



# Successful Innovations in Solid Waste Management Systems

Examples from Five Local Bodies in Tamil Nadu



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Photo credits:

Photos were taken by the author, Brooks Anderson, and contributed from the archives of Exnora Green Pammal, Gandhi Nagar Town Panchayat and Mudichur Village Panchayat.

## Acronyms

DEWATS	Decentralized Wastewater Treatment System
DRDA	District Rural Development Agency
EM	Effective Micro-organisms
EO	Executive Officer
Exnora	Excellent, Novel and Radical
MDG	Millennium Development Goals
MIS	Management Information System
MoU	Memorandum of Understanding
MSW	Municipal Solid Waste
NGO	Non-governmental Organization
SCOPE	Society for Community Organisation and People's Education
SEED	Socio Economic and Education Development
SHG	Self Help Group
SWM	Solid Waste Management
UNICEF	United Nations Children's Fund





## Introduction

Improving solid waste management services in India is an urgent challenge for all levels of the government. Littering and the indiscriminate disposal of solid waste are widely practiced, polluting India's air, water, soil and inhabitants. Such pollution impedes India's efforts to achieve the Millennium Development Goals (MDG). The nation's measures to combat malaria and other diseases (MDG 6), reduce child mortality (MDG 4), and ensure environmental sustainability (MDG 7) are all hampered by the unsightly and unhygienic conditions created by the accumulation of waste.

Accumulated solid waste clogs drains, causing water stagnation and flooding. Pools of mixed solid and liquid waste, often combined with human feces, create breeding grounds for pests such as rats, mosquitoes, dogs, flies, fleas, and cats. These pests serve as vectors that spread diseases such as malaria, polio, chikungunya, dengue, cholera, typhoid, and schistosomiasis. India's high infant mortality rate is due largely to poor sanitation. According to the Ministry of Rural Development, approximately 88% of the total disease load is due to lack of clean water and sanitation, and the improper management of solid and liquid waste.<sup>1</sup> Burning mixed waste creates toxic byproducts and noxious fumes.

The production of waste is expected to increase dramatically. In 2001, scientists estimated that in India, "the total waste quantity generated in 2047 will be approximately above 260 million tonnes—more than five times the present level." Landfill area for this quantity of waste would be approximately 1,400 square km.<sup>2</sup>

Perhaps the most rapidly growing form of waste is electronic waste. India's electronic waste stockpile as of the year 2005 was estimated to be 1,46,180 tonnes, and is expected to exceed 8,00,000 tonnes by 2012. Among the states, Tamil Nadu is the second largest producer of electronic waste in the country.<sup>3</sup>

This document illustrates examples of the implementation and impact of solid waste management innovations



in five localities in Tamil Nadu; Musiri Special Grade Town Panchayat in Trichy District, Mudichur Village Panchayat in Kanchipuram District, Pammal Municipality in Chennai, Gandhi Nagar Selection Grade Town Panchayat in Vellore District, and Melpattampakkam First Grade Town Panchayat in Cuddalore District. The solid waste management systems in these localities are widely regarded as successes that deserve replication.

This document has been produced to inspire and enable more local body authorities to emulate such successes. These innovations have brought about many immediate, as well as long-term benefits, both to residents and to local authorities. Benefits include, but are not limited to;

- ❖ appreciation from residents
- ❖ beautification of the locality
- ❖ keeps drains free of litter
- ❖ brings the locality into compliance with applicable directives and guidelines
- ❖ reduction of smelly and unsightly litter
- ❖ improvement of public health
- ❖ greater respect and recognition for the locality
- ❖ generation of employment, creating opportunities to lift people from extreme poverty
- ❖ significant reduction of the need to landfill waste
- ❖ production of compost

The experiences of these localities also demonstrate that improving waste management systems is technologically simple, but requires sustained and committed leadership, public awareness and participation, and talented management. Most importantly, success depends upon;

- ❖ the recognition that municipal waste, if managed properly, is a resource of considerable economic value
- ❖ the cooperation, support and involvement of all council members
- ❖ the willingness of the public to segregate waste at its source
- ❖ the extent to which society begins to reduce, reuse and recycle, rather than discard material goods

Funding to establish and operate solid waste management services is available through several government schemes and funds. Once established, waste management systems generate revenue, through the collection of user fees, and the sale of compost and recyclable materials, which pays for some of their operating cost. In some places, local authorities have entered into a partnership with a private company or an NGO, to design, establish or operate solid waste management services. However, the experiences of Melpattampakkam Town Panchayat and Gandhi Nagar Town Panchayat demonstrate that local authorities can establish and successfully operate solid waste management services largely on their own.

