Improving Management of Municipal Solid Waste in India

Overview and Challenges

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Solid waste management is increasingly becoming a critical issue for municipal authorities in India. Central and the state governments are supportive of local efforts to improve MSW management but this is essentially a municipal function and it is at this level that challenges have to be addressed. The MSW Rules notified in 2000 put most municipal authorities under pressure to perform. In this context an overview study like the present one may prove useful for policymakers and others concerned with environment and development issues of urban India.

This report summarizes the findings of year-long analytical work conducted by the Bank, mainly in the states of Andhra Pradesh and Karnataka and later extended to three hill towns, and developed with stakeholders including the central ministries MoUD and MoEF and agencies such as the Central Pollution Control Board. Following a background study that identified the essential institutional and technical issues with regard to management of MSW, the Bank supported the preparation of action plans for three cities each in the two states, as well as the hill towns. These plans provided valuable insights and allowed broad lessons to be drawn out. The major finding is that municipal authorities have to be encouraged to move at their own pace while they develop and implement sustainable plans for upgrading MSW facilities and systems. This report summarizes specific areas which should be priorities.

The report also identifies areas where the Bank or the donor community in general could play a useful role. Meanwhile, it is hoped that this report, focused at the policy level, can be a primary reference in strategic planning for municipal waste management in the coming years.

Authors
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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AAA</td>
<td>Analytic and Advisory Activity</td>
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<td>AIC</td>
<td>Average Incremental Cost</td>
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<td>ASCI</td>
<td>Administrative Staff College of India</td>
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<td>BOT</td>
<td>Build-Operate-Transfer</td>
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<tr>
<td>BOO</td>
<td>Build-Own-Operate</td>
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<tr>
<td>BOOT</td>
<td>Build-Own-Operation Transfer</td>
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<tr>
<td>CF</td>
<td>Carbon Finance</td>
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<tr>
<td>CFB</td>
<td>Carbon Finance Business</td>
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<td>CPCB</td>
<td>Central Pollution Control Board</td>
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<tr>
<td>DBO</td>
<td>Design-Build-Operate</td>
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<td>EA</td>
<td>Environmental Assessment</td>
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<td>ER</td>
<td>Emissions Reduction</td>
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<td>GEF</td>
<td>Global Environment Facility</td>
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<tr>
<td>IFC</td>
<td>International Finance Corporation</td>
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<tr>
<td>KUIDFC</td>
<td>Karnataka Urban Infrastructure Development and Finance Corporation</td>
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<td>MCH</td>
<td>Municipal Corporation of Hyderabad</td>
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<tr>
<td>MoEF</td>
<td>Ministry of Environment and Forests</td>
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<td>MoUD</td>
<td>Ministry of Urban Development</td>
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<tr>
<td>MSW</td>
<td>Municipal Solid Waste</td>
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<tr>
<td>NGO</td>
<td>Non-governmental Organization</td>
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<tr>
<td>NIMBY</td>
<td>Not-In-My-Backyard</td>
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<tr>
<td>O &amp; M</td>
<td>Operation &amp; Maintenance</td>
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<tr>
<td>PSP</td>
<td>Private Sector Participation</td>
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<td>RDF</td>
<td>Refuse Derived Fuel</td>
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<td>SPCB</td>
<td>State Pollution Control Board</td>
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<td>SWM</td>
<td>Solid Waste Management</td>
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<tr>
<td>TNUIFSL</td>
<td>Tamil Nadu Urban Infrastructure Financial Services Ltd.</td>
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<tr>
<td>ULB</td>
<td>Urban Local Body</td>
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<tr>
<td>USAEP</td>
<td>U.S. Asia Environment Partnership</td>
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<td>USAID</td>
<td>U.S. Agency for International Development</td>
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<td>WBI</td>
<td>World Bank Institute</td>
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<td>WSP</td>
<td>Water and Sanitation Program</td>
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Exchange Rate US$1=Rs. 45 approx
OVERVIEW AND SUMMARY

INTRODUCTION

This study summarizes the findings of a non-lending analytical activity carried out by the World Bank in 2004 and 2005. The work was driven by concern over the quality of the urban environment, and undertaken in a context of uncertainty on the suitability and effectiveness of Bank investment in this area, particularly in regard to components that generate little or no direct revenue, like waste disposal and sewage treatment. The immediate objectives involved addressing specific problems established in consultation with clients, and identifying obstacles and challenges to the improved management of municipal solid waste (MSW) in Indian cities. The broader long-term objective of this work is to support municipal authorities in improving the quality of the urban environment within their jurisdictions, with the aim of achieving related public health and economic benefits.

Most of the initial work was carried out in the states of Karnataka and Andhra Pradesh, where there was strong client interest and engagement, and where the Bank is developing a number of projects to support municipal reform. Activities also involved the Central Pollution Control Board (CPCB) and the Ministries of Environment and Forests (MoEF) and Urban Development (MoUD). The main outputs to date have been a series of working documents developed in collaboration with state- and municipal-level clients that address priority issues raised during discussions among the clients, the Bank, and other colleagues. These documents have evolved in response to client demand, and form the basis of this summary. Knowledge sharing has been an essential component of the work and the World Bank Institute is now involved in documenting and disseminating lessons emerging from practical experience as well as helping to develop a network of local training organizations.

RELEVANCE AND IMPORTANCE OF MSW

Urban sanitation and environment issues clearly contribute to basic health conditions in urban areas. Municipal Solid Waste Management (MSWM) however is typically assigned lower priority than water supply and sanitation. Very large numbers of people are engaged in the sector: waste pickers, informal waste collectors, and municipal workers among others, although the scale of this engagement is often not appreciated. The management of municipal
Improving Management of MSW in India

solid waste is often the single largest activity that a municipality undertakes, and the effectiveness with which it carries out this role is perceived as a reliable measure of its effectiveness in providing services to its citizens. MSWM is a fundamental indicator of institutional capacity.

There is no reliable national-level data on the technical or financial aspects of waste management in India, and figures are therefore approximations. The scale of the problem however is fairly clear. The country’s annual generation of municipal solid waste is in the range of 35 to 45 million tons. This volume is likely to double by 2015, and double again by 2025, by which time India would be generating over 150 million tons of waste a year. The scale is perhaps more comprehensible at the level of the individual city: Mumbai today generates about 7,000 tons per day (tpd) and Delhi generates about 6,000 tpd.

COSTS AND INVESTMENT NEEDS

Given the limited financial management and accounting systems used by most cities, the expenditures by activity are not usually recorded. Available figures suggest that solid waste management accounts for 15 to nearly 50 percent of the typical municipality’s total spending. The urban population of India is projected to be around 400 million by 2015, which would bring the running costs of providing basic MSW services to all urban dwellers to between Rs 24 and 200 billion (between US$ 500 million and 5 billion) annually. The estimate assumes expanded coverage but no upgrading of MSWM systems. The cost of providing landfill facilities to meet the requirements of the MSW Rules over the next ten years is estimated at some Rs 100 billion – about US$2 billion. Not all of this investment will be publicly-financed, and private financiers express strong interest in the sector. The level of investment eventually forthcoming from the private sector is likely to be substantial, but cannot be projected at this time. Planned allocations under the 12th Finance Commission are up to Rs 2,400 million (about US$ 500 million) in grants for MSW over the next five years which would be a major contribution toward the levels of investment required.

APPROACH ADOPTED: MUNICIPAL ACTION PLANS

The Bank work included a background report prepared on MSW; specific analysis was carried out on financial planning for MSW at the municipal level and of the experience with private sector participation. However, probably the most effective aspect of the work was support of a pilot program of Action Plans for small and medium-sized municipalities, initially with three cities each in Karnataka and in Andhra Pradesh (and later extended to three hilly towns, at the request of the Government). These Plans draw on available estimates of MSW parameters, together with city specific data provided by the municipalities through local consultants, to produce a range of possible strategic options for each
municipality. One key contribution of the Bank to the detailed planning process was on the financial aspects, using a spreadsheet financial model (developed for this purpose) to help clarify the constraints and options in the pilot cities. While the quality and relevance of the action plans varied, collectively they provided important cost data which had been previously lacking, as well as practical insights into local level constraints.

**KEY FINDINGS**

The work initially concentrated on technical questions relating to processing technologies and landfills, but institutional and financial aspects soon emerged as the more important issues.

- Considerable investment funds are available in India for urban infrastructure, and the technologies are well known and understood. The basic problem is in adapting these existing technologies to specific local conditions.

- MSW management is essentially a local function, but few local governments have the institutional, managerial, or financial capacity for a significant improvement in MSW management in the near term. There is an urgent need for much improved medium term planning at the municipal and state level so that realistic investment projections can be developed and implemented.

- While the principal responsibilities for MSW management lie at the local level, state governments play a necessary role in providing policy guidance, technical support, and funding. Realistically, state governments will have to play a major role for a considerable period of time. Some policy and regulatory matters remain with the central government. Capital funding support by the central government will be important and available resources need to be used as effectively as possible.

- The private sector can play a greater and more important role in improving the management of MSW but the current framework for Private Sector Participation (PSP) in MSW is weak and underdeveloped. Considerable contracting of labor and transportation is occurring in MSW but there is limited and generally unstructured PSP in treatment and disposal. Some standard documents have been developed but more attention needs to be given to strengthen both ULB capacity to enter into contracts and the private sector’s ability to deliver against a contract.

  Local politicians and senior officials are increasingly committed to improved MSW management, which is being served by a growing body of available practical information and expertise. Institutional and financial issues must now take center stage in bringing these improvements to pass.

**EMERGING LESSONS**

Experience in designing and implementing MSW Action Plans yielded some practical lessons which
are being driven home by financial analyses under way in the different municipalities. A number of basic points emerged strongly: the challenge of large numbers of staff working on solid waste; the value of selective and well managed contracting of certain services; the need for clear and reliable revenue streams (eventually including some form of user charges); and acceptance that processing and disposal will inevitably be a net cost, even though some income may be generated to offset the costs. Experience suggests quite clearly that municipalities can implement and, over time, operate effective and sustainable MSW management by instituting efficiencies within current expenditures. Modest user fee systems and new components can be introduced at a measured pace, and potential opportunities to privatize certain operations can be purposefully explored.

The practical lessons imparted by the MSW Action Plans also point to challenges that improved management must address and resolve. Among them are:

- **The Need to Strengthen Municipal Institutions.** Given the increasing scale and complexity of upgraded MSW systems, it is essential to have clear, senior and unified management responsibility for MSW within any Urban Local Body (ULB). Some states are moving ahead to develop coherent approaches within their own jurisdictions, and this will require improving technical and managerial skills including project development, project financing, and monitoring and supervision. Structured learning and training opportunities are clearly needed, and processes to build institutional capacity must be put into place quickly.

- **Ensuring financial sustainability in MSW Management.** Realistic cost estimates and financial projections are essential for informed decision making, and to ensure that MSW Action Plans are based on what the municipality can actually afford. Municipalities should seek to gain revenue wherever possible from components of the waste stream, but they must accept that it will usually be necessary to pay the private sector if complete treatment and disposal of the full waste stream is to be contracted out (the “tipping fee”). Carbon finance is a possibility although technical and procedural issues must be resolved. Carbon finance payments are based on verifiable and measurable results, and therefore require a sound and well operated system.

- **Working with communities and the informal sector.** Scaling up community systems is an important goal but depends very much on local conditions and on efforts of local authorities. Waste management is highly labor intensive, and promises basic employment opportunities for large numbers of people. In striving to make municipal systems more efficient,
a balance must be struck with the sector’s traditional role as a source of employment.

- **Involving the private sector more effectively.** Private sector participation has many potential advantages, though municipalities must be able to manage the contracting process adequately and deal quickly with any problems that may emerge. In the short term at least, private investment by foreign firms is likely to be limited and Indian companies will lead market entry. For states, this means developing appropriate policy and regulatory frameworks to attract and promote private sector participation in MSW management.

- **Addressing critical technological questions.** At present, it is realistic to expect that composting can lower the net cost of waste disposal, but is unlikely to generate net revenue until markets or subsidies change or new innovations are introduced. Operational experience with waste-to-energy methods are so far limited, but indicates that financial and operational risks should be passed to private operators, bidding on the lowest price to the municipality. Where local conditions are favorable, significant practical advantages are likely to be found in granting municipalities flexibility to adopt simpler, less costly systems for small landfills.

**MOVING FORWARD**

MSW management is clearly a large and important task for municipal authorities. Different municipalities will move at different paces on these issues, but momentum has been established nationally and the overall process will continue to move forward. MSW management requires both increasingly sophisticated systems management and on-going—perhaps relatively small—capital investment. Expanding and improving coverage at the national level will therefore require both upgraded institutional and financial structures and substantial investment in infrastructure. One of the most useful steps that can be taken by municipalities is to develop and implement clear plans for upgrading MSW facilities and systems, at a pace which is locally acceptable and sustainable in the long term.

The Action Plan approach is now being taken up more widely following a Supreme Court decision directing India’s 59 largest cities to draft such Plans. Many, mostly larger municipalities are preparing Action Plans, and the state of Tamil Nadu has introduced a program supporting its main cities in developing plans that is already well advanced.

There is a growing understanding of practical and pragmatic approaches to MSW management and further analytical work should now focus on a select number of outstanding issues that require deeper understanding. At
least three such areas may be seen as priorities: financial planning aspects, the development of contracting strategies to encourage private sector participation, and community and social dimensions of MSW management.

**Role for the World Bank and Other Donors**

Considerable support for MSW management is already in place among the donor community. Further timely support that responds to demand by clients could include the following:

- **Support to the ongoing devolution process and the strengthening of local government capacity** through development of training programs, information exchange mechanisms and informal networks of professionals.

- **Programmatic approaches to urban investment**, in which technical assistance is designed to support investment in key projects and to encourage an appropriate role for the private sector.

- **Cooperative efforts to bring innovations to bear on the institutional and technical challenges**, through pilot projects which introduce and demonstrate new techniques and technologies. Possible areas could include model systems, regional facilities, or technologically complex facilities/sites which may require specific operational approaches and skills.

Both the national and state governments are supportive of local efforts to accelerate the upgrading of MSW management, although this is fundamentally a municipal function and it is at the municipal level that the challenges have to be addressed directly. Considerable improvements in the level of service have been evident in a number of sites, with municipal authorities beginning to find solutions specifically tailored to local conditions. Given the scale of the challenge at the national level however, the road ahead may well be a long one.
This report summarizes the key issues addressed and activities undertaken by the World Bank in an analytical work on municipal solid waste (MSW) management in India in 2004 and 2005. The activities aimed to contribute to the improvement of urban environmental conditions by helping clients to identify and address barriers to improved solid waste management. These clients and local partners—mainly state level—worked in close collaboration with the Bank. The work relied heavily on Indian specialists who were supported by targeted inputs from international experts. Work was carried out in a highly cooperative and iterative manner, with shared ownership of its results – the working papers summarized in this report. The work’s larger impacts can be discerned in changed approaches and procedures to waste management, and increased local capacity to carry these through.

**APPROACH AND METHODOLOGY**

The approach adopted entailed working closely with clients to define issues where the Bank can provide added value. It also involved extensive collaboration between colleagues within the Bank, the Water and Sanitation Program (WSP), and the larger development community, including the Asian Development Bank (ADB), the UK Department for International Development (DFID), and the US Agency for International Development (through USAEP and urban development program).

The work was undertaken with an understanding that MSW is an important issue both in its own right, and as a practical measure of a municipality’s larger capacity. The scope and complexities of the MSW agenda are such that practical solutions are not one-off interventions, but require ongoing concerted effort by cities and state governments, working closely with community organizations and NGOs, with the support of the international development community.

The work focused on three states where World Bank urban projects are in preparation: Andhra Pradesh, Karnataka, and Tamil Nadu. Most of the analytical work was carried out in Andhra Pradesh and Karnataka, where there was particularly strong client interest and engagement. This work initially covered six cities and included preparation of MSW Action Plans, which were tailored for large towns and smaller cities.
A key objective for municipalities was to develop realistic infrastructure plans for sanitation. These would provide a basis for justifying priority investments and attracting private sector investment. Initially, the issues raised by counterparts tended to be technical, and limited attention was given to finance and implementation. In attempting to bring more meaning to these discussions, the concept of preparing the city specific Action Plans emerged. The development of these pilot Action Plans (initially for six municipalities and later expanded to cover three more cities in hilly areas in other states), provided critical data, insights into constraints and opportunities, and informed discussion of the options available to the respective municipalities. In addition, detailed work undertaken in Hyderabad included the closure of old waste dumps. Together with related analytical work, these discussions led to the identification and development of realistic approaches on a broader scale, which in turn were discussed at state and national levels.

