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SANDEC

A RESOURCE GUIDE FOR MUNICIPAL WASTE MANAGERS

DECENTRALISED COMPOSTING SOLUTIONS for INDIAN CITIES



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INTRODUCTION

If you are reading this, you are most likely an individual that is concerned about, or involved with solid waste management (SWM) in India. After all, this publication was developed in response to a collective interest on the part of waste managers to develop innovative alternatives in SWM. This interest formed the basis of a partnership between the Water and Sanitation Department of EAWAG (SANDEC) and local SWM experts from Bangalore, which culminated in this research into decentralised composting solutions. While reports outlining the investigations methods in greater detail will also be available to interested stakeholders, it is hoped that this summary publication will serve as an effective starting point for actors at various levels who wish to contribute to a more sustainable waste management paradigm.

This document will begin by confirming the notion that un-segregated municipal waste dumping is both unsustainable and a wasted opportunity for households, communities and municipalities alike to recover and re-use the biodegradable portion of waste generated in urban areas. It will then guide readers through various composting approaches that could be suitable for them by looking at the various elements of composting schemes that need to be carefully considered prior to adopting a technical and operational approach. Finally, as we hope for this material to be useful for a broad range of stakeholders, the document will discuss how affected parties can strengthen the partnerships and networks that are essential in the design of a sustainable waste management system.

WHY PROMOTE DECENTRALISED COMPOSTING IN INDIAN CITIES?



THE WASTE MANAGEMENT CHALLENGE

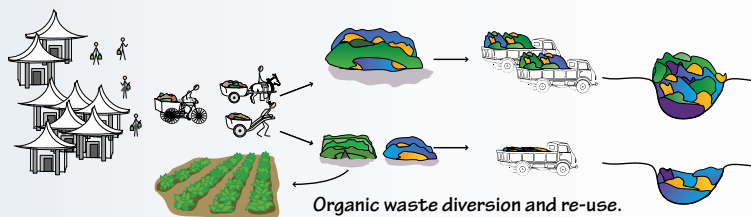
Indian cities are confronted with a serious solid waste problem. High rates of urban growth combined with increasing consumption of non-traditional consumer goods are placing greater demands on urban waste managers. Furthermore, while waste generation is increasing, existing landfills are reaching capacity and new sites must be located further and further from where wastes are generated. These factors are making the management of municipal waste streams increasingly expensive.

Low rates of collection and uncontrolled disposal, especially in marginalised communities unable to raise the necessary financial and administrative resources, is resulting in unsightly and unhealthy waste accumulation in public spaces. This leads to significant health risks for the urban citizenry and to rapid degradation of the urban environment.

THE LEGISLATION

By the end of the 1990's a committee constituted by the Supreme Court of India was established to look into all aspects of SWM in the

Class 1 cities of India and to submit appropriate recommendations for improvement. On the basis of these recommendations, national legislation was passed by parliament in the form of the "Municipal Solid Waste (Management & Handling) Rules" in the year 2000. These rules compel municipal authorities to develop a solid waste management system and to provide appropriate sites for the controlled, sustainable disposal and separate treatment of organic and inorganic wastes, as depicted below.



THE POTENTIAL

Research has shown that the organic fraction of solid waste in India ranges from 40 to 50 percent, depending on the income and life style of the population. Composting this fraction could thus make a significant contribution towards waste recovery and reducing demands on landfills, thereby closing valuable material cycles with economic and environmental benefits.

Decentralised composting is a simple biodegradable waste management alternative that can be implemented on an appropriate scale for any city. In addition to the benefits described above, cities that compost their organic waste fraction can also :

- Reduce municipal costs for waste management as organic waste is diverted from the municipal waste stream, thus reducing transportation and disposal costs.
- Reduce the environmental impact of disposal sites as the biodegradable waste fraction is largely to blame for the polluting leachate and methane problems.
- Improve soil quality through compost application by increasing levels of organic compounds and beneficial microorganisms.
- Increase the yield and quality of urban and peri-urban farm products, resulting in new markets for locally produced organic food alternatives .