Improving solid waste management services involves integrating activities that include the segregation, collection, storage, transportation, processing and disposal of solid waste. This document presents the common steps that five localities took to establish and operate innovative solid waste management systems.

<sup>1</sup> Ministry of Rural Development and UNICEF 2007.

<sup>2</sup> Singhal and Pandey 2006.

<sup>3</sup> Central Pollution Control Board 2008.

# Profiles of Five Solid Waste Management Systems

Musiri Special Grade Town Panchayat, Trichy District

Population: 30,000 Wards: 18

Waste collected: 6,000 kg/day

Number of transfer points: 11

Number of additional people employed for house to house collection: 10

Equipment: 8 tricycles, 10 pushcarts, 1 power tiller and 2 tractors with trailers

In 2005, Musiri's 4 acre dump was filled to 70% of its capacity. Panchayat officials realized that they either had to find a new dump yard, or dramatically change the way that they manage the town's waste. They approached SCOPE, a Trichy-based NGO that specializes in sanitation, and requested help to develop a system to better manage the town's solid waste.

SCOPE trained the residents of 6 wards to sort their waste at home, and accompanied Musiri officials on a tour to study solid waste management systems in Vellore and Bangalore.

With Rs. 4 lakhs from the 12<sup>th</sup> Finance Commission, the town cleared 1.5 acres of its dump, and constructed a compost shed. Ten lakhs rupees of entertainment tax money is being used to build a concrete platform for vermicompost production. SCOPE designed and donated a machine for sieving the compost. The township received Rs. 1.5 lakhs from Exnora International and Rs. 3 lakhs from the DRDA to construct a decentralized wastewater treatment (DEWATS) facility for a community toilet in the compost yard. This facility treats 4,000 litres of water per day, which is sprayed on the compost windrows. House to house collection of waste has been extended to all 18 wards. Musiri has sold over Rs. 70,000 worth of compost, and Rs. 40,000 of mixed plastic.

Mudichur Village Panchayat, Kanchipuram District

Population: 20,000 Wards: 4

Waste collected: 2,000 kg/day

Number of transfer locations: 2

Number of additional people employed for house to house collection, street sweeping, waste sorting and compost production: 30 + 2 supervisors

Equipment: 16 tricycles, 1 tractor with trailer

In 2005, Mudichur Panchayat contacted Hand in Hand/SEED Trust, a Kanchipuram-based NGO, and negotiated a 4-year memorandum of understanding (MoU) by which the panchayat provides land and buildings for vermicompost production and waste sorting, and the NGO manages the waste collection and processing system. The Kanchipuram Collectorate provided Rs. 4.8 lakhs for the purchase of waste buckets and tricycles, and the construction of physical facilities.

The NGO collects a monthly user fee of Rs. 20 from every household, and also earns revenue from the sale of compost and recyclable material.

The panchayat officials were actively involved in raising public awareness about the new waste collection system, and painted 109 large yellow notices throughout the village.

Waste is sorted into 15 categories before being sold to scrap merchants.

The NGO earns Rs. 3,000 per month from the sale of vermicompost, and Rs. 6,500 per month from the sale of recyclable material. The NGO also collects Rs. 68,000 in user fees each month.

Exnora Green Pammal

Pammal Municipality, Chennai

Population: 1,00,000 Wards: 21

Waste collected: 27,000 kg/day

Number of people employed for house to house collection, street sweeping, sorting of waste, and compost production: 159 + 6 supervisors

Equipment: 150 tricycles, 45 pushcarts, 1 ox cart, 2 tractors with trailers, and 1 power tiller

The solid waste of Pammal Municipality is collected and processed by Exnora Green Pammal, an NGO that the municipality has contracted the work to. As per the terms of the contract, the municipality allocated land for the construction of a 1.1 acre waste processing and vermicomposting facility, and PepsiCo India sponsored the construction of the facility. The facility is equipped with 120 composting tanks of 1 ton capacity each, a cow shed, storage and sorting sheds, a training hall and a meeting room. The municipality also supplied collection carts, and pays Exnora Green Pammal a daily service charge of Rs. 0.95 per house that it serves.

Sale of recyclable material earns between Rs. 10,000 and Rs. 15,000 per month, while vermicompost sales fluctuate according to seasonal demand, averaging 1,000 kg/month, at prices ranging between Rs. 3.8 and Rs. 10/kg.

