Sustainable Composting

Case studies and guidelines for developing countries

Editor: Mansoor Ali

Contributors
Malcom Harper
Anjum Pervez
Jonathan Rouse
Silke Drescher
Chris Zurbrugg

Prepared in collaboration with SANDEC/EAWAG, Switzerland

Water, Engineering and Development Centre
Loughborough University
2004

Chapter 3

Decentralized composting in India

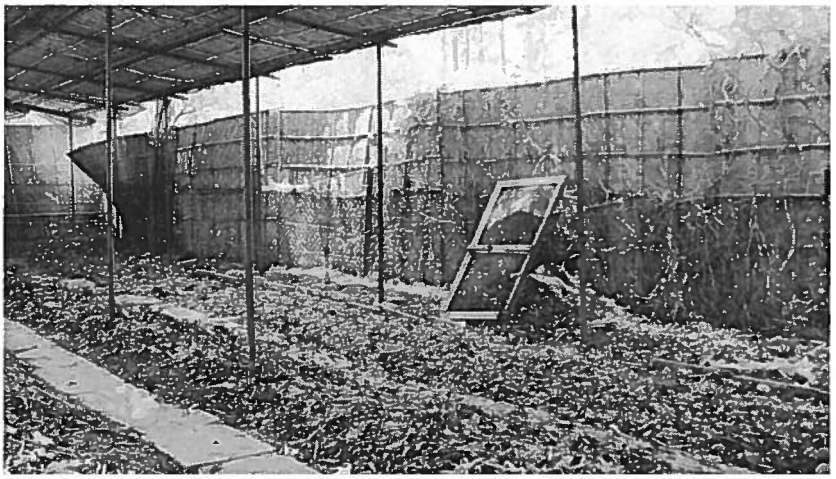
Silke Drescher and Christian Zurbrügg

EAWAG/SANDEC, P.O. Box 611, 8600 Dübendorf, Switzerland

This study was carried out as a part of the Department of Water and Sanitation in Developing Countries (SANDEC)'s Environmental Sanitation Research Programme. The project 'Decentralized Composting in India' aimed at assessing all relevant aspects of decentralized composting schemes, in order to set up recommendations for municipal stakeholders and interested individuals and groups.

The waste management situation in Indian cities was considered desperate in the late 1990s, with little hope for improvement in the near future. This gave rise to a public interest litigation filed in the Supreme Court of India. A committee constituted by the Supreme Court of India was then asked to look into all aspects of solid waste management and submit appropriate recommendations. On the basis of these recommendations (Committee Constituted by the Hon. Supreme Court of India 1999) the national legislation was adopted with the 'Municipal Solid Waste (Management & Handling) Rules 2000' (Ministry of Environment and Forests 2000). One section of the rules requires Urban Local Bodies to promote and implement waste segregation at source. The segregated 'wet' waste - the biodegradable organic fraction - has to be treated in an appropriate manner. With the existing legal backing, members of the community now have the means to force municipalities to take action.

All around India, various small-scale decentralized composting schemes are already operating with various levels of success. Often initiated by non-governmental organizations (NGOs), community-based organizations (CBOs), or motivated individuals, the experiences gained at these sites are extremely valuable for municipalities or other organizations and individuals interested in the management of organic waste.



Photograph 3.1. Shallow windrow composting at Sindh Colony, Pune. The scheme is very well protected from sight of residents and the roof protects the compost from being soaked during the rainy season. The compost is sold at Rs6/ kg to residents and neighbouring colonies.

This case study summarizes different approaches of decentralized composting schemes in the cities of Bangalore, Chennai, Pune and Mumbai. It provides information on their technical, operational, organizational, financial and social set-ups. For this case study the decentralized organizations include neighbourhood and community initiatives (by community-based organizations), company and institution initiatives for internal waste management, and private enterprises. Lessons learned from these composting experiences are briefly summarized below, but have also been documented and distributed to the Urban Local Bodies in India.

3.1 Why decentralized composting?

In the 1970s the interest in large-scale highly mechanized municipal solid waste (MSW) composting plants for urban areas grew worldwide. Most of these composting plants turned out to be serious financial failures (Dulac 2001). A study carried out in India (UNDP/WB RWSG-SA 1991) analysed 11 heavily subsidized mechanical municipal compost plants constructed between 1975 and 1985, ranging from 150 to 300 tonnes waste input capacity per day. The study concluded that in 1991 only three were in operating condition and that these plants were operating at much lower capacities than expected. The study

recommended: 'Instead of setting up one single large mechanical compost plant, it will be beneficial to set up several small manual composting plants.'

