

Research Study Series

Number 75

**Solid Waste Management :
Improvement Initiatives
in Selected Cities of India**

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Financial Institutions Reform and Expansion (FIRE)

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Preface

Solid waste management is a vital function of urban local governments in India. However, it remains a neglected function due to various reasons. The outbreak of Plague in Surat, in 1994, suddenly brought this service into focus and reinforced the need to keep cities clean. With an estimated 270 million people living in urban areas in the country and with 200 to 500 gms of waste generated per capita, the sheer magnitude of the job is daunting. Lack of adequate finances to manage the service, poor quality of equipment, and lack of scientific approach to waste management further hinder local governments from providing the service efficiently.

Solid waste management gained recognition after a Public Interest Litigation was filed in the Hon'ble Supreme Court of India in 1996 seeking directions from the court to urban local bodies as well as the Government of India and the State Governments in the country, for improving solid waste management practices expeditiously. Pursuant to the order of the Hon'ble Supreme Court of India a Committee on Solid Waste Management was constituted by the Government of India in 1998. The Committee, in its report, has recommended service levels and time frame to be followed for improving the service in different sizes of cities/towns.

In many Indian cities, initiatives have been taken by local governments and NGOs to improve solid waste management. These initiatives are in the areas of waste collection, transportation, treatment as well as disposal. The initiatives of the NGOs are mostly in the area of waste collection and treatment, and also in environmental education. Local governments too have taken initiatives such as improving service administration, using better equipment, and involving private sector in solid waste management. These initiatives can be replicated in other cities too, with modifications to suit local conditions.

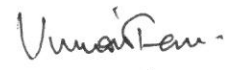
Knowledge about such initiatives and good practices in solid waste management is not widely available. The present study is an attempt to bring together some cases of good practices in solid waste management and also some local level initiatives that has led to an

improvement in the service. The study was carried out at the Institute with support from the Indo-US Programme on Financial Institutions Reform and Expansion (FIRE).

Ms. Usha P. Raghupathi, Associate Professor at the Institute, conducted the study. She was ably assisted, in research, by Ms. Shruti Satsangi and Mr. Rumi Aizaz.

Co-operation of local government officials of the selected cities and their help in providing the necessary information on the service and the improvement measures taken are gratefully acknowledged. In particular, we would like to thank Mr. P.U. Asnani for providing information on Ahmedabad and Bangalore, Mr. Asim Barman, Municipal Commissioner, Calcutta, Mr. A.K. Chakrabarty, Mr. T.K. Mandal and Mr. S.K. Mukherjee of Calcutta Municipal Corporation, and Mr. S. Jagadishan, Municipal Commissioner, Dr. I.C. Patel and Mr. Sharad Christian of Surat Municipal Corporation for their co-operation and support.

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Vinod Tewari
Director

SOLID WASTE MANAGEMENT

Improvement Initiatives

Introduction

One of the major challenges faced by urban India today is the management of solid waste. Solid waste management is an obligatory function of the urban local bodies in India. However, it remains a poorly performed service notwithstanding the fact that about 30 to 50 per cent of municipal expenditure is allotted to this service.

Solid waste management has been a neglected service as the local governments have not given it the importance it deserves. However, the service has now come to occupy a prominent place amongst the functions of local governments largely due to the Hon. Supreme Court's directive to local governments to improve the service within a given time frame. The notification of Draft "Municipal Waste (Management and Handling) Rules, 1999" by the Ministry of Environment & Forests, Government of India, would further help in directing the municipal government's attention to this service.

The waste generated in urban areas is increasing continuously due to population growth and changing lifestyles. The per capita waste generation in urban India ranges from 200 grams to 500 grams per day. The per capita waste generation increases with city size class. According to a survey conducted by the Central Pollution Control Board, the total quantity of solid waste generated by the 23 largest cities in India is approximately 30,058 tonnes per day (in 1994). Amongst them, Mumbai generates the maximum waste of about 5,355 tonnes per day while Vishakhapatnam generates the least of about 300 tonnes of waste per day. Higher incomes also lead to generation of higher quantities of waste. Metropolitan cities, in particular, are fast becoming 'use and discard' societies, and the earlier culture of 'recycling and reuse' is disappearing with rising incomes. The total waste generation in urban areas of the country is estimated to cross 39 million tonnes by the year 2001. With an average waste collection efficiency of 50 to 70 per cent, a huge quantity of waste remains uncollected on the streets and in neighbourhoods. This poses

major health problems to residents. The local governments, though aware of the problem, are not able to do enough to improve the situation. Involvement of NGOs and private sector in this activity is being encouraged to tackle the problem.

Rapid growth of urban population, lack of finances for improving the service, institutional weaknesses, lack of appropriate technical solutions, and managerial inefficiencies are some of the causes of the poor state of solid waste management in the country. Lack of public awareness and cooperation and also lack of enforcement of rules further compounds the problem of waste management in cities.

Stages of Municipal Solid Waste Management

Municipal solid waste includes domestic refuse, non-hazardous solid waste from industrial, commercial and institutional establishments (including hospitals), and street sweepings. Management of solid waste broadly entails the functions of collection, transportation, treatment/processing and disposal. It also includes recycling and resource recovery.

Primary Collection and Storage

In India, primary collection mostly involves street sweeping and street side collection. The practice of door to door collection exists only in a few cities/ towns, that too only in limited parts. Employment of private waste collectors for door to door collection is also common in some areas. The general practice of residents is to either throw waste on street side or in designated bins. Waste collection bins on street sides may be cement, metal, or masonry bins or masonry structures. Often due to inappropriate design, capacity and/ or location of bins, a large part of waste lies outside the bins than inside them. Waste outside bins attracts animals and birds that further spread the waste.

Transportation

A variety of vehicles are used for transporting waste in the country ranging from bullock carts, tractors, trucks, and dumper placers to compactors. Some of these vehicles are

loaded manually while others are loaded mechanically. Often transportation vehicles are old and breakdown frequently causing disruptions in the service.

Treatment and Disposal of Waste

Composting of waste through processes such as vermi-composting is increasingly becoming common in the country though most such efforts are small. Some cities also have mechanical composting plants. Pelletisation plants also exist in some cities, though this form of waste treatment has not been widely used yet. Waste-to-energy plants are being planned in a few cities but there are no operational examples yet on the ground. These plants are being put up through public-private partnership arrangements.

Disposal of waste in most cities and towns is done by open or crude dumping. Generally waste is dumped in low-lying areas or on road sides as landfill sites are not available in many urban areas. Properly constructed sanitary landfills are yet to come up in the country. Efforts at involving the private sector, NGOs and CBOs have been made by municipal governments in order to improve the service.

Objectives of the Study

Local governments in many urban areas have been making an effort to improve solid waste management through various measures including improving efficiency, finding administrative and technical solutions to improving waste collection and disposal, involving private sector and NGOs, and exploring new ways of financing investment. The present study documents some of the innovative initiatives taken to improve the service in certain selected cities of the country.

The main objectives of the study are:

- a) To document the best practices of NGOs, private sector, and others in waste management.
- b) To document initiatives of local governments to improve management of solid waste in selected cities.

Methodology

The present study is based on information collected from primary as well as secondary sources. Section I is based on information obtained from existing literature. The information provided in this section pertains to 1995. The names of some of the cities covered have changed since then, e.g. Bombay has changed to Mumbai, and Madras has changed to Chennai. Accordingly, the names of municipal governments have also changed in these cities, however, the present report has chosen to retain their previous names. Section II uses data obtained from the Census of India. Section III is based mainly on information obtained from the respective local governments through personal visits. The field work for collecting information from local governments for this section was undertaken in 1998.

The cities selected for the study were based on an assessment of the initiatives taken by local governments that could be replicated in other cities to improve the service.

Organisation of the report

This report is divided into three main sections. Section I highlights the best practices in four cities of the country in the 'Best Practices' format of the UNCHS. Section II gives the background information of the four cities selected for survey. Section III documents the innovative initiatives being used in the selected four cities to improve solid waste management. The document will serve as a useful tool to planners, practitioners and trainers and to all those who are interested in solid waste management.

SECTION I

BEST PRACTICES

MUMBAI

A) Door to Door Collection and Public Awareness

- a) Clean Bombay Foundation (CBF)
- b) Vasundhara
- c) Mr. George Bhopali

a) Clean Bombay Foundation (CBF)

1. The Best Practice

Improving the environment of Mumbai through educational awareness programmes, coordination with Municipal Corporation of Greater Bombay (MCGB) for garbage collection, introduction of environment friendly disposal techniques, improving working condition of labourers, and beautifying parts of Mumbai.

2. Best Practice Sponsor

Clean Bombay Foundation (Mrs. Kunti Oza): An NGO

3. Main Donor/ Support Organisation

Ladies wing of IMC Environment Guidance Cell
Rotary Clubs (20)
Inner Wheel Clubs
Interact Clubs of School Children
Earth Care Group
Forum for Environmental Concern, Nirmala Niketan
Association of Youth for Better India
Municipal Corporators

4. Partners Involved

All the above

5. Thematic Focus of Best Practice

Environmental Management
Infrastructure - *Waste management*
Civic engagement - *Community participation and Civic education*
Communications - *Media*

6. Level of Activity

City

7. Eco-system

Coastal

8. Summary

The CBF is committed to the improvement of environment in Mumbai. Seeing the bad situation due to accumulated garbage in the surroundings, a need was felt to create awareness in MCGB as well as among the residents.

Projects:

- i) Clean up and Beautification Programme: This includes house to house garbage collection, elimination of open garbage spots and rectification of drainage, road, pavement, and rubble problems and carrying out supervision of garbage trucks. Garbage management for shops and vendors and toilet facilities for them, installation of dustbins near bus stops and conducting health camps are also a part of this programme.
- ii) Environment Education Awareness Programme: This is done through audio- visuals and talks, appeal letter to houses for segregation of garbage, and nature tours. Forming association with ragpickers and keeping dialogue with the MCGB staff is also included in this programme.
- iii) Hospital waste and Mobile Toilets: This project has been undertaken with the help of USAID.
- iv) Mass Media Environment Awareness Programme: This is done through hoardings, press advertisements, articles and through radio and cable TV.

b) Vasundhara

1. The Best Practice

Environment protection cell - Awareness, work in communities, documentation, networking research

2. Best Practice Sponsor

Vasundhara (Mr. Elvis Thomas): An NGO

3. Main Donor/ Support Organisation

-

4. Partners Involved

-

5. Thematic Focus of Best Practice

Environmental Management

Infrastructure - *Waste management*

Communications - *Media*

Civic Engagement - *Community participation, Civic Education*

Disaster and Emergency - *Civic awareness and preparedness, Hazard reduction*

Technology, Tools and Methods - *Research and Development, Information*

6. Level of Activity

Community

7. Eco-system

Coastal

8. Summary

Projects:

- i) Nofra Navy Nagar: (To arrest garbage production)
Banning plastic bags by vendors, educating people not to mix wet/dry waste, instructing sweepers not to accept mixed garbage, and vermi-composting (domestic/vegetable shops).
- ii) Workshop for the BMC conservancy workers: (Occupational hazards faced)
Data revealed that most of the workers suffer from TB, respiratory, skin, eye, gastro-intestinal, orthopedic and psychological ailments. The shocking data made the MCGB improve the working conditions of its employees, in collaboration with its Solid Waste Department.
- iii) Macchimar Nagar project: (Unhealthy conditions in slum)
Attended problems of sanitation and water, warning of danger of dumping non-biodegradable garbage into the sea.

iv) Others:

Workshop on environment education for ITC teachers, environment improvement in slum communities, hawkers hygiene awareness - part of MIEP programme of the State government, distribution of leaflets to shopkeepers against plastic bags. Project STOP - Multimedia campaign of hazardous effects of plastics; also works as Resource Institute for various organizations and programmes.

c) **Mr. George Bhopali**

1. The Best Practice

Cleaning up Juhu Beach, Vakola slum

2. Best Practice Sponsor

George Bhopali

3. Main Donor/Support Organisation

Name: Municipal Corporation of Greater Mumbai (MCGB)

Type of organisation: Local Government

Nature of involvement in the best practice: Financial and Technical support

4. Partners Involved

MCGB

5. Thematic Focus of Best Practice

Environmental Management

Infrastructure - *Waste management*

Land-use Management - *Open space conservation, Land development*

6. Level of Activity

Community

7. Eco-system

Costal

8. Summary

Projects:

- i) Task of cleaning Juhu beach: Initially started with 15 hoteliers who sponsored waste collection from the hotels and dumping at the MCGB's collection points and cleaning the beach. Forty people were employed for the task who worked in morning and evening shifts (at Rs.1200 -Rs.1800 per month) sponsored by the hoteliers. MCGB now makes available Rs. 70,000 per month to cover the expenses.
- ii) Vakola slum area: It has about 30,000 households within an area of about 2 sq. km. The work of cleaning the area as well as 108 toilet blocks was taken up besides educating the local population. About 25 ragpickers were involved in this project and a monthly grant of Rs.40,000 also received from MCGB for the same. The project has been successful in converting the garbage dump into a cricket ground, which has been a boon to the local children.

