



Decentralised Composting

An Option for Indian Cities ?

Report of a Workshop held in Bangalore, India

4- 5th June, 2002

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Introduction & Programme

The workshop "Assessment of Decentralised Composting Schemes in India" was held in June 4 – 5th 2002 in Bangalore following a previous study tour by the research team in March 2002 to 6 cities and 19 composting schemes in southern India. The objective of the study tour was to appraise existing schemes in view of technical, organisational, financial, marketing, institutional, and social aspects. The main issues and results were documented in a draft report on "Decentralised composting in India – An Option for India". This report served as basis for discussion throughout the workshop.

The research team would like to thank the participants that gave us the benefit of their observations and insights during the workshop and for their interest and active participation. Special thanks goes to Mr. George Verghese of CEE, and Mr. Subramanya Secretary of the Residents Association in Kalyana Nagar, as well as Mr. Suresh of KCDC for their generous offer to show the participants around their sites and answer the numerous questions. Finally, we wish to thank the Swiss Agency for Development and Cooperation (SDC) and the Swiss Federal Institute for Environmental Science and Technology (EAWAG) for their financial support.

WORKSHOP PROGRAMME

4th May 2002.

9.00 AM.	Assembly at the Hotel The Basil
10.00-12.30	Visit of Kalyana Nagar Site
14.30-17.00	Visit of KCDC Facility
20.00-	Workshop Dinner

5th May 2002

09.00-09.30	Registration
09.30-09.45	Welcome, The Study, Institutions Involved
09.45-10.30	Presentations on the Findings of the Study
10.30-11.00	Coffee/Tea
11.00-11.30	Introduction to working group objectives
11.30-13.30	Group Work
13.30-14.30	Lunch
14.30-15.00	Finalisation of Presentation by Groups
15.00-15.15	Tea/Coffee
15.15-16.30	Presentations by Groups & Discussion
16.30-17.00	Conclusions
17.30-	Departure of out-station delegates

1 Site visits

On the 4th of June 2002 the workshop participants attended field trips to the composting schemes of Kalyana Nagar and Karnataka Compost Development Corporation (KCDC) in Bangalore.

1.1 Kalyana Nagar

A classic situation of the problem of development and provision of services and maintenance in planned and unplanned areas was evident in the 1990s in four new layouts being developed by the Bangalore Development Authority (BDA), Kalyana Nagar, Brindavan, Bhuvanagiri, and Kasturi Nagar. In partnership with the Center for Environment Education (CEE) and Technology Informatics Design Endeavour (TIDE), the BDA presented a project to the Norwegian Agency for Development Cooperation (NORAD). The project components were: 1) Geographical Information Systems; 2) Solid Waste Management; 3) Open Spaces Management; 4) Project Secretariat.

In the solid waste management project component, focus was set on developing an approach of action and mobilisation among the community to initiate and implement a community operated solid waste management system. This also involved setting up a composting scheme for the biodegradable fraction.



Figure 1: Composting bins of the main Kalyana Nagar composting site

Waste is collected in handcarts from door-to-door and sorted by the employed waste collectors during collection. Biodegradable waste and "dry" non-biodegradables are loaded into separate bins on the collec-

tion handcart. The bins are then delivered to a "recovery center". Here the biodegradable fraction is piled into composting bins (9x4x3 feet) and the non-biodegradables sorted according to their value as recyclables or rejects. Rejects are collected regularly by the municipal truck at a communal collection point.

After three years of operation, management of the schemes was handed over by CEE to a residents association which has set up a waste management committee structure. This body is now responsible for all operational and planning procedures concerning waste management.

1.2 KCDC

The Karnataka Compost Development Corporation (KCDC) was one of 11 composting units set up in 1975 based on WHO technology. Within a year, 10 of these had stopped, because the WHO technology could not handle unsegregated Indian waste, and the design caused marketing problems (glass splinters in the compost).