Producers of compost can also expect to find a market for their product, depending on the quality, cost and other market related factors. Currently in India compost and vermicompost produced from organic municipal waste sells at rates between Rs 1.60 - 3 /kg for commercial purchasers such as farmers and at Rs 5 -20 /kg for individual retail consumers for use in homes and gardens.

CHOOSING AN ORGANISATIONAL APPROACH

Existing compost schemes in India will generally fall into one of the following categories, which may potentially complement one another:

- Backyard Composting
- Community-based Systems
- Company and Institutional Composting
- Medium-scale private sector composting enterprises
- Large Scale public-private composting schemes

However, to unlock the potential of composting in the Indian context, smaller, more decentralised approaches should be given primary consideration as most often these are best suited to meet the needs of Indian municipalities and their residents. Therefore, large scale schemes will not be discussed in detail in this analysis.

In choosing the decentralised approach(es) appropriate for your

area, one should take the following technical, financial, socio-cultural and institutional considerations into account:

TECHNICAL CONSIDERATIONS

The general space requirements for composting depend on the approach used, however, 150 sq m per ton of waste per day can be used as a rough guide.

- **Backyard composting** in recycled plastic drums of 200 litres is sufficient for a household of 4 persons. This approach is feasible for households with a high level of composting awareness and a garden for placing the drum and for use of the produced compost. A second option is the mulching of biodegradable waste in drums in which vegetables or other plants are placed. These drums can be kept on terraces (also called terrace gardening).



Backyard composting is best served by segregating waste at its source into biodegradable and non-biodegradable streams.

- **Community-based systems** are frequently box-composting systems or vermi-composting systems. These schemes are usually small-scale (< 1000 households) and are integrated with a residential waste collection service. Therefore, feedstock is either sorted at source or it is sorted after collection, depending on the degree of initiative taken by residents.
- **Company and Institutional** composting operations often have similar technological approaches to the community-based schemes, but vary according to the quantity of waste being processed. However, as there is often residual space on company premises, composting can usually be practiced without affecting workplace practices or local residents.
- **Medium-scale private sector** composting enterprises are mostly larger in scale than the above (2-10 tons/ day). Schemes mostly use vermicomposting technology in windrows and treat pure biodegradable market waste that they collect themselves.

FINANCIAL CONSIDERATIONS

In almost all cases there is a start-up cost associated with initiating a composting scheme. However, this cost need not be prohibitive as long as the approach is appropriate. Decentralisation allows for a diversity of approaches to co-exist and must therefore be part of the foundation of any organic waste management system.

All multi-household schemes observed during the study relied upon land provided by the municipality, which they got either free of charge or at a very cheap lease. Therefore, financial considerations, excluding land acquisition cost, include the following:

- For **backyard composting** schemes one time investment of Rs. 600-800 is required - although other less-expensive 'homemade' apparatus will also work if designed properly. Marketing of compost is not an issue for backyard composters as the compost is generally used in the composter's own garden.
- In **community-based systems** the start-up costs will depend on the

approach used and the amount of infrastructure built to support the endeavour, such as shelters, bins, collection vehicles, etc. These costs aside, an average estimate of investment is ~ Rs 2.5 - 3.5 lakh per ton of processed waste per day (small to medium sized schemes). Operational costs consist mainly of salaries because manual labour is often used rather than mechanized equipment. For example, one labourer can process approximately 200kg/day. Income will also depend on the organisational structure of the system, as some schemes will offer community residents a free share of the compost produced while others will rather sell the compost to recover operational costs.

- **Company and Institutional** composting schemes can benefit employees, employers and even external actors such as a municipality. Companies and like institutions can save themselves money by using compost on their grounds instead of using store-bought soil conditioners, while at the same time reducing waste service fees and improving their environmental image.
- **Medium-scale private sector** composting enterprises benefit from lower investment cost per ton of waste because of economies of scale. Costs will vary according to the size and efficiency of operations, but Rs 1 - 1.4 lakh per ton of processed waste per day can be used as a rough estimate of investment costs. It is important to note that low rates of mechanisation, appropriate for the Indian context because of the existing labour surplus, will result in lower maintenance costs over the long term compared to highly mechanised facilities. Immature retail and wholesale markets for compost may present a real challenge to profit-minded operators.



