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Operation Model for Implementation of Municipal Solid Waste Management System - Through Public Private Partnership

Tapas Dasgupta
Research Scholar, AISECT University,
E-mail : dasgupta16@gmail.com

ABSTRACT:

The Public Private Partnership (PPP) requires safe and conducive environment to safe guard the interest of the private partner against risk and that of consumers against likely abuse by the private partners. The private partners are not generally attracted towards PPP arrangement in solid waste management (SWM) services because of its complex operation and maintenance cost structure and difficulty in fixing sustainability for a long period. Risks are involved due to increase in the cost of energy, chemical, main power and other allied items. On the other hand non affordability of levied tariff results in under utility of the scheme and less revenue collection. A well design cost model is therefore necessary that can provide the cost of each components, which contributes to the total operation and maintenance cost at any time of PPP arrangement. This cost model should take care of the increase in solid waste with the increase in population and incremental cost required to meet it throughout the PPP arrangement. This paper describe the approach and methodology use to design such a cost model and its applicability in PPP arrangement. The model can be used to check financial sustainability, plan for SWM and compute benefits/losses with change in basic parameters.

KEY WORDS :
Average incremental costs, operation and maintenance, public private partnership, solid waste management system.

INTRODUCTION :

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.

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.

MSW–QUANTITY & CHARACTERISTICS

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

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. The proportion of non-bio-degradable 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.

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 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.

Various forms of engagement among the ULB, private sector and community have been observed at different places in the country. 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.

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 gives. 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 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.

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. 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.

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.

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.

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.

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.

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 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.

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.

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] The anticipated waste quantities for Class I cities for the next two decades. There is an imminent need to address the service backlog 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.

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. These reformatory measures are expected to create a conducive environment for improved delivery of MSW services and enhance the scope for Public Private Partnerships.

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

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.

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.

ii. 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.

iii. 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.

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.

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.

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.

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