In the 70ies, on 15 acres of land KCDC processed 50-60 tons of mixed waste per day. They have expanded to using 22 acres and processing 150 tons/day until last year, and currently process 250 tons/day of mixed waste plus 50 tons/day of market waste for which they won a tender to collect it in their own vehicles. KCDC hopes to increase waste intake to a total of 400 tons/day after commissioning the vermi-composting bins which are currently in construction on additional 7 acres.



Figure 2: KCDC, elongated heaps (windrows) on sealed composting surface

Waste heaps (approx. 13 feet wide, 10 feet high and of varying length) are shaped by the available 3 payloaders (Front End Loaders). These vehicles are also used for turning the heaps. Cowdung slurry is used as starter culture, which is sprayed onto the waste heaps (cowdung slurry consists of 2 baskets of fresh cowdung to 200 litres of water). Two process stages, a high temperature stage (70-75 °C) lasting for 10-15 days, and a middle temperature stage (40-45 °C) after that, can be observed. Waste material only going through a composting process stays in the heaps for about 60 days. For the planned vermicomposting process, partly-composted material (after 25-30 days) is taken from the heaps and piled into bins. After leaving the waste for 3-4 days to bring the temperature down to 27-30 degrees, worms are introduced. Four species of African worms are used. This vermicomposting in bins takes about 30-40 days, depending on worm density. A top layer of vermicastings is harvested every 3 days and sieved by a rotary screen.

Aerobic windrows go through 4 sieving stages after 60 days. Mesh size is 50 mm, 25 mm, 8 mm and 4 mm, all through rotary screens (which are replacing their vibro-screens). The 50 mm screen removes 80-90% of the non-biodegradables, which amount to 30% by weight.

Two Bobcats are used for cleaning the site and feeding the rotary screens and spreading coarse compost for soaking up leachate from the heaps. Recently KCDC has also added a 50,000 litre leachate storage tank.



Figure 3: KCDC rotary screens

One rag-picker family pays KCDC Rs 5000 a year for waste-picking rights. KCDC employs 50 permanent staff (including 36 on the yard) at about Rs 5-6000 per month, plus another 40 casual daily wagers at Rs 60-100 per day (i.e. Rs 1560 to 2600 per month).

Plain 4 mm compost is sold at Rs 950/ton. Enriched compost contains 75% plain compost + 2.5-3% Rock phosphate (@ Rs 3300/t) + Neem cake (@ Rs 3900/ton) + 5-6% poultry manure (@400/ton) + 5-6% sugar-factory press mud (@ 350/ton). It is sold for Rs 1600 per ton locally or Rs 2700 per ton at Bidar in far north Karnataka. It is used on farms, estates and plantations, and sold through the Dept of Agriculture or Horticulture, with subsidies. These Departments are given 2 months' credit, and dealer margins are 10-15%. Vermicompost is sold at Rs 2.75 per kg unbagged, or Rs 3.40-3.50 per kg in 50-kg bags. City sales are at Rs 4 per kg, door delivery.

2 Presentation of Results

The research study, conducted by SANDEC (Ms. Silke Drescher & Mr. Chris Zurbrugg), Almitra H. Patel, and H.C. Sharatchandra, involved an assessment of 20 composting sites (including one anaerobic digestion scheme) in 6 cities of southern India. A draft report of the study was handed out to all workshop participants and the results were presented in a summarised form. Main messages of the presentation are summarised below.

What waste management system do we want to achieve?