Gandhi Nagar Selection Grade Town Panchayat, Vellore District

Population: 10,700 Wards: 15

Waste collected: 1,600 kg/day Number of transfer points: 0

Number of additional people employed for house to house collection, sorting of waste, and compost production: 6 + 1 supervisor

Equipment: 8 tricycles, 2 tractors with trailers, 1 power tiller

The Gandhi Nagar solid waste management system was inaugurated on 28 July, 2003. Town panchayat officials, staff and residents were guided in establishing their system by a local Exnora affiliate. The panchayat constructed a 3,600 ft<sup>2</sup> compost shed, a waste segregation cum tricycle parking shed, storage facilities, a cattle shed, and a vermicomposting shed with funding that they received from the 11th Finance Commission, the equalization fund, and the town's general funds. The panchayat officials motivated local businesses to sponsor the purchase of 8 tricycles, as well as red and green buckets for distribution to all households.

In the financial year 2006-07, Gandhi Nagar sold recyclable materials worth Rs. 1,76,005, and compost worth Rs. 37,970, and collected user fees of Rs. 3,43,334.

Melpattampakkam First Grade Town Panchayat, Cuddalore District

Population: 8,000 Wards: 15

Waste collected: 600 kg/day Number of transfer points: 1

Number of additional people employed for house to house collection, sorting of waste, and compost production: 6

Equipment: 6 pushcarts, 1 tractor with trailer

House to house solid waste collection was initiated in Melpattampakkam in March, 2007, by the town chairperson, Mr. V. Jeyamurthy. Mr. Jeyamurthy selected a 40 cent plot of government land on which he constructed 22 vermicomposting bins, a drying floor, a storeroom and a covered sorting area. He received Rs. 10 lakhs from the Commissionerate of Town Panchayats to establish these facilities, and Rs. 2.6 lakhs from the 12th Finance Commission to purchase equipment. Operating costs are covered by funds received from the town's general fund, devolution grants, and by the revenue generated through vermicompost sales. He trained his staff in vermicomposting, and receives consultation from Eco-Pro, Auroville. He charges residents no monthly user fee for collection service. He earns Rs. 4,500/month from the sale of vermicompost, which he prices at Rs. 3/kg for bulk sales. He has not yet sold his recyclable materials, which he sorts into 15 categories.



## Common Steps Taken by Five Local Bodies to Plan and Establish Solid Waste Management Systems

**Become familiar with all applicable directives, and the elements of a successful solid waste management system**

Read all applicable directives pertaining to solid waste management, and study how other localities have taken steps to improve their services. A list of resources that may assist you is provided at the end of this document. The list includes organizations that offer technical guidance and training, as well as localities that are willing to demonstrate their waste management systems. Organize exposure visits to these localities to observe their procedures and facilities.

**Gather information about the waste in your locality**

Conduct a survey of your locality's waste situation to inventory the volume, sources and types of waste that are being produced.

**Prepare a plan for managing your locality's waste**

According to the findings of the survey, and using what you have learned from other people, design a system for collecting, handling, transporting, processing, storing and disposing of such waste. Create a waste collection map for all wards, and identify collection points where waste will be transferred from smaller collection carts to larger vehicles for removal to the processing facility.

**Develop a budget**

Use the survey's findings and the map of your locality to calculate requirements for facilities, human resources, and equipment, and then prepare a budget. Although the system will eventually generate revenue that can cover some operating costs, the local body should ensure that operating expenses can be covered from assured sources of funding.

**Acquire the necessary land**

Designate an area to establish the waste processing facility. Also designate a location for a landfill to dispose of waste that cannot be recycled or composted. Carefully consult regulations regarding designing and locating a landfill.

**Identify partners**

Meet with groups in your locality to discuss the waste situation, and to identify partners who can participate in implementing a new waste management system. Such partners may include non-governmental organizations, self help groups, eco clubs, fan clubs, residents' welfare associations, individual volunteers and businesses.

**Develop an action plan**

In consultation with residents' representatives, develop an action plan for creating the waste management system, which includes the activities that will be undertaken to increase the public's involvement and cooperation, the financial and material needs, and the expected sources of funding.

**Secure the funding**

After developing the action plan, raise the funds for starting and running the system. Funding is available from the government through several schemes and funds. The system itself will eventually generate revenue that will cover some of the operating costs. Other means of covering the costs of establishing and operating the system include sponsorship from local businesses or corporations, contributions from service clubs, collection of a monthly user fee from residents and commercial establishments, and co-funding through partnership with an NGO.

