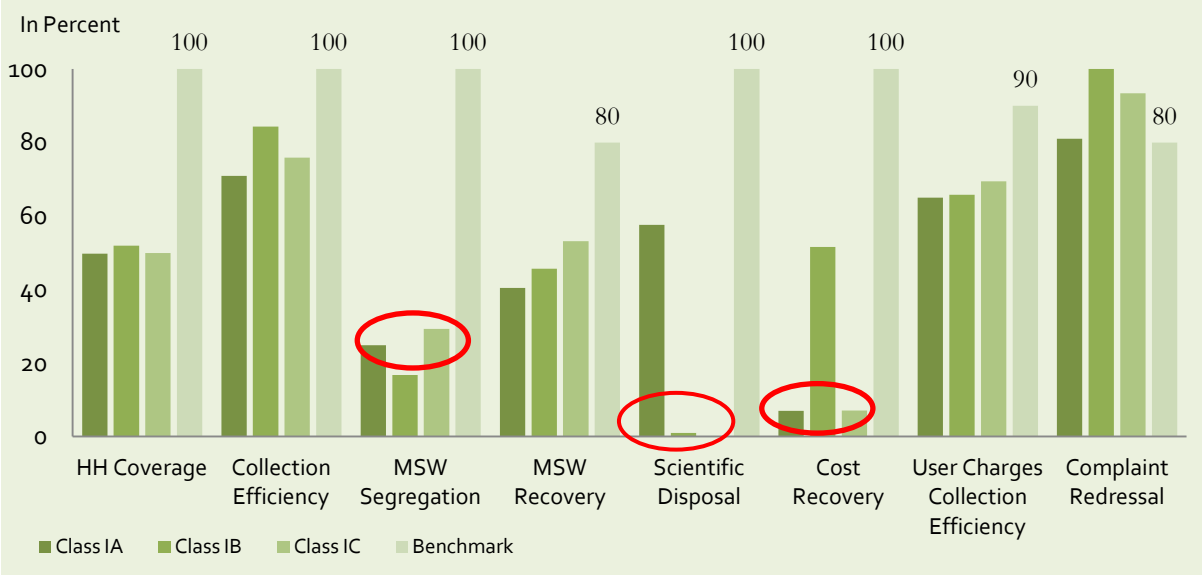
- Target met
- Target missed by 0-25 %
- Target missed by 26-50 %
- Target missed by 51-75 %
- Target missed by over 75 %

22 The 28 cities/towns included in the pilot study cover 3 Class IA, 6 Class IB and 14 Class IC cities as per the new classification of cities mentioned in the HPEC Report, MOUD, GOI (2011). The remaining 5 cities belong to Class II/III/IV+ cities/towns.

Classifying the performance of the ULBs according to the city size (Class IA, IB and IC) shows that performance on parameters such as waste segregation and scientific disposal of municipal waste is extremely poor irrespective of the city size. Cost recovery is relatively better in Class IB cities like Indore, Surat and Ahmedabad. Scientific disposal of waste is absent in Class IB and IC cities and it is practiced only in 2 of the Class IA cities sampled. Household coverage is around 50% in all the three categories.

Fig. 2.1 provides a comparative analysis of the sample of Class IA, IB and Class IC cities on all the eight parameters.

Figure 2.1: Status of MSW Management — Class IA, IB & IC Cities

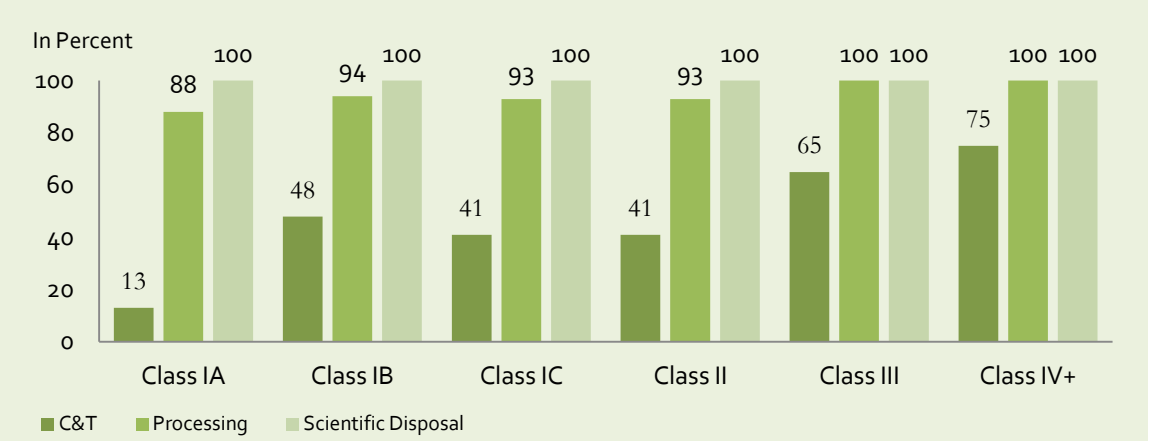


Source: Based on data available in Urban Finance, Vol. 13(1), NIUA (2010)

The performance of the remaining urban cities which are not covered in the sample is even more dismal. The report by the High Powered Expert Committee (HPEC) on urban infrastructure[23] states that 100% Class III and IV+ cities have a significant backlog in C&T; between 88% and 93% of the Class I and Class II cities have backlogs in processing of waste while 100% of all Indian cities and towns have backlogs in terms of scientific disposal.[24] Fig. 2.2 displays the service level backlogs of the ULBs in terms of three broad aspects of the MSW value chain — Collection & Transportation, Processing and Scientific Disposal.

23 Please see, HPEC Report, GOI (2011) for further details.
24 Service Backlog refers to services that should have been provided by the ULBs but were not and therefore need to be provided now.

Figure 2.2: Backlogs of Service Level Benchmarks



Source: Based on data available in HPEC Report, MOUD, GOI (2011)

II.2 Factors Contributing to Poor Service Delivery

ULBs' lack of commitment, poor financial health, untrained or inadequately trained work force and lack of equipment are the main reasons for the incomplete coverage and unscientific processing & disposal of waste in Indian cities and towns. However, with an increasing urban population, and a changing socio-economic demographic profile, there is growing pressure on the ULBs to deliver quality services to its citizens. This requires increasing the capacity of the ULBs for better management of MSW in their localities. Different segments of the MSW value chain are beset by different set of problems that render management of MSW ineffective, inadequate and inefficient.

Box 2.1: Solid Waste Management in Berhampur (Odisha)

Solid waste management service in Berhampur, a Class I Town in Odisha is poor relative to the desired levels. A pilot study on the status of SWM service in 28 cities and towns found that the household coverage and collection efficiency of waste in Berhampur was 2.6% and 81.2%, respectively against benchmark levels of 100 percent for each service. Lack of human resource and equipment capacity in the Berhampur Municipal Corporation (BMC) is possibly one of the main reasons for the poor performance in these two aspects of service delivery. BMC has a total sanctioned strength of 840 staff of which 253 positions are lying vacant. Further, the Corporation is burdened with the payment of loans and gratuity to its retired staff. Waste is disposed in open dumping grounds as well as open channels thereby creating chokage and stagnation problems.[a] Door to door collection is absent and waste collection is not practiced on a daily basis. BMC is substantially dependent on government funds and grants (around 44%) and receipts from rates and taxes form about only 6% of the total receipts. The city does not levy any user charge for MSW service.

Sources: 'Town Level Background Paper on Berhampur Town (Odisha) for The Urban India Reforms Facility,' KIIT (2011).

Inadequate collaboration by the ULBs, with all the stakeholders, namely, households, rag-pickers, non-governmental organizations, private waste management companies, households, environmentalists and local leaders, in devising possible solutions to the waste menace of the respective localities is an important factor that hinders the application of a concerted effort for MSW management. Lack of awareness about the importance of good SWM practices especially about waste segregation and the absence of any clear mandate that fixes the responsibility of waste segregation on waste generators result in mixing of all kinds of wastes by people.

Further, most ULBs depend on central and state government grants for funds that are often inadequate, as the bulk of funds are absorbed by administrative expenses. Inadequate financial resources from the ULB's internal sources, inadequate and untrained staff, obsolete or insufficient equipment and lack of sufficient motivation to provide quality and timely services to people make the delivery of reliable and affordable waste management services all the more complex. The resource gap for the Operations and Maintenance (O&M) of municipal services alone was estimated to be around ₹ 32,143 crore for the period 2005-10.[25] In this section we describe the various factors affecting performance across the value chain of solid waste management.

25 Please refer to "Norms and Standards of Municipal Basic Services in India," M. P. Mathur *et al.* NIUA (2007).

Box 2.2: Solid Waste Management in Nashik (Maharashtra)

The Report card of the Nashik Municipal Corporation (NMC) in terms of the service level benchmarks is better relative to other ULBs. Household coverage and collection efficiency of NMC are 86.9 and 87 percent respectively while the extent of MSW segregation and recovery were found to be 34.5 percent and 100 percent respectively in the pilot study by Ministry of Urban Development in 2009. The network of 'Ghanta Gadis', as the garbage collection tractors are called colloquially, in the area have resulted in significant improvement in the level of service post MSW rules enforcement. The city has 124 tipper trucks each manned with one driver and 2 garbage collectors. Though the practice of source segregation is not widely practiced, the garbage collectors in the ghanta gadis segregate the non-biodegradable waste. NMC has constructed a 300 TPD compost plant and also disposes refuse in sanitary landfill sites. Around ₹52.3 crore has been allocated for provisioning of MSW services in the city.

Sources: City CDP of Nashik Municipal Corporation under JnNURM, NMC (2010). Nashik city Development Plan: Appraisal Report, JnNURM.

II.2.1 Factors contributing to Poor Waste Segregation System

Lack of public awareness about the need for waste segregation

Creating awareness about the importance of proper waste management is an area that has not received adequate attention from policy makers. The principle of 3R's – Reduce, Reuse and Recycle is rarely practiced at the individual household or commercial establishment level. Citizens are not aware of the merits of waste segregation and scientific disposal of wastes. Even when citizens know that waste should be segregated into bio-degradable and non-biodegradable components, they do not practice it as they are not informed of the social and economic repercussions associated with the mixing of organic and in-organic waste with hazardous biomedical and electronic waste. Information, Education and Communication (IEC) campaigns highlighting the criticality of MSW management have not been undertaken at the required scale by ULBs.

Lack of accountability for waste segregation

The MSW (Management & Handling) Rules, 2000 does not fix the responsibility of waste segregation on the waste generators. However, the Committee on 'National Sustainable Habitat Standards for Municipal Solid Waste Management' has recommended fixing the responsibility on premise occupiers for temporary storage of segregated waste. The Committee has also recommended penalizing municipal corporations for non-compliance with MSW Rules. Adopting a 'Carrot and Stick' approach can ensure that the waste generator segregates waste. Providing rebate on property tax or other taxes collected by ULBs to incentivize segregation of wastes while levying penalties or non-collection of waste from individuals/establishments that do not supply segregated waste can be practiced by the ULBs. These features are likely to be incorporated in the amendment to the MSW Rules, 2000 that is under contemplation by the central government in consultation with state governments and ULBs.

II.2.2 Factors contributing to Poor Collection & Transportation (C&T) System

Unplanned and variable city features

A large number of cities and towns in India have developed in an unplanned way. The width of roads and lanes vary significantly within and among cities. Therefore, C&T systems require meticulous planning to ensure successful execution. The different urban profiles of cities and towns call for different systems for C&T. However, most of the ULBs practice a uniform C&T system for an entire city/town, as a result of which inaccessible and marginal areas are not covered.

Inadequate equipment and inappropriate technology

Inadequate vehicles and equipments at the disposal of ULBs, primarily due to lack of financial resources, is often cited as a reason for poor service delivery. Faulty designs for waste C&T system such as inappropriate size and placement of garbage bins, transfer stations, etc. has aggravated the problem of overflowing waste and insufficient removal of waste from sites. The waste characteristic in India is different from that of industrial countries as it contains a high proportion of bio-degradable wastes that increase waste density. Hence, vehicles that operate with low-density waste in industrial countries are not suitable or reliable for Indian conditions. The vehicles for transportation of waste should be adapted to suit Indian conditions pertaining to waste density, lane width, etc.

Inefficient and untrained staff

Inefficiency, rather than inadequacy, of the existing staff results in poor coverage of MSW management services. For instance, Delhi has five health workers per 1,000 persons, more than double the prescribed CPHEEO norm of 2 health workers per 1,000 persons, but its household collection efficiency is only 4.2%.[26] There is a need to increase the efficiency of the health workers in order to improve the collection system of the ULBs.

Non-integration of informal workers

Informal workers e.g., rag-pickers, waste collecting communities, etc. play a vital role in the collection, transportation & disposal of waste and compensate, to some extent, the inadequacy of the services provided by ULBs. Failure to integrate these workers in the MSW management mainstream contributes to poor service delivery. The waste pickers often rummage waste bins and cause waste to scatter around the bins. Items like plastic, metals and glass collected by waste pickers reduces the potential value of waste and also makes production of energy from waste unfeasible as plastic is an important ingredient of refuse-derived fuel used for generating electricity. These factors play a decisive role if a ULB decides to set up an integrated waste management plant for extracting value from waste as key waste elements like plastic and metals are siphoned by the informal waste workers.

I.2.3 Factors contributing to Poor Processing & Disposal (P&D) System

Insufficient fund allocation to processing and disposal

Open dumping of waste is the easiest way to dispose waste. Before the MSW (Management & Handling) Rules, 2000 were in force, ULBs were under no pressure to adopt scientific disposal practices. However, despite the introduction of the MSW rules, the practice of 'open dumping' is still rampant in the country, with only a handful of ULBs having sanitary landfill facilities in place. The problems encountered in the C&T segment of MSW management are reflected in the P&D segment as well. Collection of un-segregated waste from source makes extraction of value costly or

26 See, Urban Finance, Vol. 13(1), NIUA (2010) for further details.

economically unfeasible in most cases. The Supreme Court Committee on Municipal solid waste in 1999 noted that around 70-75% of the total expenditure on waste is spent on street sweeping; 20-25% on collection and only 0-5% on disposal of wastes by the ULBs.

Unproven technologies

Controversies in the scientific and environmental arena for some waste management technologies e.g., incineration, plasma gasification, have made ULBs apprehensive about going ahead with such technologies.[27] Some of the ULBs, for instance, the Municipal Corporation of Delhi experimented with scientific methods to process and dispose waste but encountered problems due to various reasons. Please refer to Box 2.3 for an illustration. Further, wastes to energy/compost plants require the availability of a minimum waste quantity of specified composition and nature for the smooth operation of the plants, which is usually not available.

Box 2.3: Waste to Energy Plant – Municipal Corporation of Delhi

The Municipal Corporation of Delhi (MCD) established a 3.75 MW waste-to-energy (wte) plant with assistance from Government of Denmark in 1987 to address the twin problems of waste disposal and electricity shortage faced by the city. The capacity of the plant was 300 TPD of solid waste and was set up at a cost of ₹ 25 crore by Volund Miljotecknik A/S of Denmark that also supplied the incineration technology. The plant started operation on a pilot basis but was shut down three years later due to the poor quality of unscreened or unsegregated incoming waste as the plant was design for screened waste. Subsequently a screening plant was set up with a capacity of 100 TPD but still the waste was not adequate to operate the plant.