B) Disposal

- a) Excel Industries India Ltd. (Large scale)
- b) Department of Science and Technology/ Computer Maintenance Corporation (Large scale)
- c) MCGB/IIT (Large scale)
- d) The Green Cross Society (Small scale)

a) Excel Industries India Ltd.

1. The Best Practice

Aerobic composting

2. Best Practice Sponsor

Name: Excel Industries India Ltd.

Type of organisation: Public Limited Company/ Local government

Nature of involvement in the best practice: Financial, Technical, Administrative and Managerial support

3. Main Donor/Support Organisation

4. Partners Involved

-

5. Thematic Focus of Best Practice

Production and Consumption Patterns - *Waste reuse and recycling*
Technology Tools and Methods - *Research and development, Technology transfer, Information*

6. Level of Activity

City

8. Eco-system

Coastal

8. Summary

Projects:

The project aims at the city solid waste (organic conversion into bio-organic manure. The process is carried out in two phases:

- i) Defouling: This is treatment before turning it into manure through speedy fermentation so as to remove the foul smell and pathogen, making it safe for handling by conservancy workers and waste pickers and also reducing its bad effects on the neighbouring residential colonies. This treatment is also done to prevent the nuisance of birds/vultures, which spread diseases and also are a menace to aviation. The garbage is obtained free of cost from the BMC. The waste dumping site has been leveled and paved for easy movement of vehicles and for prevention of ground water contamination. The waste, after the ragpickers have their pick, is stocked in long rows or heaps of 500 tons called windrows. The garbage is treated with microbial slurry for fermentation.
- ii) Bio-conversion: At the end of fermentation, it is easier to segregate bio-degraded organic portions, which is done through a series of sieves. The non-organic, non-biodegradable left over materials are dumped back into the dumpyard. Oversize residual matter is used for lawns and humus like biomass is packed for local use and export.

The Products: Celrich/Organic manure and Sprayer for inoculation and domestic use also.

b) Department of Science and Technology/ Computer Maintenance Corporation

1. The Best Practice

Pelletisation

2. Best Practice Sponsor

- a) Name: Department of Science and Technology (Govt. of India)/ Computer Maintenance Corporation Ltd
- b) Type of organizations: Central govt./Private sector
- c) Nature of involvement in the best practice: Financial and Technical support/ Administrative and Managerial support

3. Main Donor/Support Organisation

-

4. Partners Involved

-

5. Thematic Focus of Best Practice

Infrastructure – *Energy, non-conventional*
Production and Consumption Patterns - *Waste reuse and recycling*

6. Level of Activity

City

7. Eco-system

Coastal

8. Summary

This process is semi-automatic and requires very less manual operation. They get their raw material (mixed garbage) free of cost, from the BMC. The process of conversion of garbage into fuel pellets involves primary drying, separation of incombustibles, size reduction and pelletisation. The plant requires 1.25 persons/ton of finished product. For a capacity of 100 tons/day of processed goods (pellets), the capital investment required is Rs.4 crore. The only problem with this technology is that if the moisture content of the waste is more, which generally is the case for Indian garbage, then the energy spent is that much extra in direct proportion causing the cost of production to increase.

c) **MCGB/IIT**

1. The Best Practice (c)

Vermiculture

2. Best Practice Sponsor

Name: BMC

Type of organisation: Government (local)

Nature of involvement in the best practice: Financial and Managerial support

3. Main Donor/Support Organisation

-

4. Partners Involved

Name: Indian Institute of Technology

Type of organisation: Academic/Research Institute

Nature of involvement in the best practice: Technical support (Dr.H.S.Shankar)

5. Thematic Focus of Best Practice

Environmental Management (Ecological sustainability)

Production and Consumption Patterns (Waste reuse and recycling)

6. Level of Activity

City

7. Eco-system

Coastal

8. Summary

The vermiculture technology which is being used by BMC for its solid waste at Deonar dumping ground has been developed by Dr.H.S.Shanker, IIT Powai. The total characters involved in the vermiculture process are rock, organic matter, earthworm, bacteria and green plants. The project was set up in 1993 on trial basis treating around 35-40 tons/day. The present project capacity is 100 tons/day and the estimated project cost is Rs. 51.50 lakhs. The advantage of vermiculture is that the product has a very high nutrient value and so it fetches a better price. Also, this process can take care of virtually any type of organic matter and it requires much lesser investment than any other method. It gives excellent results at the

decentralized local community, society or household level. But on the other hand, the disadvantage of vermi-composting, especially if not managed properly, lies in the fact that the earthworms are very delicate creatures and any extremes in the conditions can affect them adversely. Besides the land and labour requirement is very high.

d) The Green Cross Society

1. The Best Practice

Vermicomposting

2. Best Practice Sponsor

Name: The Green Cross Society (Mr. Shantanu Shenoy)

Type of Organization: Voluntary Organization

Nature of involvement in the best practice: Technical support

3. Main Donor/Support Organisation

-

4. Partners Involved

-

5. Thematic Focus of Best Practice

Environmental Management – *Resource management*

Civic Engagement and Cultural Vitality - *Community participation, Civic education*

Technology, Tools and methods - *Technology transfer, Training, Information*

6. Level of Activity

City

7. Eco-system

Coastal

8. Summary

The society has helped construct about 21 vermipits in different parts of Mumbai and have got good response and cooperation from the people. According to Mr. Shenoy the NIMBY (Not in my backyard) attitude and mixing the dry and wet waste poses a big problem in managing solid waste.

Programmes: Vermikits, talk shows, seminars, coordination with other organizations, sale of culture, sale of biofertilizer, the Organic Club, farming, consultancy, micro projects, vermi toilets, books, vermi tours and exports.

Projects: 21 demonstration projects all over Mumbai.

MADRAS

- A) **Door to Door Collection and Public Awareness**
- a) **Civic Exnora**
1. The Best Practice
- Collection and transportation of garbage**
2. Best Practice Sponsor
- Civic Exnora, Madras
3. Main Donor/Support Organisation
- Name: Exnora International
Type of organisation: NGO
Nature of involvement in the best practice: Technical
4. Partners Involved (Partial)
- Name: Municipal Corporation
Type of partner organisation: Local Govt.
Type of support provided by partner: Technical/Financial
5. Thematic Focus of Best Practice
- Environmental Management - *Urban greening, Environmental health*
Infrastructure - *Sanitation*
Civic Engagement and Cultural Vitality- *community participation, civic education*
Poverty Eradication - *Job creation*
6. Level of Activity
- Community

7. Eco-system

Coastal

8. Summary

The Civic Exnoras are affiliates of Exnora International which is a non-governmental, non-political organisation with the objective of bringing about civic consciousness and environmental awareness among the masses. It is a grassroots level organisation which tries to bring about cleanliness with the help of community participation. There are approximately 1500 civic Exnoras functioning in the city.

Projects:

- i) Kamaraj Avenue - Adayar (Experimental): Here the Madras Municipal Corporation decided to experiment with hydrocontainers. First it sought the cooperation of the local residents whereby they would handover the garbage directly to a street beautifier (sweeper) who would also sweep the streets. Secondly, it also involved the local ragpicker so that he wouldn't look for recyclables in the bin, the garbage wouldn't be strewn by him and he wouldn't be deprived of his income. The beautifier was provided with a specially designed garbage removal tricycle for which the residents took a soft loan from the bank, residents paid Rs.650/month to the beautifier i.e Rs.10/household.

Case studies

- i) Pelathope Civic Exnora – In this 66 households are involved. They jointly work to solve civic problems like, water supply, drainage, and electricity.
- ii) Indira Civic Exnora Unit V - About 25 households have a vermi-composting pit in their garden. This approach of segregating and vermi-composting has definitely reduced the amount of garbage. The street beautifier not only earns about Rs.300/month from selling the recyclables, he also gets time to beautify the street.
- iii) Venkatapura Civic and Youth Exnora - The men, women and youth of this area sweep the area daily in rotation and also clean clogged drains every week. A portion of this slum, which was previously a garbage dump, has been converted into a garden. A gymnasium has been developed in this park by the youth.
- iv) Suzhpunal karai Civic Exnora - Volunteered to manually clean up a heavily silted canal.

The success rate of Civic Exnoras is clearly visible in the services rendered by it in Madras city. The movement has driven home the fact that community participation is the best solution to civic problems like solid waste management.

B) Collection and Neighborhood Disposal

a) Indian Institute of Technology (IIT)

1. The Best Practice

Collection and disposal on contract basis

2. Best Practice Sponsor

Name: IIT (SWARM) Solid waste recycling and management

Type of organisation: Voluntary Organisation

Nature of involvement in the best practice: Technical and Financial support

3. Main Donor/Support Organisation

-

4. Partners Involved

-

5. Thematic Focus of Best Practice

Infrastructure - *Waste management*

Civic Engagement and Cultural Vitality - *Community participation*

Poverty Eradication - *Income generation*

6. Level of Activity

Community

7. Eco-system

Coastal

8. Summary

To dispose garbage generated in the campus in an environmentally friendly way. SWARM is paid by the management of IIT but doesn't interfere with its operating system. SWARM has appointed 11 boys to do the conservancy work. They have been provided with 6 tricycles with 2 metallic bins. One bin is for dry waste and the other for wet. There are two bins (colour coded) placed in the campus which are mounted on iron legs, two feet above the ground, one is for organic and the

other for inorganic waste. The departments have been provided with 2 gunny bags for depositing wet and dry waste separately. The canteen has been provided with metallic containers for depositing the garbage.

The SWARM volunteers work in two shifts, the garbage that is collected is carried to ground earmarked for segregation at the western end of the campus where paper, plastic, glass and metal scraps are separated. Coconut shells are kept in separate bags to be sold as fuel material while the organic waste is vermi-composted. The volunteers are paid Rs.45 per day and those who also work in the afternoon are paid Rs.10 per hour.

C) Resource utilisation, Recovery and Recycling

a) Madras Municipal Corporation

1. The Best Practice (a)

Keeping the city clean

2. Best Practice Sponsor

Madras Municipal Corporation (MMC)

3. Main Donor/Support Organisation

-

4. Partners Involved

Don Bosco Anbu Illam Social Service Society (Social Service Society)
Asha Nivas (Voluntary Organisation)
Asian Youth Centre (NGO)
Neesakaram (Voluntary Organisation)

5. Thematic Focus of Best Practice

Poverty Eradication
Social Services
Gender Equity and Equality
Children and Youth

6. Level of Activity

City/Community

7. Eco-system

Coastal

8. Summary

The MMC has started this project for keeping the city clean by entrusting different areas to different organizations. There are 25 divisions and two zones in the city which are distributed among different organizations. The MMC finances and supervises the project and also provides any other aid required by the organisation. The work entrusted includes:

- i) House to house collection of waste.
- ii) Sweeping the streets, open public places and cleaning the open gutters.
- iii) Transporting the waste to the nearest dumping point allotted by the local body from where the municipal lorries carry it to the dumping ground. The boys who work in this project are abandoned youth, street children or ragpickers who live with no aim or destination in life. They work in 2 shifts. After collecting the garbage from door to door, the streets are swept and all this waste is put into tricycles provided by the Corporation. It is then transported to the nearest dumping point for municipal lorries to collect. In order to monitor the work done by the boys, 2 to 3 supervisors are appointed by the respective organisations. There is one coordinator who is in-charge of liaising with the Corporation. The MMC provides the boys boots and gloves and two sets of uniforms. The materials used for cleaning brooms, baskets, tricycles are also provided by them. A consolidated salary is Rs.1000-1925 per month. The boys who are employed in this project are given non-formal education. They are given identity cards by the Corporation. They all have individual passbooks in the banks and they have to compulsorily save up to Rs.150 per month. They are allowed to draw festival loans from their account.