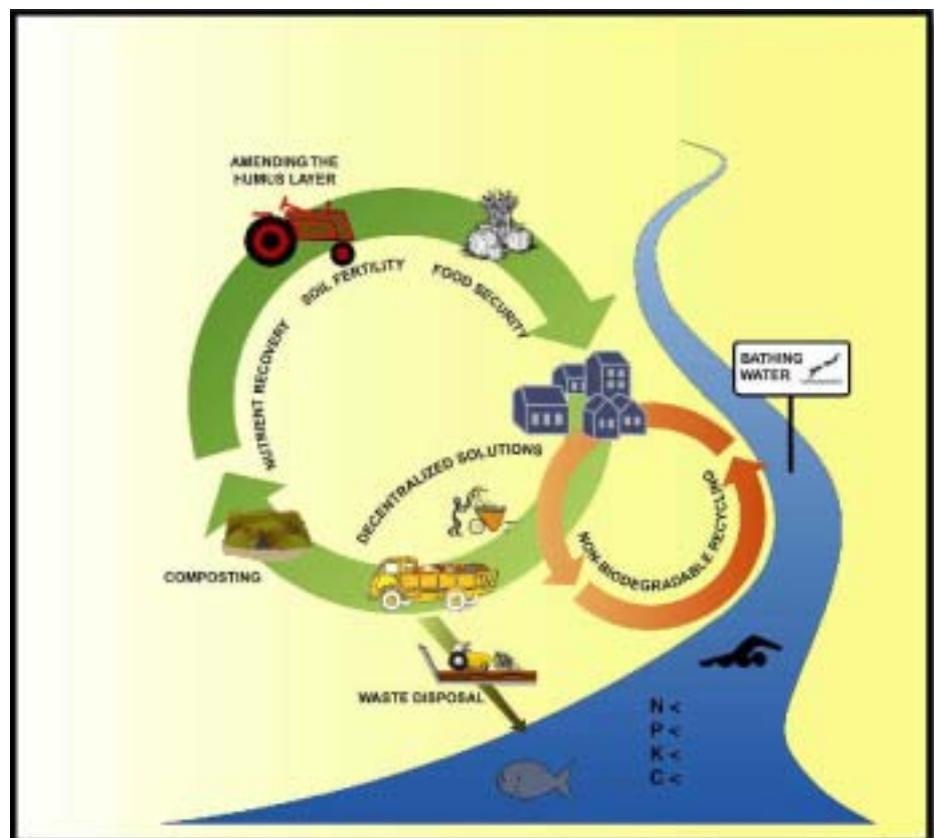


Figure 4: Ecological and sustainable waste management involves closing material cycles and thus providing maximum potential for recovery, recycling and reuse of inorganic and organic waste fractions.

What is the framework in India?

- A) The Report of the Supreme Court of India (1999): Solid Waste Management in Class I Cities in India, recommends
 - composting as one part of the SWM, decentralised if possible
 - incentives for setting up compost plants
- B) The legal framework of the Municipal Solid Wastes (Management and Handling) Rules (2000)

- Regulates composting as one treatment option for biodegradable waste
 - Aims for waste segregation at source
 - Defines standards for composting sites and compost quality
- C) The waste composition: at least 40-50% of municipal solid waste is biodegradable

Why this study?

SANDEC and the research team want to address municipal officers and decision-makers as well as the interested public, and provide insights on the potential of decentralised composting as one part of a sustainable SWM system.

Why should a municipality get involved in management of biodegradable municipal waste?

- to minimise waste amounts in dump sites and landfills
- to reduce waste management costs (e.g. transportation, disposal)
- to improve nutrient and humus content and soil condition of agricultural land
- to reduce environmental impact of uncontrolled rotting waste (e.g. ground water pollution, methane production, vermin, stray dogs)

What are the potential advantages of decentralised composting?