Source: Failure of Timarpur, Case Study, NSWA (2010).[28]

Chapter III

PRIVATE SECTOR PARTICIPATION IN SWM

In recent times, private sector participation has become an important mechanism to improve provisioning of infrastructure services worldwide. In India, several public private partnerships have been undertaken in commercial infrastructure sectors at the central, state and even local levels for overcoming capacity constraints in government bodies and for leveraging private finance and achieving efficiency.

III.1 Need for Private Sector Participation

India's annual waste generation is projected to increase to approximately 260 MT by 2047 from the present 42 MT.[29] Fig. 3.1 displays the anticipated waste quantities for Class I cities for the next two decades. There is an imminent need to address the service backlog (Fig. 2.2) as waste generation in India will increase manifold in the coming years with increasing population, industrial activity, income levels and urbanization. Class IA, IB and IC Cities will continue to account for the bulk of the waste generated in the country. Therefore, waste management and handling capacity in these cities must be enhanced.

Figure 3.1: MSW Generation: Past, Current & Future (MTD)

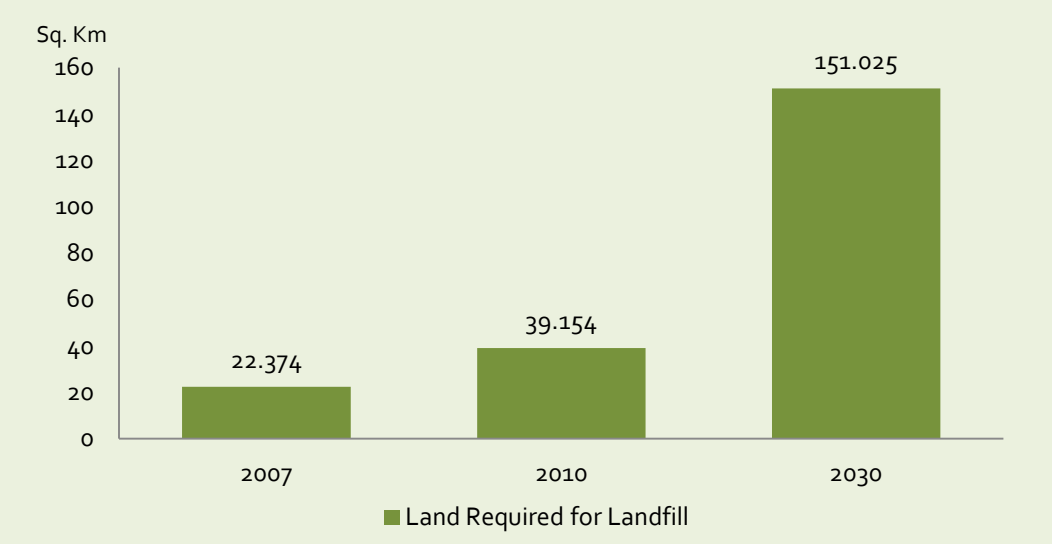
Source: Athena Research

[29] Please refer to "Successful Innovations in SWM Systems: Examples from Five Local Bodies in Tamil Nadu," GOTN & UNICEF (2010) for further details.

The land required for disposing waste is also set to increase in response to the increase in waste generation. Fig. 3.2 shows that the land requirement for landfills has increased by 75% in a span of just 3 years from 2007 to 2010 and is further estimated to increase by 285% by 2030 if prudent waste management practices are not adopted at the earliest.

While there is scope for reducing the land required for landfills by adopting suitable waste processing technologies like composting, pellatization, and bio-methanation, application of technologies other than composting requires stringent implementation and monitoring mechanisms and the choice of such techniques should be made keeping economic and environmental costs, if any, in consideration.

Figure 3.2: Future Land Requirement for Landfill in India



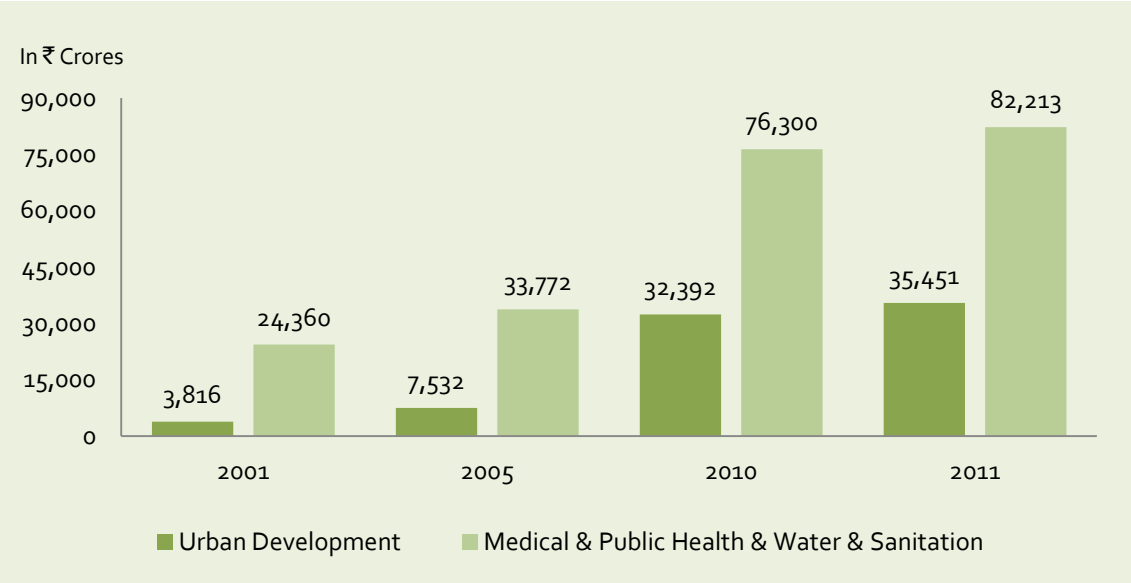
Source: Estimation of Municipal Solid Waste Generation and Landfill area in Asian Developing Countries, Khajuria *et al.*, Journal of Environmental Biology (2010).

The urban local bodies in India are not able to manage the increasing quantity of waste generated in urban cities even though they spend a substantial chunk of their budget on waste management. A United Nations Development Program (UNDP) survey, which covered 151 mayors of cities from around the world in 1997 found that insufficient solid waste disposal is the second most serious problems that city dwellers face after unemployment. Private sector initiatives and community participation have resulted in improved waste management services in several developed and developing countries and presents India n ULBs with an alternative to expensive or inefficient public delivery of MSW services.

The rationale for bringing in private sector participation in this sector is primarily to leverage private sector *efficiency*, *expertise* and *technology* rather than finance, as several government schemes are in place for providing funds to ULBs, although with certain conditions. If the private sector provides higher standards of waste management service at the same cost or provides equivalent service at a lower cost compared to the local administration, then private sector participation should be considered. The private sector has access to a wide range of technological alternatives that can be

used for the processing of waste. Asnani (2005), mentions that ULBs in India spend somewhere around 10-50% of their total expenditure on waste management services.[30] Hence the issue is not always the paucity of funds, but a lack of a professional approach to deliver services efficiently and in a cost-effective and reliable manner. Fig. 3.3 shows the total expenditure made by the government on the provision of Medical & Public Health and Water Supply & Sanitation and Urban Development services from 2001 to 2011. Expenditure on waste management services is included partly under both the accounts. Even though total expenditure on public health and urban development increased temporally, the service levels remained at dismal levels.

Figure 3.3: Combined Budgetary Transactions — Centre & State (₹ Crores)



Source: Based on Data available in 'Indian Public Finance Statistics,' DEA, GOI (2011)

There are instances where private sector participation has brought in cost reduction in MSW service delivery. Exhibit 3.1 compares the solid waste management sector before and after private sector participation. Due to non-availability of data on the pre and post-PPP experience of all ULBs indulging in PPPs, a comparative analysis of only 11 cities is presented here even though cities like Delhi, Hyderabad and Chennai among others, had some form of private sector participation earlier.

In India, significant cost reduction were observed in the case of Jamnagar and Sriganganagar after they sought private sector participation whereas Anantapur and Nellore witnessed an increase in cost of provisioning MSW services after they contracted sweeping services to private contractors. However due to the lack of any information on service levels provided to citizens of the

30 In Jabalpur, SWM is the single largest expenditure head in the municipal fund accounting for over 60% of the revenue expenditure. See http://www.jmcjabalpur.org/city_development_plan_section_6.jsp, for further details.

aforementioned ULBs, it is difficult to comment on the success or failure of involving the private sector in MSW service delivery.

Exhibit 3.1: Pre and Post Private Sector Participation in SWM in a few Cities/Towns

City/Town	Year	Cost Before PSP ₹ '000	Cost After PSP ₹ '000	Value Chain
Anantapur	1997	11500	14500	Sweeping
Rajendra Nagar	1997	20	85	Sweeping & Collection
Qutubullapur	1997	2000	4200	Sweeping
Nellore	1998	23843	27812	Sweeping
Jamnagar	1987	8000	2200	Primary Collection
Sriganganagar	1994	700	350	Sweeping
Jabalpur	1998	1164	770	Sweeping
Kapra	1999	4640	2908	Sweeping
Kamptee	1999	25	18	Commercial
Manmad	1999	300	147	Transportation
Virar	1999	4500	3500	Sweeping & Collection

Source: Compiled from 'Status of Water Supply, Sanitation and Solid Waste Management in Urban India,' Statistical Volume III, SWM 1999, NIUA (2005).

With the laying down of performance standards for MSW service delivery, it is now possible to gauge the extent of improvement in efficiency and cost-effectiveness of MSW management consequent to private sector involvement in various segments of the MSW value chain. Such an environment has facilitated a spurt in long-term partnerships with the private sector for initiating door-to-door collection, setting up of waste processing facilities and scientifically engineered landfills. The number of projects with private sector participation has been increasing over the years and the country is well-poised to engage with the private sector partnerships to deliver MSW services.

III.2 Potential for Private Sector Participation

At present, a handful of cities have ventured into public-private participation in an attempt to overhaul their waste management systems. The partnerships range from engagements for collection & transportation, processing & disposal of waste and for construction and/or management of sanitary landfills. Some ULBs, depending upon their need, have partnered only for C&T segments, some for processing and disposal, and a few only for the disposal of waste. The concept of Integrated Solid Waste Management, being relatively new in the country, has been adopted only by a few cities. The concern for efficient and safe disposal of waste has been growing in recent times as citizens are more aware of the need for and the importance of good waste management systems. The ULBs are under tremendous pressure to adopt good waste management practices and PPPs are seen as a possible option given that several ULBs lack the capacity and technical expertise to manage the growing waste quantities in their areas.

The government has attempted to address the lack of funds at the disposal of ULBs by launching the UIG and UIDSSMT schemes under the JnNURM. These schemes provide grants to the ULBs so as to aid their efforts to improve and augment the provisioning of civic amenities. However, the ULBs availing the grant under the schemes are required to undertake a set of reforms within a specified period. For instance, municipal corporations (*nagar nigams)* are required to reform rent control acts, rationalize stamp duty, migrate to double entry accrual-based accounting system and achieve 100 per cent cost recovery in solid waste and water supply services. Appendix I lists the 17 key reform parameters to be undertaken by ULBs and summarizes the achievement until 2010. These reformatory measures are expected to create a conducive environment for improved delivery of MSW services and enhance the scope for Public Private Partnerships.

III.2.1 Potential in terms of number of ULBs

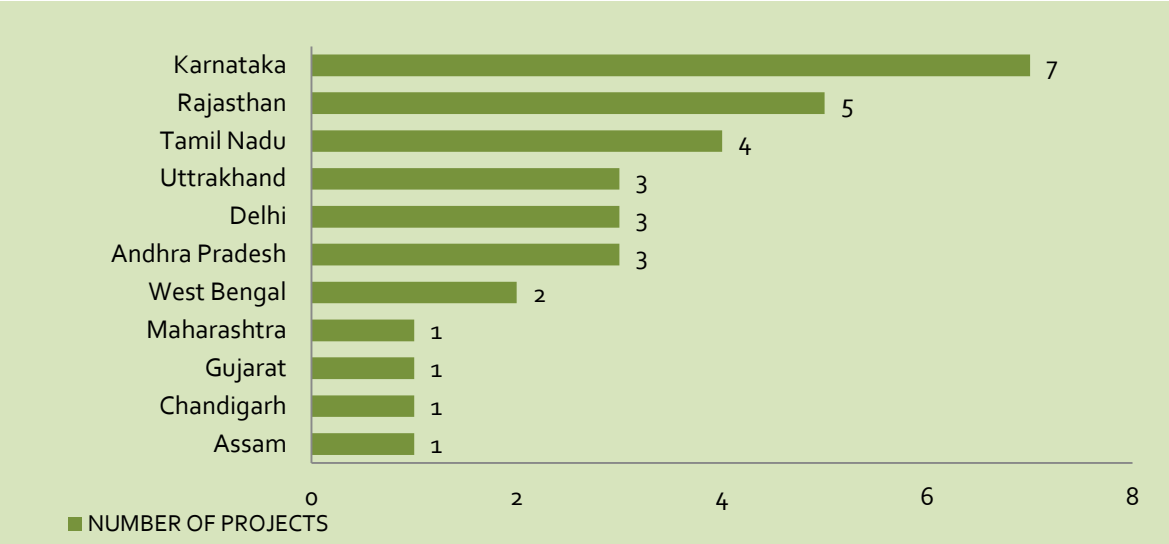
India has over 5,000 cities and towns classified broadly as urban areas. The number of metropolitan cities with population of over 1 million increased from 37 in 2001 to 50 in 2011 and is expected to increase to 87 by 2031. With increasing urbanization and correspondingly high levels of waste quantity that would be generated, the potential for PPPs is tremendous.

A quick perusal of the performance of states across select reform parameter show that Andhra Pradesh and Maharashtra (having undertaken 16 reform measures) lead the group, while Gujarat and West Bengal have completed 14 reformatory measures. Karnataka, Kerala and Tamil Nadu have undertaken 12 reformatory measures each whereas states like Jharkhand, Arunachal Pradesh and Uttrakhand have undertaken only three reforms each.[31] Fig. 3.4 depicts the number of long-term projects undertaken by the ULBs in a few states. Karnataka, Rajasthan and Tamil Nadu lead in terms of the number of long-term PPP projects undertaken by their ULBs. The type of PPP includes

31 Please refer to Appendix I for details.

BOT (toll), BOT (annuity) as well as DBFOT. 31 PPP projects worth around ₹ 2,600 crore are at different stages of implementation.[32]

Figure 3.4: SWM Projects at State Level undertaken as Public Private Partnerships



Source: Compiled from Status of PPP Projects in India, PPP India Database, DEA, (2011)

Among the major states, Tamil Nadu and Karnataka have partnered with the private sector for four and seven long term projects, respectively. The effect of sound SWM practices is apparent from these states as they are among the leading states in terms of urbanization. Maharashtra and Gujarat have only one long-term project each but are states with great potential for PPPs in the MSW management sector and also display a good track record in PPPs in the commercial infrastructure sector.