**Raise public awareness**

Raise the awareness of the public about their responsibility and role in the new system. The awareness campaign should emphasize the public's responsibility to reduce, reuse and recycle material, and to segregate biodegradable, non-biodegradable and hazardous waste at the source. Methods for raising awareness include public meetings, door to door canvassing, wall paintings, hoardings, autorickshaws with amplified announcements, processions, rallies, contests, announcements mounted on ox carts, children's programs, street dramas, public service announcements on cable TV, and leaflets.



### Establish facilities and purchase equipment

Buildings will be needed for sorting recyclable materials, weighing and storing these materials until they are sold, preparing and packing compost and/or vermicompost, and storing tools and equipment. In addition, waste processing centers should provide toilet and bathing facilities for staff. Buildings in which people will sort waste should provide shaded work area that is well lit and well ventilated. When selecting vehicles for collection, tricycles have the advantage of being able to carry several additional bags into which collectors can immediately deposit sorted waste as they collect it. Pushcarts have the advantages of requiring less maintenance, and being easier for women to operate. Tricycles, depending upon their design, can hold the waste of between 250 and 500 households. Pushcarts can hold the waste of between 150 and 200 households. All waste collectors should be equipped with a uniform, cap, gloves, mask, footwear and raincoat.

### Hire and train staff

Some of the localities featured in this document have made arrangements with women's self help groups to recruit additional staff for house to house waste collection. Waste collectors are paid between Rs. 1,000 and Rs. 2,400 per month. These arrangements with self help groups have made it possible for local bodies to afford the additional labour required for house to house waste collection.

### Conduct mass cleaning to clear accumulated litter

### Create a management information system

Design a management information system (MIS) to maintain records of staff attendance and performance, fee collection and feedback from residents, and details of waste collected, processed, sold and landfilled. Such records should be analyzed regularly to monitor and evaluate the performance of the system.

### Ensure that residents have containers for sorting their waste

Distribute red and green containers, or instruct all residents to purchase their own, so that biodegradable and non-biodegradable waste can be sorted at the source.

### Commence services

Initiate waste collection, while continuing to educate the public about the importance of sorting waste at the source. Remove street bins from all neighborhoods to reinforce the message that waste should be disposed of only by handing it over to the waste collectors.



## Collecting and Processing Solid Waste

### House to house collection of sorted solid waste

House to house collection of sorted waste begins by 7 a.m. Waste is collected 7 days per week so that waste does not accumulate in homes, biodegradable waste does not putrefy, and the volume of waste is manageable for collectors. The waste collectors announce their arrival with a whistle or bell.



### Waste is deposited into separate bins on carts or tricycles

Waste is deposited into large containers and bags on pushcarts, or tricycles. Initial sorting of recyclables may be done at this point.



### Transfer of waste from carts to larger vehicles

When carts become full, the waste is transferred at a collection point to larger vehicles for removal to the processing facility. It saves labour and time if waste is transferred directly from the collection carts to the vehicles, rather than depositing the waste on the ground for later removal.





### Sorting recyclables at the facility

After waste arrives at the facility, it is again sorted so that recyclable contents are recovered and accumulated.



### Preparing compost

Biodegradable matter is either piled in windrows or deposited into large tanks where it may be covered with a plastic sheet to retain moisture. Biodegradable matter is sprinkled with effective micro-organisms (EM) or with cow manure slurry to reduce smell and flies, and to accelerate decomposition. In Musiri, the compost windrows are sprayed with water that has been treated by the DEWATS facility.



### Preparing vermicompost

All five localities perform a secondary composting using earthworms. This process, called vermicomposting, adds commercial value and increases the availability of nutrients in the final product. When designing vermicompost tanks, precautions must be taken to protect worms from predators, such as ants, rodents and crows.



### Sieving vermicompost

The castings of the worms are collected every 15 days and sieved before packing. If composting is done on a large scale, a mechanized sieve will reduce the cost of labour.



### Packing vermicompost

The vermicompost is packed for sale.



### The daily amount of sorted waste is weighed and recorded



# Keys to Successful Solid Waste Management

The managers of these projects agree that the primary key to successfully managing solid waste is the cooperation of the public in the form of sorting biodegradable and non-biodegradable waste at the source, before it is handed over to the waste collectors. This is why, even years after starting the services, much effort is still being made to increase public awareness about the importance of sorting waste at the source. Everybody should appreciate that sorted waste is a resource.