PUNE

A) Door to Door Collection and Public Awareness

a) Save Pune Citizens Committee

1. Best Practice

Waste Segregation and Door to Door Collection

2. Best Practice Sponsor

Name: Save Pune Citizens Committee

Type of organisation: Self Help

Nature of involvement in the best practice: Financial Support

3. Main Donor/Support Organisation

-

4. Partners Involved

-

5. Thematic Focus of Best Practice

Civic Engagement and Cultural Vitality - *Community Participation*
Poverty Eradication - *Income Generation*

6. Level of Activity

Community

7. Ecosystem

Tropical.

8. Summary

This committee was started by a group of sensitive residents of a high income group area with about 300 households who always faced problems of a choked sewerage system due to litter on streets and garbage from overflowing bins finding access to sewers. A scheme for separating the household waste into 4 baskets was formulated:

- i) Kitchen waste
- ii) Paper, packaging material, broken glass, wire, rags, plastics
- iii) Soiled rags, cotton wool, sanitary towels, hair
- iv) Garden waste

All houses were contacted and urged to adopt this system. The local sweeper woman has been practically adopted by them and is paid to do house to house collection of garbage (Rs.10 per household). She collects 35-40kg wet/mixed waste and 10-12kg dry waste per day. The sweeper woman, who is also the ragpicker there, stores the recyclable material for 15 days on an unoccupied empty plot. After 15 days, she rents a bullock cart and sells her collection to the cooperative store for recyclable materials.

B) Disposal

- a) Bhavalkar Earthworm Research Institute (Small Scale)
- b) Institute of Natural Organic Agriculture (Small Scale)

a) Bhavalkar Earthworm Research Institute

1. Best Practice

Vermiculture

2. Best Practice Sponsor

Name: Bhavalkar Earthworm Research Institute

Type of organisation: Research Institute

Nature of involvement in the best practice: Technical Support

3. Main Donor/Support Organisation

-

4. Partners Involved

2000 Households

Industries

Companies

5. Thematic Focus of Best Practice

Environmental Management - *Environmentally sound technology*

Infrastructure - *Waste management and Treatment*

Production and Consumption Patterns - *Waste reuse and recycling*

Civic Engagement and Cultural Vitality - *Community participation, Civic education*

6. Level of Activity

Community/National

7. Ecosystem

Tropical

8. Summary

Vermiculture is much superior to ordinary composting where 1 mm of soil is formed within one year. In Industrial projects, the formation is as high as 350

mm/yr. One kg of dry waste gets converted to 1 kg vermicastings (biofertilizer) within one year. In ordinary composting, uncontrolled decomposition takes place in an exothermic reaction. It is biological incineration which can have hazardous effects, by this acidic leachate is produced which percolates down the soil and contaminates the ground water. Vermiculture becomes effective within 6 days, where all bacteria are of selective and good type.

b) Institute of Natural Organic Agriculture

1. Best Practice

Vermiculture

2. Best Practice Sponsor

Name: Institute of Natural Organic Agriculture (Mr. M.R. Bhide)

Type of organisation: Voluntary organisation

Nature of involvement in the best practice: Technical Support (Research and Development)

3. Main Donor/Support Organisation

Name: Department of Science and Technology/ Maharashtra Government

Type of organisation: Central government/ Local government

Nature of involvement in the best practice: Financial Support

4. Partners Involved

5. Thematic Focus of Best Practice

Environmental Management (Environmentally sound Technology)

6. Level of Activity

Community

7. Ecosystem

Tropical

8. Summary

They carry out R&D work on organic systems, use of earthworm technology in organic systems and advice individuals and organizations about the potential of

earthworm technology in organic farming. The organisation sells the technology on turnkey basis, it does projects at all scales:

- Small scale - Flats, Bungalows - 1/2 kg per day.
- Medium Scale - Hostels, Dorms, Factories - 2-3 tons/day
- Large scale - Military dairy farm - 11 tons/day

Their responsibility is only till the first harvest of vermicompost. The institution helps install smaller projects for flats etc., also at the rate of Rs.200/flat which includes: i) Setup visit ii) Harvest visit iii) Follow up visit. Being a voluntary organisation, it gives services at a non-profit basis. Vermicompost is sold at Rs.2100/ton and vermiculture with adult worms is sold at Rs. 1500/kg.

C) Resource Utilisation, Recovery and Recycling

- a) National Society for Clean City (NSCC)
- b) SNTD Women's College

a) National Society for Clean City (NSCC)

1. Best Practice

Mohalla Committee system

2. Best Practice Sponsor

Name: NSCC

Type of organisation: Voluntary organisation

Nature of involvement in the best practice: Technical Support

3. Main Donor/Support Organisation

-

4. Partners Involved

Residents forum

Ms.Sheila Christian

Ms.Geeta Vir

5. Thematic Focus of Best Practice

Civic Engagement and Cultural Vitality - *Community Participation, Civic Education*

6. Level of Activity

City

7. Ecosystem

Tropical

8. Summary

The organization deals with civic issues, they have introduced a Mohalla Committee system where the region is divided into different zones with a committee appointed voluntarily to look after its problems, peoples complaints etc. At the end of the year they organize a meeting of all mohallas from the city and discuss each others work, achievements, setbacks etc. The organisation has started a residents forum. They call people from various fields to address them, most of these guests are powerful people who are in a position to help out the residents in some way or the other. The NSCC has fully adopted vermiculture and the committee members help to set up the process. They try to create public awareness on garbage segregation. They have made an association with the ragpickers to sort out their problems/opinions.

b) SNTD Women's College

1. Best Practice

Welfare of Ragpickers

2. Best Practice Sponsor

SNTD - Department of Adult and Continuing Education

3. Main Donor/Support Organisation

-

4. Partners Involved

Ms.Chickermane
Ms.Laxmi Narayan

5. Thematic Focus of Best Practice

Social Service - *Health and Welfare*
Gender equity and Equality - *Control of Resources*

6. Level of Activity

City

7. Ecosystem

Tropical

8. Summary

They have involved themselves completely into working for the ragpickers. They have started an organisation KKPKP, whose members are the ragpickers and the cooperative stores which buy the recycled material from them. Their GRASP programme promotes the collection of segregated waste from households and commercial establishments by waste pickers bearing ID cards. Health, school enrolment, curbing domestic violence, self-help groups (savings), protecting women waste pickers against police harassment, cooperative stores, ID cards, and research are some of the activities practiced.

RAJKOT

A) Door to Door Collection and Public awareness.

- a) Primary Removal of Solid waste
- b) Primary Cleaning of Housing Societies

a) Primary Removal of Solid waste

1. Best Practice

Contracting out

2. Best Practice Sponsor

Rajkot Municipal Corporation (RMC)

3. Main Donor/Support Organisation

Name: Private Contractors

Type of organisation: Private Sector

Nature of involvement in the best practice: Human Resources

4. Partners Involved

-

5. Thematic Focus of Best Practice
Infrastructure - *Waste Management*
6. Level of Activity
Community (2 out of 20 wards)
7. Ecosystem
Semi-Arid
8. Summary

The RMC is responsible for primary solid waste removal in each of the 20 wards of Rajkot. Out of these the Corporation has contracted out 2 wards, which consist of 330 households, each with an area of 30,000 sq.ft. The total number of garbage collection centres in these wards are 120.

Comparative Financial Statement

(RMC operates at 105 solid waste collection units out of a total of 330 in Rajkot)

| <i>When Privatized</i> | <i>When not Privatized</i> |
|---|---|
| Expenditure and overloads in these 105 units Unit x Unit rate/month 105 x 1140 x 120 <p style="text-align: center;">Total Rs. 14.36 lakhs</p> | Annual establishment.exp. – Rs. 16.47 lakhs 1 Sanitary Inspector 1 Sanitary sub-Inspector 1 Naik/peon 105 Sweepers Annual cost of items –Rs. 0.50 lakh Instruments, Material <p style="text-align: center;">Total Rs. 16.97 lakhs</p> |

b) Primary Cleaning of Housing Societies

1. Best Practice

Scheme for Grant-in-aid

2. Best Practice Sponsor

Rajkot Municipal Corporation (RMC)

3. Main Donor/Support Organisation

Name: Private Contractors/ Housing societies and Trusts.

Type of organisation: Private Sector/Self-help.

Nature of involvement in the best practice: Financial Support

4. Partners Involved

-

5. Thematic Focus of Best Practice

Infrastructure - *Waste Management*

Economic Development - *Micro credit*

6. Level of Activity

Community (14 Housing societies, 4 Trusts)

7. Ecosystem

Semi-Arid

8. Summary

The scheme was introduced in 1978 under which one housing society with 87,750 sq.ft. of open area was given a grant for its internal cleaning. The scheme gained momentum in 1990 and now 14 housing societies and 4 trusts avail the grant. The whole operation was managed by the society members themselves. The policy for the approval of the grant for a society under this scheme is fixed on the basis of per.sq.ft.of open area. For an area upto 30,000 sq. ft. a grant of Rs. 600 per month is provided. The viability of grant-in-aid for internal cleanliness of the society by self-management, who in turn contracts out the service to the private entrepreneur, can be gauged by the economic benefits to the Corporation.

Economic Benefits

| <i>When Privatized</i> | <i>When not Privatized</i> |
|---|--|
| For an open area of every 30,000 sq.ft.a grant of Rs.600/month is paid by the Municipal Corporation | For cleaning an open area of every 30,000 sq.ft. the Municipal Corporation employs 1 daily wage sweeper at the cost of Rs.1100/month |
| Net financial saving of Rs.500/month for every 30,000 sq.ft of open area | |

B) Transportation

a) Rajkot Municipal Corporation

1. Best Practice

Contracting out

2. Best Practice Sponsor

Rajkot Municipal Corporation

3. Main Donor/Support Organisation

Private Sector

4. Partners Involved

-

5. Thematic Focus of Best Practice

Infrastructure - *Waste Management*

6. Level of Activity

Community

7. Ecosystem

Semi-Arid

8. Summary

In ward 16 this service has been contracted out to the private entrepreneurs. The contractors have to load the waste from the open site/dustbins into the trucks and then these are taken to the dumping site for final disposal. These dumping sites are 4-5 kms. away from the city. The payment is made on the basis of the auctioned rate. The auction amount is for lifting all the waste completely from the particular ward and transporting it to the place of final disposal. The advantage of contracting out the service to the private entrepreneur can be clearly seen from the assessment of the economic benefits to the Corporation.

Economic Benefits

| <i>When Privatized</i> | <i>When not Privatized</i> |
|--|--|
| Approx. average rate/ton – Rs.50 Maximum allowed in a truck - 4 ton Cost - 4 x 50 Total waste - Rs. 200/ 4 tons of waste | Daily establishment expenditure for 4 tons of waste: 1 Driver - Rs.60 1 Cleaner - Rs.50 3 Labourers – Rs.150 Total - Rs. 260/ 4 tons of waste |
| Net financial advantage – Rs. 60/ 4 tons of waste | |

SECTION II

BACKGROUND INFORMATION OF SELECTED CITIES

AHMEDABAD

The city of Ahmedabad is the headquarter of Ahmedabad district located in the state of Gujarat. Ahmedabad was the state capital from May 1960 to May 1970 after which Gandhinagar acquired this status. However, inspite of this change, Ahmedabad is still the largest city in Gujarat and the seventh largest in India in terms of population size as per the 1991 Census of India.

Ahmedabad city was built by Sultan Ahmadshah in 1411 AD in an open and spacious area in the vicinity of old towns of Asawal and Karnavati and to the east of the Sabarmati river. Historical records, such as the Haft Iqlim, published during the sixteenth century describe the flourishing nature of the town. The silk, gold and silver brocades, *kinkhab*, *zari* and *kasab* embroidery and cotton textiles of Ahmedabad were in demand in every eastern market of the world. The city's economic condition deteriorated considerably after the Mughal rule due to frequent fights among the local rulers under the Marathas. However, the city recovered after 1817 when the British took control. Today, Ahmedabad is among the foremost cities of the country in the development of industry, trade and commerce.