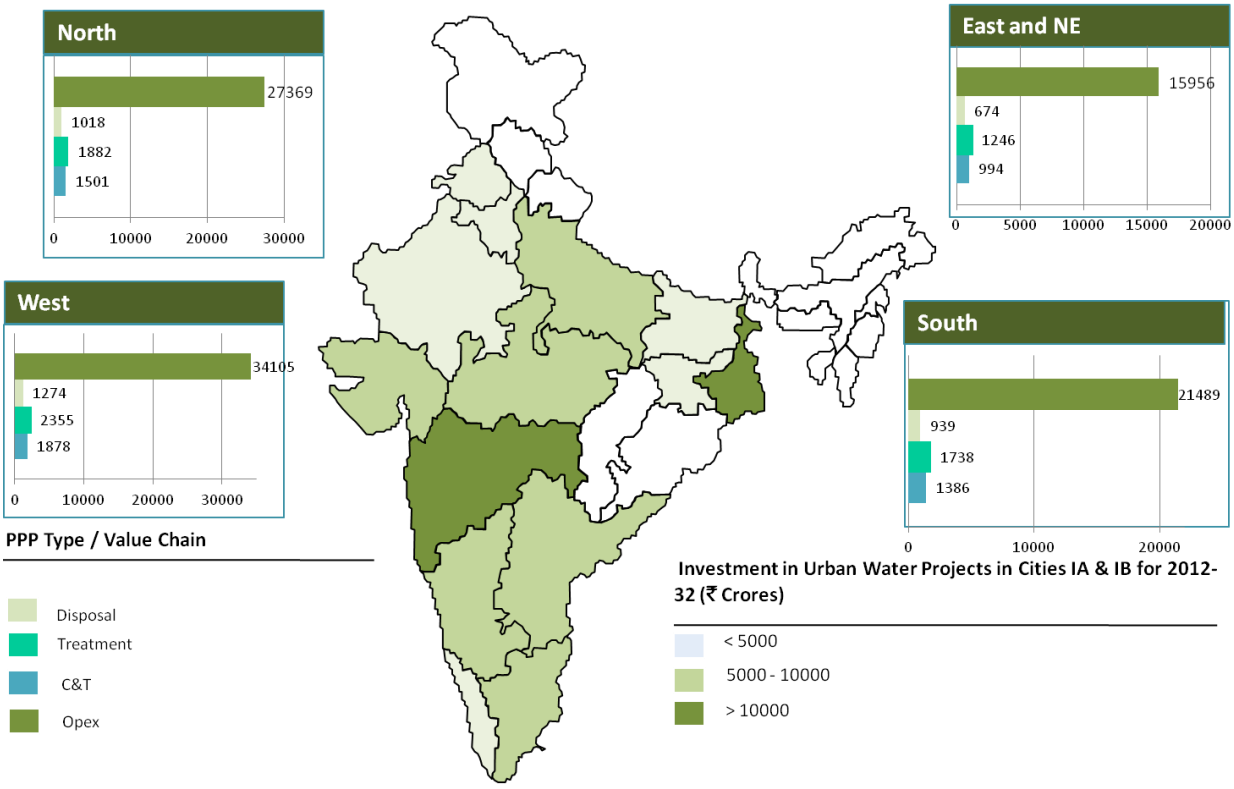
III.2.2 Potential Investment in MSW Management Services

A recent study pegged the total capital expenditure required by Indian cities over the next 20 years at $12 trillion - roughly $134 per capita per annum.[33] The annual per capita capital expenditure on solid waste management services is stated to be $15. With a population of over 1.2 billion people, the total capital expenditure even at $15 per capita annually translates into a huge investment requirement. The High Powered Expert Committee (HPEC) on the infrastructure sector calls for increasing investment in urban infrastructure from 0.7% of the GDP in 2011-12 to 1.1% of the GDP by 2031. In addition, the 13th Finance Commission has already recommended the release of ₹ 23,111 crore to ULBs for the period 2010-15.

32 The list is not exhaustive as PPP India database on solid waste management does not provide information on O&M contracts though several PPPs in O&M are underway in this sector.
33 Please see, "MGI: India's urban awakening: Building inclusive cities, sustaining economic growth," (2010).

The HPEC has recommended expanding the JnNURM in the future and increasing the reach of the mission to all cities and towns of the country. The mission would be re-christened the New Improved JnNURM (NIJnNURM) and it recommends investing 0.25% of the GDP annually on urban infrastructure. One of the recommendations of the HPEC with reference to financing of urban infrastructure is the provision for the creation of a special window for projects that would be financed or executed via PPP route or by leveraging private sources of funding. Fig. 3.5 provides a glance at the quantum of investment required in creation of solid waste management infrastructure in the Indian states.

Figure 3.5: Investment Requirement in SWM in India-2031 (₹ Crores)[34]



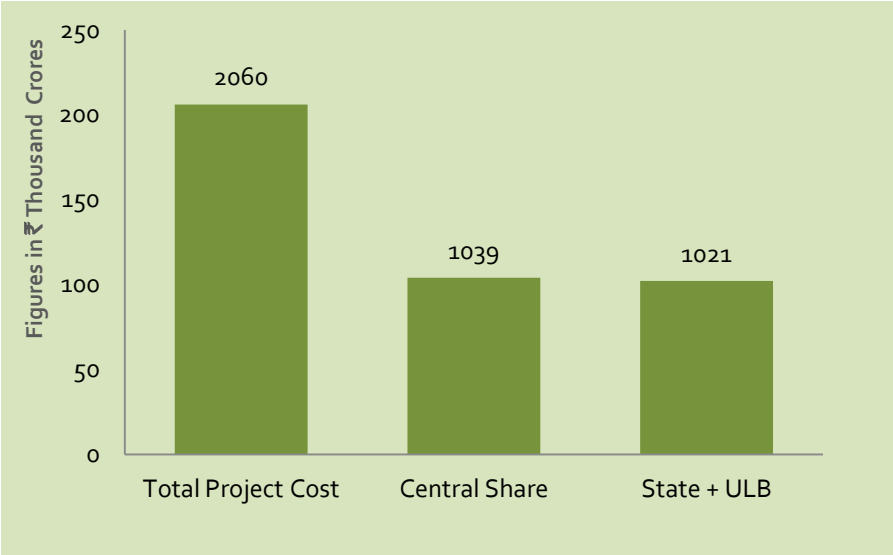
Source: Athena Research

It can be seen that the southern and western states of India would require relatively larger investment compared to states in the central and north-western region due to high levels of urbanization. West Bengal and Maharashtra require substantial investment primarily due to high population levels as well as population density. Of the three segments of the MSW management value chain, treatment of waste would require most of the investment. There is a potential for leveraging private sector participation to enhance efficiency in the entire waste management system.

[34] The research is based on per capita investment requirement projection made by the HPEC (2011) and covers only the Class IA & IB cities.

With a growing emphasis on recovering O&M expenditure through their own means, ULBs are in the process of levying user charges on the waste generators. Several such examples exist, including Trivandrum and Guwahati. Such an endeavor would reduce the dependency of ULBs on external funds and grant, make ULBs financially self-sufficient and enhance sustainability of MSW projects. Several ULBs have utilized funds available through JnNURM for setting up solid waste management projects. Fig. 3.6 shows the total value of SWM projects underway through JnNURM. Here, it can be seen that the share of the central government and state/ULB is more or less equal. However, central share is higher for individual projects in cities that are classified as Class II and below.

Figure 3.6: Sharing of Project Cost: JnNURM Funded SWM Projects

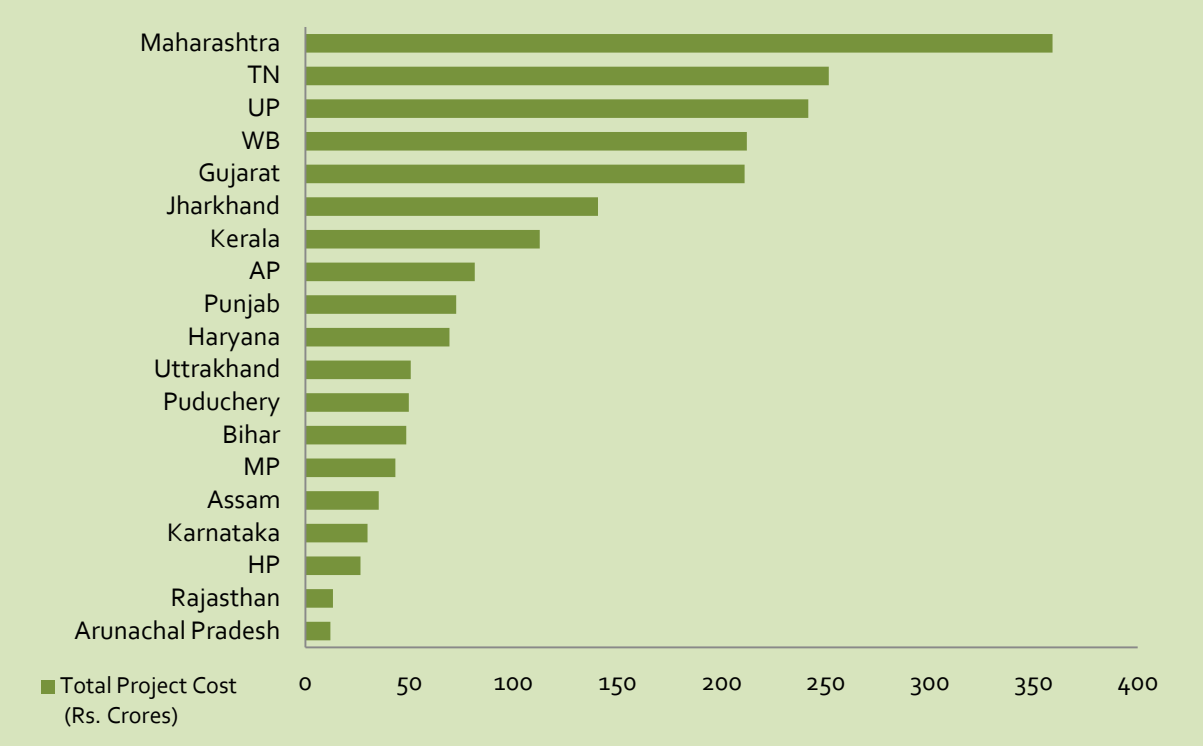


Source: Status of Implementation of JnNURM Projects, JnNURM (2012).

Fig. 3.7 shows the total investment made in the solid waste management sector at the state levels. No regional concentration of SWM projects can be observed from Fig.3.7.

Maharashtra, Tamil Nadu and Uttar Pradesh lead the list with high level of investments. States like Rajasthan, Assam and Madhya Pradesh are high potential states as large sections of the population still not covered by proper MSW management systems. AP and Karnataka, which are among the leading states in PPPs in commercial infrastructure, also have huge potential for such partnerships in the SWM sector as these states are not only progressive but are also undergoing high rates of urbanization.

Figure 3.7: State-wise Investments underway through JnNURM



Source: Status of Implementation of JnNURM Projects, JnNURM (2012).

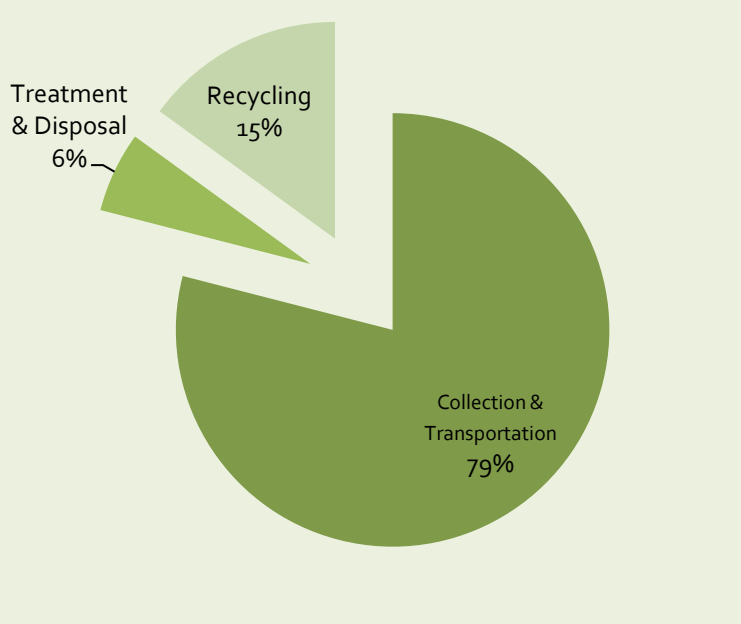
Fig. 3.8 and Fig. 3.9 show the expected growth and the breakup, value chain wise, of the MSW management services market. Buoyed by active private sector participation, the sector is expected to grow on average at a CAGR of around 22.4% for the period 2008-13.[35] Further, the collection and transportation segment of the value chain has the highest potential with a market share of 79% followed by recycling and processing & disposal. In an evolving PPP market like India, initial experiments in collection & transportation segments can pave the way for integrated MSW management services as the market matures with time.

35 Source: Frost and Sullivan (2008).

Figure 3.8: MSW Management Services Market: Revenue Forecast (2008-09)

Source: Frost & Sullivan (2009)

Figure 3.9: MSW Management Services Market – Revenue Breakup Value Chain Wise



Source: Frost & Sullivan (2009)

III.3 Strategies for Private Sector Participation

In this section, the process of selecting a suitable solid waste management model has been described.

III.3.1 Selection of the Appropriate Solid Waste Management Model

Selection of the appropriate operating and financial model is an essential first step to improving solid waste management services in a city. This, however, does not receive adequate attention in many cases. In this section, we discuss the parameters that should be considered while deciding the financial and operational models for a solid waste management system. Next, based on the parameters, we describe which financial structure, and which operational model, would be best

suited for a given city. The choice of an appropriate waste management strategy would involve the evaluation of the following basic parameters:

Exhibit 3.2: Major Determinants of Financial and Operational Model of MSWM

Determinants of Financial Model (Capital and Operational Expenditure/Income)	Determinants of Operational Model (Centralized or Decentralized Waste Management System)
i. Quantity of waste generated ii. Central and State funds availability iii. Internal resource generation by the urban local bodies iv. Financial and Human Resource Capacity	i. Availability of land ii. Composition of waste iii. Market linkages iv. Extent of Informal Workers engaged in Collection of Waste v. Health risk

The overall quantity of waste generation, ULB's internal resource generation potential, financial health of ULBs and the availability of funds from higher tiers of the government influence the selection of the financial model of the waste management system.

The choice of a centralized or decentralized waste management system is constrained by the availability of vacant land, composition of waste, market linkage for resources produced from waste, if any, health risk and the extent to which informal workers are engaged in the collection of waste. We elaborate each of these aspects briefly in the following pages.