In the 1990s many small-scale composting initiatives were initiated by NGOs or community groups, often receiving some international assistance and/or advice (Furedy no date). Some of these exist to date; others have disappeared after a few project years. However, decentralized composting schemes can be seen as promising management and treatment options for urban areas, as they:

- Enhance environmental awareness in a community
- Create employment in the neighbourhood
- Are more flexible in operation and management, adapting rapidly to changes in users' needs
- Are close to the residents, allowing close quality surveillance of the service and product
- Are based on labour-intensive technology and better adapted to the specific socio-economic situation
- Reduce waste management costs for the municipality as organic waste is diverted from the municipal waste stream, thereby reducing transportation and disposal costs
- When combined with primary collection services, can decrease dependence on malfunctioning municipal services.

3.2 Types of decentralized composting schemes

The composting schemes studied in India could be categorized according to their organizational set-up into:

- Neighbourhood initiatives and community-based waste collection and composting schemes
- Medium-scale private sector composting enterprises
- Initiatives of companies and institutions composting on their premises
- Public private partnerships in large-scale composting schemes.

With exception of the large-scale partnership composting schemes, all other types can be considered decentralized approaches as they treat waste collected from defined areas in a close radius of the composting plant. A more detailed

description will provide interesting insights on the most typical technical, financial, organizational, and social factors of decentralized schemes.

Community-based schemes

Key common features of community-based schemes are:

- Their small scale of operation
- High degree of public participation
- Initiated by residents as a response to a crisis in waste management
- Primary waste collection service is mostly the core activity of the initiative for which residents pay fees.

Photograph 3.2. Composting bins at Kalyana Nagar Residents Association, Bangalore. The area is kept clean in order to avoid complaints from the neighbourhood. The compost is mainly sold to residents but also used for public gardens in the area.

The needs and priorities of the residents themselves set the framework of the scheme. Revenues by fee collection - a very tedious and time-consuming task, mostly conducted by voluntary members - often guarantees the financial viability of the scheme.

Table 3.1. Community-based initiatives, sorted by the number of households serviced

Name of scheme	Composting technique	Land space available (sq m)	No. of households serviced	Waste composted (kg/day)
Sandu Lane ALM, Mumbai	Bin composting	16	120	?
Diamond Garden Residents Forum (DGRF ALM), Mumbai	Bin composting	100	125	60
Scientific Handling of Waste Society (SHOW), Bangalore	Bin composting with active aeration	190	180	50
Sindh Colony, Pune	Shallow windrows	150	264	200
EXNORA Ramanathan, Chennai	Bin composting	40	300	300
Shyam Nagar Slum, Mumbai	Pit composting	60	350	350
Pammal, Chennai	Vermi-composting in bins	300	476	100
CEE Kalyana Nagar Residence Association, Bangalore	Bin composting	500	980	122
Residents Initiative for a Safe Environment (RISE), Bangalore	Bin composting	290	1200	300

An unreliable secondary collection service from the municipal authorities is often the main practical reason to start composting. The schemes rely on source-segregated waste. In some cases the waste collectors also sort mixed waste into different fractions during the collection process, as not all households in the collection area can be persuaded to segregate the biodegradable fraction. Some schemes have even adapted their collection vehicle to facilitate this activity. An acceptable level of household segregation is considered to be one of the key factors of successful schemes.

Most biodegradable waste is composted in bins or by vermi-composting (see Table 3.1).

Box 3.1. Advanced locality management, Mumbai

Mumbai Municipality has been successful in supporting neighbourhood schemes called Advanced Locality Management (ALM) with technical and organizational support addressing different aspects of urban life and sanitation. However, these support structures are still provisional and unfortunately are not yet institutionalized into the regular municipal functions. ALMs are formed on the basis of streets or other small areas and consist of community-based structures or neighbourhood initiatives, which are formally recognized and supported by the municipal authorities.

The municipality provides a platform for exchange and communication among ALM representatives and municipal authorities. These meetings enable the residents to convey their area-related problems such as waste collection, road repair, lighting, water supply or drainage problems in front of the municipal authorities. Initially waste collection and street sweeping are often the priority focus of ALMs. Composting activities usually follow at a later stage. Out of 670 ALMs in Mumbai, 284 have incorporated box-composting activities. The municipal target is to have at least one composting site per ward. Even if composting is not on the list of priorities for ALMs it is important to recognize that the institutionally embedded structure of the ALM system sets the framework for such possible future activities.

Photograph 3.3. Box system located at the Diamond Garden Residents Forum, treating the waste of 125 households. The compost produced is used for the greening of public places and as potting material. The bins are located above a drainage system at the former dumping area, which saves space. The neighbour appreciated the composting bins which replaced a smelly temporary dumping area.