- supports municipal solid waste collection services
- reduces further transportation of waste
- reduces the area required for centralised waste processing and landfilling
- creates employment in the neighbourhood
- enhances environmental awareness in the neighbourhood
- direct contact and intense interaction with residents (e.g. for household segregation or payment of waste collection fees)

Observed existing experiences

20 sites in 6 cities of southern India were classified according to their organisational set-up and scale of operation into:

- A. Backyard composting
- B. Neighbourhood and Community-based (CBO) composting
- C. Composting on premises of institutions and companies
- D. Middle-scale composting enterprises
- E. Large-scale centralised composting facilities

Type	Name of site/ location	Location	Composting Technique	Feed stock	Organisational Setup
A & B	EXNORA	Chennai	Bin-composting	household segregated solid waste	NGO & CBO
B	Pammal	Chennai	Vermi-composting	household segregated solid waste	NGO & CBO
C	Central Leather Research Insitute (CLRI) / BELL	Chennai	Pit-composting	sorted mixed household waste	Company initiative
B	Scientific Handling of Waste Society(SHOW),	Bangalore	Bin-composting	household segregated solid waste	CBO
B	CEE, Kalyana Nagar Residence Association	Bangalore	Bin-composting & Vermicomposting	household segregated solid waste	NGO & CBO
B	Residents Initiative for a Save Environment (RISE)	Bangalore	Bin-composting	household segregated solid waste	CBO
C	Bharat Electronics Limited (BEL)	Bangalore	Anaerobic digestion	canteen waste	Company initiative
D	Terra Firma	Bangalore	Windrow composting and vermi-composting	market waste, agro-industry waste	Enterprise
E	Karnataka Compost Development Corporation	Bangalore	Windrow and Vermi	mixed waste	Contractor of City
E	Vennar Organic Fertiliser	Mysore	Windrow composting	mixed waste	Enterprise
E	Envirex, MSW Treatment Plant	Vasco de Gama, Goa	Windrow composting	mixed waste	Enterprise
B	Sindh Colony	Pune	Windrow composting	sorted mixed household waste	CBO
B	Diamond Garden Residents Forum ALM (DGRF)	Chembur, Mumbai	Bin-composting	household segregated solid waste	CBO
B	Sandu Lane ALM, Chembur, Mumbai	Chembur, Mumbai	Bin-composting	household segregated solid waste	CBO
B	Shyam Nagar Slum, Mumbai	Mumbai	Pit-composting	household segregated solid waste	CBO
C	Orchid Eocotel	Mumbai	Vermi-composting in bins	segregated waste and kitchen waste	Company initiative
C	Tata Power Colony	Mumbai	Pit-composting	sorted mixed household waste	Company initiative
D	Dadar Pumping Station, Vermigold	Mumbai	Vermicomposting in heaps	market waste	Enterprise
D	Varsova, Green Cross, Composting Site	Mumbai	Vermicomposting in heaps	market waste	Enterprise
D	Clean Air Island, Colaba Composting Site	Mumbai	Vermicomposting in heaps	market waste	NGO

Table 1: Overview of visited sites



Figure 5: Map of visited locations

Results on technical and operational issues?

Backyard composting in plastic recycled 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 drums in which vegetables or other plants are placed. These drums can be kept on terraces (also called terrace gardening).

Community-based systems are frequently bin-composting systems or vermi-composting systems. These usually small-scale systems (<2 t/day) are always combined with a residential waste collection service. Waste is collected either already segregated or else is sorted by the waste collectors depending on the degree of participation by the residents. Composting is usually a secondary spin-off activity of the waste collection system.

Company and Institution composting have similar technological approaches as the community-based schemes. As there is often enough space available on the premises, optimising the use of space is often not a priority issue.

Medium-scale composting enterprises are mostly larger in scale than the above (2-10 tons/ day). Schemes observed mostly use vermi-composting technology in windrows and treat pure biodegradable market waste which they collect themselves.

The general space requirements for composting depend on the approach used. An average space requirement of 150 sq m per ton of waste per day can be used, however detailed estimates have to be evaluated according to the design envisaged. All schemes observed depend on the municipality for providing land either free of charge or at a very cheap lease.

Results on the financial and marketing issues?

For **backyard composting** a one time investment of Rs. 600-800 is necessary. The life time of a drum is around 5 years. Marketing of compost is not an issue as the compost is used in the composter's own garden.