III.3.2 Financial Model

The selection of the appropriate source of funds to meet capital and operational expenditure associated with the setting up of a solid waste management system depends on the following factors:

Waste Quantity

The quantity of waste generation and the characteristics of waste generated in a city or town is an important factor for adopting a particular system to manage the wastes. A city with large quantities of waste generation requires a robust collection and transportation system with an adequate fleet of high capacity transportation vehicles. Thus, a centralized approach might be more appropriate in these cases. Class IA cities in India currently generate 2,400 MT to 7,000 MT of waste daily and it is expected to increase to 3,700 – 9,000 MT daily by 2031. The waste generation in Class IB and IC cities is relatively lower than that of the Class IA cities as observed in Exhibit 3.3 provided below.

Exhibit 3.3: Daily Waste Generation in Class I Cities in India

City	Daily Waste Quantity 2011 (TPD)	City	Daily Waste Quantity 2011 (TPD)
Greater Bengaluru	3,344	**Jaipur**	1,362
Greater Kolkata	11,520	**Ahmedabad**	2,518
Chennai	6,118	**Bhopal**	877
Delhi	11,040	**Visakhapatnam**	1,194
Greater Mumbai	11,124	**Imphal**	72
Greater Hyderabad	4,923	**Kozhikode**	429

Source: Sustainable Waste Management in India, Annepu (2011).

The per capita waste generation varies within urban areas depending upon the degree of urbanization, commercial and industrial activity and per capita income. Exhibit 3.4 below classifies the cities and towns based on the magnitude of per capita waste generation.

Exhibit 3.4: Waste Generation in Cities in India

S/N	City/Town Category	Per Capita Waste Generation
1.	Population > 1 million	High
2.	Population < 1 million; and cities in North Eastern and J&K	Low

Availability of Central and State Funds

In order to help the ULBs cope with the huge challenge of building the required infrastructure for a rapidly urbanizing population, the government is providing them grants under JnNURM. These grants are conditional upon the ULBs reforming certain aspects of their operational structure. Exhibit 3.5 provides the extent of government grants that can be availed by the ULBs depending upon their category. JnNURM is providing the ULBs with grants ranging from 50% to 100% of the project cost depending upon the city category.

Exhibit 3.5: Availability of Central and State Grants

S/N	City/Town Category	Centre Grant	State Grant	ULB/Parastatal Share/Loan from Financial Institutions*
1.	Population > 1 million	35 % - 50 %	15 % - 20%	50 %
2.	Population < 1 million	80 % - 90 %	10 %	Up to 10 %

*Source: Modified Guidelines, (Sub-Mission for Urban Infrastructure and Governance), JNNURM, GOI (2006).

Financial health of the ULBs

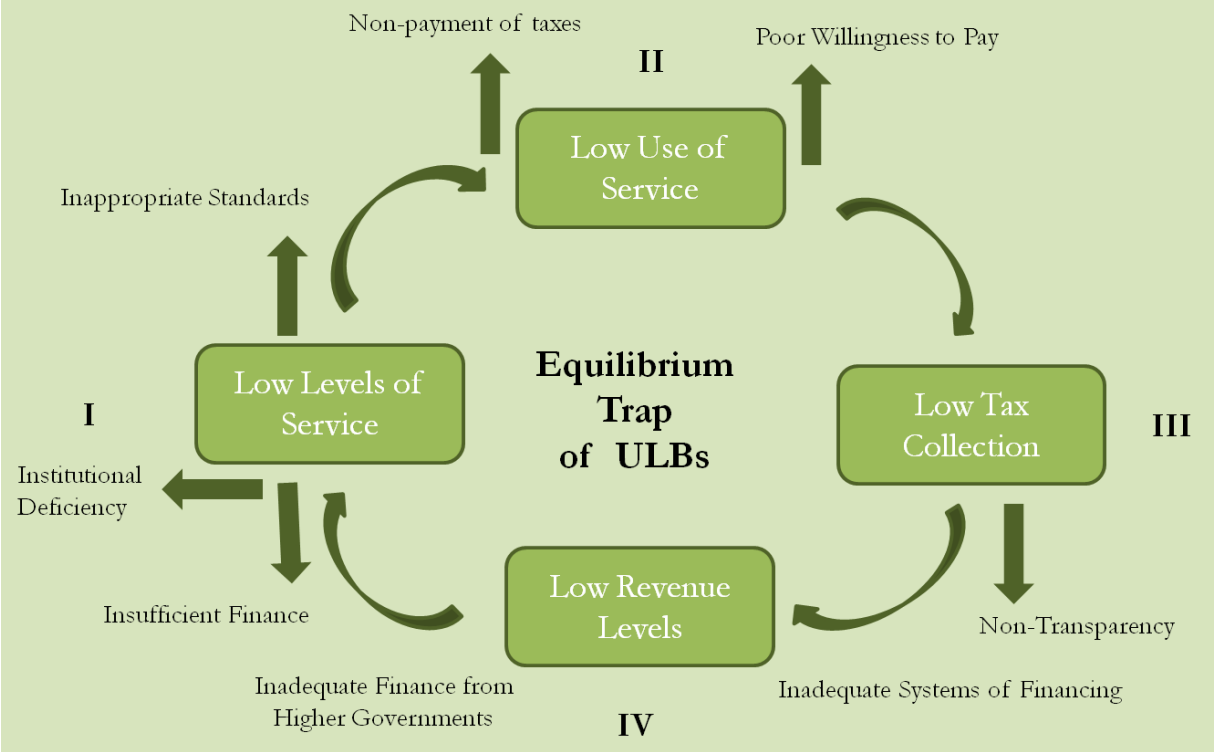
The availability of funds for the ULBs is a major factor that determines the standard of service delivery provided to the citizens. Engaging one or two private entities for a centralized system would involve substantial capital outlay (in absolute terms) on equipment and other infrastructure and require the balance-sheet of the ULBs to be sound. Payment of tipping fee to the concessionaire for collection and transportation of waste or incurring the said cost on their own if the private sector has been engaged only for treatment of wastes forms a significant portion of the revenue expenditure of the ULBs. On the contrary, the decentralized approaches to waste management in India have worked primarily on their own with little support from the ULBs. Provision of vacant/unused premises and authorization for MSW services to RWA or community for processing of waste have been two major forms of support provided by the ULBs. However, in certain cases, for example in Mumbai, the ULB provides monetary compensation to the community for management of wastes based on certain parameters.

A financially rich urban local body is better positioned to explore various alternatives that can be exercised for improving the current waste management service in the city or town. It has more degrees of freedom to use the available resource to build its own capacity in terms of skilled human resource, better equipment, state-of-the-art technology, and use of ICT in monitoring of waste management activity. Alternatively, it may leverage managerial and technical efficiency of experienced private waste management companies and devote itself to the task of monitoring the delivery of the service. It can practice centralized or decentralized waste management considering the quantity, quality of waste generation and other factors as necessary. A poorly equipped ULB is mostly dependent on government grants for improving the management of waste and has to abide by the conditions, if any, associated with the utilization of grants. Hence, it has fewer avenues for exercising different alternatives vis-à-vis rich ULBs.

Internal Resource Generation Capacity of Urban Local Bodies

Most of the ULBs in India find themselves in a 'financial equilibrium' trap which is the result of the interaction of several financial and non-financial forces. This is illustrated in Figure 3.10.

Figure 3.10: Financial Equilibrium Trap of ULBs



Source: Analysis of Finances of Urban Local Bodies in India: A Cross-sectional Study, Nallathiga (2009).

The poor service standards often result in low use of municipal services. The non-payment of taxes and user charges by the public makes a significant dent on the revenue collection of the ULBs, which in turn restrains the ULB from making new investments in infrastructure creation for enhancement of service delivery. At present, the adverse financial position of the ULBs is mainly because of non-collection of taxes e.g., property tax, and also due to the presence of sub-optimal tax collection mechanisms. Once the ULBs reform their accounting and tax structure, their internal resource generation capacity will ensure their self-sustenance.

Selection of the Financial Model

The first two parameters, namely, quantity of waste generated and availability of central and state funds for solid waste management, are largely dependent on the size of the city. Therefore, the other two parameters, ULB's internal resource generation capacity and its financial health, determine the appropriate source of funds for capital and operational expenditure.

For large cities, with a population greater than a million inhabitants, the quantity of waste generated is generally high and the central and state grants cover only up to 50% of the cost of the project. For such large cities, if the financial health of the ULB is good, then all the capital expenditure can be met through the ULB's financial resources. In case of poor financial health, some portion of the capital expenditure might need to be financed by the private sector.

Cost recovery of operating expenses would depend on the paying capacity of the users, as well as the ULB's ability to monitor generation, bill accurately and collect dues. If both the paying capacity of the users and the ULB's collection efficiency are high, full cost recovery through user charges should be attempted. In case either of the two is low or weak, partial cost recovery must be attempted, with the shortfall being financed through government grants or external grants. A model of cross-subsidization, e.g., where water is supplied to industry that pays higher rates than domestic consumers, can also be implemented. These options are summarized in Exhibit 3.6.

Exhibit 3.6: Strategy for large cities (Population > 1 million)

	Good Financial Health of ULBs	Poor Financial Health of ULBs
High internal resource generation capacity	CapEx: Central/ state grants + ULB	CapEx: Central/ state grants + ULB + Private sector
	OpEx: Full cost recovery through user charges	OpEx: Full cost recovery through user charges
Low internal resource generation capacity	CapEx: Central/ state grants + ULB	CapEx: Central/ state grants + ULB + Private sector
	OpEx: ULB with partial cost recovery user charges	OpEx: ULB with partial cost recovery through user charges

CapEx: Capital Expenditure; OpEx: Operational Expenditure

For smaller cities, with a population less than one million, there is relatively lower waste generation, both in per capita terms as well as in absolute terms. Additionally, the central and state grant allocations for provisioning of solid waste management systems are relatively high. In such a scenario, most of the capital expenditure can be met entirely from the central and state grants, while operational expenses can be recovered from users of high paying capacity in order to meet the gap between grants and requirements. These options are summarized in Exhibit 3.7.

Exhibit 3.7: Strategy for Small Cities (Population < 1 million)

	Good financial health of ULB	Poor financial health of ULB
High internal resource generation capacity	**CapEx:** Central/state grants + ULB	**CapEx:** Central/state grants
	OpEx: Full cost recovery through user charges	**OpEx:** Full cost recovery through user charges
Low internal resource generation capacity	**CapEx:** Central/state grants + ULB	**CapEx:** Central/state grants
	OpEx: ULB with partial cost recovery through user charges	**OpEx:** ULB with partial cost recovery through user charges

Source: Athena Research

III.3.3 Operational Model

Selection of a centralized or decentralized model of solid waste management is dependent on the following factors, as discussed below.

i. Availability of Land

With such an enormous quantity of waste being generated on a daily basis, a centralized or regional facility may be helpful since land for setting up multiple waste processing plants may not be available, particularly in cities like Mumbai, where land is not only scarce but also has a very high opportunity cost. Smaller cities and towns may be better positioned to have decentralized waste management systems since the quantity of waste generation is relatively low and the availability of land is not as problematic as it is in large cities. It may also be possible to transport waste in smaller capacity vehicles like hand-driven carts or tricycles.

Exhibit 3.8: Availability of Land in Indian Cities

S/N	City/Town Category	Land Availability
1.	Class I Cities	Low
2.	Other Small Cities and Towns	High

There is a paucity of space for decentralized waste management systems at multiple locations in large cities. If *Waste Concern's* decentralized model is taken as a benchmark, then in order to manage the entire waste generated in the megacities, waste processing plants of 1,000 sq. m each would be required at 1,500 to 3,000 locations.[36] However, the difference between the land requirement for centralized and decentralized waste management plants is not significant. For instance, the integrated solid waste management project at Guwahati has been allotted 1,60,536 sq. m of land for processing 300 MT of waste. If the same quantity of waste were to be processed by setting up 150 facilities with a 2 MT capacity, 1,50,000 sq. m of land would be required. However the '*Not in My Backyard Syndrome'* may hinder the provision of so many locations for waste management systems. A city may explore the decentralized system on a pilot basis to assess the response of the citizens to such systems.

ii. Waste Composition

The proportion of bio-degradable waste is high in the overall quantity of waste that is generated in Indian cities and towns. The proportion of compostables ranges between 50% and 57% in Indian cities and towns. Exhibit 3.9 displays the average waste composition region-wise. Composting is therefore a good alternative for treatment of wastes. Refer Box 3.1 below. Both centralized and decentralized systems can be applied to produce compost. Further, the calorific value of wastes in India lies between 1,523 Kcal/kg to 2,341 Kcal/kg, which is higher than the minimum calorific value required for deriving energy from wastes.

36 Waste Concern 2 MT plant requires 1,000 sq. m of land for setting up the waste management centre.

Exhibit 3.9: Composition of Waste in India

Region	Compostables (In Percent)	Recyclables (in Percent)	Inert (In percent)	Calorific Value (Kcal/Kg)
Metros	50.89	16.28	32.82	1523
Other Cities	51.91	19.23	28.86	2084
East India	50.41	21.44	28.15	2341
North India	52.38	16.78	30.85	1623
South India	53.41	17.02	29.57	1827
West India	50.41	21.44	28.15	2341
Overall Urban India	51.3	17.48	31.21	1751

Source: Sustainable waste Management in India, Annepu (2011).

Box 3.1: India's Experience with Composting

In India, composting has been practiced since ancient times to turn agricultural wastes into organic manure. During 1975-80, ten mechanical compost plants were set at various parts of the country with the twin objectives of producing manure for agricultural use and reducing the quantity of waste reaching the dumpsites.

Central Public Health Engineering & Environmental Organization (CPHEEO) has stated that MSW in urban centers in India has a favorable Carbon-Nitrogen (C/N) ratio of around 30 and is conformable to composting. However, it cautioned that composting should not be seen as a commercial venture but should be considered as a processing method and the sale price should be fixed accordingly. The MSW Rules 2000 also sees composting as the preferred method to process municipal wastes. The Planning Commission in the Tenth Five Year Plan stated that traditional technologies like recycling of organic waste have been found to be useful and relevant.

However, since the compost plants operate at a constant rate, fluctuations in provision of waste inputs to the plant, makes the project vulnerable. The commercial viability of the project is threatened further as demand for compost is seasonal..

Source: 'Composting' Chapter 14, accessed from localbodies.up.nic.in

iii. Linkages – Backward & Forward

Value in waste is the most important reason for private sector participation in this sector. Waste is often said to be a misplaced resource. Application of traditional as well as innovative technologies has made production of several goods from waste possible. Electricity, manure, bricks, bio-methanation and other recycled products from plastic, metals, etc can be produced through the application of suitable technologies. The proceeds from their sale determine the commercial viability of the waste management projects. However, the lack of backward and forward linkages in

the form of availability of the right quality and quantity of waste and a market for the goods produced from waste have restrained scaling up of waste management projects. It is therefore important to understand the market for each output produced and choose the right output mix for mitigating the revenue risks in future. Waste-to-energy projects are not fit for decentralized systems due to feasibility issues.

iv. Extent of Informal Workers engaged in Collection of Waste

The City Development Plans (CDPs) prepared by the ULBs should also include an assessment of the valorization of waste by informal workers engaged in the collection of recyclables. This would help in estimating the actual quantity of waste generated in the city/town and the extent of recycling activity supported by the informal health workers. It may not be feasible for ULBs in cities with a large number of workers engaged in rag-picking.

v. Health Risk

Decentralized waste processing plants situated in local areas may pose health risks if the facility is not built and operated according to pre-defined standards. The risk would be high if the waste processing facility is unattended or if the waste treatment is not scientific. In case of accidents or in the event of a natural calamity, the danger of leakage of leachate or other harmful liquids is a serious concern due to the proximity of residents to the waste processing facilities.