AHMEDABAD MUNICIPAL CORPORATION: A PROFILE

Area and Population Growth

According to the 1991 Census of India, Ahmedabad Municipal Corporation (AMC) has a total of 43 municipal wards with an area of 186.78 sq.kms. and a population of 2.88 million persons (Table 1). More than 80 per cent of the district's urban population is concentrated within the corporation limits. It is inferred from the Table that area and population figures show a gradual increase during 1961-81. There was a drastic increase in the Corporation's area from 98.15 sq.kms. in 1981 to 186.78 sq.kms. in 1991 due to the merger of a number of towns in AMC after 1981, namely Sardarnagar, Sahijpur Bogha, Naroda, Naroda INA,

Hansol, Odhav, Odhav INA, Nikol, Vatva INA, Ghodasar, and Isanpur. As a result, decadal growth of population, which was 30 per cent during 1971-81, jumped to 40 per cent during 1981-91.

Table 1: Area and Population Growth of Ahmedabad Municipal Corporation, 1961-91

| Year | Area (sq.km.) | Population | Decadal Growth Rate (%) | Density of Population (Persons/ sq. km.) |
|------|---------------|------------|-------------------------|--|
| 1961 | 92.98 | 1,149,918 | - | 12,367 |
| 1971 | 92.98 | 1,585,544 | +37.88 | 17,053 |
| 1981 | 98.15 | 2,059,725 | +29.91 | 20,985 |
| 1991 | 186.78 | 2,876,710 | +39.66 | 15,402 |

Source: (i) Census of India, 1961, Vol. V, Gujarat, Part II-A, General Population Tables, pp. 49, 284-6.
(ii) Census of India, 1971, Series-5, Gujarat, Part II-A, General Population Tables, pp. 28, 221-22.
(iii) Census of India, 1981, Series-5, Gujarat, Part II-A, General Population Tables, p. 37.
(iv) Census of India, 1991, Series-7, Gujarat, Part XII A&B, District Census Handbook, Ahmedabad, p. 294.

Occupational Pattern

In the AMC area, there were 831,459 main workers and 10,109 marginal workers as per the 1991 census. This working population accounted for nearly 30 per cent of the total population of AMC (Table 2). While a large proportion of the working population is engaged in secondary and tertiary activities, manufacturing (other than household industry) alone accounted for almost 37% of the main workers. The three most important commodities produced in the city are cotton textiles, machinery parts and medicines. A significant proportion of workers are also engaged in trade and commerce (26%) and other services (22%).

Table 2: Distribution of Main Workers among Major Economic Activities in AMC, 1991

| Category | Number/Per cent |
|---|-----------------|
| Main workers | 831,459 |
| Marginal workers | 10,109 |
| % of main plus marginal workers to total population | 29.25 |
| % distribution of main workers among major activities : | |
| i. Manufacturing (other than HH industry) | 37.07 |
| ii. Trade and commerce | 25.50 |
| iii. Other services | 21.55 |
| iv. Transport, storage and communication | 9.07 |

Source : Census of India, 1991, Series-7, Gujarat, Part XII A & B, *District Census Handbook*, Ahmedabad, pp. 296-99.

Housing

The number of occupied residential houses in AMC has grown by nearly 50 per cent from 369,920 in 1981 to 548,691 in 1991. A similar growth is observed in the number of households (Table 3).

Table 3: Number of Occupied Residential Houses and Households in AMC, 1961-91

| Year | Number of Occupied Residential Houses | Number of Households |
|------|---------------------------------------|----------------------|
| 1961 | 217,984 | 228,383 |
| 1971 | 289,382 | 292,921 |
| 1981 | 369,920 | 371,973 |
| 1991 | 548,691 | 552,164 |

Source : Census of India, 1961, 1971, 1981 and 1991, *op.cit.*

There is a heavy concentration of slums within the limits of AMC. As many as 770 notified slum settlements with a population of approximately 426,956 persons are listed in the Ahmedabad district census handbook of 1991. These figures imply that nearly 15 per cent of the population of AMC resides in such settlements. Present estimates reveal that this proportion is nearly 40 per cent. Also, except for three wards, notified slums are present in all the remaining 40 wards of AMC. While most slum settlements have population below 1,000 persons, there are a small number of such settlements, which have a population above

2,000 persons. In fact, two settlements, namely Ramdevpir Tekra na Zumpda and Navi Vasahat have recorded a population as high as 15,000 and 9,620 persons respectively.

BANGALORE

Bangalore city is the headquarters of Bangalore district and the capital of the state of Karnataka. Bangalore was founded in 1537 AD by Kempe Gowda who was a descendant of the Yelahanka line of chiefs. It is today one of the most important centres of southern India due to its central location in the region and its flourishing trade and commerce activity. Many large-scale public sector industries were located around Bangalore in the early fifties. This resulted in the growth of small and medium scale industries. Eventually, the entire region became a hub of electronic and other high-tech industrial activities. Bangalore has shown a rapid growth in its population and is today the sixth largest city in India.

BANGALORE MUNICIPAL CORPORATION: A PROFILE

Area and Population Growth

The Bangalore Municipal Corporation (BMC) area has grown over the years due to jurisdictional changes in almost every decade. In 1951, Bangalore City and Civil and Military Stations merged to form Bangalore City Corporation (BCC) due to which the decadal growth rate of population climbed to 91.51 per cent during 1941-51. In 1961, the Trust Board Area of 380.7 sq.km. was included in BCC, which led to a drastic decline in the density of population from 11,568 to 2,445 persons per sq.km. In 1971, 3 towns, namely Jodikempapura, Yeswanthapura and Kethamaranahalli merged with BCC and the Trust Board Area. In spite of this merger, the area declined from 447.34 sq.km. in 1961 to 134.42 sq.km. in 1971. In 1981, both area and population figures registered an increase. Also, Bangalore City Corporation and Trust Board Area (which were together in 1971) were designated as Bangalore City Corporation and Bangalore Development Authority respectively in 1981. According to the 1991 Census of India, the area and population figures of BCC have observed a decline after 1981. While on one hand, the corporation area has decreased from 151.16 sq.km. in 1981 to 125.90 sq.km. in 1991, on the other hand,

decadal growth of population has fallen from 60.72 per cent in 1971-81 to as low as 7.42 per cent in 1981-91 (Table 4). In terms of density of population, BCC with a density of 21,129 persons per sq.km. in 1991 is comparable with Calcutta Municipal Corporation, which has only a slightly higher density.

BCC estimated a population of 5.13 million and an area of 226.16 sq. km. for Bangalore during the year 1998.

Table 4: Area and Population Growth of Bangalore Municipal Corporation, 1951-91

| Year | Area (sq.km.) | Population | Decadal Growth Rate (%) | Density of Population (Persons/sq. km.) |
|---------|---------------|------------|-------------------------|---|
| 1951(a) | 67.34 | 778,977 | +91.51 | 11,568 |
| 1961(b) | 447.34 | 1,093,798 | +40.41 | 2,445 |
| 1971(c) | 134.42 | 1,540,741 | +40.86 | 11,462 |
| 1981(d) | 151.16 | 2,476,355 | +60.72 | 16,382 |
| 1991(e) | 125.90 | 2,660,088 | + 7.42 | 21,129 |

Source : (i) Census of India, 1961, Vol.XI, Mysore, Part II-A, General Population Tables, pp. 19, 180-2.

(ii) Census of India, 1971, Mysore, Series 14, Part II-A, General Population Tables, pp. 346-8.

(iii) Census of India, 1981, Karnataka, Series-9, Part II-A, General Population Tables, p. 148.

(iv) Census of India, 1991, Series-1, India, Part II-B(i), Vol.I, Primary Census Abstract, General Population, p. 532.

Notes : (a) Bangalore City Corporation; (b) Bangalore City Corporation and Trust Board Area; (c) Bangalore City Corporation and Trust Board Area; (d) Bangalore Corporation and Bangalore Development Authority; and (e) Bangalore Municipal Corporation.

Occupational Pattern

In 1991, there were 868,525 main and 5,471 marginal workers in BMC. The main workers are generally engaged in secondary and tertiary sector activities. The working population accounted for about one-third of the total population of BMC (Table 5). About 31 per cent of the main workers are concentrated in Manufacturing (other than household industry). Silk and cotton textiles, machinery and other equipment and electrical and electronic goods are some of the important commodities manufactured in the city.

Table 5 : Distribution of Main Workers by Major Economic Activities in BMC, 1991

| Category | Number/Per cent |
|---|-----------------|
| Main workers | 868,525 |
| Marginal workers | 5,471 |
| % of main plus marginal workers to total population | 32.86 |
| % distribution of main workers among major activities : | |
| i. Manufacturing (other than HH industry) | 30.98 |
| ii. Trade and commerce | 25.89 |
| iii. Other services | 24.77 |
| iv. Transport, storage and communication | 8.98 |
| v. Construction | 6.96 |

Source: Census of India, 1991, Series-1, India, Part II-B(i), Vol. I, Primary Census Abstract, General Population Tables.

Housing

There were 511,125 occupied residential houses in Bangalore Municipal Corporation as per the 1991 Census of India. Since 1961, their number has gone up by more than 2.5 times. This growth was significant especially during the period 1971-81 when the number increased from 245,057 to 431,967 (Table 6).

Table 6 : Number of Occupied Residential Houses and Households in BMC, 1961-91

| Year | Number of Occupied Residential Houses | Number of Households |
|------|---------------------------------------|----------------------|
| 1961 | 194,615 | 205,048 |
| 1971 | 245,057 | 297,717 |
| 1981 | 431,967 | 438,096 |
| 1991 | 511,125 | 515,138 |

Source: Census of India, 1961, 1971, 1981, 1991, op.cit.

CALCUTTA

Calcutta, the capital of West Bengal, is the second largest city of India in terms of its population size. It is located on the east bank of River Hoogly about 80 miles upstream from the head of the Bay of Bengal. The phenomenal growth of Calcutta is mainly due to the presence of a historic port, which was developed by the English East India Company in 1690. The British used this port as a point of transshipment from water to land and from river to sea. As British power extended over the sub-continent, the whole of northern India became a hinterland for the port of Calcutta. Today, it is the dominant urban centre of eastern India having a large industrial and commercial base.

CALCUTTA MUNICIPAL CORPORATION: A PROFILE

Area and Population Growth

Calcutta district comprises of 141 wards of Calcutta Municipal Corporation (CMC) and four special charges, namely fort, canals, port seagoing vessels and port inland vessels. According to the 1991 Census of India, the Corporation of Calcutta along with the special charges covers an area of 185 sq. km. and has a population of 4.39 million persons (Table 7). This population accounts for 6.5 per cent of the total population of the state and nearly 25 per cent of the state's urban population. During the decade 1961-81, the area and population figures of the Corporation showed a gradual increase (Table 7). However, during 1981-91 there was a sudden increase in the area and population of the city. The area of the city showed a growth of more than 85 per cent during the decade while the population showed a growth of nearly 34 per cent. This was due to the merger of three municipalities, namely South Suburban, Garden Reach, and Jadavpur, with CMC in the year 1984.

Table 7 : Area and Population Growth of Calcutta Municipal Corporation, 1961-91

| Year | Area (sq.km.) | Population | Decadal Growth Rate (%) | Density of Population (Persons/sq. km.) |
|--------|------------------|------------|-------------------------------|---|
| 1961 | 95.62 | 2,914,412 | - | 30,479 |
| 1971 | 98.79 | 3,136,391 | + 7.62 | 31,748 |
| 1981 | 98.79 | 3,288,148 | + 4.84 | 33,284 |
| 1991*# | 185.00 | 4,399,819 | +33.81 | 23,783 |

Source: (i) Census of India, 1961, Vol. XVI, West Bengal and Sikkim, Part II A, General Population Tables, pp. 105, 330-1.
(ii) Census of India, 1971, Series-22, West Bengal, Part II-A, General Population Tables, pp. 29,357-8.
(iii) Census of India, 1981, Series-23, West Bengal, Part II-A, General Population Tables, p. 106.
(iv) Census of India, 1991, Series-26, West Bengal, Part II-A, General Population Tables, pp. 84-5.

Notes: (i) * includes area and population of Calcutta Municipal Corporation and other four special charges.
(ii) # South Sub-urban Municipality, Garden Reach Municipality and Jadavpur Municipality were merged with CMC in 1984.