The work employed a bottom-up approach designed to build on existing reform processes while fostering an environment in which successful new MSW projects are likely to find sources of investment and support. Expected synergies between reform efforts and MSW did emerge in the process of balancing fiscal responsibility with the pressures to support upgraded urban services, including sanitation and solid waste.

The Union Government in Delhi was engaged principally through the Central Pollution Control Board (CPCB), and the Ministries of Environment and Forests (MoEF) and Urban Development (MoUD) were also directly involved. Interaction with these government agencies focused on policy level issues.

The analytical work in select municipalities identified appropriate mechanisms for increasing private sector participation as a strategic priority – particularly in treatment and disposal. Private provision of waste collection and transportation services is quite common, but practical, empirical information on more complex systems was not available. Taken together, the analyses provided a starting point to bring regulators and potential investors together and some initial discussions were held to identify and address barriers to increased investment.

**Feedback**

A Technical Round Table on the study outcomes with key national and state agencies and other interested parties was held in October 2005 to ensure that the findings reflected the perspectives of different stakeholders. These consultations reinforced the need for better systems management, institutional and financial reforms, effective contracting procedures for private sector investment, capacity building, and better understanding of the community and social dimensions of MSW management.
Relevance of MSW

Increasing urbanization in India is a part of the global trend with 27.8 percent of India’s population (285 million) of the total 1027 million living in urban areas (as per the 2001 census). The number of towns and cities has increased to 4378 of which 393 are Class-I towns, 401 are Class-II towns, 1,151 are Class-III towns and remaining are classified as small towns with populations ranging between 20,000 to less than 5000. The number of metropolitan cities having million plus population has increased to 35 as per 2001 census, and this has also seen growing public concern with exponential increase in sanitation and environmental issues.

Urban sanitation and environment issues are clearly contributors to basic health conditions in urban areas but MSWM has a lower priority than water supply and sanitation. Although incidents such as the plague episode in Surat suggest that there are important health aspects to MSW, it is basically an environmental issue rather than a health one and certainly the recent pressures in India for improved MSW have had an environmental focus. The various “smoky mountains” of burning garbage that are features of many urban areas can have serious local environmental impacts. Identified impacts can be serious (such as anecdotal stories of animals dying after drinking polluted surface water) but are typically localized at present. The broader environmental concerns come from the large and growing scale of the MSW problem and its potential long-term consequences. At the same time, MSW clearly does have health consequences, especially when it is related to the broader sanitation issue through concerns such as reducing open defecation and management of drainage systems to prevent urban flooding, as well as the role of dumped garbage in encouraging disease vectors like insects and rats.

Another very important dimension is the very large numbers of people involved in this sector, whether as...
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“scavengers” or “ragpickers”, (informal waste collectors,) or municipal workers. The numbers of people and their roles are important in any effort to improve the management of MSW although this dimension is often under-appreciated. Some progress has been achieved under this activity to clarify this complex area but much more remains to be done.

However, perhaps the main reason for paying increased attention to management of MSW is the reality that MSW is normally the single biggest activity that a municipality undertakes – sometimes 20-50% of total expenditure and sometimes more than all the other functions combined – and the municipality’s ability to manage MSW well, is a clear measure of its overall effectiveness in providing services to its citizens.

**SCALE OF THE CHALLENGE**

The widespread public concern about the poor level of MSW management in most urban centres tends to obscure the fact that there are some good examples and some relatively well managed systems. There are numerous examples of cities becoming cleaner. A number of cities have taken important initiatives, and the state governments are giving this issue more attention and providing increased resources. Private sector is interested and increasingly involved. However, progress is patchy and there is no overall coherent program, although state level initiatives are emerging and the Union Government is starting to play a greater coordinating role.

There is no reliable national data on waste management, covering either the technical or the financial aspects and therefore any overview figures represent, at this point, approximations. Given that MSW is inherently a municipal function a top-down approach to data collection would be costly and not very reliable. However, there is a need for good management and comparative data at the municipal and state level and this issue needs to be given more attention. In terms of waste quantities and characteristics, a major study was carried out in 1995 by NEERI. CPCB has commissioned an update of these estimates, and the results are expected around mid 2006.

A Background Report prepared under this activity summarizes the readily available information and provides an indication of the scale of the problem. This Report compiled information from various sources and estimated that in year 2000, the major urban centres in India generated about 100,000 tons per day (tpd) of municipal solid waste.

On an annual level, therefore, approximately 35 million tons of MSW
Overview and Challenges

Overview of Main Components of MSW

MSW management covers the full cycle from collection of waste from households and commercial establishments through to acceptable final disposal. In the process, efforts are made to reduce the final volumes, through recycling and materials recovery, as well as processing/treatment. The accompanying diagram outlines the typical system of waste management in India. An analysis along these lines should be carried out for any municipality, as a first step to understanding and dealing with the necessary upgrading of the system.
Addressing the challenges of waste management in India is a complex task. The residential sector contributes about 65 percent of the total solid waste, leaving the commercial sector with the remaining 35 percent. This distribution of waste highlights the need for targeted strategies to manage waste effectively.

**Box 1: Progress in Waste Management in Hyderabad**

The Hyderabad urban agglomeration contains an area of about 1,864 square kilometers, with 9 municipalities, and 106 gram (village) panchayats. The city generates 2,200 Metric Tons (MT) of solid waste. The residential sector contributes about 65 percent of the total solid waste, it follows that commercial sector contribute the remaining 35 percent.

**Door-to-Door Collection from Residents**

There are 3,850 notified garbage collection centers, which are attended every day. The residents dispose of the garbage directly into bins at the nearest notified centers. In some areas, residents deliver garbage to rickshaw (tricycle) pullers under the Voluntary Garbage Disposal Scheme (VGDS). Four hundred sixty-three Resident Welfare Associations covering 60,000 houses are using the VGDS at present. This program has also been extended to 350 slums, where neighborhood committees are using the scheme to effectively manage their solid waste.

**Street Sweeping**

Seventy-five percent of the city’s area is now being cleaned by the private contractors both day and night. These include 14 self-help women’s groups managed by Development of Women and Children in Urban Areas (DWCUA). Under privatization, the Municipal Corporation of Hyderabad introduced a scientifically designed and structured unit area and unit rate system for cleaning and transport works.

**Enforcement System for Control of Littering and Debris**

The Municipal Corporation of Hyderabad has introduced a separate enforcement system to levy fines and charges on residents or commercial establishments for littering and dumping. Eleven mobile enforcement squads are deployed in the city to constantly track any littering or dumping on the streets and fine the offenders. For example, during a recent six-month period, more than 5,000 offenders were caught and fined a sum of Rs 4 million. This has considerably reduced public littering. This enforcement system is being strengthened with regular monitoring.

**Doorstep Collection from Bulk Garbage Generators**

Under the principle of “users pay, beneficiaries pay, and polluters pay,” the Municipal Corporation of Hyderabad has introduced a scheme for collecting user charges from bulk garbage generators in the city. One thousand seven hundred establishments—such as hotels, restaurants, function halls, hospitals, markets, commercial complexes, and so on—that generate bulk garbage are identified and classified into 12 categories for levying user charges. During 2003–04, 20 transport work packages were proposed to be launched for providing doorstep collection to these establishments and collecting user charges of Rs 20 million.

**Source:** WBI Training Module on SWM 2005.
approximate and undoubtedly increasing efforts will be made to reduce the volumes of waste generated and to increase the rates of recycling and recovery, so as to reduce the size of the disposal problem. Nevertheless, the problem has the potential to overwhelm municipalities, both literally and figuratively. These projections are fully consistent with international experience – a recent World Bank study for China showed even more dramatic projections for waste increases there.\(^6\)

**FINANCIAL ASPECTS**

Lack of investment is the reason most often given for lack of progress on MSW upgrading but there are considerable funds available in India for urban infrastructure investment and the constraints are more complex than a simple lack of funds.

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**Box 2: Improved MSW Management in Nagpur**

Nagpur, in Maharashtra state, is a major center of education, culture, and commerce. It has a population of more than 2.1 million and covers an area of about 220 square kilometers, distinguished by ethnic, cultural, and religious variety. It is divided into 10 zones and 45 divisions. It is estimated that 700–800 metric tone of garbage are produced every day in Nagpur.

The Nagpur Municipal Corporation (NMC) authorities earlier found it difficult to provide cost-efficient service to citizens; therefore, MSW management was outsourced in 30 Municipal wards to private sector organizations, such as the Center for Communication Development (CDC). The CDC was made responsible for primary garbage collection service of the Lakad Ganj zone (eight wards), which subsequently increased to nine of ten zones, as part of the Swachta Doot Project. The organization started with awareness building among the citizens and providing complete range of MSW management, including street sweeping, door-to-door garbage collection, container lifting, dumping, recycling, and vermicomposting.

Daily door-to-door garbage collection is the core of the Nagpur – Swachta Doot model. Trained laborers collect the waste from households and shops everyday 365 days a year. The service is provided between 6:00 A.M. and 1:00 P.M.. Swachta doots (loaders of garbage into containers) use bells and whistles to alert customers of their arrival in the neighborhood, and also pick up the dustbins directly at the doorstep to assist elderly or infirm citizens. Specially designed vehicles are used to transport the garbage directly to transfer stations. The containers from transfer stations are brought to landfill sites outside the city by the NMC workforce. There is close cooperation between the CDC and the municipal bodies so that waste is not stored longer than necessary in residential areas, which has resulted in significant improvement in cleanliness of streets.

MSW management is often the largest single area of annual expenditure for a municipality in India. Given the relatively low standards of financial management and accounting in most cities, expenditures by activity are not usually recorded and so comprehensive data is not available but it is widely accepted that 20-50 percent of the typical municipality’s (revenue) expenditure goes on MSW. Typically the MSW management expenditure for smaller towns ranges between 30-50 percent while for large cities it ranges between 15-25 percent. For example, figures for Hyderabad show that Rs 750 million (approximately $19m) was spent on solid waste in 2004, which is about 15 percent of the Corporation’s operation budget, and in Bangalore, expenditures of Rs 6400 million (approximately $160m) in 1999 had almost doubled by 2001, to cover major upgrading of the municipality’s systems.

Using data compiled for the Background Report, current operating costs for MSW (not including proper treatment and disposal) are typically quoted in the range of Rs 60-500 capita/annum (see Fig.3), with the higher numbers in metros which have more advanced and more complex systems. The current costs also vary for each municipalities depending on the level of MSW management services, such as area covered for street cleaning, door to door collection, percentage of waste collected and transported etc. In simple terms, with an urban population of the order of 400 million by 2015, the annual running costs of basic MSW systems for all urban dwellers would be of the order of Rs 24-200 billion. This is assuming an increase in coverage of the services but no upgrading of the systems.

As part of background study it was also observed that several municipalities regularly use the option to contract out a part of MSW Manage-
ment services to cope with increasing demand to cover new urban areas and improve the quality of services, which typically include use of private contractors for street cleaning, collection and transportation of waste. The typical expenditure on sub-contracting ranges between 10-25 percent of recurring municipal budget, and often does not get reflected as cost of MSW management. A brief overview of data from some municipalities in Karnataka indicates that the cost of MSW management per ton of waste handled, as incurred by private contractor is significantly less (in the range of 20-40 percent) compared to the cost of waste handled by municipalities. One of the reasons for relatively lower costs incurred by the contractor is quoted as differential wages, particularly when private contractors tend to pay lower than minimum wages to their sanitary workers. Table 2 provides an indicative cost of MSW management for the municipality and private contractor. It is observed that smaller municipalities tend to use services of private contractors much less compared to larger municipalities. However, it is important to note that level of MSW management service coverage in some municipalities is quite low. Therefore lower costs per ton of MSW may not fully represent quality of MSW management in a city.

Various estimates of overall investment needs have been made by different parties, particularly the financial community, but these figures are typically not for quotation and in any case are based on different assumptions. In the absence of any real data on the actual costs of landfill construction (which in any case will vary with local circumstances), informed estimates indicate additional costs of about Rs 300-500 per ton are needed to meet the requirements of the MSW Rules. Over the next ten years, with annual waste quantities

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**Table 1: Projected Municipal Waste Generation for the Urban Population in India**

<table>
<thead>
<tr>
<th>Year</th>
<th>Projected Urban Population (in thousands)</th>
<th>Waste generation rate (gms/capita/day)</th>
<th>Total MSW generation (million tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>281255</td>
<td>327</td>
<td>33.7</td>
</tr>
<tr>
<td>2005</td>
<td>315276</td>
<td>391</td>
<td>45.0</td>
</tr>
<tr>
<td>2010</td>
<td>355205</td>
<td>471</td>
<td>61.0</td>
</tr>
<tr>
<td>2015</td>
<td>401698</td>
<td>571</td>
<td>83.8</td>
</tr>
<tr>
<td>2020</td>
<td>455823</td>
<td>696</td>
<td>115.8</td>
</tr>
<tr>
<td>2025</td>
<td>517178</td>
<td>848</td>
<td>160.1</td>
</tr>
<tr>
<td>2030</td>
<td>586052</td>
<td>1032</td>
<td>220.7</td>
</tr>
</tbody>
</table>

* Population projection data from United Nation Population Division

Source: Background Report.
Table 2: Indicative Costs of Existing MSWM for 10 sample Towns in Karnataka

<table>
<thead>
<tr>
<th>Population 2001</th>
<th>Waste handled</th>
<th>Percentage (%) share of waste handled per day by Unit</th>
<th>Percentage(%) share of Annual MSWM costs for</th>
<th>Cost per ton for municipality</th>
<th>Cost per ton for contractor</th>
<th>Overall cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Municipality</td>
<td>Contractors</td>
<td>Municipality</td>
<td>Contractors</td>
<td>Rs /per ton</td>
</tr>
<tr>
<td>Small Town</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Town 1</td>
<td>53,043</td>
<td>12</td>
<td>75</td>
<td>25</td>
<td>86</td>
<td>14</td>
</tr>
<tr>
<td>Town 2</td>
<td>48,000</td>
<td>10</td>
<td>100</td>
<td>0</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>Town 3</td>
<td>47,060</td>
<td>9</td>
<td>100</td>
<td>0</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>Town 4</td>
<td>49,408</td>
<td>4</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>City Municipal Council</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Town 1</td>
<td>274,105</td>
<td>60</td>
<td>43</td>
<td>57</td>
<td>83</td>
<td>17</td>
</tr>
<tr>
<td>Town 2</td>
<td>248,592</td>
<td>52</td>
<td>37</td>
<td>63</td>
<td>66</td>
<td>34</td>
</tr>
<tr>
<td>City Corporation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Town 1</td>
<td>317,000</td>
<td>60</td>
<td>75</td>
<td>25</td>
<td>90</td>
<td>10</td>
</tr>
<tr>
<td>Town 2</td>
<td>399,600</td>
<td>110</td>
<td>50</td>
<td>50</td>
<td>79</td>
<td>21</td>
</tr>
<tr>
<td>Town 3</td>
<td>398,000</td>
<td>110</td>
<td>40</td>
<td>60</td>
<td>55</td>
<td>45</td>
</tr>
<tr>
<td>Town 4</td>
<td>427,929</td>
<td>126</td>
<td>33</td>
<td>67</td>
<td>67</td>
<td>33</td>
</tr>
</tbody>
</table>

Source: Data collected by consultants for Action Plan study (2005)
Overview and Challenges

doubling to 70m/t/a or more, the required total new landfill capacity would be 500m tonnes. Using a unit cost of Rs 200/t the investment requirements would be Rs 100bn. (about $2.5bn) over the decade. This figure represents the probable order of magnitude but there are many important variables, such as the rate of implementation and the level of investments in processing facilities, which would reduce the landfill investment required. The cost of treatment will vary for various treatment options and application may be limited by requirement of land, operational costs and management complexities of various available treatment techniques. The background study suggested the approximate cost comparison for various technologies in India (Table 3).

**PROGRESS OF MSW MANAGEMENT**

Over the years, the problems of MSW have been highlighted by civic and environmental activists, resulting in direction by the Supreme Court to MoEF to draft Rules on MSW, which were gazetted in 2000. Annex 1 presents a summary of MSW Rules including institutional roles. In October 2004, the Supreme Court issued further specific direction to the larger cities to demonstrate progress on meeting the requirements of the Rules.