Selection of the Operating Model

Selection of the right operating model is driven by cost implications. While the area of land required per ton of waste disposal does not vary significantly between centralized and decentralized models, the availability of such land for decentralized systems in large, dense cities is likely to be low. Even if land is available, its cost is likely to be prohibitive within large cities. Thus, if the cost of land, including the opportunity cost, is included in the capital expenditure required for the decentralized model, it is likely to be higher than the capital expenditure required for centralized systems, especially due to the economies of scale that are possible in the latter. The willingness of the community to actively participate in the management of waste in their surroundings is also an important factor that influences the choice of the operational model.

Box 3.2: Level of Citizens/Community Participation

Participation by the citizens and the community is another important aspect that should be considered while deliberating on the operational model. A community which is adequately informed and aware not only helps in proper segregation of waste at source but also in reduction of waste at source. Several examples of active citizens and community participation are in practice in different cities. For instance, RWAs in Chennai with the help of Exnora, an NGO, initiated waste management services in their localities as early as 1990s.

The decentralized system is applicable for both for-profit and not-for profit organizations but requires a high degree of commitment from the community in waste management as their participation is crucial for all segments of the MSW management. The MSW Rules 2000 does not stipulate management of waste by the citizens themselves. In some cities citizens and informal waste workers have come forward to manage municipal wastes in their localities. For instance, RWA manage wastes in some areas in Mumbai with support of the Greater Mumbai Municipal Corporation (GMMC). In Pune, the Pune Municipal Corporation (PMC) is financially supporting Solid Waste Collection and Handling (SWaCH), a co-operative formed by waste pickers in 2007. The organization provides door-to-door garbage collection services across the city. PMC committed to support the operations of the co-operative for five years since inception. PMC provides management and equipment support and bears infrastructure and some welfare costs during the start-up phase whereas the co-operative in this incubation period explores revenue sources and becomes a self-sustainable entity by the end of the period.

However, the sustenance of community based systems can be endangered with a change in commitment of the local administration consequent of a change in government. Further, once the concerned ULB starts levying and collecting conservancy charges on waste generators, it is unlikely that all users of the community waste management services would be willing to pay the user charges/conservancy charges twice. Hence, it is crucial to take note of the institutional framework governing the waste sector before adopting a particular approach.

The operational expenditure in decentralized systems is generally low due to the use of non-motorized vehicles like hand-held carts or tri-cycles employing informal workers for C&T of wastes. Use of high density waste transportation vehicles to cover greater distance between the waste processing facility and the collection centers involve higher operational expenditure. Exhibit 3.10 summarizes the typical cost differences for the two systems, though the actual tradeoffs can only be assessed on a project-to-project basis, with detailed data.

The selection of a suitable operation model is thus driven by a number of factors, briefly summarized below in exhibit 3.10.

Exhibit 3.10: Centralized vs. Decentralized Solid Waste Management Systems

Type	Suitable when:
Decentralized	• Land sites for composting are available • Large number of informal workers in existing waste management system (rag-pickers) • High degree of organic content in waste • Risk of poor self-governance is low • Markets for compost are accessible • Possible to manage health risks adequately
Centralized	• Significant economies of scale are possible • Health hazard of inefficient disposal is high • Composition of waste allows high value extraction through use of technology, for e.g., waste-to-energy plants • Land is not available close to the community for decentralized model

III.4 Public-Private Partnership Models: Issues and Lessons

This section presents a few case studies of PPPs in the MSW sector and attempts to capture the key issues faced by stakeholders. The case studies prepared include Solid Waste Management Projects in Tirupur, Kanpur, Hyderabad and Timarpur.

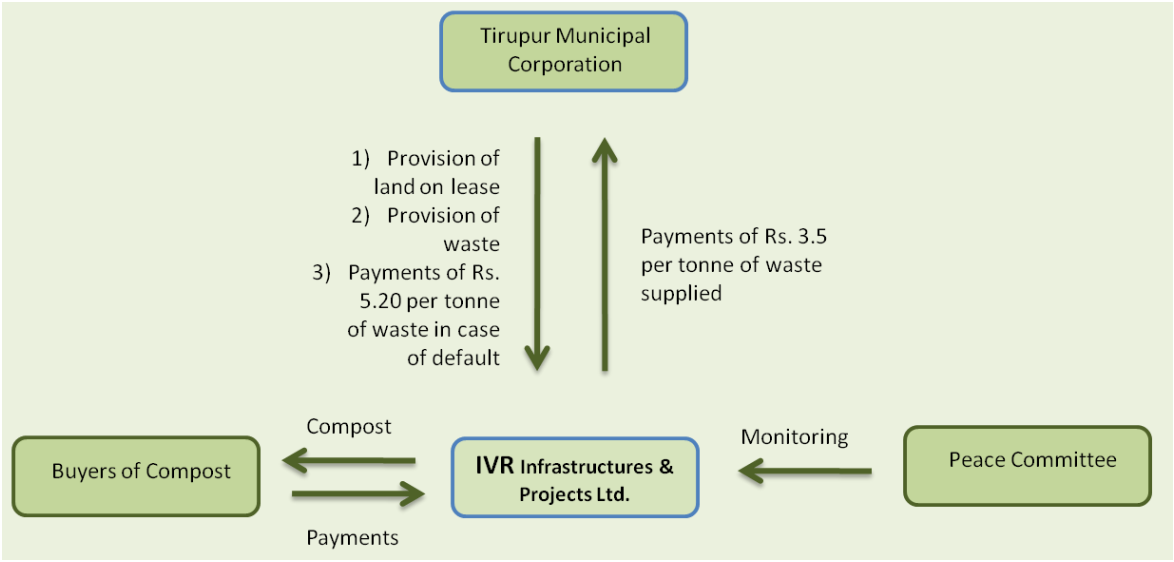
A. The Tirupur Solid Waste Management

Introduction

During 1990s, the Tirupur Municipal Corporation (TMC) started facing difficulties in managing the municipal waste generated in the area due to the increasing quantity of solid waste generation. The total waste produced by the town can be broadly categorized into three types: bio-degradable, non–biodegradable and recyclable. The Tamil Nadu Urban Development Fund (TNUDF) suggested that TMC should develop a composting plant on a PPP basis to treat the biodegradable waste. In 1999, IVR Infrastructures and Projects Ltd. was selected through a competitive bidding process to finance, construct and operate the plant on a Build-Own-Operate-Transfer (BOOT) mode for a period of 20 years.

A specially designed 'windrow compost' yard having a 50 day life cycle piles was set up on a seven acre land.[37] This land was taken on lease by the private concessionaire from the TMC at ₹ 1.75 lakh per annum. The concessionaire imported a plant worth ₹ 55 crore. The entire project cost was borne by the concessionaire.

Figure 3.11: Structure of the PPP model in Tirupur



Source: Athena Research

As per the concession agreement TMC was supposed to provide 100 MT of mixed waste per day to the private concessionaire, of which at least 40 MTD would be bio-degradable waste. The concessionaire would pay ₹ 3.5 per ton of waste sold to it. If the municipality defaults in providing the concessionaire the waste, it would compensate the concessionaire by paying it ₹ 5.20 per ton of waste not supplied. This meant that the demand risk was completely borne by the TMC. It was responsible for getting the required quantity of a given type of waste, thereby ensuring the sustainability of the project. The waste supplied after composting it into fertilizer would be sold to the farmers. This was the source of revenue for the concessionaire. A model briefing the flow of funds and the respective responsibilities taken by the various stakeholders involved is shown in the figure above.

37 Windrow composting refers to the conversion of municipal waste into a stable mass by aerobic decomposition. Please refer to 'Composting' Chapter 14 accessed at urbanindia.nic.in/publicinfo/swm/chap14.pdf.

Issues faced and lessons learnt

Formation of peace committee

The construction of the plant was completed in 2000. The concessionaire faced problems from the villagers who refused to allow its operation by threatening the workers at the plant. The concessionaire had to seek help from the municipality, which engaged a local NGO to convince the villagers about the importance of the plant and its use for waste management. A "Peace Committee" comprising of the village elders was formed to monitor the plant and ensure that there was no foul odor in nearby areas due to the processing of waste.

Change in Compliance (Implementation of MSW Rules, 2000)

While the compost plant was being designed and constructed, the Ministry of Environment and Forests, Government of India released the Municipal Solid Waste (Managing & Handling) Rules in September 2000. The Urban Local Bodies (ULBs) are responsible for the implementation of the rules, for infrastructure development for collection, storage, processing and disposal and operating the solid waste management system. The ULB may contract out its role of provision of infrastructure and operation to a service provider. The state pollution control board would be in charge of monitoring compliance to the rules. Accordingly, Tamil Nadu Pollution Control Board (TNPCB), set up in 1982 was given the role for ensuring compliance with MSW Rules 2000. TNPCB had to be consented for the following purposes. First was the suitability of the land for establishing a processing facility or a sanitary landfill. Second, allow operation only if the facility met the existing standards of pollution control.

After the construction of the processing plant was completed in Tirupur, the private concessionaire approached TNPCB to get its consent for operations. TNPCB refused to give its consent because the processing plant did not comply with the MSW Rules. In particular, the solid waste would be sent for processing into the composting plant without segregation. MSW Rules mandated that the segregation of waste should be taken place at the source of generation and suitable technology should be available to recycle each kind of waste. Both, TNUDF and the private concessionaire pleaded TNPCB to excuse this project from following the MSW Rules as the concession agreement was signed before the rules came into place. TNPCB refused and instead asked the ULB to ensure segregation of waste at the source and only supply bio-degradable waste to the concessionaire. It further insisted that the concession agreement should be re-written to include the provision of at least 40 MTD of biodegradable waste by the TMC, since this was the amount of waste to be treated in the compost yard of the total 100 MT of waste supplied. The objective of this measure was to reduce the quantity of municipal waste brought to the landfill site, and thereby reduce the high capital cost involved in developing a landfill site. This meant that the TMC could no longer supply 100 MT of mixed waste to the concessionaire. The concessionaire refused to accept this demand and asked for 100 MTD of biodegradable waste as mentioned in the original agreement. This issue was solved after the TMC conducted a number of campaigns to create awareness about the segregation of the waste. This also allowed the rag-pickers to continue earning their livelihood by collecting un-segregated waste, segregating recyclables and selling them.

Current Status

At present, the population of Tirupur (including floating population) generates 450 MT of waste per day. Of this, 100 MT is bio-degradable waste, 340 MT is non-bio-degradable and 10 MT is recyclable. TMC supplies 40 MT of bio-degradable waste to the private concessionaire, which will be increased by initiating privatization of collection and transportation of wastes in the town, aided by awareness campaigns.

B. The Kanpur Solid Waste Management

The need for a PPP in solid waste management of Kanpur

The waste generated by the residential households and commercial establishments in Kanpur largely consists of organic waste, followed by waste from construction. The Kanpur City Development Plan prepared under the JnNURM mentions that bio-degradable waste is 56% of the total municipal waste. Prior to the engagement of a private player, the municipal corporation was responsible for collection of the waste and its disposal. There was no mechanism for segregation of waste and there was no waste processing plant. Considering the waste management scenario in the city, Kanpur decided to adopt a PPP framework to manage its MSW. Two concessionaires were selected for managing MSW in Kanpur. A private developer (Concessionaire 1, henceforth) was responsible for collection and transportation of waste. Another private developer, A2Z Pvt. Ltd. (Concessionaire 2, henceforth) was selected for processing and disposal of waste.

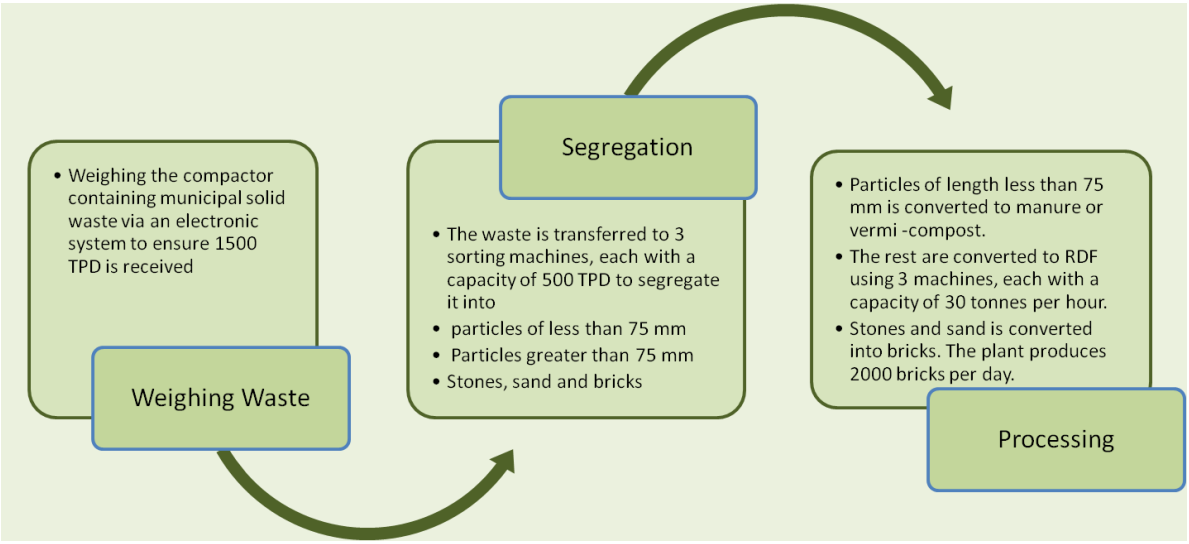
Processing and Disposal of Waste

In June 2008, a concession agreement was signed between KMC and Concessionaire 2 for processing municipal waste in Kanpur on a BOT basis with a concession period of 30 years. This project of ₹ 65 crore received a capital grant from JnNURM. The operations expenditure was to be met by the private operator by levying tipping fees.

At this time, Concessionaire 1 was already selected which was responsible for collection of waste from the households and commercial estates and transport it to the processing plant; operated by Concessionaire 2. The waste transported to the processing unit (around 1,500 tons a day) would be

segregated and converted into refuse-derived fuel (RDF), compost or bricks. The value chain describing the activities undertaken by A2Z Private Limited is shown below.