In **community-based systems** investments show large variations from Rs 1 - 71 lakh per ton per day. This depends on the approach used and the supporting type infrastructure built or purchased (office building, collection vehicles, etc.). An average estimate is ~ Rs 2.5 - 3.5 lakh per ton per day. Operational costs consist of 70 - 90 % for salaries due to the manual labour approach used in these schemes. Markets for sales are usually restricted to the neighbourhood where prices are comparatively high but demand is low.

Medium-scale composting enterprises, benefit from lower investment cost per ton of waste because of economies of scale. An average of Rs 1 - 1.4 lakh per ton per day can be used as an approximation. Limited markets for compost sales are a large challenge which all systems face.

In all financial evaluations, land costs were never taken into account!

Financial and economic cost and benefits

Financial evaluations focus on the composting scheme itself. However, for a holistic view, the cost savings from decentralised schemes from reduced transportation and landfill costs would need to be taken into account. A simple example can illustrate this aspect.

Municipal waste transportation costs average Rs 1250 per ton of waste.

A small neighbourhood initiative with a composting scheme of 600 kg waste per day diverts 22 tons a year from the municipal waste stream. This amounts to savings in transportation costs for the municipality of Rs 27,500 per year.

Assuming all currently 670 existing neighbourhood schemes divert the same amount of waste, this amounts to cost saving for the municipality of Rs 1.8 crores per year on 400 tons of waste a day.

Realistically this figure is probably even higher as this calculation does not include cost savings due to saved landfill space or reduced environmental pollution potential by the landfill.

Social and organisational aspects

Community-based schemes have important social cohesion and empowerment functions which go far beyond only waste management. Collection and cleanliness is the main priority for the residents, composting thus is not regarded as essential. These schemes depend very strongly on municipal goodwill and collaboration for land allocation and collection of rejects. The examples of Advanced Local Management citizen groups called ALMs in Mumbai are a good example of such successful public/community partnerships.

Company and institution composting have the advantage of centralised and clear decision-making structures which can be of great advantage for the municipality for easier negotiations and coordination. Often a lack of employee and employee household member participation was observed.

Middle scale enterprises focus on existing pure waste streams such as market waste or agro-industrial wastes – thus there is very little involvement on the residential level.

Large scale composting schemes suffer greatly from indiscriminate delivery of non-biodegradable waste mixed with organic waste. The refuse accumulates although agreements with authorities to collect and dispose of this fraction are arranged.

Institutional aspects

Community-based schemes depend to a large extent on municipal support and possibilities of communication and coordination. Sometimes a certain degree of support is available through the allocation of land, however most often these schemes are not recognised or accepted by the municipality as partners in solid waste management. Mumbai municipality has shown efforts to support and integrate them into the "system" through the ALM program.

Middle scale enterprises depend on municipality for land and for waste allocation contracts. They all lack support with buy-back arrangements for compost or by development of market demand.

Role of Citizens and Institutions

- Cease littering and indiscriminate dumping
- segregate waste at source
- avoid mixing of wet, dry or inert wastes
- enable provision of separate individual or communal bins for different waste fractions
- undertake composting in backyards and/or utilise compost

Role of Municipal Authorities and State Government

- Political will and development of state policy and regulations as well as a municipal policy, acts and regulations
- Development of a "master plan" for separation and composting

- Active promotion of waste minimisation and recycling
- Active promotion of household segregation
- Education and training of municipal officers and workers
- Recruiting a resource person for support and advice
- Encouraging institutions and companies to adopt recycling strategies
- Using compost in public spaces

3 Working Group Results

Three working groups were established to discuss the main challenges faced by decentralised options, to describe potential solutions and to recommend necessary support by the public and by the authorities. Challenges identified by the working groups were discussed and prioritised (by points) by all participants in a general forum.