There are some examples where results have been achieved but overall progress has been weak. There is no systematic collection of data which would allow implementation to be tracked but a recent review of a large number of cities provided a good snapshot of the current situation. The review collected responses on progress on each of the main components of MSW covered in the Rules and the results are presented in Fig.4.

The immediate deficiencies are evident in terms of waste collection, treatment, and disposal. However, the technologies are well known and well understood and the problem is not one of overall technological challenges but of the difficulties in adapting and

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**Table 3: Relative Capital Cost of various MSWM Technologies in India**

<table>
<thead>
<tr>
<th>Technology</th>
<th>Assumed MSW Quantity (Metric ton)</th>
<th>Land required (acre)</th>
<th>Cost (Rs in million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomethanation</td>
<td>150</td>
<td>6-7</td>
<td>60-90</td>
</tr>
<tr>
<td>Pelletisation</td>
<td>125</td>
<td>3-4</td>
<td>40-50</td>
</tr>
<tr>
<td>Incineration</td>
<td>100</td>
<td>2-3</td>
<td>60-70</td>
</tr>
<tr>
<td>Composting</td>
<td>150</td>
<td>7-8</td>
<td>15-20</td>
</tr>
</tbody>
</table>
implementing known technologies to specific local conditions. The typical expression of the current problems is lack of funding to implement technical solutions (and it is clear that the solutions required by the MSW Rules are expensive). However, much can be achieved even within the current constraints but guidance and technical support are needed.

The fundamental underlying problems are in fact financial and institutional. There are some individual good examples and (not surprisingly) the larger municipalities tend to have better systems in place but overall, financial, human and institutional resources are limited.

A realistic timescale will be required to see substantial progress, although there is increasing real commitment by local politicians and senior officials and a growing body of information and expertise to support practical efforts to improve MSW. At national level, MoUD has realized the need to address MSW issues on priority and the 12th finance commission has allocated grants to the tune of Rs 25000 million covering 423 Class I towns.

"Five rupees? For carrying so much garbage down four floors! And I give you Rs. 10 for the bottles!!"

Fig. 4 : Progress on Compliance (mid 2004)
<table>
<thead>
<tr>
<th>Year</th>
<th>Regulatory Initiatives on MSW Management by Government of India</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960s</td>
<td>Ministry of Food and Agriculture offered soft loans to urban local bodies for promoting composting of municipal solid waste.</td>
</tr>
<tr>
<td>1969-74</td>
<td>Fourth five-year plan provided grants and loans to state governments for setting up MSW composting facilities.</td>
</tr>
<tr>
<td>1974</td>
<td>GoI introduced a modified scheme to revive municipal waste composting in cities with a population over 0.3 million.</td>
</tr>
<tr>
<td>1975</td>
<td>GoI constituted the first high-powered committee for a holistic review of municipal waste management problems. This committee in its report covered eight areas of waste management and made 76 recommendations.</td>
</tr>
<tr>
<td>1994</td>
<td>Bubonic Plague in Surat (Gujarat)</td>
</tr>
<tr>
<td>1995</td>
<td>High powered committee under the chairmanship of Prof. J.S. Bajaj (Member, Planning Commission), was constituted. Ministry of Health and Environmental Engineering Organization (CPHEEO), under the Ministry of Urban Development, drafted a policy paper. More than 35 composting facilities emerged with PSP. Number of PILs filed, greater acceptability and participation of NGOs/CBOs.</td>
</tr>
<tr>
<td>1996</td>
<td>Ministry of Non-conventional Energy Sources (MNES) initiated pilot program to promote waste-to-energy projects. Number of PILs filed, greater acceptability and participation of NGOs/CBOs.</td>
</tr>
<tr>
<td>1998</td>
<td>Committee formed under the Supreme Court of India to review MSW management in Class-I cities, under the chairmanship of Mr. Asim Burman (Commissioner, Calcutta Municipal Corporation), constituted by municipal corporation, CPWD, MoEF, MoUD and public representatives.</td>
</tr>
<tr>
<td>1999</td>
<td>September 1999, the MoEF issued draft rules for Municipal Waste (Management and Handling).</td>
</tr>
<tr>
<td>2000</td>
<td>January 2000, the MoUD brought out the Manual prepared by an expert group, on MSW management.</td>
</tr>
<tr>
<td>2000-04</td>
<td>In accordance with Supreme Court directions, the Ministry of Urban Development set up a Technical Advisory Group (TAG), under which the following three core group have been constituted: 1. Appropriate technologies, research and development 2. Financial resources and private sector participation 3. Capacity building, human resource development, information, education, and communication</td>
</tr>
<tr>
<td>2005</td>
<td>MoUD giving priority to MSWM has allocated grants to the tune of Rs 25000 million covering 423 Class I towns as part of 12th finance committee.</td>
</tr>
</tbody>
</table>
KEY ISSUES

Interactions with key clients and with Bank colleagues on MSW initially revolved around a number of technical questions, relating to processing technologies and to landfills. After series of discussions with ULBs, data support from pilot MSW management action plans and stakeholder consultations, the most urgent issues to be addressed emerged as the institutional and financial aspects. A number of difficult technical questions have to be resolved and effective solutions can only be achieved through sustainable institutional and financial mechanisms. In moving to address these issues in more detail, municipal level data and analysis was required but such data is not available. In order to have some specific case studies, it was agreed with the participating state governments that pilot “Action Plans” would be developed in a small number of municipalities.

IMPORTANCE OF ACTION PLANS

MSW management is a key municipal task and local elected officials increasingly feel pressure to deliver “clean cities” but there are other issues, such as water supply and sanitation, which are often at least as urgent and important as MSW, and often more so. In order to move forward toward compliance with the MSW Rules while balancing municipal priorities, a useful tool would be the development and implementation at the local level of clear plans for upgrading MSW facilities and systems, at a pace which is locally acceptable and sustainable in the long term. It was agreed that preparation of a number of pilot or indicative examples plans would be a very worthwhile contribution of the Bank’s analytical work.

A first set of pilot Action Plans was developed for three cities each in Karnataka and Andhra Pradesh, covering a range of size and circum-

“We missed the garbage truck again! Perhaps this is what they mean when they talk of waste-to-energy!”
stances. The Action Plan was intended to set out the current situation, the upgrading required, and to outline a realistic and financially sustainable program for moving ahead. (The outputs were at the level of broad options, not specific investment plans.) To help anchor these plans a simple but comprehensive spreadsheet financial model for MSW was developed and refined, in consultation with clients and donors in India. The purpose of the model is to help cities understand their current expenditures on MSW; allow them to estimate the costs of different options; and – above all – to generate informed discussion of possibilities and priorities. (It is consistent with more sophisticated models and approaches being developed, such as those under the USAID FIRE Program, but is not intended to substitute ongoing efforts to upgrade overall municipal financial management systems.) It should be noted that a similar Action Plan approach has been widely adopted, including a recent requirement by the Supreme Court that the 59 largest cities in the country prepare some form of plan.

This first round of pilot Action Plans provide useful results (although sometimes of mixed quality) and their outcomes generated discussion with the municipalities themselves and the state governments. Subsequently, in order to understand the complexity of issues in hilly regions, three hilly towns were supported in the second round of pilot Action Plans in close collaboration with CPCB\textsuperscript{11}. The Bank is now supporting efforts by CBCP to expand the approach, accepting that the concept is still developing and that different versions are emerging. These efforts include working with WBI to develop training and capacity building systems to support MSW development.

Data Developed under Action Plans

The Action Plans draw on available average figures on waste generation, characteristics, existing schemes and assets, together with city specific data provided by the municipalities through local consultants and some specific survey and data collection. There is a wealth of experience within the health department staff and the revenue department staff of the municipality about the various facets of waste management, including financial and institutional aspects but this is rarely coordinated and documented. A major contribution of this work has been to help municipalities
to extract data on MSW from the municipal accounts, in a format which allows key parameters to be calculated. (Very few municipalities nationally keep their accounts in a way that this data can easily be extracted).

Table 4 summarizes some of these key figures, such as the cost per ton of MSW collected and the ratio of workers to waste. The data is presented as ranges, without identifying the individual cities, given the uncertainties in some of the numbers and the very different circumstances of the cities, making simple comparisons misleading. The development of benchmark indicators for MSW, along lines such as these, is an essential step towards increased efficiency in the sector.

**FINANCIAL SUSTAINABILITY**

Almost every municipality in India is under financial pressure. A small number have good financial management systems in place and are operating within acceptable budget constraints. However, the majority do not have adequate accounting and budgeting systems and do not operate on a multi-year capital and financial planning basis. This makes the process

<table>
<thead>
<tr>
<th>Parameters for Benchmarking</th>
<th>Large Cities (Above 1.5 million)</th>
<th>Mid size Towns (between 0.5–1.5 million)</th>
<th>Small Towns (less than 0.5 million)</th>
<th>Typical Range for Hilly Towns</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MSW management expenditure in Rs per capita per annum</strong></td>
<td>165–175</td>
<td>150–180</td>
<td>120–150</td>
<td>350–400*</td>
</tr>
<tr>
<td><strong>MSW management expenditure as % of total municipal revenue expenditure</strong></td>
<td>15–25</td>
<td>15–25</td>
<td>20–40</td>
<td>25–45</td>
</tr>
<tr>
<td><strong>MSW management cost per ton (Rs )</strong></td>
<td>900–1200</td>
<td>800–1200</td>
<td>800–1600**</td>
<td>2500–3000#</td>
</tr>
<tr>
<td><strong>Relative costs per ton by size/population (taking mid–size town as 1.00)</strong></td>
<td>0.22–0.27</td>
<td>1.00–1.11</td>
<td>2.78–5.00</td>
<td>4.44–7.78##</td>
</tr>
<tr>
<td><strong>Salaries as % of overall MSW management costs</strong></td>
<td>45–55</td>
<td>60–70</td>
<td>65–75</td>
<td>80–90</td>
</tr>
<tr>
<td><strong>Ratio of worker per ton of waste managed</strong></td>
<td>3.5–4.5</td>
<td>2.5–6.0</td>
<td>2.5–5.0</td>
<td>8.0–16.0</td>
</tr>
<tr>
<td><strong>Cost of primary collection as % of total MSW management expenditure</strong></td>
<td>25–30</td>
<td>40–70</td>
<td>30–40</td>
<td>20–40</td>
</tr>
<tr>
<td><strong>Cost of transportation as % of total MSW management expenditure</strong></td>
<td>20–25</td>
<td>10–20</td>
<td>10–15</td>
<td>15–25</td>
</tr>
<tr>
<td><strong>Cost of MSW management contract as % of total MSW management expenditure</strong></td>
<td>35–40</td>
<td>25–30</td>
<td>5–10</td>
<td>Less than 5</td>
</tr>
</tbody>
</table>

Note : These nine Action Plans have provided insights in managing MSW and have been the basis for identifying many of the key issues discussed below.

* For hilly towns the municipal expenditure is generally high due to specific revenue importance such as tourism and seasonal variation in population etc

** Higher percentage of MSW management expenditure is observed in smaller cities where sub contracting of MSWM services as well as level of services is generally lower.

# Higher costs in hilly towns is attributed to difficult terrain and extreme climatic conditions

## # MSW Management costs in hilly town varies significantly depending on geography and tourist importance
of understanding costs, commitments and revenues difficult for specific activities like MSW management. In order to address this shortcoming, the spreadsheet model was used in collaborative manner with municipal staff in order to improve the understanding of financial aspects of MSW management.

A key aspect of devolution is an emphasis on increased self-sufficiency for cities, within a framework of some ongoing financial support from higher levels of government. A basic objective of the Bank’s municipal reform efforts is to support this move towards greater self-sufficiency, including improving accounting and financial management systems and assisting in increasing revenue collection. The provision of MSW management services – a core function of any city – is a good test bed for upgraded systems and the selection of three states where municipal reform operations are under way was a deliberate effort to make this link.

**PRIVATE BENEFITS AND PUBLIC GOOD**

MSW management systems provide two broader types of benefits. The first is the removal of waste from the premises (domestic, commercial etc) and from the locality (block, street, colony). This type of benefit is that most immediately relevant to the typical citizen. The second type of benefit comes from the treatment and final disposal of the wastes in a way which is environmentally sound. The extent of the private benefits can be estimated, in economic terms, by the amount that people are prepared to pay (in cash and in other terms) for waste removal. In practice, in most municipalities, many households already pay a waste collector to remove rubbish from the house and also often pay some element of an MSW charge to the municipality (often in the property tax). Estimation of the value of the public benefits is much more difficult but this is a benchmark against which public investment in waste management should be assessed. In practice, these public benefits are typically valued at a very low level in most communities, as evidenced by the lack of general concern over the impacts of waste dumping.

The financial challenge for city managers is to expand the scope of their MSW operations to address the treatment and disposal issues, which
can be expected to increase costs significantly while typically not generating any additional revenue. However, to move in this direction requires a good understanding of the real current costs and a realistic evaluation of the options for new treatment and disposal systems. In these circumstances, improved financial management is critical.

**COSTS OF MSW MANAGEMENT**

There is no detailed accounting of current expenditures on MSW in most municipalities and there is very little experience in constructing and operating treatment and disposal systems. There are some unit costs for collection and transport and some authorities (such as KUIDFC) are developing detailed figures. Reasonable estimates can be made for storage and transport equipment but estimates for treatment and landfilling are generally not reliable. The typical distribution of expenditure on waste management for a city is that about 75 percent or more of the total MSW expenditure goes on collection, 20 percent on transportation and only 5 percent or less on disposal. Table 5 and table 6 provide: (i) an approximate indication of expenditure patterns across municipalities (ii) break up of costs from a typical pilot town based on data collected as part of Action Planning study.

Another important factor is the significance of economies of scale in treatment and landfilling. Small systems, say below 100t/d, which would represent a population of 300-400,000, are likely to have significantly higher unit costs, especially for technically sophisticated and complex systems. This is one of the key reasons that alternative technical requirements are now being considered for small systems and that regional solutions may emerge, driven by cost issues.

**Estimated Good Practice MSW costs:**

There is no base of data on actual costs but order of magnitude costs for a typical MSW system have been estimated by knowledgeable specialists in India to be roughly as follows, looking at the average cost per ton managed. However, treatment and disposal costs in particular are very site specific and there are many factors which change these order of magnitude numbers for any given case.

Results from the pilot Action Plans (summarized in Box 3) suggest that these numbers may be low, given that actual current costs appear to be generally significantly higher. However, few municipalities are managing
You want a challenge? Let’s see you turn those dumps into malls.

their wastes for efficiency or cost minimization and it should be possible to bring costs more into line with

- Collection of wastes: 300-400 Rs/ton
- Transport of waste: 300-400 Rs/ton
- Treatment/disposal (average costs, excluding land): 400-600 Rs/ton
- Total cost per ton of waste collected and disposed: 1000-1200 Rs/ton (approx. $25)

the good practice estimates. For example, it is reported that Bangalore is contracting on BOT basis for waste treatment and disposal (in a scientifically designed landfill), at a price below Rs 200 per ton.