Figure 3.12: Value Chain for Processing and Disposal of Waste



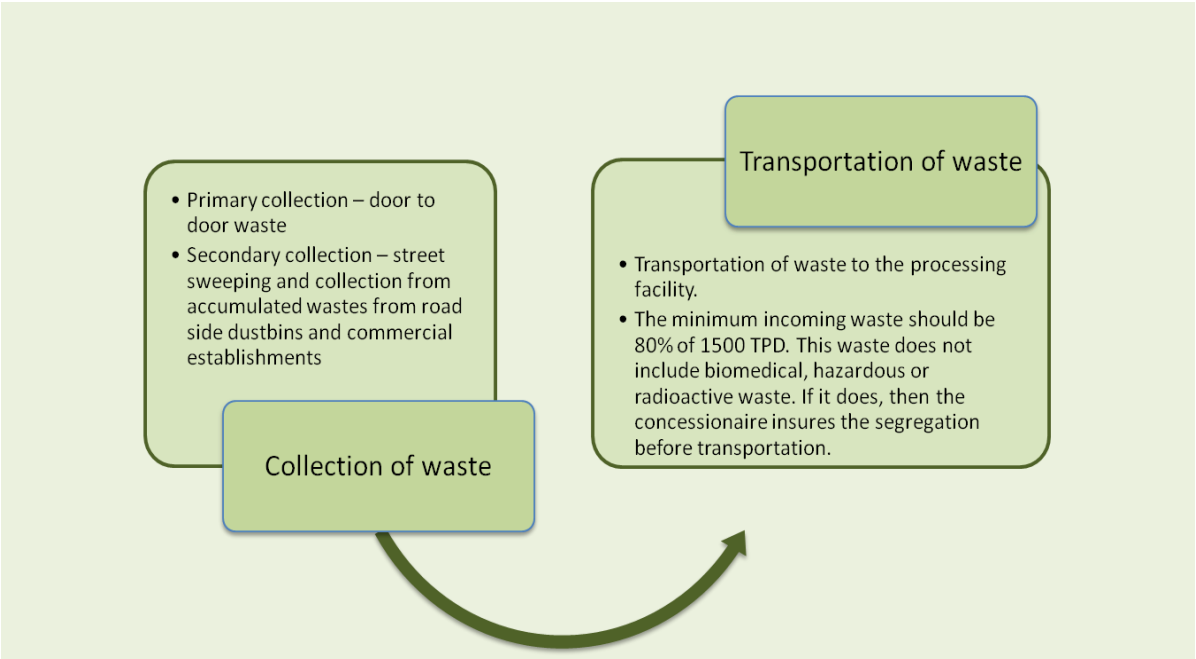
Source: Athena Research

Collection and Transportation of Waste

Concessionaire 1 responsible for collection and transportation was incentivized only by the tipping fee paid to it by the KMC, based on the quantity of the waste collected. Hence, the concessionaire 1 understood its responsibility as moving garbage to the processing plant rather than providing raw material to concessionaire 2, which would be used to process to generate revenue.

After the commencement of operations of the processing plant by Concessionaire 2, it was realized that the waste transported by Concessionaire 1 to the unit did not hold enough calorific value to be converted into RDF, compost or bricks. This increased the financial risk of Concessionaire 2 as it was not being able to generate revenue from selling the processed products to cover its operations and maintenance costs. Considering this situation, KMC terminated the contract of collection and transportation of waste with Concessionaire 1. Later, it entered into another contract with A2Z Private Limited (Concessionaire 3, henceforth) to undertake the responsibility of collection and transportation of waste on a BOT basis for a period of 30 years. The value chain that summarizes the role of A2Z Private Limited is given below.

Figure 3.13: Value Chain for Collection and Transportation of Waste



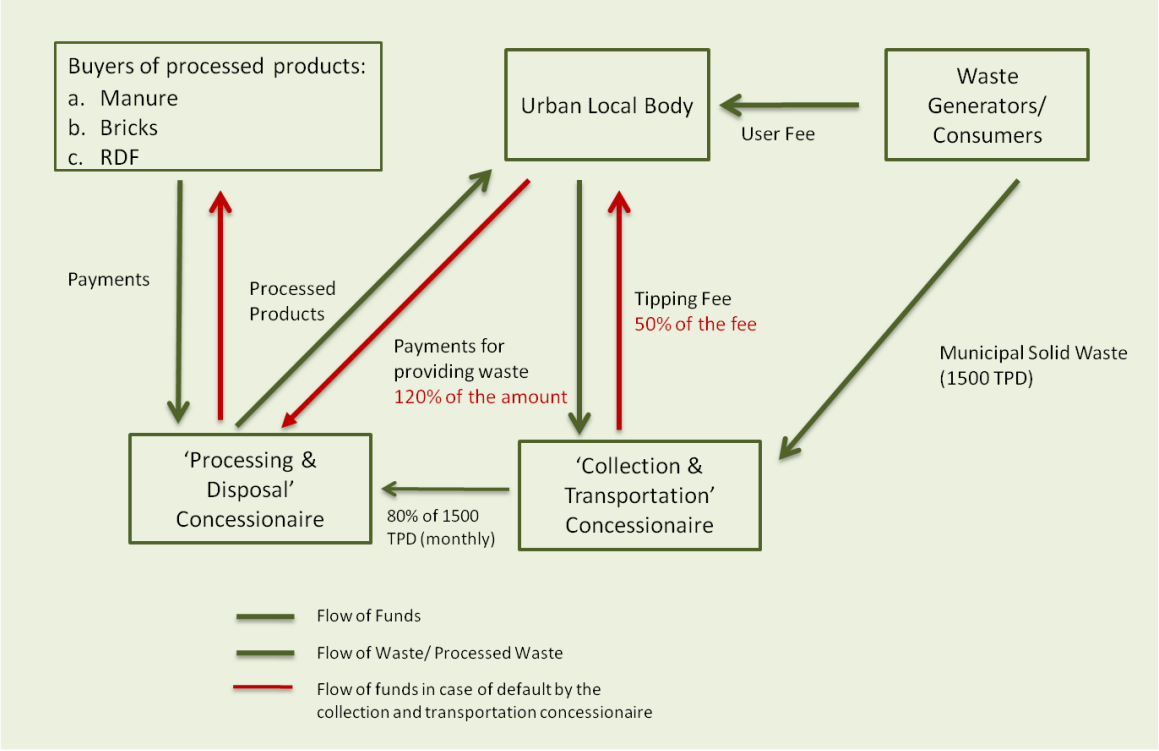
Source: Athena Research

Reverse Integrated Solid Waste Management

A2Z Private Limited is now responsible for both the aspects of MSW management; collection and transportation and processing and disposal. This process of first being responsible only for processing and disposal and later for collection and transportation as well is called the 'Reverse Integrated Solid Waste Management' Project. The stakeholder model of Integrated MSW in Kanpur is shown below.

The project has made provisions for penalties incurred by the concessionaire and the municipal corporation in case of default for not transporting the stipulated quantity of waste to the processing facility as per the agreement. Concessionaire 1 also collects user charges from the waste generators on behalf of the municipal corporation. Efficiency in collection of user charges is based on a given percentage of the total amount of user charges billable on a monthly basis (1st Year – 30%, 2nd Year – 40%, 3rd Year – 50%). If the Concessionaire 1 defaults, the tipping fee paid by the ULB is reduced by the amount of the shortfall. Further, if Concessionaire 1 collects more user fees than required, the extra amount collected in that particular month is added to the tipping fee paid. If this takes place on a cumulative basis, then an incentive is given to the concessionaire (which is calculated on an annual basis). [38]

Figure 3.14: Stakeholder Model of a Reverse Integrated Solid Waste Management Project



Source: Athena Research

38 The incentive is 20% of the total amount collected reduced by the amount to be collected.

Lessons

Having separate concessionaires for 'collection and transportation' and 'processing and disposal' may not be a sustainable project

Prior to the Reverse Integrated Solid Waste Management project, the 'collection and transportation' concessionaire did not realize the economic value of the waste it was collecting and transporting it to the concessionaire who had to recycle/process it. The concession agreement for collection and transportation of waste provides an incentive to the private developer only in the form of a tipping fee paid based on the quantity of waste collected. This issue made it challenging for the concessionaire responsible for processing and disposal to mitigate its operational and financial risk, as converting waste into revenue generating products. Hence, when the MSW management is decentralized with private sector participation for each segment of value chain, then the model may not be sustainable unless the tipping fee paid to the concessionaire responsible for collection and transportation is based on both the quantity and quality of waste. KMC resolved this issue by using a PPP model whereby all segments of the value chain of solid waste management are handled by a single entity.

Involvement of community

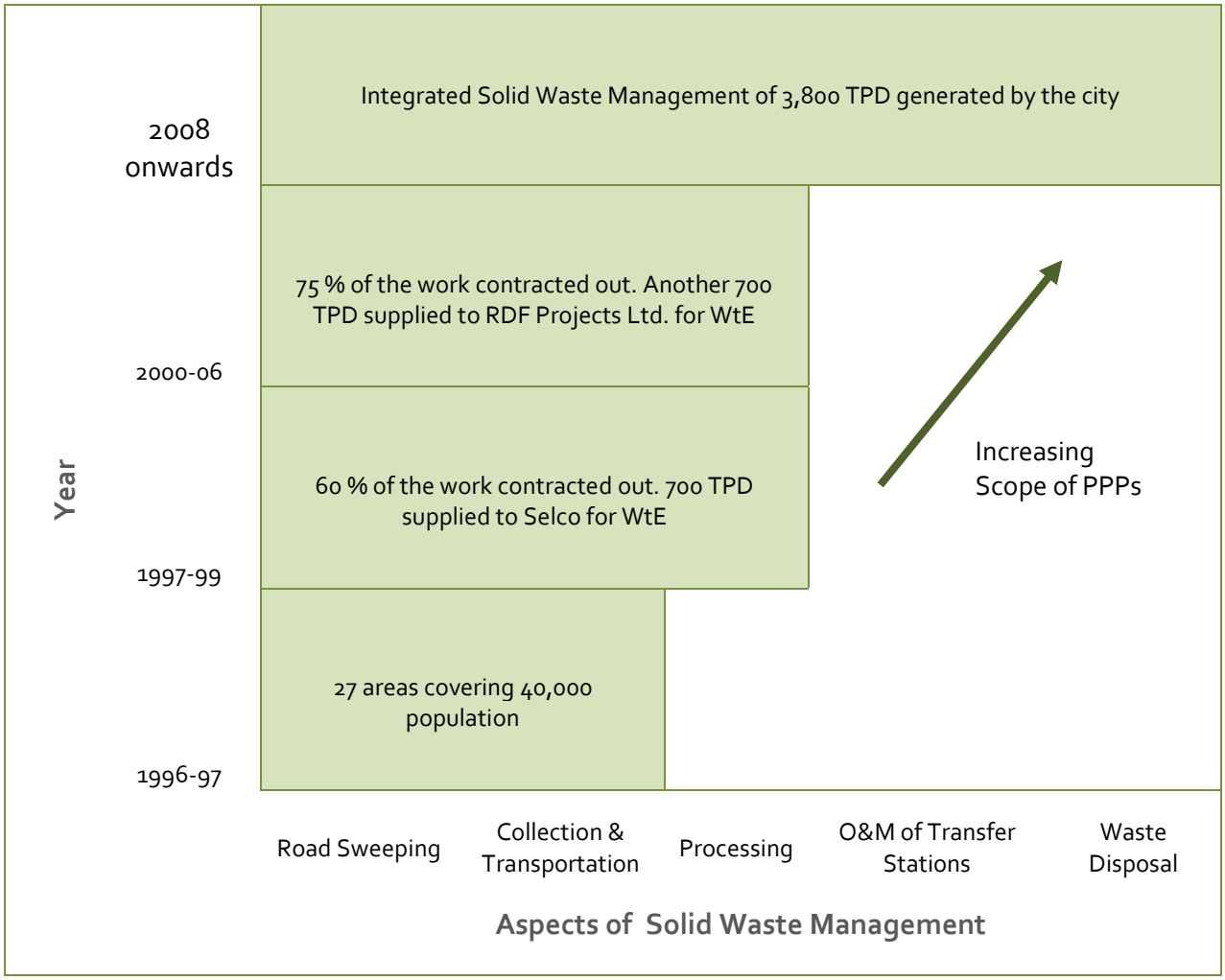
The issue of rag-pickers making a living out of the waste was solved by the private developer training them in collecting waste and retaining them. Before the KMC decided to handover MSW management in Kanpur to private developers, the collection and disposal of waste was carried out by rag-pickers. The rag – pickers would generate income for their livelihood by the sales of recyclable waste that they collect. This was an issue in Kanpur, as contracting out collection of waste to a private developer meant taking away the rag-pickers' source of income. A2Z Private Ltd., instead of hiring new workers for their project, chose to retain the rag pickers. The rag – pickers were trained for using various tools of collecting waste and were paid a monthly income for doing the job.

C. The Hyderabad Integrated Solid Waste Management

The need for PPP in Integrated Solid Waste Management of Hyderabad

The Greater Hyderabad Municipal Corporation (GHMC) in 2007 estimated that the city would generate nearly 3,800 tons of waste per day. Before 2007, the storage of waste at the source of generation and its segregation was limited to a few parts of the city. This was usually done when a huge heap of waste was accumulated at some location or when there were complaints from the public demanding its clearance. Only about 10-15% of the households disposed it in the nearby community points. There were no means of quantifying the efficiency and monitoring of the garbage clearance mechanism. However, GHMC had already privatized large proportions of the solid waste management in the city — 75% of the total area of the city was privatized for street sweeping and collection & transportation in the form of service contracts. Also, the corporation had already entered into two MoUs with private concessionaires for conversion of waste to energy. Each concessionaire was provided with 700 metric tons of waste, thereby privatizing as well as treating only 37% of the total waste generated.

Exhibit 3.11: Increasing Scope of PPPs in Hyderabad



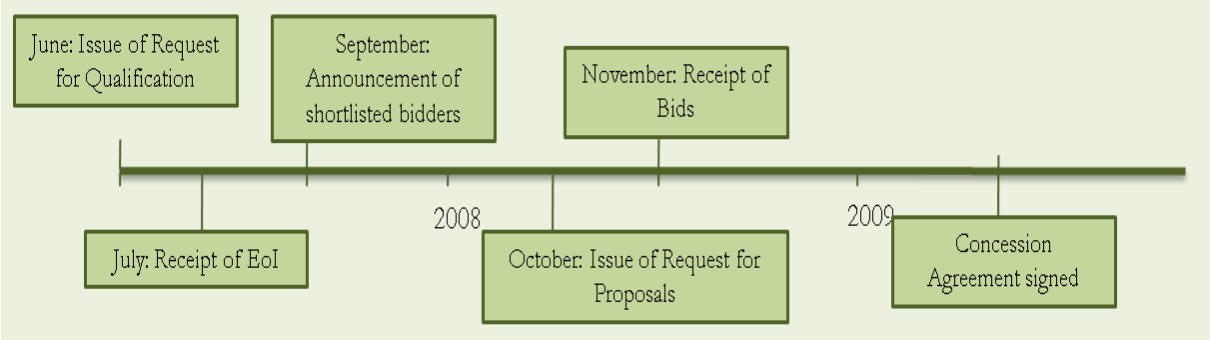
Source: Athena Research

In order to meet the compliance rates of MSW (Management & Handling) Rules, 2000 and to implement the "Clean Hyderabad 2006-07 Program"; the GHMC decided to adopt an integrated solid waste management system under the PPP mode.