It was observed that there is some confusion over the terminology concerning technological approaches as well as a general lack of scientific knowledge on the composting process. The term vermi-composting is very often used even when the number of worms contributing to the process is minimal and the resulting product did not consist of vermicastings (with the exception of Pammal, Chennai). Composting in bins, observed frequently, consists of filling the biodegradable fraction into brick-built bins constructed with aeration structures. Composting duration is approximately two to three months. Limited turning and watering was noted which reflects the limited technical knowledge of some schemes.

The compost produced is mainly sold in the neighbourhood, where marketing strategies are limited to word-of-mouth information by the collectors or core members of the associations. Scientific Handling of Waste Society (SHOW), an NGO in Bangalore, has also been able to target companies for compost use in their gardens and parks. Compost prices have a vast range from Rs6 in Pune up to Rs20/kg in Mumbai which also reflects the middle and high income users targeted in the areas where these schemes are often located.

The main challenges for the schemes are odour complaints by the nearby residents and the lack of municipal support and formal acknowledgement. Municipal support is often only limited to informal agreements of land provision for composting. Table 3.1 gives an overview of all the community-based composting schemes visited, considering their technique, size and capacity.

Medium-scale business oriented enterprises

These systems are run by individual entrepreneurs or NGOs, who have identified the organic waste treatment as a business opportunity and found a market for the end product. Entrepreneurs have invested private money in the business or taken loans. Banks consider investments in solid waste management projects as high-risk businesses due to a lack of experience and proven winners in this field. The high cost of land is a major obstacle for the set-up of a viable composting plant in urban areas. Therefore it is not surprising that many plants use municipal property which is provided free or at moderate rents.

The composting businesses observed do not use household wastes as feedstock. They all focus on 'pure organic' waste streams such as waste from vegetable, flower or fruit markets as well as residues from agro-industries. There is often already intense demand for these wastes, so the composting businesses have to compete for access to waste. Household waste is not preferred, as mixed waste sorting is too time-consuming and source segregation is not commonly practised.

Even though there is a potential for using segregated waste, awareness building and the implementation of such systems among households are too challenging and expensive for most of the private enterprises.

Table 3.2. Overview of small and medium size composting businesses visited

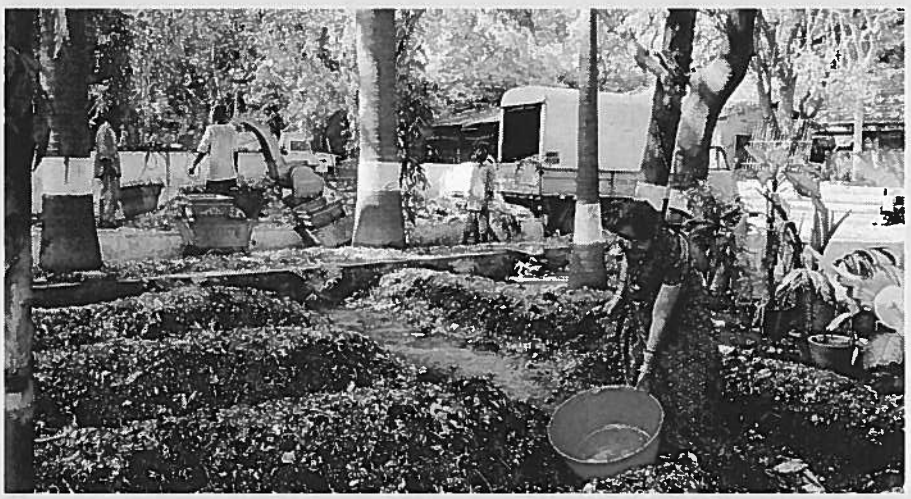
Name of scheme	Composting technique	Land space available (sq m)	Waste composted (kg/day)	Compost production (kg/ day)
Terra Firma, Bangalore	Windrow and vermi-composting	40 000	96 000	13 800
Vermigold at Dadar Pumping Station	Small windrows for vermi-composting	1 700	5 000	Not sold
Green Cross near Varsova Pumping Station	Shallow windrows	1 400	5 000	Unknown
Clean Air Island Composting Site at Colaba Pumping Station	Composting beds	760	5 000	Unknown

The assessed composting enterprises have difficulties in covering their costs through the sale of compost. This can be attributed to the difficult market situation but is also a result of weak marketing and sales strategies. With the exception of Terra Firma in Bangalore, which markets the compost through a large fertilizer distribution company, the schemes do not fully exploit the compost market. Three of the four schemes visited do not even have records of the amount of compost sold and could not tell the researchers the criteria that were used to select a market segment. For additional income some entrepreneurs act as consultants for associations or companies wanting to start composting activities or cross-subsidize the composting activities with the revenues from waste collection fees. Composting in India is still solely seen as a means of solid waste treatment, though it should be considered as a demand-driven activity addressing potential markets for compost.