**FINANCIAL PLANNING**

In the absence of adequate accounting and budgeting systems in ULBs, a simple spreadsheet based financial model (referred in an earlier section) has been developed. The

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### Table 5: Summary of Annual Operational Expenditure on Various Activities (excluding contract costs) in MSW Management as Percentage (%) of Annual MSW Management Expenditure in Selected Municipalities in Karnataka

<table>
<thead>
<tr>
<th></th>
<th>Population</th>
<th>Waste handled</th>
<th>Supervision</th>
<th>Primary Collection</th>
<th>Transport</th>
<th>Sweeping disposal</th>
<th>Process &amp; MSWM</th>
<th>Contract as % of budget</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Small Town</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Town 1</td>
<td>53,043</td>
<td>12</td>
<td>9</td>
<td>39</td>
<td>14</td>
<td>38</td>
<td>0</td>
<td>14</td>
</tr>
<tr>
<td>Town 2</td>
<td>48,000</td>
<td>10</td>
<td>7</td>
<td>38</td>
<td>17</td>
<td>38</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Town 3</td>
<td>47,060</td>
<td>9</td>
<td>7</td>
<td>41</td>
<td>10</td>
<td>42</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Town 4</td>
<td>49,408</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
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<tr>
<td><strong>City Municipal Council</strong></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
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<td>Town 1</td>
<td>274,105</td>
<td>60</td>
<td>4</td>
<td>42</td>
<td>12</td>
<td>42</td>
<td>0</td>
<td>17</td>
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<tr>
<td>Town 2</td>
<td>248,592</td>
<td>52</td>
<td>10</td>
<td>34</td>
<td>22</td>
<td>34</td>
<td>0</td>
<td>34</td>
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<tr>
<td><strong>City Corporation</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Town 1</td>
<td>317,000</td>
<td>60</td>
<td>6</td>
<td>40</td>
<td>14</td>
<td>40</td>
<td>0</td>
<td>10</td>
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<tr>
<td>Town 2</td>
<td>399,600</td>
<td>110</td>
<td>10</td>
<td>41</td>
<td>8</td>
<td>41</td>
<td>0</td>
<td>21</td>
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<tr>
<td>Town 3</td>
<td>398,000</td>
<td>110</td>
<td>10</td>
<td>40</td>
<td>11</td>
<td>39</td>
<td>0</td>
<td>45</td>
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<tr>
<td>Town 4</td>
<td>427,929</td>
<td>126</td>
<td>4</td>
<td>38</td>
<td>7</td>
<td>37</td>
<td>14</td>
<td>33</td>
</tr>
</tbody>
</table>
### Table 6: SWM Data from One Pilot City, as taken from Accounts and also Presented in Financial and Functional Terms

<table>
<thead>
<tr>
<th>2003–04 in Rs</th>
<th>percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Solid waste management Heads of Account (as taken from municipal accounts)</strong></td>
<td></td>
</tr>
<tr>
<td>Health Inspectors</td>
<td>275,256</td>
</tr>
<tr>
<td>Sanitary Mastrys</td>
<td>260,374</td>
</tr>
<tr>
<td>Establishment</td>
<td></td>
</tr>
<tr>
<td>Permanent</td>
<td>3,628,000</td>
</tr>
<tr>
<td>Temporary (same work same pay)</td>
<td>844,600</td>
</tr>
<tr>
<td>Other Items</td>
<td></td>
</tr>
<tr>
<td>Conservancy materials and purchase of dust bins</td>
<td>10,428</td>
</tr>
<tr>
<td>Contracts for Gandhinagar and other area cleaning</td>
<td>948,000</td>
</tr>
<tr>
<td>Drivers and loaders payments</td>
<td>144,000</td>
</tr>
<tr>
<td>Vehicle fuel</td>
<td>328,308</td>
</tr>
<tr>
<td>Tractor rents</td>
<td>101,619</td>
</tr>
<tr>
<td>Vehicle maintenance and insurance</td>
<td>246,536</td>
</tr>
<tr>
<td>New hearse van</td>
<td>611,708</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>7,398,829</strong></td>
</tr>
</tbody>
</table>

| **B. Financial Classification of costs (using data from Section A above)** | |
| Supervision | 535,630 |
| Sweepers | 4,472,600 |
| Driver+loaders | 144,000 |
| **Salaries total** | **5,152,230** |
| Fuel + vehicle hire | 429,927 |
| Vehicle Purchase | 611,708 |
| Vehicle repair | 246,536 |
| Sanitary Materials, dustbin , Uniforms etc. | 10,428 |
| Sanitary Contracts (external service) | 948,000 |
| **TOTAL SWM EXPENDITURE** | **7,398,829** |

| **C. Functional classification of operational costs (extracting capital expenditures)** | |
| Municipal system costs | |
| Supervision costs | 535,630 |
| Primary collection | 2,241,514 |
| Transport | 820,463 |
| Processing | 0 |
| Disposal | 0 |
| Sweeping | 2,241,514 |
| **Total of Municipal system** | **5,839,121** |
| Cost of Contract system | 948,000 |
| **TOTAL COST OF SWM OPERATIONS** | **6,787,121** |
| *excluding cost of hearse (611,708)| |
| Waste handled by Municipal system (tpa) | 2,920 |
| Waste handled by contract system (tpa) | 1,460 |
| Cost per ton of waste handled by municipal system | 2,000 |
| Costs per ton of waste handled contract system | 649 |
Overview and Challenges

The financial planning using the model demonstrates that the ULBs can considerably improve the MSW management service levels with limited incremental costs, maximizing the system efficiencies. While Annex 2 presents the typical results of option based financial analysis in one of the pilot cities as a case study, the lessons from this exercise are presented in the box that follows. Also, the key observations include the following:

**ULBs Affordability**

The financial situation of most ULBs (outside of the metros) is relatively weak and many are unable to fulfil the responsibilities that are being passed to them under decentralization efforts. At present, a very large proportion of municipal expenditures go on wage and salary costs, with MSW often being one of the largest items. In practice, few ULBs currently have scope for increased expenditure on equipment or on capital works. Thus, improving the capabilities and financial strength of ULBs is a key objective to be addressed on priority\(^\text{13}\). However, work done in Karnataka, for example\(^\text{14}\), has allowed estimates to be made of the realistic scope that exists in a sample of municipalities for increased capital expansion.

**Allocating Costs and Charges**

In outline planning, little differentiation is made between household and commercial wastes, since the characteristics are broadly similar. Similarly, street sweepings are generally included with the overall waste loads, for basic system sizing etc.

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**Box 3 : MSW Management Costs – Observations from Pilot Action Plans**

- Typically smaller municipalities spent between 20-40 percent of operational budget on MSW management. Higher expenditure is observed in hilly areas due to the terrain conditions. However, MSW management budgets in bigger cities did not exceed 20 percent of the municipal operational budgets.

- The major share of MSW management budget is spent on collection, to the tune of 75 percent with significant part (up to 75 percent) spent on salaries.

- The average cost MSW management per ton of waste in plains varied between Rs 800 to Rs 1600. The cost of MSW management in hilly areas is up to double this amount.

- There seem to be some relationship although not fully established, between the unit costs of MSW management vis-à-vis size of the municipality, The largest pilot city is able to provide complete service at relatively lower than the average cost which probably reflects scale of economy and competency of management.

- All the pilot towns have limited contracting for services ranging from sweeping, primary collection to transportation. The unit cost of private sector operation is found to be about 30 to 40 percent lower than those of municipalities own operations. Thus indicating scope for efficiency improvements to considerable extent.

- Though limited, community based collection systems are proving to be effective in demonstrating: (i) devolution of primary collection responsibilities (ii) the concept of paying for the service (approximately Rs 20 per household per month
However, when looking into the details of systems design and when allocating costs to different waste sources and system elements, it is important to develop more detail so that an allocation can be made to the different sources of the costs involved. This is essential as the basis for designing cost recovery schemes, which should reflect – to the best practical extent – the charges to be recovered from the different parties involved. Decisions on cost recovery for MSW management services are part of mandate of the elected officials in any municipality but it is important for the managers and planners to provide the officials with reliable information and a range of practical options.

**Costing Treatment and Disposal**

Municipalities often see private sector participation as a vehicle for raising the capital. However, there is not enough experience yet to assess how cost effective and reliable is this approach. The costs of contracting out “treatment” are even more difficult to estimate confidently, especially since there is such limited experience. The uncertainties are illustrated by informal reports of recent tenders in Delhi (for collection and transport) and in Bangalore (for treatment and landfilling) where the difference between low and high bids is of the order of 2-3 times. For planning purposes, municipalities should investigate options for both self-owned and operated systems and contracted systems, noting the high uncertainties at present on realistic contract charges.

**Benchmark Costs for Landfills**

Proper landfills are costly to site and to construct, and since there are also significant operating and maintenance costs, the empty volume in a landfill actually has a real opportunity cost for the municipality. This opportunity cost of landfill (which is the last resort for any scheme) should be the benchmark for evaluating waste treatment and disposal options for any municipality. This can be estimated as the marginal (AIC) cost (over say 5-10 years). The importance of this figure is for areas where landfill space is limited – often because a site is close to being full and other sites are difficult and/or expensive. As the cost of space gets higher, there is an increasing value to treatment methods which reduce the volume required for each ton of waste collected.

**Revenue Streams**

The government regulations have expanded the required scope of MSW operations to address the treatment and disposal issues. However, the
capital support to ULBs has remained the same or diminished on account of devolution, so there is an increasing need for self-sufficiency. The obvious revenue stream from increased property tax and user fee concepts could not materialize in majority of the municipalities due to public concerns and political reasons. Though the ULBs hope to generate revenue streams from the waste, the critical solution is to move towards improved financial management with a clear understanding of current costs and a realistic evaluation of the options for new treatment and disposal systems.

**Paying for the Service**

A good approximation of the value that people place on MSW management is the amount that they are prepared to pay for this. On the basis of simple assumptions, a household would produce 600 kgs waste per annum, which would translate into an annual cost per household of about 600 Rs/t (say 50 Rs/month). Therefore, from these rough estimates it would appear that the costs of improved MSW are broadly affordable to non-slum areas. In case of community based-collection systems, the incremental costs would be of the order of Rs 30. Some municipalities in Karnataka and Andhra Pradesh have recruited community based organizations and resident welfare associations (RWAs) authorizing them to undertake door-to-door collection, which work through collection of user fee (in

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**Box 4 : Lessons on Cost Management from Action Plans**

- A good understanding of current and future costs and expenditure patterns is essential to MSW management system planning. The relevant information on current costs is generally recorded in municipal budget but not in a format which is readily usable by municipal planners. The MSW management costs data needs to compiled and presented in a structured format to facilitate better planning. The costs of an improved MSW management system is likely to be marginally higher than the current costs, provided ULBs undertake measures to improve system efficiency, particularly by rationalizing expenditure on staff costs.

- Costs in most ULBs are dominated by staff salary costs, which ranges between 45-50 percent in large cities, increasing up to 75 percent for smaller cities. Increasing the coverage of waste collection while maintaining the present expenditure levels on staff is a realistic objective.

- Data from action planning indicates that costs of MSW management services using private contractors could be significantly lower than those of municipalities. The need and extent of private sector participation, however, needs to be seen in light of the quality of service delivery as well as the risks of service failure.

- Involvement of community based organizations including SHGs need to be explored for improving door-to-door collection, which is found to be cost effective but difficult to scale up.

- Clear analyses of potential revenues from MSW need to be understood before taking up large capital investment on MSW management.

- With limited capacity for capital investment, many ULBs see involvement of private sector as a means to reduce costs and improve efficiency. However, many ULBs are finding it challenging to commit a tipping fee in order to keep the private investor interested.

- Several ULBs feel that meeting the requirements of MSW rules particularly in relation to requirements of designs of MSWM infrastructure could be expensive and often unaffordable. Therefore, the designs of such infrastructures, such as landfill needs to be related to site specific requirements and done in phase manner to fully comply with MSW rules.
Improving Management of MSW in India

the range of Rs 30-40 per month) directly from residents. This has allowed municipalities to reassign sanitary staff to focus on improving efficiency of segregated waste collection directly from the primary bins. For example, over the past year, Shimla Municipal Corporation has implemented MSWM user fee for door-to-door collection through NGOs (monthly fee ranging from Rs 35 for households to Rs 805 for big hotels). The key issue is therefore less one of affordability than one of political priorities.

Royalty on Waste

Early entrepreneurial efforts by the private sector to generate revenue from waste included the payment of a fee to the municipality for the right to collect waste from certain parts of a municipality. This fact, together with a belief that the private sector could make money from waste, resulted in an attitude in some municipal managers and elected officials that the private sector should pay to take waste. This attitude is reinforced by legal requirements (in at least one state) that no government function should be contracted to the private sector unless the government receives a payment in return.

While some components of the total waste stream could have a net value if available in a segregated state (e.g. organic waste from markets), proper treatment and disposal of the overall MSW stream will have a net cost, in any realistic scenario. If a municipality undertakes the treatment and disposal itself, it will have to provide for these costs, which may be offset in part by any revenue that can be gained from specific components of the waste stream, such as market waste. If treatment and disposal are contracted out, then there still will be a net cost which will have to be paid to the private sector. At best, a municipality may agree to provide waste at zero cost (although in practice, it appears that there are often hidden costs to the municipality in such a deal). More recent contracts are being structured to generate competition among private sector providers, with the key parameter being the lowest net fee (usually per ton) to be paid by the municipality to the private contractor for complete treatment and disposal of the wastes, in accordance with all appropriate requirements.

Waste to Income?

Municipal officials understandably are looking for any potential...
income that can be generated from waste, to offset the cost of disposal. Basic recyclable wastes (glass, plastic, metal) are typically removed at the point of collection. This reduces the total volumes and provides income to the groups involved but also reduces the nominal value of the overall waste.

MSW in India has a high organic content and therefore composting is a popular option. Some private companies offer to take waste from municipalities and turn it into compost, on a commercial basis. The history of government supported composting plants is generally unsuccessful in India and a focused commercial approach might be more successful. However, there is limited experience and care needs to be taken in setting up such approaches.

Waste-to-energy (WTE) is an approach which is being promoted increasingly in India. There are a small number of WTE plants in India which operate on a “commercial” basis but in practice rely on significant government subsidy, both capital and operational, particularly in the form of preferential power tariff imposed upon already financially weak power systems. Such schemes do have potential to be part of a workable MSW system but their technical performance needs to be confirmed and sensitivity to government support must be taken into account.

**Carbon Finance**

When garbage is left to rot in piles or dumps it typically releases considerable amounts of “landfill gas” which contains high proportions of potentially explosive methane. Control of landfill gas is good practice for a number of reasons including safety, and raises the possibility of use of the gas for energy production (although this is typically quite costly to set up). Methane is a powerful greenhouse gas and there are financial incentives for its control, in the context of addressing climate change. GEF funding has been used to support MSW projects in other countries and there is potential for “carbon finance” through the Carbon Finance Business (CFB) at the Bank or one of the other mechanisms that are now emerging. The fundamental requirement in each case is that the “project” has some innovative aspects which reduce the greenhouse gas emissions below “business as usual”. The basic difference is that GEF provides an initial capital subsidy while CFB provides regular payments for reductions actually achieved during operations.

There is growing interest in seeking Carbon Finance for controlling methane, especially given the lack of other revenue sources typically associated with landfilling. The principle is straightforward: capturing and destroying methane, or changing systems to prevent its generation, can be the basis for claiming “Emissions Reductions (ERs)” and these ERs – once verified — can be sold for cash on an increasingly open carbon market. As opposed to GEF grants, which are applied at the construction stage, ERs are based on confirmed results from an operating scheme and become a revenue stream for a successful project, for a period of
Improving Management of MSW in India

typically 7-14 years. Applying the principle of mass balance and assuming the different parameters as recommended by IPCC for India, it is estimated that roughly about 1.4 million tons of CH₄ which is equivalent to about 30.0 million tones of CO₂ is generated from the MSW disposal in India per year. However, there is very limited practical experience.

A number of clear possibilities for attracting CF exist. For existing dumps, closing a dump in a way which prevents further release of methane could be eligible for Emissions Reductions. Constructing new landfills in a way which prevents the generation (or at least the release) of methane is another possibility, although the protocols for Carbon Finance require an innovative approach which achieves additional reductions beyond “business as usual.”¹⁷ One particularly interesting opportunity is the use of composting, where careful processing of waste in aerobic conditions helps eliminate the generation of methane. There are no clear indications or examples of CF revenues generated by Indian agencies (municipalities or private operators) from the MSWM business. However, Table 7 provides a rough estimate of comparative and potential CF revenues for various treatment technologies.

Such finance could be very important in covering the costs of activities which are otherwise non-revenue generating. Although simple in principle, the approach is new and the details are not well established, so there are a number of technical issues which have to be resolved and there is a lack of experience with the procedural requirements.¹⁸

<table>
<thead>
<tr>
<th>MSW treatment &amp; disposal options</th>
<th>CO₂ Emissions (t CO₂E/tMSW)</th>
<th>Potential Emission Reductions (tCO₂E/tMSW)</th>
<th>Carbon finance for treatment of MSW Rs/tMSW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assuming Landfill without LFG recovery as baseline</td>
<td>0.20-0.25</td>
<td>0.95-1.20</td>
<td>175-200</td>
</tr>
<tr>
<td>Landfill with LFG recovery &amp; flare</td>
<td>0.21 (may be less if energy component is considered)</td>
<td>More than 0.95</td>
<td>More than 175 Rs/ton</td>
</tr>
<tr>
<td>Landfill with LFG recovery and energy generation</td>
<td>More than 1.16</td>
<td>More than 200 Rs/ton</td>
<td></td>
</tr>
</tbody>
</table>

Composting

Biomethanation

More than 1.16

More than 225 Rs/ton

Source: Carbon finance business estimates.