Structure of the PPP Model

The Infrastructure Corporation of Andhra Pradesh (INCAP) provided the consultancy services for project structuring, bid processing, financial analysis and selection of the concessionaire for the Hyderabad Integrated Solid Waste Management Project (ISWM). The entire time line of the bidding process has been shown in Fig. 3.15. 22 EoIs were received, of which six were shortlisted. Two different concessionaires submitted financial bids of ₹ 1,431 and ₹ 1,680 per ton of waste. Since the lowest tipping fee was the bid criteria, Ramky Enviro Engineers Limited (REEL) whose bid was ₹ 1,431 per ton of waste was awarded the project.

Figure 3.15: Timeline ISWM in Hyderabad



Source: Athena Research

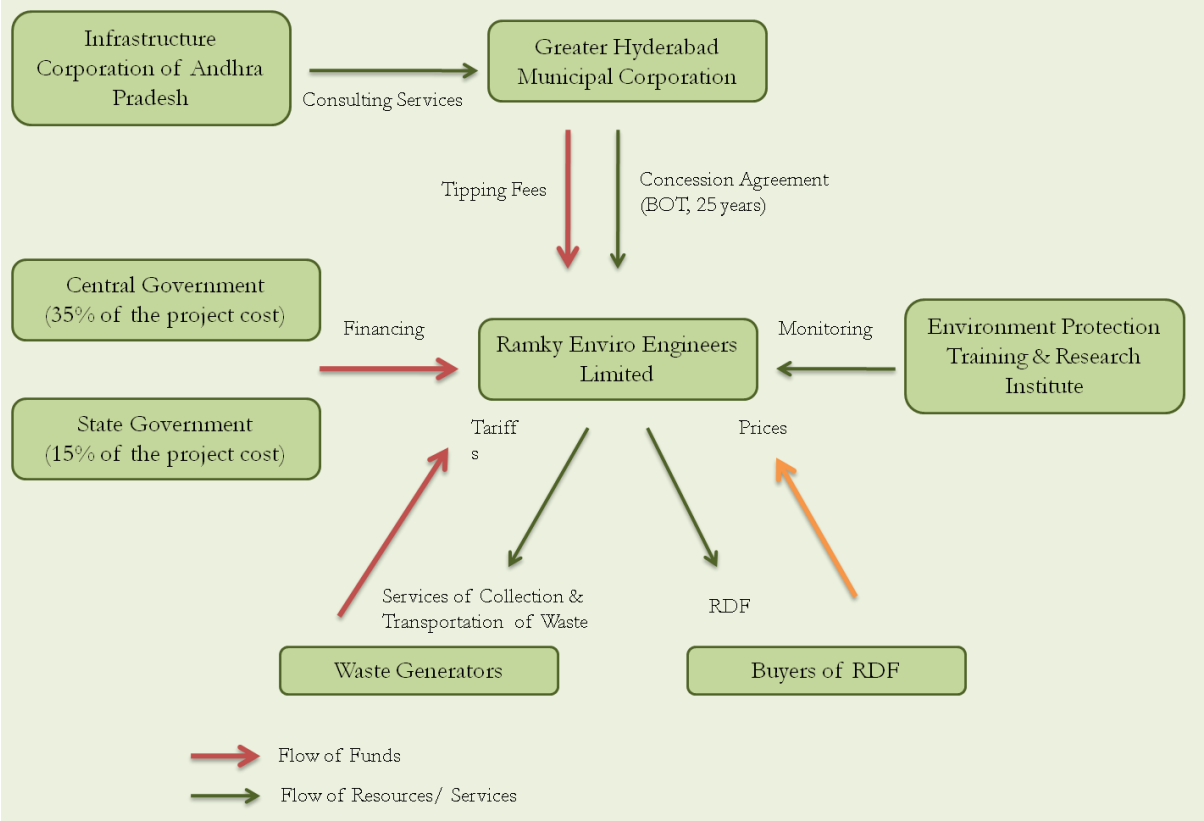
The Greater Hyderabad Municipal Corporation (GHMC) and REEL entered into an agreement for integrated solid waste management in Hyderabad in February 2009. The project was to be carried out on a DBFOT basis for 30 years. The scope of the project included:

- Door to door collection of waste
- Collection of waste from storage points
- Transportation of waste to a transfer station
- Construction, operations and maintenance of transfer station
- Secondary transportation of waste from the transfer station to a processing facility
- Construction, operation and maintenance of the processing facility
- Disposal of waste by means of scientific landfill
- Construction, operations and maintenance of the landfill
- Capping of existing dump sites

The total project cost was ₹ 434.91 crore and was eligible for a grant from the State Government and the Central Government under the JnNURM scheme, with a share of 15% and 35% of the total project cost, respectively. In the event of being unable to obtain the grant, GHMC was responsible

for making a provision of grant equivalent to 50% of the total project cost, thereby covering the share of Government of India and Government of Andhra Pradesh. The arrangements for the remaining 50% of the project investments were to be made by the private concessionaire itself. The other obligations of GHMC include the provision of road connectivity to the transfer stations, the treatment & disposal facilities, and the handover of all existing infrastructure such as dustbins, landfills, vehicles, etc. to the concessionaire. The GHMC was also responsible for provision of power connections to the transfer stations and treatment and disposal sites. However, the arrangements of the distribution network, usage charges, water supply and power back up facilities were to be made by the concessionaire. A brief stake holder model describing the flow of funds and other resources in this project is given below.

Figure 3.16: Stakeholder Map of MSW Management in Hyderabad



Source: Athena Research

The project allowed the collection and transportation of garbage by the private developer on a trial basis, starting with the east and the west zone of the city. After reviewing the performance in six months, the developer may be asked to carry out the activities for the municipal solid waste generated by the twin cities (Hyderabad and Secunderabad), which would be approximately 4,000 metric tons. According to the agreement, REEL had to commence the collection and transportation facilities within six months of being awarded the project and establish the processing facilities in two years. Despite the agreement being awarded in 2008, the project implementation was kept in abeyance for over a year due to objections raised by the municipal workers. The municipal workers argued that once the private developer would take the responsibility of collection and

transportation of waste, their role would be restricted to sweeping of roads. However, after consultations with the labour union leaders and the municipal of administration and urban development, a memo was signed and the project was commenced.

REEL paid ₹ 3 crore as project development fee and submitted bank guarantee of ₹ 18 crore towards the performance guarantee. GHMC appointed Environment Protection Training & Research Institute (EPTRI) as the independent consultant for the project to monitor the performance of the firm for 25 years, plus another 15 years of monitoring the landfills after closure.

The concession agreement stated that of the 3,800 metric tons of waste collected by REEL, 700 MT would be given to each of the firms – SELCO and RDF Power Generation Limited for processing, and the remaining amount would go to back to REEL.

Lessons

Financing support by the state

A financing issue was faced during the project implementation phase. Government of India refused to contribute its share of 35% of the project cost, amounting to ₹ 152 crore by claiming that the state had already exhausted its investments of seven years under the JnNURM. To resolve this problem, the state government agreed to bail out GHMC by bearing that part of the project cost which was to be provided by the GOI.

Commitment by the government

In July 2009, there was a strike by the GHMC employee unions arguing that the private concessionaire would limit their role in Hyderabad MSW Management for works such as street sweeping and not for the actual collection and transportation of waste. However, the Municipal Administration and Urban Development (MA&UD) released a memo to begin pre-construction works after having consultations with the heads of the labour union. It is essential for the government to intervene when such obstructions by the municipal employees cause delays in project development.

Role of independent engineer

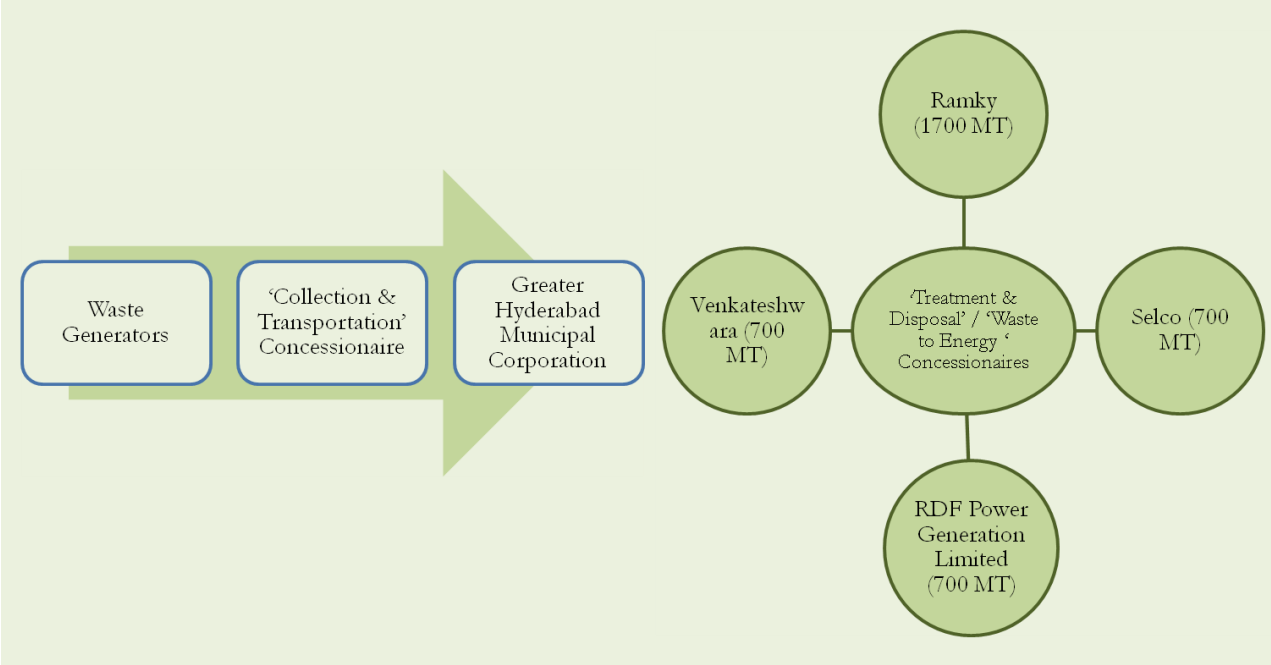
It was during the initial stages of the collection and transportation of the waste, when the Environment Protection Training & Research Institute (EPTRI) sent a letter to the GHMC commissioner saying that the collection, transportation, treatment and disposal of the waste should be taken up simultaneously as per the agreement. It also said that the payment of the tipping fee should only come into effect when the treatment and disposal facility is constructed and is under operation. In this regard, REEL's argument was that the Tipping Fee of ₹ 1,431 per ton, to be paid by the GHMC is for three components – 40% of it for collection & transportation, 20% for transfer to processing stations (dumping yards) and the remaining 40% for treatment and disposal of waste. Hence, until operations of treatment of waste begin, REEL should be paid only 60% of the

tipping fee. This indicates the importance of the role of an independent engineer, to monitor the implementation of the project as per the concession agreement.

Lack of clarity in the concession agreements of the municipal corporation with multiple private players for MSW management

Initially, of the 3,800 metric tons collected by REEL and given to the GHMC, about 2,400 MT would be given back for power generation. Despite the fact that the concession agreement stated that GHMC would not enter into any agreement with other power generating companies, GHMC did enter into an agreement with Venkateshwara Power Ltd. to supply 700 MT of waste. REEL objected to this agreement, but the MA&UD argued that the agreement with Venkateshwara Power Ltd. was signed before the one with REEL for ISWM project. Recently, RDF Power Generation Ltd. demanded 200 MT extra from the GHMC. GHMC could not refuse to supply since it had to pay the remaining ₹ 5.45 crore for 26% of the equity share in its agreement with RDF Power Generation Limited. Currently, RDF Power Generation Limited is supplied 900 MT which it uses for power generation, further sold to Tata Power Trading Company for ₹ 3.6 per unit. The rest of the power generation companies are supplied 700 MT each and the rest of the waste collected is supplied to REEL for its power plant set up at Jawaharnagar. Thus, the lack of clarity amongst various concessions of the GHMC with other waste processing private developers, lead to the reduction of waste available to REEL for processing from 2400 MT to 1500 MT. This would increase the revenue risk of REEL.

Figure 3.17: Sharing of Solid Waste in Hyderabad



Source: Athena Research

D. The Timarpur-Okhla Solid Waste Management Project

Introduction

This project was initiated in 2007 when Municipal Corporation of Delhi (MCD) and the New Delhi Municipal Corporation (NDMC) decided to implement a '16 MW Waste to Energy Project' on BOOT basis by setting up an integrated municipal waste processing facility at Okhla and Timarpur in New Delhi.[39] The project was an outcome of the continued difficulties faced by the ULBs of Delhi in disposing/treating solid waste. Around 2050 tons of waste (one-third of the total municipal waste generated in Delhi) was targeted to be processed to generate over 16 MW of green electricity. The project cost was estimated at ₹ 175 crore (later escalated to ₹ 200 crore[40]) with a construction period of two years.[41]

The project attracted 30 private players initially of which six submitted their bids. Four bidders qualified on technical parameters and finally Jindal Urban Infrastructure Limited was selected based on the lowest tariff for electricity generated from the project. The company had quoted ₹ 2.49 per kwh for the first year and a leveled tariff of ₹ 2.83 per kwh.

[39] MCD and NDMC are two separate ULBs in Delhi with separate jurisdictional areas.