Composting plants with a business approach provide job opportunities to low-income groups in India. Both male and female workers profit from the business; they are employed for waste collection, sorting, composting or as drivers. Middle-income groups with a higher education level also profit from such businesses, especially if they are run in a professional way. Secretaries,

Box 3.2. Vermigold Ecotech Pvt. Ltd., Mumbai

Vermigold is a vermi-composting company with five years' experience of providing mainly composting solutions to other organizations such as hotels, colleges, clubs and individuals, which are willing to compost their waste. Based on the premises of an old waste water treatment plant, they produce compost and worms in order to provide the material as starter and feedstock for new vermi-composting plants. They do not sell compost as fertilizer. The site is provided by the municipality at low rent. Vermigold does not get a collection fee for the market waste they collect for the scheme. The business is facing high risk as it is difficult to sell composting solutions regularly.



Photograph 3.4. Vermi-composting scheme at the Dadar Pumping Station, composting shredded market waste in small windrows

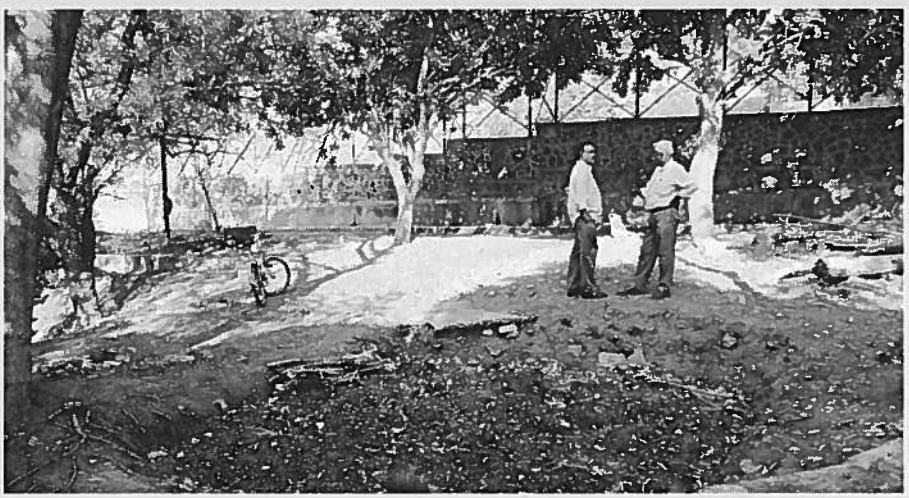
supervisors or accountants take over special duties in the whole process. In contrast to the small-scale plants, the jobs are more likely to be full time jobs and additional income from selling recyclable material is not sought.

Composting on institution and company premises

Systems and scales of operation that are chosen in these schemes are usually similar to the ones already mentioned. The systems mostly observed were bin composting in combination with vermi-composting or open pit composting.

Box 3.3. TATA Power Residents Colony, Mumbai

This corporate housing colony has 520 flats in a spacious well-wooded campus. Earlier, contractors were hired to collect the waste and dump it in municipal bins. After an enquiry and proposal from a waste-pickers co-operative, the colony changed the contractor. This women's initiative provided a significantly better service than the former contractor, however their knowledge about composting was limited. They sort the waste, sell recyclables, and compost the organic fraction on shallow beds on the campus premises. The compost remains on the campus as it cannot be sold in the Mumbai market. The initiative provides jobs to 18 women and two supervisors. The residents do not directly pay the collection fees but a residents association pays about Rs50,000 per month coming from rental fees. The shortfall of Rs15,000 is paid by a grant from the TATA Power Company.



Photograph 3.5. Pit composting at TATA Power Residents Colony, one of the least cost solutions for composting. Such systems are only feasible if plenty of space is available and residents live at a considerable distance, as odours can result from the uncontrolled composting process.

These schemes are set in a special organizational framework as they are initiated, controlled and managed by the institution or company in question. It is either the employees of the institution that operate the facilities themselves or else outside workers are contracted for this activity. The compost produced is mostly used on the premises and so does not need marketing. The decision to engage in composting results either from cost savings aspects or environmental consciousness. Cost factors can come into play where a company or institution

has to pay the municipality for transport of waste from their premises to the landfill. Thus savings of collection and transport fees can be achieved by recycling and composting. Decisions on the 'if, how and when' of a recovery scheme are usually taken by the department in charge of environmental aspects of the organization. The advantages of such top-down set-ups are the relative ease and speed of decision-making as well as tight monitoring of a scheme. The participation of residents or employees is often minimal which in turn reflects in their environmental awareness.