Occupational Pattern

CMC registered a total of 1,444,968 main workers and 7,335 marginal workers at the time of census count in 1991. Workers, thus, accounted for one-third of the Corporation's total population (Table 8). The main activities, which engage a high proportion of main workers, are the secondary and tertiary sectors. These include trade and commerce (30%) and other

Table 8 : Distribution of Main Workers among Major Economic Activities in CMC, 1991

| Category | Number/ Per cent |
|---|------------------|
| Main workers | 1,444,968 |
| Marginal workers | 7,335 |
| % of main plus marginal workers to total population | 33.01 |
| % distribution of main workers among major activities : | |
| i. Trade and commerce | 29.68 |
| ii. Other services | 27.97 |
| iii. Manufacturing (other than HH industry) | 26.02 |
| iv. Transport, storage and communication | 11.39 |

Source : Census of India, 1991, Series-1, India, Part II-B(i), Vol.II, Primary Census Abstract, General Population Tables, pp. 705-10.

services (28%). Manufacturing (other than household industry engages 26 per cent of the main workers while transport, storage and communication engages another 11 per cent. Together these four activities engage more than 95 per cent of the workers in the CMC area.

Housing

The expansion of economic activities in Calcutta and the consequent migration to the city has resulted in a significant growth in the number of residential houses (Table 9). There were a total of 848,085 occupied residential houses and 857,109 households in CMC as per the 1991 census.

Table 9 : Number of Occupied Residential Houses and Households in CMC, 1961-91

| Year | Number of Occupied Residential Houses | Number of Households |
|-------------|--|-----------------------------|
| 1961 | 582,906 | 574,137 |
| 1971 | 554,389 | 631,510 |
| 1981 | 590,828 | 601,841 |
| 1991 | 848,085 | 857,109 |

Source : Census of India, 1961, 1971, 1981 and 1991, op.cit.

In Calcutta, nearly 40 per cent of the total population lives in slums. The living conditions in slums such as Tiljala, Narkeldanga, Tangra and Beliaghata are abysmal.

SURAT

Surat city is the headquarters of Surat district of Gujarat. It is located on the western coast of India adjoining the Gulf of Khambhat in the Arabian Sea. Its history as an eminent and prosperous city can be traced to 1546 when a castle was built at the instance of Sultan Mahmud III of Gujarat to protect the city from the regular onslaught of the Portuguese. The English and the Dutch opened their factories in Surat during 1613 and 1620 respectively. In the reign of Shahjahan, Surat was developed as the chief port of the Mughal Empire for inland and seaborne trade. The emergence of Bombay (now Mumbai) as a major port on the western coast of India hampered Surat's trading

activities. However, the city recovered after a period of nearly two centuries with a significant improvement in its trade, textiles, wood lacquer and ivory handicrafts, embroidery, jewellery and fine silver. Today, Surat is more known for its diamond cutting and polishing industry as also for the production of zari and art silk.

SURAT MUNICIPAL CORPORATION : A PROFILE

Area and Population Growth

There are 54 municipal ward offices in Surat Municipal Corporation (SMC) which occupy an area of 111.16 sq.km. and have a population of 1.49 million persons as per the 1991 census (Table 10). The share of SMC's population in the total urban population of the district is nearly 90 per cent. Table 1 reveals that there has been a rapid growth in the area and population of SMC since 1961. The high growth rate of population (93%) experienced during the decade 1981-91 reveals that SMC is one of the fastest growing corporations in India. A high natural growth of population, migration mainly from other parts of Gujarat, the adjoining state of Maharashtra and even from Orissa, Andhra Pradesh and Tamil Nadu and expansion of Corporation's limits are some of the main factors responsible for the prevailing growth of SMC. Towns merged in SMC after the 1981 census include Udhana, Karanj, Nana Varachha, Umra, Limbayat, Pandesara INA, Bhedvad, Dindoli and Bhestan.

Table 10 : Area and Population Growth of Surat Municipal Corporation, 1961-91

| Year | Area (sq.km.) | Population | Decadal Growth Rate (%) | Density of Population (Persons/sq.km.) |
|------|---------------|------------|-------------------------|--|
| 1961 | 8.26 | 288,026 | - | 34,870 |
| 1971 | 35.56 | 471,656 | + 63.75 | 13,264 |
| 1981 | 55.68 | 776,583 | + 64.65 | 13,947 |
| 1991 | 111.16 | 1,498,817 | + 93.00 | 13,483 |

Source : (i) Census of India, 1961, Vol.V, Gujarat, Part II-A, General Population Tables, pp. 54, 314-16.
(ii) Census of India, 1971, Gujarat, Series-5, Part II-A, General Population Tables, pp. 33, 245-6.
(iii) Census of India, 1981, Gujarat, Series-5, Part II-A, General Population Tables, p. 43.
(iv) Census of India, 1991, Series-7, Gujarat, Part XII-A&B, District Census Handbook, Surat, p. 370.

Occupational Pattern

In comparison to other large municipal corporations in Gujarat, such as Ahmedabad and Vadodara, Surat Municipal Corporation has a higher work force participation rate. At the 1991 Census count, the proportion of main plus marginal workers in the total population of SMC was more than 34 per cent. This proportion was less than 30 per cent in both Ahmedabad M.C. and Vadodara M.C. during the same year. It is clearly seen from Table 11 that more than one-half of the main workers are engaged in manufacturing (other than household industry). The important manufacturing industries in and around the corporation area produce art silk fabrics, synthetic cloth, zari goods and diamonds. The other main activities, which engage a significant proportion of workers, include trade and commerce (19%) and other services (13%).

Table 11 : Distribution of Main Workers by Major Economic Activities in SMC, 1991

| Category | Number/ Per cent |
|---|------------------|
| Main workers | 508,864 |
| Marginal workers | 3,462 |
| % of main plus marginal workers to total population | 34.18 |
| % distribution of main workers among major activities : | |
| i. Manufacturing (other than HH industry) | 55.73 |
| ii. Trade and commerce | 18.83 |
| iii. Other services | 13.30 |
| iv. Transport, storage and communication | 4.53 |

Source : Census of India, 1991, Series-7, Gujarat, Part XII-A&B, District Census Handbook, Surat, pp. 372-5.

Housing

An extremely high growth of population of SMC has resulted in a rapid increase in the number of residential houses. In fact, during the period 1981-91, the number of occupied residential houses and households has grown by more than 100 per cent (Table 12).

Table 12: Number of Occupied Residential Houses and Households in SMC, 1961-91

| Year | Number of Occupied Residential Houses | Number of Households |
|-------------|--|-----------------------------|
| 1961 | 40,296 | 48,411 |
| 1971 | 74,059 | 75,637 |
| 1981 | 124,448 | 125,862 |
| 1991 | 272,770 | 279,907 |

Source : Census of India, 1961, 1971, 1981 and 1991, op.cit.

A shortage in authorised residential houses within the Corporation limits has given rise to a growth in the number of slums. Today, slums are found to be located in all the six sanitary zones of Surat Municipal Corporation. Apart from this, slums are also rapidly developing along the railway track and on the banks of the river Tapi. The Surat district census handbook of 1991 lists a total of 42 notified slum settlements in 1989 covering an area of 0.164 sq.km. and having an approximate population of 51,089 persons. However, other estimates show that if all slums are considered then nearly 40 per cent of the city's population resides in slums (notified as well as not notified). At present there are 306 slum pockets in the city.

SECTION III

SOLID WASTE MANAGEMENT STATUS AND INITIATIVES FOR IMPROVING THE SERVICE

AHMEDABAD

STATUS OF SOLID WASTE MANAGEMENT IN AHMEDABAD

Governance

Solid waste management in Ahmedabad is the responsibility of the Department of Health in Ahmedabad Municipal Corporation (AMC). It is one of the obligatory functions that AMC has to perform. The administration of solid waste management in the city is organised zone-wise. The entire city has been sub-divided into 5 zones for the purpose. The service in each zone is supervised by a Zonal Deputy Commissioner/Health Officer/Additional Health Officer. The city's elected councillors have constituted a special committee for solid waste management in order to improve the service in the city.

Generation and Collection of Waste

Ahmedabad generates about 1710 metric tonnes (MT) of solid waste every day (1998). Of this, only 1219 MT of waste is collected daily, indicating a collection efficiency of a little over 70 per cent. The garbage collected from roads is removed by wheel barrows (handcarts). The wheel barrows in the city have six small containers, each with a capacity of 40 litres. Waste is then dumped into bigger containers placed on street corners. These containers, each with three to six tonnes capacity, have four to six compartments. The garbage dumped in containers is off loaded into trucks to be dumped at the landfill sites. AMC has introduced 80 litre capacity community bins for slums and middle class areas, which are not emptied in trucks, but lifted to landfill sites by specially designed trucks.

For collecting debris and construction waste, special metallic skips and skip lifters are used in the city. There is no system for the collection and disposal of industrial waste, including hazardous solid waste. Industrial waste is either kept in the open or

indiscriminately dumped on the streets on government or municipal land. Nearly 70 per cent of the total waste generated in the city is from the domestic sources, 18 per cent from industrial sources and 11 per cent of the waste comprises of building debris.

AMC has a total of about 6,000 sweepers for street sweeping and waste collection. A significant proportion of garbage is also collected by scavengers and recycled.

Disposal of Waste

Waste disposal in the city is done by landfill method at R.T.O., Sabarmati, Sadar Bazar, Sewage Farm, Odhav Canal, Vatva and Jalpa Society. A large number of ponds are filled with garbage and then covered with inert material. Land is levelled using bulldozers and sometimes levelling is done manually too. Refuse brought to the site contains not only domestic waste but also human excreta, hospital waste and hazardous industrial waste. An incinerator is used for burning waste generated in government and civic hospitals.

IMPROVEMENT INITIATIVES TAKEN IN AHMEDABAD

In order to improve the solid waste management service in the city, a project of Rs. 38 million was undertaken by AMC in 1985 with financial assistance from the World Bank. By 1998, the Corporation was spending about Rs. 180 million annually handling and disposing the city's solid waste. The AMC was the first municipal body in the country to introduce the closed container system for primary collection and transportation of city garbage. For efficient operation of the system, the Corporation took measures to impart formal training to the staff engaged in operating the hydraulic driven machines. Popular media was also used for educating people to keep their surroundings clean and dispose their waste only in community bins.

Primary Collection and Storage

The initiatives taken for improving primary collection and storage of waste in the city include:

- a) Introduction of house to house collection system.
- b) Introduction of community bins in hutments and chawls and special cleansing scheme for them and for housing societies.
- c) Introduction of litter bins in public places.
- d) Introduction of metallic containers for storage of waste, and mobile waste collection system in congested areas.
- e) Changing the design of handcarts.
- f) Transportation of waste in closed metallic containers.

Introduction of House to House Collection System

The house to house system of collection of domestic waste in the city started in 1996 with active participation of State Bank of India union and the Ahmedabad City Clean campaign (NGO). This involves ragpickers who collect waste from each household covered by the system. At present it covers 60,000 families who segregate their waste at source.

Introduction of Community Bins for Hutments and Chawls

Community bins of 80-litre capacity have been introduced in the slum and *chawl* areas of the city. One bin is placed for a group of 25 families for the storage of domestic waste. This is done in areas where handcarts and tricycles cannot function. In other areas, waste is directly transferred from the handcarts/tricycles to the community bins. At present, about 225,000 households at 2,412 locations are benefiting from this facility. A total of 5,400 workers are involved in this operation.

Special Scheme for Cleansing the Hutments, Private Chawls and Housing Societies

For ensuring hygienic conditions and preventing the recurrence of epidemic in the hutments/*chawls*, etc., the Corporation has decided to give a grant of Rs. 150/month/3000 sq.mtr. of open area to those who shall arrange for the primary cleaning of their area with the help of part time or full time paid workers. At present 1,383 *chawls* and 1,089 hutments are availing this scheme.

Introduction of Litter Bins

Litter bins have been placed in public places such as hospitals, public parks, theatres, and important bus-stands and on major roads. These bins are cleaned on a daily basis. The bins have been designed by AMC and are available at Rs. 450 each. Private companies have also been brought in to sponsor the bins.

Introduction of Metallic Containers for Storage

All the open communal waste storage sites have been abolished in the city and instead roll-of- roll-on containers of 4.5 cu.m. - 10 cu.m., i.e., 3 - 6 tonnes capacity with 4 to 6 lids have been introduced. The bins are placed on asphalted land to facilitate cleaning. With the introduction of these containers, waste brought by hand carts is directly transferred into them, eliminating the practice of double handling of waste by first putting it on ground. These containers are manufactured by AMC and cost Rs. 25,000 to Rs. 50,000 each.