Table 7: Indicative Carbon Revenues potential Using Various MSW Management Technologies
The Bank team is working with the Carbon Finance Business (CFB) group in the Bank and with clients, including the Governments of Karnataka and AP and the cities of Delhi and Hyderabad, to design Carbon Finance projects with clients, including the Governments development for landfill remediation, for large scale new projects, and for programmatic projects, typically at the State level.

**INSTITUTIONAL SUPPORT**

**Role of State Governments**

Although municipalities have the basic responsibility for MSW management, state governments will retain a significant role for the foreseeable future. Apart from assisting in funding and finance, State governments will have to provide technical advice and assistance until municipalities have sufficient internal resources and expertise to manage the MSW function successfully. The governments with whom the Bank is working on municipal reform projects have established clear functions and responsibilities in relation to infrastructure investments but the responsibility for ongoing technical support on MSW issues has been less clear. State governments are now formally defining the responsibility for this support—typically in the Municipal Administration Department—although the relevant units are relatively under-developed. There has been dialogue with state governments, particularly in Karnataka, on the mechanisms needed to provide the necessary support to the cities which want to invest in upgraded MSW facilities and systems.

In order to provide coherent guidance to municipalities in rather complex and changing circumstances, a number of state governments have prepared or are in the process of preparing state policies or frameworks on MSW, including all of the states covered in this activity. In Karnataka, the state policy on *Integrated MSWM* sets out objectives, key principles and technical guidance. It also makes reference to a range of contractual approaches that are supported by the state government (with model contract documents in preparation). In addition, KUIDFC have prepared detailed technical guidance on modern collection and transportation systems (which could form the basis for a broader draft guidance manual.)

In Andhra Pradesh, an inter-departmental Task Force established by the Urban Secretary provides guidance, through a formal Government Order. The overall objectives are to provide support to individual cities moving ahead on implementation issues. The policy focuses on Waste Management framework, possible technologies for different type of municipalities, government support to private sector initiatives through various contractual incentives and constitution of a Technical Committee and State Level Official Committee for coherent technical and administrative decisions. In Tamil Nadu, the Commissioner of Municipal Administration has been working with all the Class I cities in the state to prepare individual Action Plans and a state framework has been prepared. The situation in other states appears to be
mixed, with some well advanced in support to municipalities while others have done little, because of lack of skills, resources or enthusiasm. This issue is currently under discussion with CPCB. The objective is to develop a practical coordination approach across states, ideally with the Urban Ministry, which could be supported by the Bank.

While individual states are moving ahead to develop coherent approaches within their own jurisdictions, there is a growing need for an effort at the national level to ensure that the lessons learnt from the more advanced states are shared with the slow starters. Though there is limited experience in private sector participation, individual states have realized the efficiencies and economic gains and appropriately facilitated the PSP through state policies. These need to be revised on a regular basis to meet changing trends.

Municipal Institutional Structures

The traditional structure under which MSW is addressed in a Urban Local Body (ULB) is for the street sweepers and all other staff involved in MSW directly to be under the control of the Public Health Officer (or equivalent), while the machinery needed (trucks, tractors, lorries etc) is under the control of the Chief Engineer. This system has worked as long as the MSW system only covered “lifting” of waste from primary collection points and then transporting it to a dumping ground. In most municipalities, there is high level of inefficiency reported in the management of primary collection, as well as high down time and inadequate road worthiness of vehicles carrying solid waste.

Various models are possible for a more coherent structure which would

Box 5: Government of Karnataka State: Policy on Integrated MSW Management

- The policy aimed at catalyzing modernization of MSW Management services uniformly in the state includes:
- Specific plans to improve seven components including segregation, storage at source, primary collection, secondary storage, secondary transport, treatment and landfill;
- Plan for mechanical handling of waste minimizing human contact with waste;
- Specific normative standards including standard tool kits for BOT or O&M practices; manuals on specifications of equipments and vehicles and on treatment and landfill issued for all type and size of local bodies; and approach for information, education and communication
- Specification for various type of equipments and vehicles recommended for Primary Collection (such as auto tipper, Tricycle and Push cart) and for secondary Storage (such as variable capacity metal containers)
- Recommendations on secondary transport using hydraulically operated systems for Class I cities (such as twin container and dumper Placer); and for non Class I cities (such as Single container and tractor Placer)
- Recommendations on treatment & disposal facilities for various types of towns - Class I cities to have both treatment and sanitary landfill sites in accordance with MSW Rules 2000 while other Non Class I towns to have only engineered landfill sites.
Overview and Challenges

enable an integrated MSW system. The common and simplest one is to assign or strengthen overall responsibility at the level of Additional Commissioner. For larger municipalities or those where major system expansion is planned, it is probably preferable to have a specific designated manager, with operational responsibility, who could be a Solid Waste Manager, or a Chief Engineer, Solid Waste.

Larger municipalities are moving ahead on this issue. Bangalore has had a high level committee managing its expanded MSW efforts; Mumbai Corporation appointed an external organization to help manage its program for MSW; Delhi has completed a major study of its options and strategy. In Hyderabad, the Bank has been assisting the Corporation in dealing with dump closure and future options, and a management team is being assembled.

Typically in smaller municipalities, the public health department is responsible for collection, street sweeping, transport and disposal of solid wastes generated in the local body’s wards (see in Fig.6 for a typical organization chart outline for existing MSW management system in Bangalore). The head of Health Department reporting to Municipal Commissioner is generally head of the MSW management system but there is often poor coordination between the engineering department (which is responsible for

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**Fig. 5 : Institutional Context for MSW Management**

<table>
<thead>
<tr>
<th>Level</th>
<th>Mainstream Government Hierarchy for MSW Management</th>
<th>Policy and Regulatory Bodies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Tier - Central Government</td>
<td>Ministry of Urban Development Government of India</td>
<td>Ministry of Environment and Forests, Government of India Central Pollution Control Board</td>
</tr>
<tr>
<td>2nd Tier State Government</td>
<td>Urban Development Department</td>
<td>State Pollution Control Board</td>
</tr>
<tr>
<td></td>
<td>District Administration</td>
<td></td>
</tr>
<tr>
<td>3rd Tier Urban Local Bodies</td>
<td>Municipal Corporations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Municipalities</td>
<td></td>
</tr>
</tbody>
</table>
transportation and disposal) and health department.

**Information Base for Planning**

Many municipalities have records on how much waste is generated, collected and disposed. However, it is difficult to determine consistent figures across data from different sources which can be based on population figures: number of bins; number of sanitary staff; number of collection trucks; and volume reaching and accumulating on dumping site. Further, the lack of a fund based accounting system (or Double Accrual Based Accounting practice) limits understanding of costs involved and resources required in carrying out MSW management activities. Thus the municipal systems need to manage a structured and credible information base to facilitate physical as well as financial planning.

**Professional Associations and Other Institutional Resources**

One emerging trend is the growing acceptance that municipal solid waste is a legitimate and important area of municipal government and that recognition needs to be given to this as a legitimate professional field. Karnataka government has realized this need and inducted technically skilled professionals (environmental engineers) to take on the MSW management responsibilities from

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**Fig. 6: Organization Chart for MSW Management System, Bangalore**

![Organization Chart](image-url)
Health Officers.

The Bank with the involvement of WSP and WBI, is currently supporting an Urban Managers program at ASCI which partially covers the MSW agenda. Further, with the involvement of WBI, the Bank is currently developing a focused program on MSW management capacity building for ULBs. In parallel, discussions are also underway with the CPCB and with different state governments on adapting this approach so that appropriate training and capacity building versions can be delivered in different states.

**REGIONAL SOLUTIONS**

A particularly complex and sensitive institutional issue is the question of regional approaches for MSW treatment and disposal facilities. There are strong economies of scale in most MSW treatment and disposal systems. This fact, allied to the time and complexity typically associated with planning and development approvals for MSW facilities, argues for the development of regional facilities as an effective approach for groups of smaller municipalities. This approach also opens a clear opportunity for private sector involvement in the finance and operation of such a regional facility.

Transportation costs have to be offset against economies of scale and so solutions become site specific. However, given traditional municipal rivalries, it is unlikely that regional facilities will be developed without outside impetus.

A number of state governments (and the Union Government) see the identification and support of appropriate regional approaches as an important task. In Andhra Pradesh, possible “catchment areas” for such facilities have been outlined, using the larger municipalities as the anchor for such approaches.

**IMPROVING COLLECTION AND SEGREGATION: ROLE OF COMMUNITIES AND THE INFORMAL SECTOR**

MSW management systems are very labor intensive, particularly in developing countries. Most municipalities have significant numbers of unskilled staff working as sweepers or in waste collection but collection coverage and the quality of the operations is often low (especially in poor areas). As a result, in many areas the collection is done through informal or semi-formal mechanisms outside the municipal system. At the same time, good control at the initial stages of household collection and at-
source segregation are critical to both the efficiency of the system and to opportunities for later recycling or processing.

There is limited data for comparative figures and trends but the coverage of municipally managed household collection is probably less than 50 percent (reported figures tend to suggest higher but these are not reliable). Middle-income and high-income neighbourhoods tend to take matters into their own hands, hiring their own neighbourhood pushcart waste collector and covering the necessary costs. In many municipalities and corporations, neighborhoods have formed committees or association giving contracts to NGOs or private sector or to individuals for house-to-house collection of waste using containerized tricycles/handcarts, for which residents pay directly. A number of pilot programs implemented by the NGOs and community based organizations are showing positive results and are pushing municipalities to improve their part of the system. These pilot programs are often very successful in their own context and provide potential models for replication. Although there are a number of examples where local community groups have been established (with considerable effort21), there are no good models of how to scale up significantly to achieve a major increase in the number of community groups involved. A recent study (2005) by Shristi, an NGO, on up-scaling public participation in waste management noted a number of NGO led initiatives as well as some led by city municipalities. The same study notes: “even if we take the two largest interventions, namely Muskan Jyoti Samiti at Lucknow and Centre for Development Communication at Jaipur, they deal with only 3.6 percent and 2.5 percent of the city waste, respectively. But they are making a significant contribution to the form of providing employment to waste collectors and providing door-to-door collection service”. The case example from Visakhapatnam, one of the pilot cities appears to be a sustain-

**Box 6 : Institutional Capacity Building - Key to Successful MSW Management**

- Given the increasing scale and complexity of upgraded MSW systems, there is a clear need to have clear, senior and unified management responsibility for MSW in any ULB.
- The institutional mechanisms within ULBs (especially smaller municipalities) need to be strengthened to achieve effective co-ordination between administrative, engineering and finance functionaries.
- A structured information system (covering physical and financial) on MSW management is essential at ULB level to facilitate strategic planning.
- There is a clear need to build a legitimate MSW management profession attracting professionals who can understand the engineering and environmental issues and run the MSW management operations effectively.
- A structured learning and training mechanism is essential to enhance the ULB capacity to manage a number of issues and subjects related to MSW management.
able model where primary collection is driven through municipality and citizens’ partnership.

Community initiatives depend strongly on the interest and activism of key players and therefore sustainability and replicability are a real challenge. The coverage of current community based collection systems is not known accurately but is believed to be, at best, of the order of 15 percent of any urban area. Scaling up is difficult because it depends on the local context, but committed and energetic municipalities are achieving some progress. One key condition seems to be an explicit recognition by municipalities of the role of these community systems and a willingness to adapt municipal systems to mesh with community efforts.

In terms of recycling, a key factor is the high level of informal recycling that occurs at the household or primary collection stage, which results in the removal from the waste stream of much of the recyclable material such as paper, cardboard, plastics and metals. Some of this work is done by the door-to-door collectors but the rag-pickers or scavengers who hunt through roadside heaps or larger dumps in search of items of value. The value of waste increases as it moves up the chain. For example, plastic and PET bottles, which are bought at Rs 2 per kg at the small waste dealers level are sold at a price which is 125-150 percent higher, while some tin and metal items (such as cans, etc) see about 80 percent increase in value as it reaches large waste dealers’ level.

The scale of this informal economy is not well understood but it is certainly large, for example, with one estimate that there are 75,000 waste pickers in Delhi. These waste pickers collect different recyclables items such as plastic bags, metal cans, wires, paper and plastic items etc, and sell it to local waste dealers, who in turn sell it to recycling units. A commonly accepted figure is that waste pickers take away 10-15 percent of the waste (by weight). The pickers are poorly paid and work in very bad conditions, although the middlemen who control the system are typically quite well-off. The chart (Fig.7) outlines a typical network of municipal solid waste recyclers’ in India.

Typical efforts to deal with the conditions of the waste pickers tend to address the problems of individuals or groups by providing protective equipment or better working facilities. However, from discussions with local officials and with NGOs active on these issues, it is clear that the plight of individuals or groups of pickers needs to be considered in the context of informal recycling as a substantial economic system.

A recent study by an NGO looked in detail at the operation of the waste pickers in the central New Delhi area, based on a survey of several hundred waste pickers. The study documents a hierarchy
of waste pickers, waste collectors (thiawallas), small kabaris (middlemen) and big kabaris. The big kabaris sell recovered material onto the secondary materials industry and therefore are the link between the informal and formal sectors. The secondary materials industry is itself a significant part of India’s industrial structure. The study suggests that the numbers employed in the informal sector are from 40,000 people upward, which is lower than other figures quoted but not totally inconsistent. The study also suggests that the quantities of waste generated are underestimated by the authorities and that the proportion collected by the informal sector is greater than the normally assumed figure of about 15 percent.

A key point made in this report and by others working on these issues is the critical importance of allocating space locally for waste management purposes. Attempts to develop local recycling efforts, such as composting/vermiculture often fail because of lack of space and the informal recycling sector (like any other logistics system) needs depots (“godowns”) at strategic points in order to make the collection system efficient. However, space is at a premium and expensive in any metropolitan area and urban dwellers are resistant to having waste facilities as in the neighborhood.

Taking the informal sector, the street sweepers and the collection staff of municipalities, there are tens and hundreds of thousands of people employed in waste collection in Indian cities. A review of the informal sector and its links with community collection systems, considered as an economic system, has been discussed with NGOs and others working in this area.

Box 7: ULB – Community Partnership for Primary Collection – Case Example from a Pilot City

Primary Collection of Solid Waste in municipal wards is done through combination of conventional method of street level bins and house level collection. While municipal workers collect the street level waste in 75-80 percent of the area, about 20-25 percent of the areas are covered through household level collection. The latter is managed under a specific program called “Janachaitanyam” (public awareness). Under this self-help scheme, Municipality provides a rikshaw with four containers and a monthly cost of about Rs 600 to the Neighborhood Residents Association (NRA) of less than 200 families who in turn organize a workers (generally rag pickers) and pay about Rs 20 per family for collection of waste from households. Currently about 200 units are operating in the city. This program is further extended to other participatory community sanitation services like street sweeping, drain cleaning and solid waste collection under the program: “Subhram (cleanliness)”. Both of these programmes are currently operating successfully. These programs have resulted in:

- Community ownership of primary collection through ULB-Citizens partnership.
- Substantial improvement is sanitary conditions.
- Organizing the rag pickers through NRAs.
- A successful model which is currently being replicated in other ULBs in Andhra Pradesh.
Overview and Challenges

Using the Private Sector more Effectively

Role of the Private Sector

Engaging the private sector for providing services is common in sectors such as MSW. In India, there is already widespread use of contractors (both labor and equipment) but usually on a simple contract basis and not for broader delivery of specific MSW services. A background study (2005) on various MSW management contracting practices in India (commissioned as part of this analytical work) notes that increasing number of ULBs in India see private sector participation as a panacea and have experimented at different levels in the MSW management chain. Particularly, cities such as Delhi, Chennai and Bangalore have undertaken PSP in collection and transportation activities of MSW. While most ULBs have used service contracts for MSW collection and transportation, Delhi and Chennai Corporations have also entered into Concession Contracts. These contracts encompass a larger proportion of area in the cities. Street sweeping contracts involving private sector participation have generally been executed as service contracts. Hyderabad and Mumbai have experimented with fixed rate contracts with rate fixation being done by the Corporation and the contractors selected on the basis of a lottery system. Experience of PSP in

Fig. 7: Typical Solid Waste Recycling Network

Source: Background Report
Improving Management of MSW in India

treatment and disposal in India is very limited so far. Municipalities such as Bangalore, Delhi and Thiruvananthapuram have initiated activities for the development of engineered sanitary landfills with private sector collaboration.