From the employment point of view, it is often the urban poor that benefit through regular employment for collection and composting.

3.3 Conclusions

Examples of these community initiatives reveal some of the advantages of decentralized composting, such as the improved environmental conditions in residential areas. However, this also depends on a well functioning and regular primary waste collection. There is less waste to be collected by the municipality and an increased environmental awareness among residents: citizens welcome the positive changes in their immediate environment. Separate collection and composting of market wastes also contributes to reducing the environmental impacts at disposal sites. Nonetheless, decentralized composting cannot fully develop its effectiveness due to some critical prevailing operational and institutional issues.

The direct stakeholders involved in decentralized composting are recommended to reflect and improve on the following points in order to attain long-term feasibility and operational profitability.

Accounting and transparency

The data collected during the field study revealed a scarcity of documentation on mass flows and unclear financial figures. Numerous cases lack an information database and project planning is therefore not possible. Input-Output Tables for waste, compost and recyclables as well as monthly Cost-Revenue Balances would increase transparency and would also provide a sound basis for negotiations with the municipal authorities. Improved data documentation would thus increase the professional status of citizens' initiatives as well as junior companies.

Composting technique

Improvement measures are also required for most of the composting schemes, particularly to ensure a controlled composting process to prevent odour emissions and related complaints from nearby residents. During the field study, various competence centres for composting were identified for their important role in the dissemination of appropriate composting techniques (e.g. Institute of Natural Organic Agriculture or INORA, Pune).

Marketing

Development of adequate strategies and the identification of market segments for compost are the prerequisites for successful and long-term operation of decentralized composting. Nearly all enterprises examined lack an appropriate business plan including a marketing strategy. A timely assessment of different improvement options is required, such as direct marketing or the use of already available outlets of other contractors of agricultural products.

The role of municipal authorities

Common challenges for all decentralized composting schemes were identified that constrain the replication of such activities on city-wide level. A main common difficulty of all decentralized schemes is considered to be the lack of municipal acceptance and support.

Municipal support for decentralized schemes was observed to be limited to the provision of land, and, even these sites are usually allocated in an informal manner and do not give the composting schemes any legal backing. It is recommended that municipalities ensure:

- Political will and continuity of policy
- Development of action plans on how to ensure appropriate organic waste management
- Education and training of the entire MSW personnel
- Prompt and regular lifting of compost rejects (materials without recyclable value, currently especially thin polyethylene bags) from decentralized composting sites
- Encouragement of institutions, companies and citizens to take up composting
- Recruiting resource persons who can provide sound technical guidance on composting

- Buy-back arrangements and use of locally produced compost by the city authorities
- Promotion of and assistance with marketing activities for compost use in private gardens as well as for agricultural purposes
- Household segregation.

If there are financial profits from compost sales, they are small. Currently it does not seem possible to achieve 'gold from waste', as is sometimes stated. However, the increased interest of municipalities in organic waste management by composting, increased awareness on compost benefits, and developing markets for compost could significantly change the picture in the near future.

3.4 References and further reading

Committee Constituted by the Hon. Supreme Court of India, (1999). Solid waste management in Class I cities of India. Hon. Supreme Court of India, India.

Dulac, N., (2001). The organic waste flow in integrated sustainable waste management. A. Scheinberg, editor. Tools for Decision-makers -- Experiences from the Urban Waste Expertise Programme (1995-2001). WASTE, Nieuwehaven.

Furedy, C. (no date), Initiatives for Source Separation and Urban Organic Waste Reuse. Internet source: www.gdrc.org/uem/waste.

Ghosh, A., (1998). Management of Urban Environment - A Study on Post-Plague Initiatives of Surat Municipal Corporation. Urban Studies Department, Institute of Social Sciences, Delhi.

Ministry of Environment and Forests, (2000). Municipal Solid Wastes (Management and Handling) Rules 2000. The Gazette of India, New Delhi.

Rajagopal, K., (1998) India's Environment Pollution and Protection. Report No. 97ED57, Submitted to Central Research Institute of Electric Power Industry (CRIEPI, Japan). Tata Energy Research Institute (TERI), New Delhi, http:// www.teriin.org/reports/rep01/rep01.htm.

UNDP/WB RWSG-SA, (1991). Indian experience on composting as means of resource recovery. UNDP/WB Water Supply and Sanitation Program South Asia, Workshop on Waste Management Policies, Singapore 1-5 July 1991, India.