Mobile Waste Collection System in Congested Areas

Waste collection vehicles of 1 cu.m. capacity have been introduced in areas where large size containers cannot be placed. These vehicles are parked at identified sites where sweepers bring their waste in handcarts and transfer it into mobile vans. The vans have tilting facility for unloading the waste. The mobile vans are emptied mechanically in large size containers at the transfer stations instead of being taken to the landfill sites, thereby making the operation speedy and cost effective.

Transportation of Solid Waste

AMC, in order to modernise its solid waste infrastructure, is making changes in its equipment and in the work methodology. The initiatives in the modernisation of transport are as follows:

Changing the Design of Handcarts

The new design of handcarts has 6 small containers of 40 litre capacity each with three wheels and sealed ball bearings. It facilitates direct transfer of waste into the community bins and deposition of waste on the ground is totally curbed. These carts have tilt facility.

Transportation of Waste in Closed Metallic Containers

Closed metallic containers are in use for the transportation of waste. Other additions are compactors which carry more waste (7 tons), the front end loaders and the flat bed trucks with net cloth covering to prevent dropping of garbage. About 900,000 properties are covered through this facility.

Resource Utilisation, Recovery and Recycling

AMC along with voluntary organisations and NGOs have come up with an innovative concept of 'Zero Garbage on Roads'. The salient features of this programme are the appropriate utilisation of material as well as human resources to help in resource recovery, and recycling. In Ahmedabad, SEWA, an NGO, operates an excellent system for separation of dry and wet waste. Households are given large bags (for dry recyclable waste) and SEWA arranges with local ragpickers to collect the contents of the bags weekly. The bags are sponsored by different industries that print their names and logo on the bags. This serves dual-purpose as it gives the corporate sector enormous publicity at negligible cost apart from providing environmental benefits.

These measures have helped improve solid waste management in Ahmedabad considerably and have increased the skills of the waste handling staff. The efficiency of collection and transportation has also gone up due to the introduction of new systems.

BANGALORE

STATUS OF SOLID WASTE MANAGEMENT IN BANGALORE

Governance

Bangalore City Corporation (BCC) has the obligatory duty to provide the services of waste management in the city of Bangalore. It has also involved private sector in some activities of solid waste management. NGOs have been active in the city helping with waste management at the neighbourhood level.

Waste Generation

Bangalore generates an estimated 2,500 metric tonnes (MT) of solid waste daily of which about 1700 MT is collected daily (1998). This indicates a collection efficiency of 68 per cent. The highest proportion of waste is generated by the households (1000 MT), followed by markets (600 MT), and shops, offices, establishments and institutions (600 MT). About 300 MT of waste is generated from other sources.

Most of the households, shops and establishments in the city store waste at source in plastic buckets, metallic bins or polythene bags. The rest dispose off waste on the streets or in the municipal bins, if nearby.

The households segregate only the recyclable material that can be sold to *kabadiwalas*. This includes newspapers, plastic material, and bottles. However, wastepaper, plastic, broken glass, metal, etc. which is not required is thrown along with the domestic waste.

Primary Collection of Waste

Collection of Domestic and Trade Waste

Waste in the city is collected through street sweepings which is the main system of primary collection of waste. Recently, efforts have been made for doorstep collection of waste through NGOs and private contractors and about 5 per cent of the population is covered under this system. The rest of the waste is either collected from the street or from the dustbins.

Collection of Hospital Waste

The city has around 1,500 hospitals and nursing homes for which there is no system provided by the municipal corporation for primary waste collection. A few hospitals have their own incinerators, the rest do not have any facility for incineration, nor is any common facility provided by the corporation or the private sector for the disposal of hospital waste. Most of the hospital waste, therefore, gets mixed with the municipal solid waste.

Waste from Hotels, Restaurants and Markets

The BCC has, by an administrative order, given directions to the hotels and restaurants to make their own arrangements for collection and transportation of their waste and to dispose it off in the manner prescribed by the Corporation. In furtherance to this order, the hotels and restaurants have made their own arrangements for collection and disposal of hotel waste at the municipal disposal sites. The Corporation does not handle the collection of this waste nor are the hotels and restaurants allowed to dispose off their waste in the dustbins placed in the city.

There are 115 markets in the city of which 12 are large vegetable, fruit and meat markets. In most major markets, private contractors operate to deliver organic waste to the Karnataka Compost Development Corporation. The rest of the markets dispose their waste on the streets.

Provision of Dustbins

Bangalore has about 14,000 bottomless cement bins provided by the Corporation that measure 0.9 metres in diameter and have a storage capacity of 0.6 cubic metres. Large masonry bins are also kept at a distance of about 100 to 200 metres. Besides, there are 1,500 places where waste is deposited but no bins have been provided so far. Recently, 55 metal containers have been placed in the city for the storage of waste in a hygienic manner.

The frequency of removal of waste varies from place to place. In commercial areas, it is removed daily, whereas from other bins waste is collected on alternate days. Street sweeping is carried out on all days of the year including all holidays.

The city has 252 health wards for sanitation purposes. Of these, street sweeping, collection and transportation of waste from 56 wards is being done by the regular staff of the Corporation. In 72 other health wards, the Corporation sweepers do street sweeping while the waste is transported through hired vehicles. In the remaining 124 wards services of waste collection and transportation are rendered through contractors by inviting tenders.

Transportation of Waste

Waste is transported in two ways: (i) Departmentally, by engaging 82 trucks of the Corporation; and (ii) through contractors, by engaging 129 vehicles for layout and markets and 72 lorries on contract for transportation of other waste. Besides this, the Corporation has 13 dumper placers for transporting metallic containers of 2.5 to 3 ton capacity and 6 mini-compactors for transportation of waste. The contractors collect and transport all the waste in their own vehicles from 124 out of 252 health wards of the city.

Processing of Waste

The City Corporation has entered into an arrangement with a few private entrepreneurs and Karnataka Compost Development Corporation (KCDC) for the treatment and conversion of municipal solid waste into bio-organic fertilizer. A private entrepreneur has set up a plant on

private land and receives waste at the plant site from the Corporation for its treatment. Similarly, KCDC also receives waste from the City Corporation at its plant for conversion of garbage into compost. Another private entrepreneur is also receiving waste from the Corporation for conversion of waste into compost through vermi-composting. In addition to this, NGOs like Swabhimana and EXNORA are also collecting kitchen waste for converting it into manure through vermiculture.

The entire responsibility for treatment and sale of end product rests with private entrepreneurs. The only obligation of the Corporation is to deliver the fixed quantity of waste at the plant site. About 600 MT of waste in the city is treated and turned into compost. The remaining waste is not processed and is disposed off in an unscientific manner.

Disposal of Waste

The Municipal Corporation until recently did not have any site identified for the disposal of waste. The waste was being disposed off by the Corporation on the roadsides outside the municipal limits without any environmental consideration. As a result a huge quantity of waste is piled up on the roadsides covering a very large area.

Recently the Corporation has made serious attempts to identify landfill sites, after a Public Interest Litigation was filed in the Supreme Court of India. Seven landfill sites in different parts of the city have been identified for this purpose. The total area of these sites is 40.75 acres and their capacity is 986,966 cu.mtrs. This may last for hardly 12 months if the entire waste is disposed off at these landfill sites. The Corporation has started preparing the landfill sites and is likely to resume the disposal of waste at the identified landfill sites shortly. Since some of these sites are close to residential areas, efforts are being made by the corporation to handle such sites efficiently.

IMPROVEMENT INITIATIVES TAKEN IN BANGALORE

Door-to-Door Collection and Public Awareness

Sadashiv Nagar Welfare Forum

The forum began its activities by introducing the ragpicker's scheme for door-to-door collection of waste. This activity is operating in 800 out of the 1,000 households in the Sadashivnagar area. The households segregate their waste in buckets and bins and place them outside the house for collection by the ragpickers who deposit the waste into municipal bins. At present, there are 8 ragpickers, who cover 100 houses each per day and earn Rs.800 per month, if needed they segregate kitchen waste from other waste. They use tricycles and wheelbarrows to transport the waste to the 0.25 acre sanctioned plot. For this programme, the municipal corporation has provided green colour bins for kitchen waste and plain ones, for street sweepings. Kitchen waste is collected in compost pits and is converted into manure through vermiculture (in 2 and a half months) and microbes (in 6 months).

While introducing the scheme, a systematic and planned approach was developed and NGOs like 'Waste Wise' were asked for assistance. Lady volunteers helped in the process of public awareness through distribution of pamphlets for various programmes, e.g., conversion of garbage to compost. The organisation takes Rs.10 as contribution from households. It has received a donation of Rs.10,000 from the Rotary club and Rs.40,000 more has been promised for composting pits in the future. The ragpickers involved are police verified and are provided with uniforms.

Ragpickers Education and Development Scheme (REDS)

This scheme works exactly on the same concept as that of Sadashivnagar Welfare Forum, the only difference being that of scale, i.e., 175 households are covered and 300 kg. of waste is collected everyday. The waste is segregated by the residents themselves and the ragpickers dispose off the waste with the help of tricycles, onto municipal lorries. Service charges for the residents is Rs.10 per month. The entire activity is funded by the Marianist Society of Mary.

A special feature of REDS is that 300 children are given basic education and non-formal training in carpentry and screen printing. Children in the school going age are sent to schools, sponsored by various NGOs.

Civic Amenities and Cultural Association, Indira Nagar

This scheme covers 20 to 30 households. Each household has been requested to separate wet and dry wastes. The prominent activities here include waste segregation and self-composting as all houses are practising self-composting in the house gardens or any other space available. However, the Corporation sweepers collect dry waste.

Acts Trust

The main thrust in this is on door-to-door collection, environmental education in schools, full cycle garbage disposal and recycling. For door-to-door collection of unsegregated waste, the same principle is followed and 500 households are covered. Their other programmes are:

- i) PEES - Programme for Environment Education in Schools, which is designed for motivating children into concrete action.
- ii) Full cycle garbage disposal and recycling project, in which 2 blocks in Koramangala are covered. Two tons of waste is collected here every day.

Collection and Neighborhood Disposal

Centre for Environment Education (CEE)

The Bangalore branch of CEE, a national institution supported by the Department of Environment and Forests, which aims at creating environmental awareness among children, youth and the general community initiated a programme of waste management. This programme was based around segregation of waste at source into organic, toxic and dry components, conversion of organic components into compost, disposing soiled and toxic waste into the Corporation bins and selling of recyclable items.

As an institution, CEE has contributed in the aspects of collection - treatment of waste and creating awareness. Presently, the programme covers about 235 households in Frazer

Town, Jayanagar I-E Block and rest house crescent. The details of the program are as follows:

- **Collection and Transportation:** Door-to-door collection is done by street youths who are aged 14 yrs. and above. Tricycles (sponsored by the local branch of State Bank of India), separate bins for wet/dry waste, plastic bags for organic waste and buckets for fetching waste have been provided to them. They work six days a week, typically from 7 a.m. to 10.30 a.m.
- **Disposal:** The collected organic waste is taken to the composting site (provided by the BCC) and further segregated into dry, organic soiled and toxic wastes. On an average, the wet waste generated per day from the participating households is 65 to 70 kg. and the dry waste is about 8 kg. per day. Aerobic composting in 8 pits of 500 kg. capacity is done. The pits are filled upto 3/4th to facilitate turning. The heat generated in the pit reaches upto 60 degrees centigrade but is brought down to less than 30 degrees centigrade by watering and turning regularly every 2-5 days. The compost generated is sold and the money obtained is used for the needs of the waste pickers. In Jayanagar alone, 1,000 kg. of compost was generated in two months.
- **Finance:** The ragpickers get an additional Rs.100-125 by selling dry recyclable waste. The salary of each ragpicker is Rs. 550 per month, which is funded by Norwegian Agency for Development Co-operation (NORAD).
- **Public Awareness:** Door-to-door campaigning through public meetings, TV, telephone, and media is done. As a result, more than 40 per cent of the residents have started segregating their waste.
- **Special Feature:** CEE provides breakfast to the ragpickers. It also provides them with gloves and gum boots. Ragpickers are made to undergo a literacy programme, which specially stresses health and hygiene related aspects.

Mythri Sarva Seva Samithi (MSSS)

This organisation has started a project called 'Waste-Wise' which is a tie up with Waste Wise Asia Pacific, an informal network of organisations dedicated to promote solid waste management policies that are environmentally friendly and socially responsible.