Sorting waste at its source keeps recyclable resources clean, prevents contamination of biodegradable material, significantly reduces the cost and trouble of post-collection sorting, and can increase the value of recovered recyclables.

Another key is to encourage residents to compost biodegradable waste at home, thereby reducing the amount of material that the service provider has to collect, transport and process.

An effective way to encourage public participation and acceptance of the system is to ensure regular and punctual daily collection. Another feature of a successful system is an accountable and responsive process by which residents can communicate their feedback to service managers.

## From Waste to Wealth



Rs.7/kg



Rs.11/kg



Rs.16.50/kg



Rs.10/kg

## Testimonials



*Melpattampakkam used to suffer horribly from clogged, smelly drains. Drain maintenance was a constant headache. Daily collection of waste directly from homes and shops has substantially reduced our town's drainage problems.*

Mr. V. Jeyamurthy, Panchayat Chairperson Melpattampakkam



*Because of the collection of our waste, our town has become a green municipality. After seeing the benefits of this service, I tell my relatives and friends to segregate their waste before they dispose it, so other areas are maintained clean.*

V. Priyanka Pammal



*We used to throw our garbage at the end of the street. Now, daily waste collection reduces the problems of mosquitoes, bad smell and flooding because the drains are free of garbage.*

Mrs. Chandra Pammal



*Door to door collection of waste reduces the amount of garbage in the town's drains. We now spend less time cleaning the drains, and have less problem with water stagnation and mosquitoes.*

Mr. Jawaharlal Nehru, Councilor Gandhi Nagar, Vellore



*Clinics are crowded because of our polluted environment. It is better to spend money on waste collection than on medicine.*

Mr. P.M. Jaikar Pammal



*I used to discard my waste in an open area and burn it, creating hazardous smoke. Now people come and collect the waste at my door. I feel that they have been sent by god.*

Mrs. E. Rajalakshmi Mudichur



*Initially, some council members were not sure if our town could afford to provide this service. But we discovered that it generates its own revenue through the sale of compost and recyclable materials. Residents greatly appreciate that it has made the town's streets very clean.*

Mr. P. Mohammad Yussuf, Councilor Melpattampakkam



*If students are brought up in a garbage-free environment, they will be more responsible and will not litter the environment. We have to live on this earth, and to save it for future generations.*

S. Suriya Sundar Pammal



*Previously, by throwing our waste on the street and burning it, our health suffered and we spoiled the environment. Now I'm very happy that the waste is collected from my house and the air is no longer polluted.*

Mrs. G. Anbu Mudichur



*The door-to-door collection of sorted waste is much nicer than our previous habit of throwing it on the street. This system is much better, and our streets are much cleaner.*

Mrs. Malliga Pandiyan, Councilor Mudichur



# Resources for Solid Waste Management

Exnora International  
#20, Giriappa Road, T Nagar,  
Chennai 600017.  
Office: 044 2815 3376 / 044 2815 3377 / 044 2475 9477  
fax: 91 44 4219 3595  
e-mail: exnora@gmail.com, exnoraindia@hotmail.com

Town Panchayat Chairperson  
Melpattampakkam Town Panchayat  
Melpattampakkam  
Cuddalore District 607104  
Tamil Nadu  
Office: 0414 227-6489

For vermicomposting:  
Ecoscience Research Foundation  
No. 98, Baaz Nagar,  
3/621, East Coast Road  
Palavakkam, Chennai 600041  
www.erfindia.org  
email: sultanismail@gmail.com  
Cell: +91-9384898358

Executive Officer  
Gandhi Nagar Town Panchayat  
Gandhi Bhavan  
29, 4th E. Main Rd.  
Gandhi Nagar, Vellore  
Vellore District 632006  
Tamil Nadu  
Office: 0416 224-2382

For use of effective micro-organisms (EM) :  
Eco-Pro  
Aurosarjan Complex, Auroshilpam  
Auroville - 605101  
Villupuram Dt. T.N.  
Office: 0413-2906482  
e-mail: eco\_pro@auroville.org.in

The Tamil Nadu Commissionerate of Town Panchayats' manual on solid waste management  
[http://www.tn.gov.in/dtp/publications/solid\\_wm.pdf](http://www.tn.gov.in/dtp/publications/solid_wm.pdf)

Solid and Liquid Waste Management in Rural Areas: a Technical Note. 2000. Department of Drinking Water Supply, Ministry of Rural Development and UNICEF  
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<http://www.terienvi.nic.in/times6-1.pdf>