Potential benefits of increased private sector participation (PSP) in MSW have been summarized as follows:26

- Private sector stake in the project guarantees their commitment to economic efficiency while serving the public interest.

- Improving efficiency and lowering costs by introducing commercial principles (focused performance objectives; financial and managerial autonomy; hard budget constraint; clear accountability).

- Equitable risk allocation with reduced level of risk for Government and taxpayers for a rate of return to the private investor.

- Access to latest technology and enhanced efficiency.

- Better customer focus and delivery.

- Access to broader funding sources.

There are several different possible levels of involvement of the private sector and contractual approaches to PSP27. In India, there is growing experience with contracting the private sector for some MSW activities. A number of cities have entered into service contracts with private operators for collection of MSW from different waste generators (primarily households, commercial establishments, hotels and restaurants etc.) but the area of operation has been limited to a few localities. The use of contractors for labor-intensive work is regulated by employment legislation and so flexibility is limited under current approaches. On the other hand, it is very difficult to change working conditions for municipal employees and so flexibility is also limited in this area. On the transport side, there are different approaches taken to contracting haulage firms and there are different claims as to the cost reductions and efficiencies.28

There is a reasonable assumption that the private sector can provide most of the MSW services at lower costs than currently borne by many ULBs using their own equipment and staff. However, this assumption is not always true and some municipalities are reportedly carrying out functions at a lower costs than comparable PSP in other cities. At the same time, there are clear inefficiencies and wastage in some ULBs and there are definite opportunities for reducing the overall cost of service within the existing structures, if the will to do so exists. Experience worldwide shows that strong management in a competitive environment can bring down costs, even where the system is owned and operated by the public sector. In practice, a mix of public and private provision is often a good solution.

Apart from contracting for collection and transport, contracting out treatment facilities is likely to become
more widely adopted. There is strong interest in India in PSP options for treatment and disposal facilities and a number of examples are underway or under discussion\(^2\). The approach most commonly suggested in India puts the complete responsibility on the private sector to build, own and operate the required facilities (the approach known in its variations as BOO, BOT, BOOT etc). This has apparent advantages in terms of simplicity, from the point of view of the municipality, but it remains to be seen if it can be made effective and efficient. There is considerable private sector interest in such contracts but limited real experience, although some cities are considering entering into concession agreements / management contracts with the private operators for operation and maintenance of treatment and disposal facilities on a Build-Operate-Transfer (BOT) basis.

Initial efforts by private operators under the small number of current contracts have typically not been satisfactory. Some of the primary issues of concern include\(^3\): 

- Inability of the ULBs to provide the guaranteed quantum of waste to the private operator.
- Delay in decision making often resulting in huge opportunity costs and loss of private sector participation.
- Poor operation and maintenance of the facilities by the operators.
- Anticipation of “royalty” for supplying MSW by many ULBs.
- Inappropriate division of roles and responsibilities.
- Inadequate risk mitigation measures.
- Lack of credible information.
- Unsustainable operations of the facilities owing to high capital and O&M expenses.
- Poor monitoring and supervision by the ULBs leading to inefficiencies.
- Lack of political will to ensure sustainable MSW management operations.

World Bank experience in other countries suggests that there has been reluctance on the part of the private sector to accept all the financial risks associated with a treatment/disposal facility and that a more acceptable approach is the Design-Build-Operate (DBO) route where the municipality carries or at least shares the financial risks.\(^3\) Whatever system is preferred, the key principles in contracting the private sector for this type of service

"The sweepers are getting agitated, Sir. Do we have anything in the manual about dealing with the situation?"
provision are competition, transparency, and accountability.

**Managing the Contracting Process**

A key factor in the poor performance to date has been that few municipalities appreciate the importance of developing their own internal management and financial capacity to design and supervise properly these new contracts. There is clearly excellent legal advice and basic contractual experience available through companies and individuals in India but there is very little significant implementation experience on the types of contracts now being used. Municipalities must do their own careful risk assessment of contractual approaches and develop plans for dealing with the practical and contractual problems which will inevitably arise.

Under this activity, a review has been commissioned of the contracts let to date on MSW, with the aim of extracting good practice lessons. The reviews note key characteristics of the MSW sector, including preferred contract types, as depicted in Table 8.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Characteristics</th>
<th>Preferred contract types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collection and Transportation</td>
<td>- Large number of employees including informal&lt;br&gt;- Logistics intensive&lt;br&gt;- Citizen interface&lt;br&gt;- Investment ranges widely depending on scope</td>
<td>Service contracts&lt;br&gt;Management contracts and Concession</td>
</tr>
<tr>
<td>Street sweeping</td>
<td>- Labour oriented&lt;br&gt;- Minimal investment&lt;br&gt;- No requisite skill set/technical skills&lt;br&gt;- Logistics intensive</td>
<td>Service contracts</td>
</tr>
<tr>
<td>Transport</td>
<td>- Technology intensive&lt;br&gt;- More capital intensive&lt;br&gt;- Ongoing O&amp;M</td>
<td>Concession contracts</td>
</tr>
<tr>
<td>Disposal</td>
<td>- Capital intensive&lt;br&gt;- Technically skilled manpower required&lt;br&gt;- Ongoing O&amp;M</td>
<td>Concession contracts</td>
</tr>
</tbody>
</table>
differing risk and responsibility allocations. The main types are service contracts, management contracts and concessions contracts. A thoughtful assessment of the appropriate type of contract needs to be made in each case, depending on the scope and objectives of the work to be done. The essential requirement for encouraging an equitable partnership in any case is careful preparation, including framing of the objectives and the project structuring options, so that a clear, comprehensive and balanced contracting process can be implemented. There is considerable international expertise in operating MSW systems and at least one current example in India but the scale of the typical scheme and the uncertainties about contractual approaches mean that, in the short term at least, international involvement is limited and PSP is likely to be led by Indian companies. A report looked at the strategies and priorities of the major international players in MSW service provision and concluded that this market is unlikely to attract much international interest until it matures and risks for international

<table>
<thead>
<tr>
<th>Nature of Risk</th>
<th>Brief Description</th>
</tr>
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<tbody>
<tr>
<td>Design risk</td>
<td>The risk of designs being adequate/ deficient.</td>
</tr>
<tr>
<td>Sponsor</td>
<td>Ability of sponsor to invest and provide desired services</td>
</tr>
<tr>
<td>Quantity Variation</td>
<td>This may be broken down into the following sub-heads:</td>
</tr>
<tr>
<td></td>
<td>· Underestimation of quantities</td>
</tr>
<tr>
<td></td>
<td>· Change of scope</td>
</tr>
<tr>
<td></td>
<td>· Unforeseen ground/ environment conditions</td>
</tr>
<tr>
<td>Revenue</td>
<td>· Adequacy of consideration for stakeholders</td>
</tr>
<tr>
<td>Environment/ social</td>
<td>· Conformance to provisions of applicable law</td>
</tr>
<tr>
<td>Time Overruns</td>
<td>· Delay in Land Acquisition</td>
</tr>
<tr>
<td></td>
<td>· Delay in approvals</td>
</tr>
<tr>
<td></td>
<td>· Contractor’s delays</td>
</tr>
<tr>
<td>Force Majeure</td>
<td>· Non-political Events*</td>
</tr>
<tr>
<td></td>
<td>· Political Events**</td>
</tr>
<tr>
<td></td>
<td>· Other Events***</td>
</tr>
<tr>
<td>Quality risk</td>
<td>Risk that quality of construction would be lower than expected, leading to:</td>
</tr>
<tr>
<td></td>
<td>· Higher costs of maintenance</td>
</tr>
<tr>
<td></td>
<td>· Non-availability of service</td>
</tr>
<tr>
<td>Failure of the Contractor</td>
<td>Risk that the Contractor would fail, and a replacement would lead to cost and time overruns.</td>
</tr>
<tr>
<td>Termination</td>
<td>Risk arising from termination of the Agreement and could result in time and cost overruns.</td>
</tr>
<tr>
<td>Variations</td>
<td>Risk that would arise due to any variation in the scope of work on the Contractor</td>
</tr>
<tr>
<td>Defects Liability</td>
<td>Risk arising from any defects or damage appearing in any part of the Works</td>
</tr>
<tr>
<td>Dispute Resolution</td>
<td>Risk arising from any dispute, difference or controversy between the parties</td>
</tr>
</tbody>
</table>

* Natural force majeure events, terrorism, strikes, boycotts, etc.
** Change in law, expropriation, other governmental action having material adverse effect.
*** War, ionising radiation, volcanic eruption, rebellion, riots, etc.
investors are reduced.\textsuperscript{34}

**Local Equipment Market**

A less frequently discussed but very important aspect of private sector involvement in MSW is the opportunities present for the local equipment market. There are already a number of prototype small-scale collection vehicles that have been developed in consultation between state governments and equipment manufacturers. Given the scale of the MSW sector, there will be many business opportunities and one of the issues raised in discussions with CPCB and IFC is how this market can be encouraged. There

### Table 10: Key Risks Not Covered in Contracts

<table>
<thead>
<tr>
<th>No.</th>
<th>Risk</th>
<th>Key Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Completion Risk</td>
<td>• Many agreements do not set out any timelines or penalties to address the risk.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The security deposit is used in many cases as a mitigant for this risk thus failure of agreement could lead to forfeiture of the security deposit.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• In some cases performance penalties are set but no penalties are set related to delays in approval by ULBs or to ensure timely or speedy execution of the treatment and disposal projects.</td>
</tr>
<tr>
<td>2.</td>
<td>Operating Risk</td>
<td>• The risk of management of the project facilities and the quality is generally allocated to the Contractor. There are however, no penalties or monitoring systems set in place.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• In some cases independent agencies are involved in review or monitoring.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• In many agreements the specifications for equipment etc are not set out and left to the discretion of the Bidder.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• In some, technology is provided by another party while the responsibility of operation is passed on to the bidder.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• In some cases the ULBs do not retain their right to review the adequacy of design of plant and machinery but generally they retain say in performance monitoring.</td>
</tr>
<tr>
<td>3.</td>
<td>Revenue Risk</td>
<td>• In some cases no demand estimation and geographical distribution of work is often inadequate but concessionaire is suitably protected from this risk as payments are made by letters of credit within a given timeframe.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Many ULBs have used tipping based model but in several cases no payment guarantees or risk mitigants are set out for revenue risk.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Some municipalities have resorted to taking royalty payment from private operators without an assessment of revenue risks in case of reduced sale of either compost or power.</td>
</tr>
<tr>
<td>4.</td>
<td>Force Majeure* Risk</td>
<td>• Most contracts do not adequately set out the risk allocation for Force Majeure events.</td>
</tr>
<tr>
<td>5.</td>
<td>Environmental &amp; Social Risk</td>
<td>• Many contracts do not explicitly address environment and social risks as these are left to the discretion of private operators.</td>
</tr>
<tr>
<td>6.</td>
<td>Political Risk</td>
<td>• Most contracts do not identify or address political risks.</td>
</tr>
</tbody>
</table>

* unforeseeable circumstances
will be some need for importation of specialized equipment but given local ingenuity and engineering expertise much of the market demand can be filled by local equipment.

**TECHNOLOGICAL QUESTIONS**

A number of important technological questions have been raised in the course of this work. The focus is not on technology but there are some issues on which comments are warranted.

**Composting**

Composting is a long established approach. Technically, it has been demonstrated that compost can be manufactured from MSW at a relatively large scale (hundreds of tons per day) but numerous efforts to commercialize composting have failed – not just in India, but across the world – because of a lack of suitable markets at acceptable prices.

Although the material is generally known as compost, it is more properly described as a soil conditioner since it does not have high nutrient levels. Therefore, for commercial sale it is often reinforced with some form of fertilizer (such as chicken meal). This compost/soil conditioner does have a market but it is not seen as a high value product. At the same time, chemical fertilizers are strongly supported and subsidized and consequently the opportunities for breaking into the commercial market is limited.

An allied concern of the agricultural authorities is that heavy use of chemical fertilizer can be associated with declining soil productivity as the soil structure changes, a trend which could be combated by more use of compost as a conditioner. Consequently, MoUD in co-ordination with Ministry of Agriculture, is planning to promote a compost market by requiring fertilizer companies to sell a mixed product to their customers, in a 7:3 ratio (fertilizer to compost). There are

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**Box 8 : Characteristics of Current MSW Management Contracting**

**Collection and Transportation**
- There exists a disparity between contract payments and actual performance of the Parties
- No clear monitoring mechanism to assess the performance
- Issues with regard to environmental and social risks have not been addressed

**Treatment and Disposal**
- Commercial terms are not equitable
- Revenues risks are high due to unviable model of royalty payments by the private investor
- Timelines and penalties for default are not comprehensively addressed
- Termination risks are not equitably shared
- No clear monitoring mechanism set out in the contracts and payments are not linked to service performance
- Issues regarding to environmental and social risks have not been addressed adequately
also proposed directives to improve the viability of compost plants, which include: (i) 50 percent subsidy on capital for proposed compost plants on Public-Private Partnership; (ii) free leasehold land provision by ULBs (iii) no royalty on waste; (iv) exemption of local taxes; (v) transport subsidy amount of Rs 150 per ton of compost. The final package of measures to support compost are not decided and there are a number of practical issues that will have to be addressed, but there is a clear recognition of the potential value of compost use and actions are being taken by the government.

At present, there is interest in the Indian private sector in contracting with municipalities to take MSW and make compost, on the basis of a “tipping fee” to be paid by the municipality, with the company selling the compost “commercially”. Some states, such as Tamil Nadu, are looking at different approaches to support the expected emergence of a sustainable compost market, but there is very little experience yet in such schemes.

In summary, composting does meet requirements of the MSW Rules for “inertization”; it can qualify for carbon finance, and it will generate some revenue as a compost market develops.

**Waste to Energy**

Mass burn incineration does not appear to be a realistic option in India for technical, operational and financial reasons. The alternative of Waste to Energy (WTE) plants using Refuse Derived Fuel (RDF) has been demonstrated to be technically possible. At the time of writing this report, there is one operating WTE plant in Hyderabad which produces approximately 6MW (a standard generator size) and nominally consumes about 700t/d of mixed municipal waste. A second plant (an evolution of this design) has started operating in Vijayawara. There are also proposals for larger plants for Hyderabad and for Delhi. All of these operate on “fluff” – a form of RDF based on waste that has been sorted, dried and pulverized.

The current plants are not operating in a manner where the actual volumes of waste used (and the volumes rejected) can be measured. In each case, they are situated in a dumpsite surrounded by waste. A concern is that if and when a WTE plant shuts down, the municipality will be left with a large dump which is going to cost money to clean up. Evaluation of the economics of such
plants must consider all the life cycle costs.

An alternative form of WTE is that of bio-methanation plants, which relies on gas produced from slurry of organic waste. There are at least two such plants operating in India. A large one in Lucknow which has a number of operational problems to date and a smaller one in Vijayawada. At the appropriate scale and with a good waste stream, this approach clearly has potential but the economics are again not completely clear.

The details of any contract needs to be carefully considered, especially in relation to the volumes of waste accepted and the disposal of waste not used or left after RDF preparation. In this context, it makes sense for the RDF plant to be on a major municipal landfill site but it must also be monitored separately or otherwise the municipality may end up paying for all the waste handling, without realizing it. It is essential to design and apply a proper competitive bidding process with a well designed contract. Unsolicited bids are rarely a good deal for a city.

**Landfill Issues**

The MSW Rules set out requirements for landfills which are consistent with best international technology for landfills. However, the high technical standards also mean relatively high cost systems and there is no flexibility in the current Rules to consider alternative approaches for different circumstances.

The Bank accepts that development of landfills often has to be carried out in stages and is generally supportive of staged or “differentiated” approaches, based on environmental protection as the priority and with careful assessment of individual sites. Selection of a good site is fundamental; if this can be achieved then the specifics of the landfill design are less critical in achieving the desired environmental performance. Systems have been identified in other countries which allow “differentiated” requirements and which could serve as models for India. The possibility has been discussed of developing a small number of well instrumented and monitored landfills to test different technical approaches. This idea should be implemented.