Waste-Wise was initially started to incorporate ragpickers in the scheme for employment generation by promoting self-help through garbage collection and also involving residential groups. They also organise awareness campaigns and develop material regarding waste management, besides they also act as resource persons and give technical advice to other organisations venturing into this field. They prepare a quarterly fact sheet that deals with various issues i.e., incineration.

They are involved in the clearing up of solid waste in 8 localities (3000-4000 households each), out of which 4 localities have their own decentralised waste management treatment systems.

CALCUTTA

STATUS SOLID WASTE MANAGEMENT

Governance

In Calcutta, management of solid waste is the responsibility of Calcutta Municipal Corporation (CMC). The Corporation has assigned this task to its Conservancy and Motor Vehicles Department, which provide the garbage cleaning, and removal services within Calcutta municipal limits.

Collection of Waste

The average daily generation of garbage from all sources in CMC area is 2,500 metric tonnes (MT) of which 1625 tonnes is collected, indicating a collection efficiency of 65 per cent. CMC has made elaborate arrangements for waste collection. CMC has to bear the burden of clearing waste generated by nearly 8 million people every day (residents and daily commuters of about 4 million). In order to carry out their activities efficiently, the present Corporation area of 187.33 sq.kms. is divided into 141 wards and nearly 15,000 municipal workers are engaged in service provision. CMC has launched numerous special cleaning drives and intensive awareness campaigns since September 1995 to ensure cleanliness in the city. As a result of these efforts, Calcutta's system of waste management has improved considerably.

Collection of Waste from Slums/Basti Areas

CMC has placed containers at the entry point of *basti* areas and *basti* dwellers are constantly being encouraged to throw garbage themselves in these containers. By creating awareness among this section of the population on the advantages of a neat and clean environment, CMC has been successful to some extent.

Collection of Industrial Waste

Management of industrial waste generated by industrial units in Calcutta is the responsibility of the Calcutta Pollution Control Board. At present, these units have their own arrangements for the disposal of industrial waste.

Transportation of Waste

Waste transportation within CMC is being done jointly by the conservancy vehicles maintained by the Motor Vehicles Department and private carriers. Together these vehicles cover almost the entire corporation area and transport a significant proportion of waste collected at *vat* points for final disposal. Due to the presence of ragpickers at collection points and the habit of people to throw garbage in the drains, the target of 100 per cent collection, transportation and disposal of waste is yet to be achieved.

The vehicles are out on the roads by 5.30 a.m. and all efforts are made to ensure that the transportation work is completed by 1.00 p.m. every day. The main preference is, however, given to the roads used by VIPs before covering other areas. An average of 450 vehicle trips are performed daily to remove the garbage from the different parts of the city to the disposal ground. While private carriers transport 40 per cent of the daily garbage, for the remaining 60 per cent of the waste is transported by manually loaded vehicles, payloaders loaded vehicles and containerised vehicles. After the garbage is loaded on the truck, it is covered with a plastic sheet so that waste does not spill over during transportation.

The workforce engaged in waste transportation as well as operation and maintenance of vehicles comprises of 33 technical supervisory staff, 449 repairing staff and 450 lorry drivers.

Disposal of Waste

The entire solid waste collected from different *vat* points in CMC is taken to Dhapa dumping ground for final disposal. This ground is located in the eastern fringe of the city and has an average area of 700 acres. The average distance of Dhapa dumping ground from

the collection points in different parts of the city is 12 kms. Once the vehicle carrying the waste reaches the disposal site, computerised weighbridges are used to measure the quantity of waste brought by the vehicle. An hourly record is maintained at the disposal site of the quantity of waste being brought by the different vehicles every day. For the purpose of spreading and compacting the garbage, bulldozers are deployed at the disposal ground.

Disposal of hospital waste by CMC is being done in a way that is quite different from what is followed in the case of other types of waste. As already stated, amputated human body parts are taken to the Hind burial ground. However, the remaining type of hospital waste is transferred to the Dhapa disposal site by private as well as corporation vehicles.

IMPROVEMENT INITIATIVES TAKEN IN CALCUTTA

In Calcutta, the municipal corporation has shown considerable concern towards the management of solid waste. This is evident from the numerous efforts that have been made from time to time in the collection, transportation and disposal of solid waste. Some of the recent attempts of CMC for improving solid waste management have been discussed below.

Initiatives taken to improve the Collection, Transportation and Disposal of Waste

Street Sweeping and Collection of Domestic/Commercial Waste

The system of primary waste collection in Calcutta includes street sweeping and house to house collection. The field staff begins their work every day at 5 a.m. and continues till 12 noon. There is a break of half-an-hour in between. Street sweeping and removal of collected garbage to the assigned *vat*/container is completed by 7 a.m. From 7.30 a.m. to 10 a.m., the conservancy workers move to their assigned areas with handcarts and use whistles for giving signal to the residents so that they come and drop their garbage in the hand cart. Garbage collected in this manner is then taken to the nearest container from where vehicles transfer the same to the disposal ground. The house-to-house collection of garbage is presently practised in all 141 wards, however, it is not being done in totality especially in those wards which have a higher proportion of commercial areas. In such

areas, enforcement of discipline by CMC and shortage of personnel are the two major problems.

System of Group Work

There are some wards in the city where house-to-house collection of garbage is not fully practised. In such wards, a system of "Group Work" is introduced under which all workers of a block work together under the direct supervision of a block Sarkar. This system is carried out daily after 9.30 a.m. and this is useful to clear any backlog of garbage.

Hospital Waste Management

CMC has started, for the first time in the country, transportation and scientific disposal of hazardous hospital waste (segregated at source) from all hospitals, nursing homes, laboratories and clinics in Calcutta.

CMC has recently taken precautions in the handling of hospital waste due to its hazardous nature. Previously, the hospital staff was transferring waste generated from these establishments to the containers placed along the roads. In this process, hospital waste was getting mixed with other types of waste and then taken to the disposal site in open trucks. This also resulted in the recycling of a large number of items such as bottles, injections, etc.

It is only since February 1, 1998 that 306 hospitals and nursing homes and 264 laboratories and clinics in Calcutta, as per the instructions laid down by CMC, have started segregating hazardous waste at source. By October 1998, as many as 360 establishments including large hospitals had joined the programme. Such an arrangement has been made possible only due to the directives given by the Green Bench of Calcutta High Court as per which all health care institutions have to join this system and pay the required charges, failing which their licence would be cancelled.

Transportation

For the transportation of hospital waste from the site, special types of trucks, which are fully covered and locked, are used. CMC has also taken adequate steps for the collection and safe disposal of amputated human body parts. Such waste is specially packed in polythene bags at source and transferred to the Hind burial ground where it is buried.

Disposal

For the purpose of disposal, an exclusive disposal ground with sanitary landfilling and leachate collection system has been prepared. There is a separate approach road for vehicles carrying hospital waste which leads directly to the chamber where such waste is dumped. This chamber has been recently constructed and has a dimension of 300 ft. by 40 ft. After the waste is dumped in the chamber, it is properly levelled manually as well as by mechanical devices. During work, employees take full precautions to protect themselves from the hazardous waste, by using aprons, gloves, gumboots, etc. For covering this waste, drainage silt is dumped by the side of the chamber. Drainage silt is used to turn this waste into earth because it is rich in bacteria and reduces the injurious effect of such waste.

During rainy season, there is a possibility of generation of leachates in large quantities which pollute water sources. To reduce this possibility, a temporary shade is established which helps in minimising the generation of leachates. In addition to this, bleaching powder is used to bring leachate to a level which is not injurious and is gradually allowed to pass down through a separate channel.

Public Relations Survey

To improve house-to-house collection and also to create trust and confidence amongst the citizens of Calcutta, CMC launched a public awareness-cum-survey campaign during the period 25th September 1997 to 30th October 1997. A total of 6 lakh leaflets with questionnaires were distributed to the residents over this period of one month. Due to the cosmopolitan nature of the city, the leaflets were prepared in four languages, namely English, Bengali, Hindi and Urdu. This also helped in reaching a wider section of the population. About 2 lakh questionnaires were received back by CMC that provided

information on people's opinion about the nature of services given by CMC and their suggestions to improve the service. The feed back received from the citizens was quite revealing and helped CMC greatly. The officials of CMC hold the view that they have been able to raise awareness among the people of Calcutta in a much better way compared to the situation prevailing five years earlier. Today, the residents are much more aware of not throwing/disposing garbage on the streets.

Charges for Throwing Garbage on Street

CMC has introduced this charge from 1st January 1997. Under this system, any person dropping garbage on the street is made to pay a minimum charge of Rs. 20/- in a domestic area and a minimum of Rs. 50/- in a commercial area. In case of repetition, either a written notice is issued or CMC applies for summons at the municipal court.

Contracting

CMC takes assistance from a non-governmental organisation - Mass Education - in several matters relating to solid waste management. There are some areas in the city, such as the new housing colonies or the peripheral areas where conservancy workers are not deployed at the moment. For such areas, Mass Education has been asked to introduce the system of house-to-house collection from the doorstep. The NGO, thus, directly discusses with the residents about the cleaning arrangements and financial aspects. About Rs. 15 to 20 per house per month is being collected from the residents for doorstep collection and disposal.

Another area of their concern is the collection of segregated clinical and biomedical waste from the hospitals and nursing homes in Calcutta. For this purpose, they operate five vehicles in assigned zonal areas to collect the segregated waste and transfer the same to the disposal ground. Mass Education receives an amount of Rs. 1000/- per vehicle daily from CMC who, in turn, raise this money from the hospitals and nursing homes as per the approved charges passed by the Mayor-in-Council of Calcutta Municipal Corporation.

Incentive to Drivers

In addition to their salaries, drivers are paid an extra amount of Rs. 8/- per tonne of garbage if the quantity transported exceeds 12 tons. For example, if a driver carries 16 tons by making more number of trips, then the 4 tons of extra garbage carried will be considered in calculating his incentive. His labour will get half this amount as incentive. Thus, the driver will receive Rs.32/- while his labour will get Rs. 16/-.

CMC's experiment of giving incentives to drivers for an increased quantity of waste transported has had its share of problems. In order to earn more money, many drivers tend to overfill their trucks beyond its capacity as a result of which garbage spills over throughout the route of transportation.

Future Activities

One of the areas of CMC's concern is the segregation of waste at source for better recycling and to reduce rag-pickers menace at *vat*/container points. In fact, according to CMC, one of the main reasons for the incomplete transfer of waste from the collection points to disposal site is the presence of rag-pickers who are constantly shifting away the recyclable items. Already, a project to the tune of Rs. 5.5 lakhs has been sanctioned by the World Health Organisation under the Healthy Cities Programme, whereby initially segregation of waste at source will be attempted in domestic and business areas. CMC plans to introduce the idea of two separate containers for degradable and non-degradable materials amongst the citizens of Calcutta. Poor people would be provided these containers free of charge by establishing an arrangement with the better-off sections of the society within the overall interest of the city's welfare. It is proposed that the rag pickers would also be integrated into this system.

Composting of market waste (organic) by CMC is presently being done on an experimental basis. To give a full impetus to this activity, CMC has made an agreement with a private firm for the processing of garbage. Once this system becomes fully functional, the firm will accept nearly 700 tons of garbage daily and will produce compost.

SURAT

STATUS SOLID WASTE MANAGEMENT

Governance

In Surat, the Surat Municipal Corporation is responsible for providing the service of solid waste management to the citizens of Surat. This is one of the obligatory functions of the municipal body.

Surat has experienced rapid growth in its population, area and economic activities, especially during the period 1981-91. Due to large availability of employment opportunities in the city, as many as 300,000 persons commute daily to the city. The number of occupied residential houses and households have increased by more than 100 per cent during 1981-91 and slums are on the rise. These have exerted tremendous pressure on SMC. Their system of city management collapsed in early 1994 mainly due to internal managerial problems within the Corporation. The plague of September 1994 is the result of SMC's negligence towards the citizens of Surat in the provision of basic urban services. The city's situation improved considerably by the year 1996 because of the initiatives taken by a group of concerned officials belonging to the executive and the elected wing of the SMC.

Waste Generation

At present, SMC has the task of managing about 900 metric tonnes (MT) of solid waste generated from all sources daily (1998). With almost 850 MT of waste collected daily, it has achieved an efficiency level of 95 per cent, ranking amongst the best cities in the country.