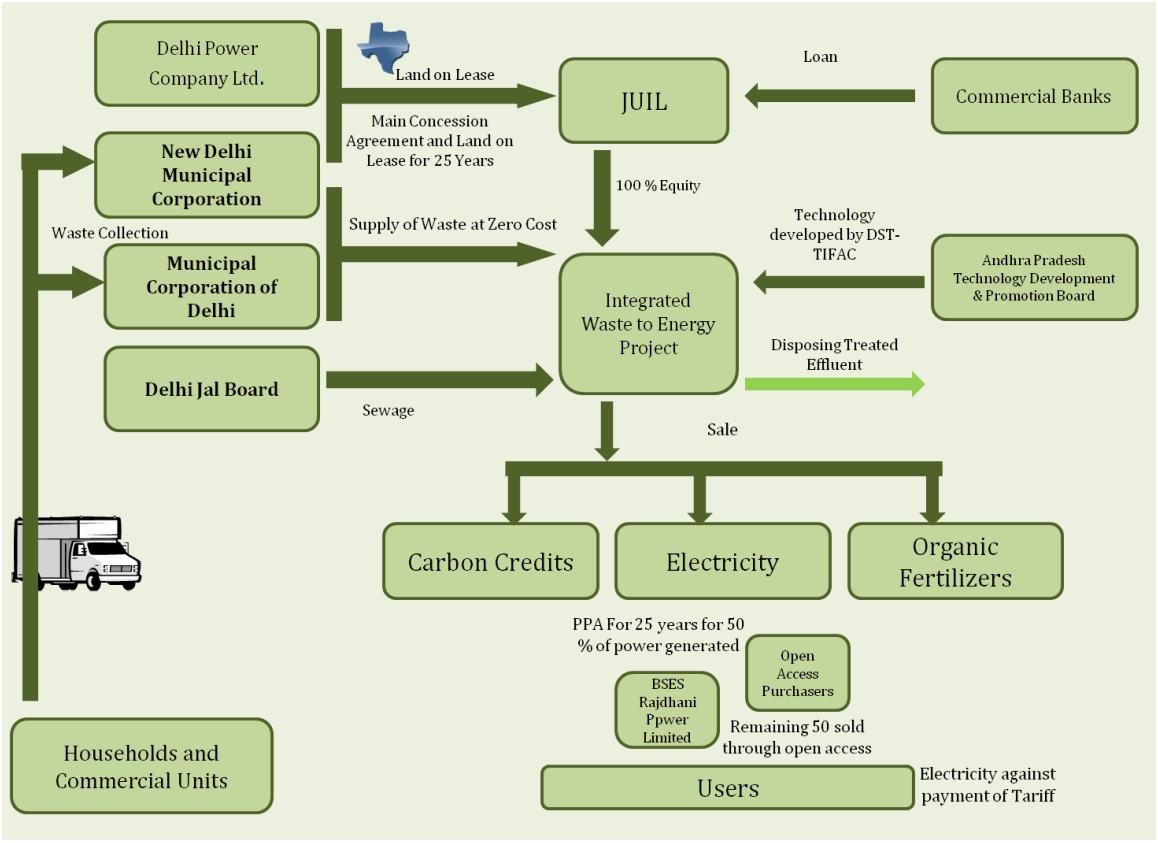
40 This escalation was primarily due to increase in capacity of power plant from 16 MW to 20 MW.

41 Please refer to 'Timarpur-Okhla Solid Wate Manangement Project' document retrieved at http://ilfswasteexchange.com/html/TOWMCPL.pdf and 'Hon'ble CM of Delhi Smt. Sheila Dikshit lays the foundation stone for the Jindal Ecopolis Timarpur-Okhla Municipal Solid Waste Management Project' retrieved at http://www.towmcl.com/Pressrelease_Details.aspx?MKey=18&NKey=8, for different in project cost.

Some Notable Features:

- The project is the first and largest integrated waste management project ever being set up in the country, aiming for a sustainable solution (Zero Waste Concept) taking MSW through an environmentally friendly process to generate clean and renewable energy from MSW.
- The project is CDM is registered with United Nations Framework Convention on Climate Change (UNFCCC) for earning carbon credits. The plant is expected to annually lead to emission reductions of 266,066 metric tonnes of carbon dioxide equivalent per annum.[42]
- The project achieved financial closure within 4 months from award of Letter of Intent (LOI).
- The project demonstrated high level of preparedness as technical studies, statutory approvals, regulatory approvals, contractual framework, project appraisals, etc. and tying up all linkages, was undertaken before the bidding process was initiated.
- The project did not require grants from the government for meeting its capital or operational expenditure.

Figure 3.18: Stakeholder Mapping of Timarpur-Okhla Integrated Waste Management Project



Source: Athena Research

Lessons

Project Preparedness

This project demonstrated high degree of preparedness from the government as during the pre-bid phase the government undertook detailed technical studies, evaluation of financial and risk elements and obtained the required regulatory clearances. The Special Purpose Vehicle (The Timarpur Okhla Waste Management Company Ltd.) was incorporated before the government proceeded with the bidding process.

Lack of Coordination

The bidding process stretched over three years primarily due to delay in obtaining No-Objection Certificate (NOC) from different government departments for the project. Provision for a 'single window clearance' can help in addressing the issues posed by different stakeholders in the government.

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[42] See, 'Okhla waste plant to power BSES,' retrieved at http://www.thehindu.com/news/cities/Delhi/article83310.ece, for further details.

Choice of Technology

The project allowed the private sector consortium the flexibility to choose the technology for processing of waste. The consortium found RDF appropriate given the high organic composition of the city's waste. The choice of the technology was made after assessing it at alternative locations. Running pilots before applying a technology at a larger level could entails significant resource savings

Stakeholder Consultation

The project is located in close proximity of human settlements. This resulted in protests by different stakeholders, including residents and NGOs. The government conducted public hearings in association with different stakeholders to address the concerns of the residents. It is important that the location of MSW processing sites be chosen after proper planning and far away from human settlements. In case of severe location constraints, a well designed Information, Education and Communication (IEC) system is a must to get stakeholder buy-in.

Chapter IV

CONCLUSION AND FUTURE MEASURES

Management of solid waste has been a major challenge for the local governments. Lack of concerted effort to create awareness about good waste management practice and failure of the ULBs to provide this important municipal service to the public are primarily responsible for development of a poor waste management system in the country. The severity of the issue has increased due to rapid urbanization coupled with rising income levels that could increase the problem of waste management manifold in the near future. By creating the required infrastructure for environmentally sustainable and cost-effective collection & transportation system, recycling, processing & scientific disposal, it is possible to reduce the quantity of refuse reaching landfills and also extract value from the waste.

With India undertaking adequate measures to address the financial constrains of the ULBs through JnNURM and 13th Finance Commission grants it is important that the ULBs build capacity to appropriately allocate the funds and manage waste in an environmentally sound and cost-effective manner. This would Adequate planning and adopting waste management solutions that suits the socio-economic and geographical profile of the urban areas is particularly important. Lack of data is a major constraint towards this end. The government and other stakeholders need to come together to address the data gap in terms of waste quantity, composition among other aspects that would allow for informed decision making.

The private sector has been assisting the ULBs to improve the management of waste in some segments of the MSW management. In some instances private sector participation has been able to enhance cost efficiency of delivery of the MSW management services. There is a need to take the public private partnerships to the next phase where such partnerships are based on a mature rationale. The emphasis of PPPs should be to leverage the private sector efficiency so as to ameliorate the ways in which waste is managed by the ULBs.

The next stage of this project will involve developing recommendations for the stakeholders based on the extensive research undertaken during this exercise. To support the ULBs in their solid waste management strategies, capacity building exercises on the choice of financial and operational model would be conducted in a few select ULBs in the states of Tamil Nadu, Karnataka, Andhra Pradesh and Madhya Pradesh.

APPENDIX I

Exhibit I.1 Performance of State with respect to JnNURM Reforms

S/N	JnNURM Reforms	AP	ARP	ASM	BR	CG	DL	GOA	GJ	HRN	HP	J&K	JRD	MPR	MZM	MP	MAHA	NL	ODA	PNB	PDY	RS	SKM	KNK	KL	TN	TRP	UK	UP	WB
1	74th CAA (Transfer of 12 Schedule Functions)	√			√	√			√							√	√							√	√	√	√			√
2	74th CAA (Constitution of DPC)	√	√	√	√	√		√	√	√	√					√	√		√	√				√	√	√	√		√	√
3	74th CAA (Constitution of MPC)	√							√								√							√		√				√
4	Transfer of City Planning Function	√		√		√			√	√	√					√	√		√					√	√	√	√			√
5	Transfer of Water Supply & Sanitation	√		√	√	√			√	√	√					√	√		√	√					√	√	√		√	√
6	Reform in Rent Control													√	√	√		√	√			√		√					√	√
7	Stamp Duty Rationalization to 5 Per Cent	√						√	√				√				√		√			√	√				√			
8	Repeal of ULCRA	√	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√	√	√		√	√	√	√	√	√	√	√	
9	Enactment of Community Participation Law	√		√	√				√	√						√	√					√			√		√		√	√
10	Enactment of Public Disclosure Law	√	√	√	√		√		√	√	√			√		√	√		√			√		√	√	√	√		√	√
11	E-Governance Set UP	√							√								√					√		√		√			√	√
12	Migration to Double Entry Accrual-based Accounting	√		√					√							√	√		√	√		√		√	√	√	√	√	√	√
13	Number of Cities with Coverage of Properties > 85 Per Cent	√				√			√								√				√			√	√	√			√	√
14	Number of Cities with Property Tax Collection >90 Per Cent	√							√								√							√	√				√	√

15	100 Per Cent of O&M Cost Recovery in Water Supply	√																√							√					
16	100 Per Cent Cost Recovery in Solid Waste	√		√	√	√					√			√			√	√	√	√		√				√			√	√
17	Internal Earmarking of Funds for Services to Urban Poor	√		√	√	√			√		√			√		√	√	√	√	√	√	√		√	√	√	√	√	√	√
	Number of PPP Projects	**3**		**1**			**3**		**1**								**1**					**5**		**7**		**4**		**3**		**2**
	Number of Reform Measures	**16**	**3**	**7**	**8**	**8**	**2**	**3**	**14**	**6**	**7**	**1**	**1**	**5**	**2**	**10**	**16**	**4**	**10**	**6**	**2**	**9**	**2**	**12**	**12**	**12**	**11**	**3**	**12**	**14**

REFERENCES

Annepu, R. K. (2012). Sustainable Solid Waste Management in India. Master of Science Thesis in Earth Resource Engineering, Earth Engineering Centre, Columbia University, (2012). Accessed from http://www.seas.columbia.edu/earth/wtert/sofos/Sustainable%20Solid%20Waste%20Management%20in%20India_Final.pdf

Enayetullah, I., and A.H. Md M. Sinha (2002). Community Based Decentralized Composting: Experience of Waste Concern in Dhaka. Urban Management Innovation, Case Study #3. All India Institute of Local Self Government, New Delhi.

Esakku, S., Swaminathan, A., Karthikeyan, O.P., Kurian, J., and K. Palanivelu (2007). Municipal Solid Waste Management in Chennai City, India. Eleventh International Waste Management and Landfill Symposium, S. Margherita di Pula, Cagliari, Italy; 1 - 5 October 2007. CISA, Environmental Sanitary Engineering Centre, Italy.

ICRA Management Consulting Services Limited (2011).Toolkit for Public Private Partnership Frameworks in Municipal Solid Waste Management, Volume I – Overview and Process. Ministry of Urban Development, Government of India.

ICRA Management Consulting Services Limited (2011). Toolkit for Public Private Partnership Frameworks in Municipal Solid Waste Management, Volume II–Case Studies of PPP Projects. Government of India.

ICRA Management Consulting Services Limited (2011). Toolkit for Public Private Partnership Frameworks in Municipal Solid Waste Management, Volume III – Model PPP Templates and Documents. Ministry of Urban Development,Government of India.

ICRA Management Consulting Services Limited (2011).Toolkit for Public Private Partnership Frameworks in Municipal Solid Waste Management, Volume IV –, Baseline Status of MSWM in Select Satellite Towns. Ministry of Urban Development,Government of India.

Jain, G.V., Mahadevia, D., and C. N. Ray (2005). Urban Governance for Sanitary Waste Management Services in Jabalpur. Working Paper No.26, School of Planning, CEPT , Ahmedabad.

Kanpur Municipal Corporation (2010). Concession Agreement for the Collection and Transportation of MSW for Kanpur Municipal Corporation. Accessed from http://kmc.up.nic.in/PDF_Files/others/A2Z%20Agreement%20Copy.pdf

Khajuria, A., Yamatoto, Y., and T. Morioka (2010). Estimation of municipal Solid Waste Generation and Landfill Area in Asian Developing Country. Journal of Environmental Biology, 31(5), pp. 649-654.

Kumar, S., Bhattacharyya, J.K, Vaidya, A.N., Chakraborty, T., Devotta, S., and A.B. Akolkar (2009). Asessment of Status of Municipal Solid Waste Management in Metro Cities, State Capitals, Class I Cities, and Class II Towns in India: An Insight. Waste Management, 29, pp. 883-895.

Mahalingam, A. (2010). Urban PPP Case Studies: Tamil Nadu. TNUDF, Government of Tamil Nadu.

Mohan, D (2002). People's Right to Safety. Health and Human Rights, 6 (2), pp.161-167.

Ministry of Environment & Forests (2000). Municipal Solid Waste Management (Management & Handling) Rules, 2000. Government of India.

Ministry of Environment & Forests (2011). Report of the Committee set up to frame National Sustainable Habitat Standards for the Municipal Solid Waste Management. Government of India.

Ministry of Urban Development (2006). Modified JnNURM Guidelines – UIG. Government of India.

Ministry of Urban Development (2006). Guidelines for Preparation of Detailed Project Reports and Selection of Technologies for Processing and Disposal of Municipal Solid Waste Using 12th Finance Commission Grants. Government of India.

Ministry of Urban Development (2006). Report of the Working Group on Urban Development (excluding Urban Transport), Urban Water Supply and Sanitation (including Low Cost Sanitation, Sewerage & Solid Waste Management) and Urban Environment for the Eleventh Five Year Plan (2007-2012). Government of India.

Ministry of Urban Development (2008). Handbook on Service Level Benchmarking. Government of India.

Ministry of Urban Development (2010). Improving Service Outcomes 2008-09: Service Level Benchmarking Databook. Government of India.

Ministry of Urban Development(2011). Municipal Solid Waste Management on a Regional Basis - Guidance Note. Government of India.

Ministry of Urban Development (2011). Report on Indian Urban Infrastructure and Services. High Powered Expert Committee. Government of India.

National Institute of Urban Affairs (2010). Benchmark for Efficient Services. Quarterly Newsletter, 13(1). Accessed from http://www.niua.org/Publications/newsletter/UF_ENG_JAN-MAR10.pdf

Rathi, S. (2007). Optimization Model for Integrated Municipal Solid Waste Management in Mumbai. Environment and Development Economics, 12, pp. 105-121.

Sarkar, Papiya (2003). Solid Waste Management In Delhi – A Social Vulnerability Study. In Martin J. Bunch, V. Madha Suresh and T. Vasantha Kumaran, eds., Proceedings of the Third International Conference on Environment and Health, Chennai, India, 15-17 December, 2003. Chennai: Department of Geography, University of Madras and Faculty of Environmental Studies, York University. Pages 451 – 464.

The World Bank (1999). What a Waste: Solid Waste Management in Asia. Urban Development Sector Unit, East Asia and Pacific Region, World Bank Group, Washington DC.

UNICEF (2010). Successful Innovations in Solid Waste Management Systems: examples from Five Local Bodies in Tamil Nadu. Government of Tamil Nadu, India.

Urban Management Centre (NA). Integrated Waste Processing Plant on PPP (Build Operate Own) Process: Rajkot Municipal Corporation. Accessed from http://www.pas.org.in/Portal/document/ResourcesFiles/GoodPracticeDocs/Integrated%20Waste%20Processing%20Plant.pdf

USEPA (2010). Municipal Solid Waste Generation, Recycling and Disposal in the United States: Facts and Figures for 2010. Environment Protection Agency, US government.

Vishwanath, C., and J. Trankler (2003). Municipal Solid Waste Management in Asia: A Comparative Analysis. Environmental Engineering & Management, Asian Institute of Technology.

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