As part of work carried out in Andhra Pradesh, a simple matrix was developed to identify key components of good landfill design and construction and to show how these could be introduced progressively, starting from a simple basic system and developing into a full modern sanitary landfill.

“There goes the second draft of my novel! My wife calls it waste-segregation-at-source.”
Operational Skills

Although the basic skills to operate an MSW landfill are relatively simple, there is very little experience in India (in public or private sector) on how to operate an overall landfill system effectively and efficiently. In the same context that the design and construction of a number of model landfills is generally accepted as a very sensible approach, the use of such sites for formal training of operators – particularly supervisors and managers – is strongly recommended.

Dump Closure/Upgrading

The public and political pressure for action on MSW treatment and disposal is typically driven by the nuisance caused by large dumps, particularly where urbanization is now approaching sites which once were relatively remote. These large dumps, some of which are still in operation, cover tens of acres, contain millions of tons of waste which has been dumped over several decades, and are often burning, at least in sections. In close cooperation with USAEP (US Asia Environment Partnership), the Bank provided advice to the Municipal Corporation of Hyderabad (MCH) on aspects of closure of one major dump at Autonagar on the outskirts of the city.

The decision has been taken to close this dump, as a matter of urgency. However, analysis of alternatives systems has not yet been completed and the resources to deal with Autonagar are limited. The overall objective is to help MCH to develop a financially and environmentally sustainable Integrated MSW Management system. In relation specifically to the existing dump, the objectives are to clean up the dumpsite as efficiently as possible, and in doing so to maximize the potential value of the asset to MCH. These possibilities and the potential for seeking carbon revenue are being addressed, in order to identify potential financial revenues.

A “Road Map” was developed and provided as a working document to MCH, setting out the steps necessary in developing an Action Plan for upgrading the treatment and disposal of MSW, including:

- Identify and implement actions to close the existing dump.
- Evaluate potential landfill site(s), needed as a core element of the long-term system, starting with sites that have already been identified for this purpose.
- Identify and assess those treatment options that have the highest potential to contribute to the overall long term solution.
- On the basis of the previous steps, identify and develop a small number of the most attractive treatment and
disposal alternatives, taking into account transportation factors.

- Compare and evaluate this set of options, taking into account both technical and financial parameters and on broader acceptability and implementation factors.

**Landfill Siting and Approvals**

Siting is a difficult issue in major metros (such as Delhi and Hyderabad) where efforts have been underway for several years with limited progress. However, for smaller municipalities, experience (such as that in Karnataka) has shown that acceptable sites can be identified and obtained. In such cases, it is usually possible to identify a few potential sites within a reasonable distance of the core urban area and, with a careful and consultative selection process\(^3\), acceptable sites can be found.

Selection of a good site is critical to reducing the potential environmental impact of a landfill and also to increasing the prospect of public acceptance. However, Indian law does not require an Environmental Impact Assessment for a landfill clearance from the local SPCB is required but the procedures and criteria are not well established). Early drafts of the MSW Rules did require some level of EIA and although this requirement is not in the current Rules, the issue is again under discussion.

The major problems the urban local bodies facing in the country in regard to landfills is the non-availability of large area of land at a suitable location which meets the parameters laid down under the MSW Rules 2000. The need of land is estimated at 15 acres per 100,000 populations for the purpose of landfilling for 25 years. This requirement is huge and can be minimized only if city governments go deep and go well above the ground like the western world using high skills in landfill operation. The not-in-my-backyard (NIMBY) syndrome and vested interest play a vital role in municipal authorities not getting adequate land for disposal of waste. The state governments are also very slow in allotment of land to the local bodies for this purpose at a nominal cost.

Landfill investments supported by the Bank through municipal projects would normally require a “limited“ (e.g. Category B) Environmental Assessment\(^3\). An outline of the requirements for such an EA has been drafted. As long as there has been a careful and inclusive site selection process, it appears that such requirements are not onerous and can be accepted by clients.\(^3\)
The current work is coming to completion, having successfully supported a number of approaches and initiatives which are part of a broader effort by governments and their partners at all levels in India to upgrade management of MSW. However, the long term work of upgrading systems to provide improved and sustainable MSW services to the hundreds of millions of urban dwellers is really only beginning.

**CURRENT CONTEXT**

It is clear that MSW management is, and will continue to be, a large and important task for municipal governments, at all levels. Different municipalities will move at varying pace on these issues but momentum has been developed nationally and the overall process will not be turned back. MSW management requires both increasingly sophisticated system management and on-going – although relatively small – capital investment. As a technical function it falls between a major infrastructure scheme (water supply, for example) and a manufacturing system. National level expansion and improvement of coverage will therefore require both institutional (including financial) upgrading and also considerable infrastructure investment.

The growing pattern in India, which is consistent with international practice, is for an increasing level of private sector participation in different aspects of MSW service provision. Outside of relatively straightforward transport or labor contracting, there is still limited experience with contracting MSW functions to the private sector but this situation is beginning to change and considerable learning (sometimes painful) can be expected over the next few years.

Both the national government and state governments are very supportive of efforts to accelerate the upgrading of MSW. However, this is fundamentally a municipal function and it is at this level that the challenges have to be addressed directly. There has been considerable improvement in the levels of service and there are many examples of local governments beginning to find the solutions that are appropriate to their own conditions. However, given the scale of the challenge, the road ahead is a long one.

**KEY AREAS**

In this context of the increasing awareness and growing efforts being put into managing MSW, a number of key areas have been identified which
Overview and Challenges

Strengthening ULB capacity

Upgrading MSW will only occur with continuing strengthening of the financial and management capacity of most ULBs. This process will take time but should start with an emphasis on ongoing assistance in the overall process of financial system upgrading (a key objective of the Bank’s municipal reform efforts) to include a reliable accounting system for MSW. It is also important to strengthen MSW management by the clear allocation of responsibility (and appropriate authority) to a senior officer in the ULB for all MSW functions.

MSW Management Core Group

Completing these changes will take some time but significant progress can (and should) be made quickly. At the same time, efforts need to be put into mechanisms for providing support to the ULBs as they go through the process of upgrading their systems. This is clearly a state function and it is probably essential to establish small state level MSW management program groups which will have mandate to develop a program of upgrading, through working with individual ULBs and other key parties. The program would set out criteria for support, performance monitoring requirements and incentives for ULBs to participate in upgrading their MSW services. The group should be provided with technical and human resources to work with individual ULBs and increasing the availability of targeted training programs for municipal officers.

ULB Staff Capacity

While some ULBs have the staff positions and skills to take on the challenge of upgrading MSW, there are weaknesses in others. Given the importance of MSW in the operations and finances of ULBs, efforts must be put in place to upgrade staff capabilities. While the resources could be mobilized for this purpose, a quick process to institutionalize this efforts should be put in place. The commitment of ULBs to upgrade the capacity of staff would be a key criterion for the initiating his effort. The Bank with the involvement of WBI is initiating a capacity building program considering the felt need.

Developing Practical Experience

Much of MSW management requires hands-on experience, which is currently lacking. At the State level, a small number of ULBs, which put themselves forward for the purpose, may be selected as pilot or demonstration cases where additional resources and support would be provided in order to rapidly build experience and expertise, which can then be shared with other ULBs.

Improving ULBs’ Financial Situation and Management of Resources

Serious and sustained progress in addressing MSW can only come with improvements in the financial resources and financial management in the typical ULB, given the large share
Improving Management of MSW in India

of MSW expenditures in any ULB’s finances. Such improvements will take time and will be achieved through a number of different efforts. These include:

- Adopting better accounting and financial management systems, which will allow the municipality to manage better its financial resources and also to increase its collection of revenues.
- Increase efficiency in the operation of its current MSW activities, and use resultant saving of financial and human resources to expand the system to meet the new requirements.
- Providing more integrated management of all aspects of the MSW system, allowing available manpower, equipment and other resources to be put to best use in the expanded system.

User Fee for the Service

A good approximation of the value that people place on MSW management is the amount that they are prepared to pay for this. On the basis of simple assumptions, the MSW management cost per household is about Rs 50/month. This cost is affordable by majority of the population (except slum-areas) and part of these costs is already paid by many households in case of community collection systems. Also there are successful examples in collecting the user fee. In view of this, efforts should be towards a systemic shift to “Paying for the Service” approach.

Realistic Plans for Upgrading

Upgrading will take time and will require that new resources are found. It is important that realistic implementation plans be developed and adopted by each ULB, with support from State governments (or other sources), as necessary. The structure and content of any plan document is much less important than the need for involvement of all relevant parties in the adoption of agreed steps forward in improving the system.

Organizing Communities for Segregation and Collection of Waste

It is clear that there are several good models for community level segregation and collection of MSW. Most municipal governments recognize this and are supportive of increasing the coverage of such groups. However, since community based organizations or NGOs are inherently “bottom-up” groups, it has proved difficult to replicate or scale up significantly the existing good examples. A number of authorities are embarking on Information, Education and Communication (IEC) programs to encourage the formation of more local groups. Increasing the coverage of such community groups is important since it would be very difficult for municipalities to expand their own collection efforts at this level, given constraints on size of workforce and the costs involved.

Incorporating Informal Sector

MSW is a labor-intensive operation, involving significant numbers of
Overview and Challenges

poor people in informal activities and a large unskilled workforce. The role of these people must be taken into account in upgrading MSW, aiming to improve the overall efficiency of the system while providing reasonable opportunities for the people affected. In the long term, the objective should be to incorporate the informal sector into a more structured and organized collection and recycling system. For the ULB workforce, the aim should be to upgrade the skills and effectiveness of the workforce to help deal with the growing workload that will come with improved management and increased coverage.

Working with the Private Sector

It is clear that there will be a high level of private sector involvement in providing MSW services in India. This will build on existing involvement in the areas of collection and transport but will require significant new initiatives in treatment and disposal. There is so little experience in this field that there will inevitably be a period of trial and error. It would be of significant value in establishing structures to review both the technical and operational aspects of the emerging approaches. In any case, very careful attention needs to be paid to the contractual mechanisms used. This should emphasize understanding the technical and commercial risks involved in any proposal and then clearly and openly define the allocation of these risks between the parties involved.

Performance Monitoring/Benchmarking

There are no established or broadly accepted parameters for monitoring the performance of MSW systems, although there are various norms for the design of collection and street sweeping systems. Efforts should be made to begin to collect performance data on parameters such as unit costs, efficiency of different systems, typical costs and prices etc, in order to provide a baseline for new systems.

Regional Approaches

International experience shows that economies of scale, scarcity of facilities and other factors often suggest that regional solutions may have advantages over a proliferation of small schemes, around metropolitan areas, for example. However, in India, as elsewhere the first approach is usually for each municipality to seek its own solution, typically for reasons of control and political independence. With some exceptions, little attention has been given to possible regional solutions. These should be included, at least as medium term approaches, in any planning process.

Role of State and Central Governments

Although MSW is fundamentally a municipal responsibility, state governments will have an important role to play over the next several years, both in helping to deal with the financial needs and also in providing assistance with organizational and technical
issues at the level of ULBs. At present, governments are just beginning to accept and prepare for these responsibilities.

The central government has set the basic framework and is currently in the process of reviewing the limited experience of the initial years of trying to implement the MSW Rules. It will be very helpful if the Government can provide guidance and support to a new and perhaps more realistic implementation program.

**Impact of Dumps and Priority Remediation**

Little attention has been given to the issue of cleaning up existing dumps (with the exception of a couple of cases in major metros). Although the first priority should be to identify improvements or alternatives to existing dumpsites, this issue should not be forgotten and planning efforts should include at least a first order review of the state of existing dumps used by any ULB. This review should identify those worst cases which are causing immediate or long term damage to nearby communities or to the environment (water systems).

**Carbon Finance Opportunities**

Methodology for methane reduction through MSW composting mechanism has been approved for Carbon Finance (CF). The bigger municipalities are looking to avail of this opportunity to increase to the MSW revenue stream (typically with specialist consultant assistance) but the transaction costs are quite high at the moment and the benefits would not justify these transaction costs for smaller ULBs. The Bank with the involvement of the Carbon Finance Business (CFB) unit is currently working with Karnataka, Tamil Nadu and Andhra Pradesh on a “Bundling Approach” for CF. Intended to bundle the potential carbon credits from different municipal investments in MSW composting into one project scheme per State, it reduces the costs. The opportunities look attractive but there is very little practical experience so far.

**Building the Networks required**

The critical issues are organizational and financial. The basic steps are known and understood but adapting them to the specific circumstances of each state and city is a long and difficult task. This cannot be done centrally and there is an essential need to support the emergence of networks and systems which will allow individual ULBs to share experiences and to learn from each other. The objective would be to promote the exchange of ideas and emerging findings, drawing from the experience of the municipal authorities themselves and others who are testing approaches on the ground.
ANNEX – 1

SUMMARY OF MUNICIPAL SOLID WASTES (MANAGEMENT AND HANDLING) RULES,
25\textsuperscript{th} SEPTEMBER, 2000

The MSW (M&H) Rules are notified by the Ministry of Environment and Forests (MOEF) under the powers conferred by section 3, 6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986). The summary of rules is presented below focusing on the expected “Implementation Schedule”, “Management of Municipal Solid Wastes” and “Roles and Responsibilities of Different Agencies” involved in implementing the rules. The detailed notification as published by the MoEF can be referred at http://www.envfor.nic.in/legis/hsm/mswmhr.html.

Schedule I: Summary of Implementation Schedule

<table>
<thead>
<tr>
<th>Serial No.</th>
<th>Compliance Criteria Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Setting up of waste processing and disposal facilities By 31.12.2003 or earlier</td>
</tr>
<tr>
<td>2.</td>
<td>Monitoring the performance of waste processing and disposal facilities Once in six months</td>
</tr>
<tr>
<td>3.</td>
<td>Improvement of existing landfill sites as per provisions of these rules By 31.12.2001 or earlier</td>
</tr>
<tr>
<td>4.</td>
<td>Identification of landfill sites for future use and making site (s) ready for operation By 31.12.2002 or earlier</td>
</tr>
</tbody>
</table>

Schedule II: Summary of Management of Municipal Solid Wastes

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Parameters</th>
<th>Compliance criteria</th>
</tr>
</thead>
</table>
| 1.    | Collection of municipal solid wastes | 1. Littering of municipal solid waste shall be prohibited in cities, towns and in urban areas notified by the State Governments. To prohibit littering and facilitate compliance, the summary of steps to be followed include:-
   i. Organising house-to-house collection of municipal solid wastes;
   ii. Devising collection of waste from all categories of waste generators;
   iii. Make use of biodegradable waste;
   iv. Bio-medical and industrial wastes shall not be mixed with MSW;
   v. Proper management of waste collected including transportation;
   vi. Shall collect horticultural and construction or demolition wastes separately and dairy waste regulated as per state regulations;
   vii. No burning of any type of waste
   viii. Stray animals shall not be allowed to move around waste storage facilities or at any other place in the city or town and shall be managed in accordance with the State laws.
2. The municipal authority shall notify waste collection schedule and method to be adopted for public benefit.
3. It shall be the responsibility of generator of wastes to avoid littering and sure delivery of wastes in accordance with the collection and segregation system to be notified by the municipal authority as per para 1(2) of this Schedule.

ULBs shall organize awareness programs for segregation of wastes and shall promote recycling or reuse of segregated materials. The ULB shall undertake phased program to ensure community participation in waste segregation. For this purpose, regular meetings shall be arranged by the ULB with citizens and NGOs.