Sieving compost prior to application or sale will rid it of any significant non-biodegradable components.

SOCIO-CULTURAL CONSIDERATIONS

While the most immediate concerns of a waste manager may be the technical and financial aspects of a compost scheme, composting also has social and cultural aspects that should be taken into consideration when deciding on an appropriate approach.

- **Backyard composting** is a very independent composting approach and is therefore well suited to those neighbourhoods desiring less community interaction.
- **Community-based systems** have important social cohesion and empowerment functions that go far beyond waste management. For residents, improved collection and cleanliness may be the main priorities, but composting should be regarded as equally beneficial. These schemes will benefit from municipal support and collaboration on waste collection. The example of Advanced Locality Management (ALM) citizen groups in Mumbai are one good example of successful public/community partnerships of this nature.
- **Company and institutional** composting schemes have the advantage of centralised and clear decision-making structures, which can be an advantage in negotiating and coordinating with the municipality. However, often a lack of employee household member participation can impair success.
- **Medium-scale private sector** enterprises tend to focus on existing pure waste streams such as market waste or agro-industrial wastes and thus there is very little interaction with households. However, these firms should still be accountable to the

communities in which they work to ensure that they are meeting local needs in an appropriate and mutually beneficial fashion.

INSTITUTIONAL CONSIDERATIONS

Compost schemes and waste management systems do not exist in an institutional vacuum - they are influenced to varying degrees by government through the authorities responsible for managing waste streams and setting policy to guide the delivery of waste management services. The following aspects of this relationship are important to take into consideration:

- **Backyard Composting** is perhaps the least affected by municipal authorities or other levels of government. However, if the authorities wished to be pro-active (through policy, education and/or funding initiatives) they could be very effective in encouraging the implementation of this approach at the household level.
- **Community-based systems** depend to an extent on municipal support and coordination, but are largely driven from within communities. However, an enabling policy environment and grants of land or equipment are invaluable in helping communities get projects off the ground. The municipality of Mumbai has set a good example of this through the ALM program.
- **Company and Institutional** composting are less dependent on governmental collaboration because as with backyard schemes they are capable of operating independent of the municipality. However, by offering incentives and technical assistance to companies in the process of initiating programs, authorities could improve both their own and their partner's financial bottom line.
- **Medium-scale private sector** enterprises are often contracted by municipalities to undertake anything from market to neighbourhood to city-wide waste management and are therefore direct partners with government authorities. Clear contractual arrangements are advisable as they will ensure proper monitoring, evaluation and improvement over time.

BUILDING ON THE STRENGTHS OF WASTE MANAGEMENT STAKEHOLDERS

While the previous section's function was to enlighten waste management stakeholders as to the technical and operational options available to them, the role of this section is to ensure that these systems run as efficiently as possible. Here, recommendations for stakeholders are made that will build on existing strengths while more clearly defining the most appropriate roles for each actor.

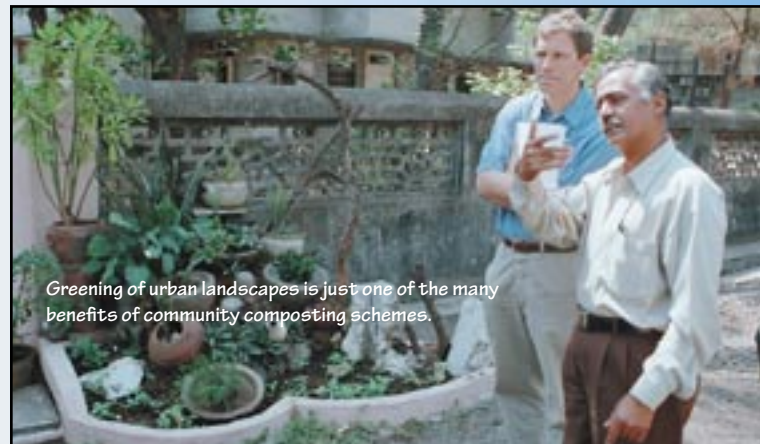
ROLE OF MUNICIPAL AUTHORITIES

Municipal authorities and governmental organisations are at the epicenter of urban waste management as they are ultimately responsible for designing and implementing waste management policy. Important considerations for municipal authorities include:

- Clear strategies for ensuring appropriate effective organic waste management and recycling (i.e. what combination of systems is appropriate for the city, the budget, the time frame for implementation, etc.).
- Strong political will and continuity of waste management policy. The Commissioner / Chief Officer and the Standing Committees should pass resolutions to promote decentralised composting and be willing to support it at all levels as required.
- Educate and train municipal SWM personnel and municipal partners as to the advantages of composting and what roles they will play in the operation of an effective and sustainable system.
- Ensure collection of segregated dry waste and keep debris, road

dust, drain silt, and commercial waste out of the biodegradable waste stream while stressing recovery and recycling. This can be accomplished through appropriate regulation and enforcement organised with the help of NGOs working with waste-pickers and waste-buyers (kabadiwalas).

- Ensure that waste streams consisting predominantly of biodegradable waste (park and garden waste, market waste, eateries, etc.) are not mixed with other contaminating waste streams. Enforcement should be easy since these sorts of establishments all require municipal licences to operate. Ensure prompt and regular lifting of compost rejects from decentralised composting sites.
- Encourage institutions, companies and citizens to initiate decentralised composting solutions by establishing and staffing a resource centre that can offer sound composting advice.
- Municipalities can offer a buy-back program for locally produced compost to use in its parks, gardens, traffic islands and dividers. This would be an economical way for city gardeners to satisfy their soil amendment requirements and at the same time induce more people to begin composting.
- Assist in researching and promoting the links between waste management, composting and compost use in agriculture.



Greening of urban landscapes is just one of the many benefits of community composting schemes.

ROLE OF CITIZENS AND INSTITUTIONS

Community participation is the key to sustainable and integrated solid waste management. Law enforcement can help to obtain a certain degree of participation, however, enhancing environmental consciousness and promoting awareness of the detrimental effects to public health and the environment is by far more effective achieving this goal. All members of society should be encouraged to contribute by:

- Ceasing littering and indiscriminate dumping of refuse in open spaces, footpaths, lanes, streets, and into drainage channels or water bodies.
- Segregating waste at source into a pure biodegradable "wet" fraction and non-biodegradable "dry" waste.
- Provision of separate individual or communal bins for biodegradable waste in buildings, institutions, companies, and residential colonies.
- Utilising compost for gardening and urban farming. Increased awareness and knowledge on compost use and its numerous benefits for soil improvement is a key to increasing market demand and thus encouraging new composting initiatives.
- Investing in pollution abatement measures such as composting facilities and viewing them as (business) opportunities, not costs.

ROLE OF THE COMPOSTER

Those charged with operating and maintaining composting facilities (e.g. individuals, households or entrepreneurs) represent the front lines of composting schemes and have much to do with ensuring their success. Specific demands of this important role include:

- Composting organic waste based on sound application of the science of composting, ensuring production of a quality product while minimising environmental impacts (such as odour, leachate, and dumping of waste rejects)
- Meeting quality standards for compost as set by the relevant national or state authorities, especially that which is being produced for resale to agricultural users
- Sharing expertise with others in the community, informally or formally through professional associations or federations.
- Assisting in raising awareness of the merits of composting in communities and participating in building stronger markets for locally produced compost product

ROLE OF NGOS

NGOs can play a significant role in promoting decentralised composting solutions. Their strengths lie in their close contact with residents and community structures, which make the delivery of educational and training programs more effective. Their role, in cooperation with municipal authorities, can be to:

- Initiate awareness building campaigns with regard to waste segregation, recycling and reuse
- Initiate and support decentralised composting schemes with technical and methodological advice
- Assist in creating market demand for compost through promoting the linkages to organic farming and gardening

ROLE OF THE INTERNATIONAL COMMUNITY AND DEVELOPMENT ASSISTANCE PROVIDERS

While research and development institutions such as SANDEC may have a more global perspective and formal expertise than most Indian municipalities, they are not well suited to be championing composting initiatives at the local level. However, international institutions can still play a number of important roles, including:

- Building networks among partners and stakeholders
- Providing sound technical and logistical advice, know-how and capacity building opportunities
- Providing a range of development assistance mechanisms, in cooperation with other programs and donors



DECENTRALISED COMPOSTING - 'TROUBLESHOOTER'

PROBLEM

SOLUTION

1) *Insufficient market demand for compost*

- Skepticism and lack of awareness
- Competition from chemical fertilizers
- Far distance to market (farmers)

1) *Create and sustain a market for compost*

- Devise a contextually appropriate marketing strategy
- Set-up demonstration projects and offer free samples
- Set certifiable quality standards
- Integrate with existing market and distribution networks
- Shift subsidies towards organic fertilizers

2) *Contaminated feedstock*

- Inorganic contaminants, such as heavy metals, plastics and glass shards, entering the production cycle

2) *Separate waste at source*

- Collect and contain industrial waste streams separately from street sweeping wastes, market waste and household waste
- Introduce and support waste segregation at the household level into organic and inorganic fractions (if not further, into wet and dry organic fractions and recyclable and non-recyclable inorganics)

3) *Insufficient knowledge or technical expertise*

- Trepidation prevents those yet to acquire the necessary skills from initiating compost schemes
- Those with limited knowledge produce a low-quality compost that is less marketable and could be contaminated

3) *Form composter networks and associations*

- Creating networks between competent composters (public organisations, private entrepreneurs and NGO's) and those institutions and individuals eager to learn more can vastly improve the quality and quantity of compost production

4) *Community lacks commitment*

- Lack of awareness, understanding and enthusiasm
- NIMBY syndrome (Not In My Backyard)

4) *Generate awareness, understanding and enthusiasm*

- Explain and promote the economic, social and environmental benefits of decentralised composting schemes
- Offer support to composters conceptually and financially that is accessible, applicable and consistent
- Select appropriate sites for community composting schemes
- Integrate all stakeholders into planning, design and implementation of a municipal waste management program

CONCLUSIONS AND KEY FINDINGS

"When economic, social and environmental benefits are all taken into account, decentralised composting solutions are certainly a viable waste management option and a self-sustaining means of transforming waste into a beneficial soil conditioner." - C.Z.

ECONOMIC IMPACTS

- Well coordinated, decentralised composting schemes can be economically beneficial to both municipalities and communities. Therefore, it is important for waste managers to consider the nature of communities and their developmental needs when choosing a composting approach. Decisions as to such variables as the size, scale and degree of mechanisation will play a role in determining who benefits most from compost initiatives. Generally speaking, maintaining control of organic and inorganic material recovery at the grass-roots level will ensure that the benefits (and profits) remain in the hands of those who need them most.
- Finding lucrative and untapped markets for compost in India would be exceptional as compost is a relatively new product in the India context and markets are still developing. However, willing consumers of compost will enjoy the benefits of reduced spending on chemical fertilisers, improvement of depleted soils and higher quality produce.
- From a municipal standpoint, reduced demand on landfill sites, reductions in environmental pollution from landfill leachate and greater tourism revenues for local businesses as a result of the cleaner and more aesthetically pleasing surroundings are just some of the benefits that can be anticipated.

SOCIAL IMPACTS

- A concerted, municipality-backed decentralised composting strategy will build and strengthen community networks, benefit the relationship between communities and their municipal service providers and build new partnerships among local waste management stakeholders.
- Decentralised composting schemes can open up new opportunities for the urban poor, opportunities that can not only provide incomes but also the opportunities to learn new skills and start small businesses.

ENVIRONMENTAL IMPACTS

- Rather appropriately, the environmental impacts generated from decentralised composting are to a great extent those responsible for producing social and economic gains, including: long-term preservation of valuable agricultural land; improved soil fertility and structure as a result of more readily available and affordable compost; improved community cleanliness and less littering in public spaces as a result of a more coordinated and integrated waste management strategy; and land fill sites that will be less polluting, less odourous and less full as a result of the diversion of biodegradable wastes from the municipal waste stream.

If you would like more information on the benefits of decentralised composting solutions, including access to the full project report, workshop report or other materials, please feel free to contact us.

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