3.1 Technical and Operational Issues

Problem	Lack of Technical and Operational Knowledge
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- Lack of on-job training facilities/possibilities for decentralised composting unit operation. (7 points)
- Lack of sound resource persons/institutions identified that can provide assistance for composting/vermicomposting knowledge transfer. (3 points)
- Lack of knowledge on composting/vermicomposting in CBOs, municipal authorities and institutions/companies and enterprises. (Information is available but is not well disseminated) (2 points)

Suggested Solutions

- Forming of a specific body (Composters Association or Federation)
- Supported financially by the government authorities
- Responsible for networking
- Conducts pre-operational surveys for suggesting appropriate composting technique
- Monitors member schemes in technical and operational issues
- Serves as hotline for troubleshooting
- Develops information material, literature and audio visuals
- Advises on quality improvement (see below)

Problem:	Lack of Quality Assurance (3 Points)
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Suggested Solutions

- Support by authorities to analyse compost samples (e.g. Pollution Control Board Labs)
- Developing guidelines coupling quality criteria to appropriate use of the product

- Developing common standards for compost (in preparation by KVIC)

Problem: **Lack of list of proven technologies**

Suggested Solutions

- Pot and container composting (on household level on terraces or gardens)
- Drum or bin composting (for households with gardens)
- Pit composting (if large spaces available, ideal for pruning and garden waste; only if groundwater and water supply contamination potential does not apply)
- Vermicomposting in windrows or bins (depending on available space and waste; for neighbourhoods, CBOs, institutions, companies, as well as middle-scale enterprises)
- Aerobic composting in windrows or bins (for scales larger than 0.5 tons per day; available space and waste type)

3.2 Financial and Marketing Issues

Problem **Financial challenges of CBO/NGOs**

- Lack of payment by residents due to mindset, reluctance or lack of information (8 points)
- Lack of seed money or shared cost arrangements with municipality (due to cost savings) (2 points)

Problem **Financial challenges of enterprises**

- Lack of approved project reports for use in obtained approval or bank loans (2 points)
- Lacking provision of pilot phase where royalties are excluded
- No tax exemption for capital costs of such pollution abatement schemes
- No penal clauses for uncollected or unsegregated waste

Suggested Solutions

- Support from all government Organisations for developing market for compost
- Increased awareness building and fee payment enforcement for residents
- Sales taxes exemption for investments made and for the compost product

- Provide cost sharing structures with municipalities and government agencies for partly reimbursement of avoided costs to municipality
- Exempting royalties in a pilot phase
- Sales taxes exemption for investments made and for the compost product
- Support in kind by municipality in providing prompt and regular collection and transport of rejects.

3.3 Social Mobilisation and Organisational Issues

Problems

- Lack of awareness, sensitivity and acceptance (NIMBY) and lack of participation (5 points)
- Lack of support from authorities for social mobilisation (3 points)
- Lack of good and sustainable leadership (2 points)
- Lack of support from media (1 point)
- Threat of privatisation trend which will kill local activities (1 point)
- Lack of participation of public and private institutions
- Misunderstanding concerning segregation (better phrase – do not mix)
- Threat of court cases by a few aggrieved individuals which can close down successful schemes

Suggested Solutions

- Awareness programs for children with site visits of dump and composting schemes
- Public awareness campaigns including use of media
- Forming sustainable organisational structure in CBO initiatives
- Ensuring government and local authority support for enforcing segregation at source
- Increased awareness building and fee payment enforcement for residents

3.4 Institutional Issues

Problems

- No policies and legal guidelines or regulations for decentralised schemes (3 points).

- No institutional framework to plan, support and co-ordinate composting activities
- Lack of acceptance by municipalities of decentralised composting approaches.
- No land use planning and earmarking of composting sites

Suggested Solutions

- Develop institutionalised framework for planning, authorisation and support of decentralised composting schemes
- Develop local policies for organic waste management
- Earmark some Civic Amenity sites in new layouts as designated waste-processing sites for decentralised options.

4 List of Participants

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