Contd.
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Parameters</th>
<th>Compliance Criteria</th>
</tr>
</thead>
</table>
| 3.    | Storage of municipal solid wastes             | ULBs shall establish and maintain storage facilities in such a manner as they do not create unhygienic and insanitary conditions around it. Summary of criteria to be followed for establishing Storage Facility includes:  
  i. Quantities of waste generation in a given area and the population densities. A storage facility shall be so placed that it is accessible to users;  
  ii. Storage facilities shall not be exposed to open atmosphere and shall be aesthetic and user-friendly;  
  iii. Storage facilities or 'bins' shall have 'easy to operate' design for handling, transfer and transportation of waste. Bins shall be painted green, white and black respectively for biodegradable, recyclable and other wastes;  
  iv. Manual handling of waste shall be prohibited. If unavoidable due to constraints, manual handling shall be carried out under proper precaution with due care for safety of workers. |
| 4.    | Transportation of municipal solid wastes      | Vehicles used for transportation of wastes shall be covered. Waste should not be visible to public, nor exposed to open environment preventing their scattering. The following criteria shall be met:  
  i. The storage facilities set up by municipal authorities shall be daily attended for clearing of wastes. The bins or containers wherever placed shall be cleaned before they start overflowing;  
  ii. Vehicles shall be designed to facilitate multiple handling of wastes, prior to disposal. |
| 5.    | Processing of municipal solid wastes          | Municipal authorities shall adopt suitable technology or combination of such technologies to make use of wastes so as to minimize burden on landfill. Following criteria shall be adopted:  
  i. The biodegradable wastes shall be processed by composting, vermicomposting, anaerobic digestion or any other appropriate biological processing for stabilization of wastes. It shall be ensured that compost or any other end product shall comply with standards as specified in Schedule-IV (refer http://www.envfor.nic.in/legis/hsm/mswmhr.html for details);  
  ii. Mixed waste containing recoverable resources shall follow the route of recycling. Incineration with or without energy recovery including pelletization can also be used for processing wastes in specific cases. Municipal authority or the operator of a facility wishing to use other state-of-the-art technologies shall approach the CPCB to get the standards laid down before applying for grant of authorization. |
| 6.    | Disposal of municipal solid wastes            | Land filling shall be restricted to non-biodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing. Land filling shall also be carried out for residues of waste processing facilities as well as pre-processing rejects from waste processing facilities. Land filling of mixed waste shall be avoided unless the same is found unsuitable for waste processing. Under unavoidable circumstances or till installation of alternate facilities, land-filling shall be done following proper norms. Landfill sites shall meet the specifications as given in Schedule –III (refer http://www.envfor.nic.in/legis/hsm/mswmhr.html for details). |
**Schedule III: Specifications for Landfill Sites**

Schedule III as per the notifications covers the specifications for Landfill sites covering: Site selection criteria, facilities to be provided at the site, specifications for land filling, provisions for pollution prevention, water and air quality monitoring requirements, plantations to be maintained at the landfill site, closure of landfill sites and post-closure care and special provisions for hilly areas.

**Schedule IV: Standards for Composting, Treated Leachates and Incineration and Operating and Post Closure Standards**

**Forms:** The Notification provides standard formats for different applications including: Application for obtaining Authorization from pollution control boards, Annual report submission by Municipalities, formats for issue of authorization by state pollution control boards, format for annual review to be submitted by SPCBs to CPCB and Accident reporting formats.

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**Summary of Institutional Responsibilities for Implementation of MSW (M&H) Rules - 2000**

<table>
<thead>
<tr>
<th>Municipalities</th>
<th>State Government / UTs</th>
<th>SPCBs/Cs</th>
<th>CPCB</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Submit form I for grant of setting up MSWM facility to SPCB/C</td>
<td>• Respective DoUDs in State/UTs shall have the overall responsibility for the enforcement of provisions of MSW (M&amp;H) Rules</td>
<td>• Grant approval for disposal facility taking into consideration the views of state UDD/TPPD/GWB and any such agency prior to approval in form III* including airport and airbase authority</td>
<td>• Shall co-ordinate with SPCB/Cs with specific reference to implementation and review of standards and guidelines and compilation of monitoring data</td>
</tr>
<tr>
<td>• Shall abide by the implementation schedule under Schedule I</td>
<td>• District Magistrate or Deputy Commissioner of district shall have the responsibility for enforcement with in territorial limits of jurisdiction</td>
<td>• SPCB/C shall issue authorisation to ULB or operator within 45 days stipulating compliance as per Schedule II, III &amp; IV*</td>
<td>• Consolidate annual reports submitted by SPCB/Cs to central government before 15th December every year</td>
</tr>
<tr>
<td>• Shall manage and handle MSW in accordance with Schedule II* meeting specifications and standards as specified in schedule III &amp; IV*</td>
<td>• DoUD shall co-ordinate with the concerned organizations for obtaining the necessary approvals and clearances</td>
<td>• Monitor the compliance of standards i.e. GW/AA/leachate quality, compost quality and incineration standards under Schedule II, III &amp; IV*</td>
<td>• Nodal agency for approving state-of-the-art technology</td>
</tr>
<tr>
<td>• Report accidents at any MSW facility (from collection to disposal stage) in Form V to the Secretary-in-charge of UD in metros and to district collector and Deputy Commissioner in all other areas</td>
<td></td>
<td>• Submit annual report on implementation by 15th of September every year in Form IV* to CPCB</td>
<td></td>
</tr>
<tr>
<td>• Areas under the jurisdiction of “Development Authorities”: it shall be the responsibility of development agency to identify the landfill sites and hand over the sites to the concerned municipalities for development, operation and maintenance</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: Access the Schedules and Forms referred in the above table at [http://www.envfor.nic.in/legis/hsm/mswmhr.html](http://www.envfor.nic.in/legis/hsm/mswmhr.html)*
Approach

For the pilot cities, the capital requirements (by year) have been estimated for MSWM under the broad headings of: primary collection and sweeping; secondary collection and transport; and processing and disposal. It is evident that most ULBs would require a combination of external grant and loans to develop and implement an upgraded integrated solid waste system. However, municipalities should be able to operate and maintain the system if they could keep a separate solid waste account and can identify and introduce an assured stream of revenue to maintain and replace the assets. Most ULBs would require an appropriate combination of municipal staff and private sector in primary collection in order to cope with requirements to service new areas and the approach would have to be based on some user fee model to make this operation self-sustainable.

The range of practical options examined on the ground are demonstrated from the example of one mid-size city. After considerable work with the effective and knowledgeable staff and rounds of discussions with senior officers and elected officials, a range of practical options were identified, as summarised below and in the accompanying table.

A Case Study of a Mid-Sized Town

Several options including cost and revenue projections were studied under the action planning process for the Pilot City, and the summary of results can be presented in the following manner.

Option 1 (Partial privatization): This option is expected to be a most likely scenario for the city in view of Government’s policies, as it envisaged that 70 percent of the primary collection would be undertaken by the private sector/NGOs and the user fees and the user fees would make this operation self-sustainable. The balance of primary collection in the 30 percent of the municipal area which is mainly comprised of slums would be undertaken by the ULB. The municipality has adequate staff, so sweeping and sanitation services could remain the domain of ULB. The bins for secondary storage and vehicles for transportation of MSW, would be procured by the ULB and operated by the private sector contractors who would be paid on a contractual basis, based on number of trips made. The MSW processing is proposed to be carried out by a private party on BOT basis.
Then landfill disposal would also be undertaken on BOT basis and a gate fee would be payable by the ULB @Rs 500 per ton. The sweeping and sanitation is expected to remain a responsibility of the ULB as in the Pilot City adequate municipal staff is available.

**Option 2 (Partial privatization):**
The option 2 is similar to option 1 except for the provision that the primary collection in this case would be done entirely by the ULB and the sanitary landfill development and operational costs would be incurred by the ULB, but would be made perative by a private party. This scenario is also quite likely to be implemented in the Pilot City as not many private parties/NGOs are coming forward for primary collection and also that due to high initial capital investment required for the land-fill, a BOT project may not yet be feasible. In this case, the Capex for land-fill has been taken as Rs 30 million. However no gate fees are envisaged which would lead to a saving of Rs 5.8 million in the operational costs.

The cost of primary collection in this option (Rs 14.8 million) would be 3 times higher that the option 1 (Rs 4.6 million).

**Option 3 (Partial privatization):**
This option is a combination of options 1 & 2 and under this option the investment for the landfill site would be made by the ULB and it would be operated by a private party. The projected scenario for other functions under this option is the same as in the option 1. The gate fees payable in this case would be lower @ Rs 200 per tonne, and thus the operational costs for the disposal would be lower.

**Option 4 (100 percent responsibility of ULBs for MSWM):** Option 4 is among the least likely scenarios where all functions and components of MSW management are undertaken by the ULB. This option is also the most expensive proposition in view of the

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**Summary of Future Scenarios Considered (Pilot City )**

<table>
<thead>
<tr>
<th>MSWM Components</th>
<th>Option 1</th>
<th>Option 2</th>
<th>Option 3</th>
<th>Option 4</th>
<th>Option 5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Collection</strong></td>
<td>70% Private 30% ULB</td>
<td>100% ULB</td>
<td>70% Private 30% ULB</td>
<td>ULB</td>
<td>Private</td>
</tr>
<tr>
<td><strong>Secondary Storage &amp; Transport</strong></td>
<td>Purchase by ULB, Operation by Contract.</td>
<td>Purchase by ULB, Operation by contract.</td>
<td>Purchase by ULB, Operation by contract.</td>
<td>ULB</td>
<td>Private</td>
</tr>
<tr>
<td><strong>Processing</strong></td>
<td>BOT</td>
<td>BOT</td>
<td>BOT</td>
<td>ULB</td>
<td>Private</td>
</tr>
<tr>
<td><strong>Disposal</strong></td>
<td>BOT</td>
<td>ULB</td>
<td>Investment by ULB, operation by contract.</td>
<td>ULB</td>
<td>Private</td>
</tr>
<tr>
<td><strong>Sweeping &amp; Sanitation Services</strong></td>
<td>100 % ULB</td>
<td>100 % ULB</td>
<td>100 %ULB</td>
<td>100% ULB</td>
<td>Private</td>
</tr>
</tbody>
</table>
inefficient functioning of the ULB Staff.

**Option 5 (100 percent privatization of MSWM):** This is an idealistic option in which all activities would be carried out in the private sector, except for sweeping & sanitation services, which owing to inadequacy of municipal staff is likely to remain as the functional responsibility of the ULB.

**EVALUATION AND RECOMMENDATIONS**

Estimates were made of the investment and operating costs for the main items for each of these options. At this point, many of the figures are approximate but there is sufficient data to see the key patterns and issues emerging. The comparative evaluation carried out has been summarized in the table given below.

Accepting that these figures are best read as comparative rather than absolute, a number of broad conclusions can again be drawn. It is known that current unit costs in this city are already above the average and the additional costs of upgrading even only the collection and transport system to provide complete coverage would mean a significant increase in the unit costs of MSW. To then provide an upgraded processing and disposal could in some cases virtually further double the unit cost to levels that are simply not considered affordable at present.

The analysis behind the figures provides some background and insight.

- It has been observed that for street sweeping, the private operators are 3-4 times more cost efficient than the ULBs and the same ratio has been reflected in the cost figures, wherever applicable. However, an immediate shift to all private contracting is not practically nor politically feasible.
- The overall costs would be the lowest in Option 5, where the entire investment and operation for processing and disposal as well as transportation is undertaken by

<table>
<thead>
<tr>
<th>Estimated annual expenditure Rs/ Mil.</th>
<th>Option 1</th>
<th>Option 2</th>
<th>Option 3</th>
<th>Option 4</th>
<th>Option 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed operating cost</td>
<td>32.11</td>
<td>41.90</td>
<td>32.11</td>
<td>43.57</td>
<td>33.75</td>
</tr>
<tr>
<td>Variable operating cost</td>
<td>10.48</td>
<td>6.80</td>
<td>7.43</td>
<td>6.80</td>
<td>6.60</td>
</tr>
<tr>
<td>Total operating cost</td>
<td>42.59</td>
<td>48.70</td>
<td>39.54</td>
<td>50.37</td>
<td>40.35</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Estimated unit costs Rs/t</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Collection &amp; transport</td>
<td>981</td>
<td>1292</td>
<td>990</td>
<td>1337</td>
<td>922</td>
</tr>
<tr>
<td>Processing &amp; disposal</td>
<td>149</td>
<td>0</td>
<td>59</td>
<td>0</td>
<td>149</td>
</tr>
<tr>
<td>Capital Expenditure Unit Cost</td>
<td>514</td>
<td>1150</td>
<td>1045</td>
<td>1362</td>
<td>0</td>
</tr>
<tr>
<td>Total projected costs</td>
<td>1216</td>
<td>1484</td>
<td>1223</td>
<td>1564</td>
<td>1070</td>
</tr>
</tbody>
</table>

*Note:* The Capex for the year 2005-06 has been taken as one-sixth of the total value for calculation of Unit MSW management costs. This has been done based on an assumption that the average economic life of the equipment is 6 years.
the private operators, due to the assumed better cost efficiency of the private sector. However, there are clearly operational and financial risks in this approach, even if it is feasible.

- Under the most probable scenario, which is Option 1, the operating costs for MSW for the year 2005-06 would be Rs 42.59 million, which is about 26-27 percent of the municipal budget. Under Scenario 4, where all investments and operations are to be done by the ULB, the cost of operation and investment together would rise to approximately 50 percent of the municipal budget.

- The ULB should probably consider adopting Option 1, a plausible mixed option, which can be practically implemented and is in line with government policy. However, the various technical options now need to be re-assessed to find potential costs savings and the city must work on an implementation schedule for upgrading which will be consistent with its ability to raise revenue.
1. Population size 100,000 and above
2. Population size 50,000 to 99,999
3. Population size 20,000 to 49,999
4. However, review of the available literature and discussion with colleagues inside and outside the Bank failed to identify any body of work which is able to demonstrate these links quantitatively and is also relevant to the Indian context.
5. SENES 2004 - Referred to as Background Report
6. Sector Study by EAP
7. NSWAI/ENVIS Report 2003
8. Detailed figures starting to come from the action plans suggest that these may be underestimates, probably because many of the costs are not easily identified in current municipal accounts.
9. It is also estimated that approximately 1 acre of land is required for Sanitary Land filling of 40,000 tonnes of MSW
10. Bellary, Shimoga and Tiptur in Karnataka; Hyderabad, Visakhapatnam and Vijayawad in Andhra Pradesh
11. Shimla and Nanital in North India and Shillong in North-East India
12. Based on the experience from the pilots, it is planned to simplify and make the model available, with some support, to other municipalities or States who request it.
13. Municipal reform work through Bank’s Infrastructure unit envisages to enhance financial strength of ULBs
14. Studies for KUIDFC by CRISIL have assessed the available debt raising capacity for a number of municipalities. A relatively small number have any real capacity.
15. A range of typical figures is expected to emerge from the site specific exercises that are now beginning.
16. In Bank funded projects in Mexico and China, for example.
18. To date there has been only one fully developed Carbon Finance project in MSW in India. This is a bio-methanation plant at Lucknow which has had a number of problems preventing it from achieving full success.
19. In each case some form of Infrastructure Corporation, within the State’s Urban Department.
20. This document is available in draft and has been approved by the State Government. The final version has not yet been distributed
21. Such as work supported by JICA in Delhi.
22. Report on Scaling up Public Participation by Toxics Links, an NGO working on waste collection and reduction; and other sources.
23. Quoted in article in “Down to Earth: 200 Special” CSE Delhi, 2001
24. Graphically described in various articles. See CSE (ref) and recent article in Independent Newspaper of London.
26. “Review of Contractual arrangements in India – background study by IDEC under this AAA
27. See, for example, “Guide Pack on PSP in MSW management” by Cointreau and Coad, SKAT/WB 2000
28. Informal discussions suggest very different views on efficiency. There is no comparative data available.
29. The FIRE program supported by USAID has been doing considerable work on this issue.
30. Findings from a review of contractual performance by IDEC, as part of this AAs.
31. The Bank has drafted standard DBO contract documents which are now being applied in cases in the Middle East and the Philippines, although experience with this approach is also relatively limited.
33. ONYX of France, through associates, have been contracted to carry out collection and transport for Chennai Corporation.
34. Prunier, unpublished report
35. Ref Technical Paper
36. For example, South Africa and the State of Tasmania in Australia have detailed systems. Some of the ideas from these systems have been used in discussions with the State of Karnataka.
37. A process for site selection among alternatives has been drafted by consultants for CPCB and has been used in some examples in Karnataka. This may be overly complex but the basic principles and approach are clearly helpful.
38. Large schemes, especially within metro areas, might be Category A but these would be a minority of the possible investments and would probably be addressed as separate projects rather than as part of broader municipal investment programs.
39. Once specific investments have been proposed by clients for possible financing under municipal projects, site specific ToRs will be prepared and from experience with these processes, the generic approach will be updated and refined.
40. Over the past one year Shimla Municipal Corporation has implemented MSW user fee for door-to-door collection (monthly fee ranging from Rs 35/- for households to Rs 805/- for big hotels). The user fee is over and above the property tax.
41. For example KUIDFC in Karnataka, Delhi Municipal Corporation is also undertaking IEC.
42. Andhra Pradesh, as one example, has begun to identify possible regional systems.
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