To accomplish the task of solid waste management, the Corporation area of 111.16 sq.km. has been divided into six zones which are further sub-divided into 52 sanitary wards for better waste collection. Each zone has its own zonal office, which is responsible for the

management of wards within its area. In case of payment of their tax or for reporting problems of waste management, etc., citizens can go directly to the zonal office. The solid waste management activities are executed under the supervision of the Municipal Commissioner and the Deputy Commissioner. They are supported by one Deputy Health Officer, one Sanitary Officer, two Chief Sanitary Inspectors, six Sanitary Inspectors (SI), 15 Sanitary Sub-inspectors (SSI), 35 *mukadams* (Supervisors), and 4886 sweepers (*Safai Kamdars*). Of the total sweepers employed with SMC, 4,701 are responsible for cleaning the wards, 53 for market areas and 132 for the health centres. To maintain discipline, the work of sweepers is regularly supervised by the *mukadams*, SSI's and SI's.

Collection of Waste

Street Sweeping and Collection of Domestic Waste

The sweepers work in two shifts in the city. Work in the first shift starts at 6.30 a.m. in the morning and goes on upto 11.00 a.m. during summer while in winter the timings are from 7.00 a.m. to 11.30 a.m. The second shift is from 2.30 p.m. to 5.30 p.m. The sweepers sweep the roads, collect garbage from the houses and transfer the waste into the garbage bins or containers at the nearest spot using a hand-driven trolley. One sweeper covers an average distance of 1000 yards from the place of collection of garbage to the containers or garbage bins. The ring road, which is the main road in the city, is cleaned during the morning hours by the corporation workers and by a private contractor at night from 10 p.m. to 3 a.m. due to the presence of heavy traffic during the day. The contractor receives an amount of 40 paise per sq. mt. of the road cleaned.

In order to prevent disposal of garbage on roads by the citizens, SMC has provided several small platforms of 3" height and 6'x10' width along road sides for garbage containers throughout the city. This, in turn, has facilitated cleaning of the area near the containers. Besides the placement of these small dustbins at every few metres, there are many large containers (approx. 700) and rectangular dustbins (approx. 425) for storing waste before it is transferred to the disposal site.

Collection of Waste from Slum Areas

Slum settlements are prominent in the city. SMC has made suitable arrangements for maintaining a clean and healthy environment in the slum areas. SMC officials brief slum residents from time to time on better waste management. This has created a concern among them and they do not throw garbage on the roads any more. The sweepers clean the slums on a regular basis every day and all waste is dumped into the Corporation truck, which is parked at the entry point of slums. For easier cleaning within the slums, the narrow lanes are paved with kota stone.

SMC also constructed 40 toilet complexes in slum areas with support from two NGOs, Sulabh and Paryavaran. Each complex has 20 seats on an average, with water, electricity and sanitation facility and they function on 'pay and use' principle.

Collection of Hospital Waste

There is no separate system for the collection and disposal of hospital waste. Presently such waste is being mixed with other types of waste and transferred to the disposal site. Incinerators are not available with the hospitals or at the disposal site. However, there is a proposal for one incinerator in each zone and at the disposal site with a capacity of 2.5 ton. SMC has planned to tie up with a private party for managing the disposal of hospital waste.

Collection of Industrial Waste

Industrial units in Surat have their own arrangements for the collection and disposal of industrial waste.

Waste from Hotels

The kitchen waste generated from the hotels in the city was previously being dumped into community bins. This caused the wet waste to flow on the road and create an unhealthy environment. The SMC officials made numerous efforts to raise awareness among the hotel staff. Now this waste is packed in plastic bags and transferred to the disposal site with the help of 6 tractors operated by the hoteliers themselves.

Transportation of Waste

SMC and private contractors jointly undertake waste transportation from the six zones. SMC's vehicles transport 60 per cent of waste while the remaining waste is transported by privately operated vehicles. Vehicles that operate in the central zone and the east zone do not go to the disposal site directly. In these two zones, small trucks first carry the collected garbage to the transfer station at Anjana in the central zone and Umarwada in the east zone where the garbage is dumped in larger containers. From the transfer station, large trucks, which can accommodate 4-6 containers at one time, are used to transport the waste to the disposal site. This arrangement helps in reducing the number of vehicular trips made to the disposal site. However, in the remaining zones, waste is directly transported to the disposal site.

Disposal of Waste

The Surat Municipal Corporation has three waste disposal sites. Katargam, located in the northern part of the city, has two sites and caters to only the north zone. This site has a lesser capacity and is nearly full. About 225.50 MT of garbage reaches this site every day. A third site is situated between the south-west and the south zone at Bhatar. This site receives 625.50 MT of garbage daily from the remaining zones of SMC. SMC officials are of the opinion that the site at Bhatar will continue for another 3-4 years before it reaches its optimum capacity. The garbage brought to these sites is levelled and covered with sand. At present there is no composting of waste at the disposal sites, however, there is a plan to establish a system of composting with Excel Industries Limited. In case this plan does not materialise, then SMC would acquire a 200 acre land for waste disposal in Khajod village beyond the west zone.

IMPROVEMENT INITIATIVES TAKEN IN SURAT

A series of initiatives were undertaken by SMC at the time of plague in 1994. SMC officials are of the view that the same level of efficiency is being maintained even now which is also evident from the proportion of waste collected in the Corporation area. In SMC, improving the administration of solid waste management seems to be the key to bringing about significant change in service delivery and, hence, urban environment.

Collection of Waste

The waste collection work in the city starts at 7.30 a.m. and goes on up to 12.30 p.m. daily. All zonal chiefs and zonal officers, deputy medical officers (health), deputy engineers, and other staff visit the field daily. They all are provided with mobile phones/ wireless sets for communication. They are proactive in detecting problems during supervision and if a problem is detected the message is immediately conveyed to the concerned zonal officer by wireless sets. A compliance message is received by the concerned officer.

A meeting of all the concerned officials is held daily, even on holidays. All zonal chiefs and divisional heads participate in the meeting and joint decisions are taken on various matters. Reports from the field are discussed and reviewed daily and steps are taken to solve the problem. Planning for system upgradation is done regularly and there is experience sharing amongst officials.

Levy of Administrative Charges

SMC has introduced a system of levying administrative charges on those who litter the streets or dispose of the waste on the streets after the street cleaning is over. The administrative charges have ranged from Rs. 100 to Rs. 50,000 and these are recovered on the spot from the defaulter. This is not levied as penalty but as administrative charge for cleaning the street again. This has brought about a sea change in the behaviour of people. Within the first few months of the drive, more than Rs. One crore (Rs. 100,000,000) was recovered by way of administrative charges and the city got disciplined through these

enforcement measures. This has also forced people into the habit of keeping their own bins and depositing their waste in the municipal system only.

Complaint Redressal System

SMC has set up a complaint redressal system in place. All complaints receive a white or a red card which entitles them to an answer detailing action taken or to be taken. White cards deal with 14 categories of sanitation and public health related complaints while red cards deal with 13 PHE related complaints. Complaints registered on red cards are answered within 24 hours while complaints on white cards are answered with 3 to 7 days. SMC has a record of answering 96 per cent of the complaints within the specified time limit.

Grievance Redressal System

SMC has also set up a grievance redressal system. Citizens can launch complaints on pagers. A grievance officer is appointed for each zone and headquarter to deal with these complaints. Complaints can be lodged manually also at any of the ward offices during the office hours and round the clock at the zonal offices. Development of an automated complaint lodging and monitoring system is also being undertaken. In this system the complainants will be able to lodge complaints using telephone and a special code "1913" has been assigned for it by DOT.

Private sector involvement

At present, SMC has taken the initiative to clean Mancharpur, which is one of the dirtiest locality situated in the central zone of the city. SMC workers had been neglecting this area for a long time due to which people were forced to throw garbage in the lanes just outside their houses. The situation of this area came to the notice of concerned SMC officials and subsequently a contract was given to a private tempo operator on an experimental basis for door to door collection of waste from the households. This arrangement came into effect during the last week of November, 1998. Street sweeping still remained the responsibility of SMC sweepers who sweep the lanes every day, collect waste in plastic bags and transfer the same to the nearest container or dust bin.

The private tempo now visits the area regularly and the local people are aware of this change. They, in turn, have shown full co-operation by transferring garbage generated in their houses only in the tempo. The tempo with a small trailer attached to it makes three trips in the morning and one in the afternoon. The tempo operator parks the vehicle at some selected points in the locality and gives a signal to the residents so that they can come and throw the garbage in the trailer. The collected garbage is transferred by the tempo to the Anjana transfer station in the central zone. For the services provided, SMC pays Rs. 340/- per day for an eight-hour duty to the tempo operator.

For monitoring this work, SMC has identified certain people within the locality who are influential and have a habit of practising their supremacy. These people take interest in the work assigned to them and they also feel that they now possess some power in their locality. The SMC, however, does not pay anything to these people. Mancharpur locality has acquired a new look now and the residents are very satisfied with the arrangements made by SMC.

SUMMARY AND CONCLUSIONS

Solid waste management is a complex task requiring cooperation from all sections of society. This service consumes a large part of the municipal expenditure but is often a neglected service. Local governments have been unable to keep pace with the growing requirements of waste management in the urban areas, mainly due to rapid growth in population and the changing consumption patterns. Solid waste management is, at present, handled unscientifically in most cities as the municipal officials in-charge of the service do not have adequate and updated knowledge of the scientific and environmentally sustainable methods of disposal. Nor do they have access to funds required to be invested for introducing such disposal methods. Given this situation, they have to look for public-private partnerships for managing solid wastes. Some local governments have successfully managed to improve the service by their innovative management methods. Private sector has also been brought in by local governments to help in solid waste management. A number of NGOs and individuals have also played a major role in bringing about changes at the local level.

The present study documents some of the improvement initiatives taken by local governments in four selected cities (Ahmedabad, Bangalore, Calcutta and Surat) in the country. A brief summary of some of the initiatives in the selected cities to improve solid waste management is given below:

Ahmedabad

The Ahmedabad Municipal Corporation (AMC) was the first municipal body in the country to introduce the closed container system for primary collection and transportation of city garbage. For efficient operation of the system, the Corporation took measures to impart formal training to the staff engaged in operating the hydraulic driven machines. Popular media was also used for educating people to keep their surroundings clean and dispose their waste only in community bins.

The initiatives taken by AMC for improving primary collection and storage of waste in the city include - introduction of house to house collection system; introduction of community

bins in hutments and chawls and special cleansing scheme for them and for housing societies; introduction of litter bins in public places; introduction of metallic containers for storage of waste, and mobile waste collection system in congested areas; changing the design of handcarts; and transportation of waste in closed metallic containers.

AMC along with voluntary organisations and NGOs have come up with an innovative concept of 'Zero Garbage on Roads'. The salient features of this programme are the appropriate utilisation of material as well as human resources to help in resource recovery, and recycling.

Bangalore

Efforts have been made in Bangalore for door-to-door collection of waste through NGOs and private contractors. Many NGOs have employed ragpickers for door-to-door collection of waste. The ragpickers segregate the waste collected and the kitchen waste is converted into manure through vermiculture and microbes. One community association in Bangalore city has achieved waste segregation and self-composting in the house gardens/ any other space available. Some NGOs engaged in solid waste management in Bangalore have gone beyond merely providing employment to the ragpickers. The ragpickers are given basic education and non-formal training in carpentry and screen printing. Children in the school going age are sent to schools, sponsored by various NGOs. Creating environmental awareness amongst the children as well as the general population has also been promoted by the NGOs in Bangalore. The topics on which environmental awareness is created includes segregation of waste at source into organic, toxic and dry components, conversion of organic components into compost, disposing soiled and toxic waste into the Corporation bins and selling of recyclable items.

The Bangalore City Corporation, by an administrative order, has given directions to the hotels and restaurants to make their own arrangements for collection and transportation of their waste and to dispose it off in the manner prescribed by the Corporation. . In most major markets, private contractors collect waste and deliver organic waste to the Karnataka Compost Development Corporation. The Corporation has recently made serious attempts to identify landfill sites, after a Public Interest Litigation was filed in the Supreme Court of

India. Seven landfill sites in different parts of the city have been identified for this purpose and the Corporation has started preparing the landfill sites for waste disposal.

Calcutta

In Calcutta, house to house collection of waste is done by the conservancy staff of Calcutta Municipal Corporation (CMC) using whistles for giving signal to the residents so that they come and drop their garbage in the hand cart. This system of waste collection from residential areas is being practiced in all the wards of the city.

CMC started, for the first time in the country, transportation and scientific disposal of hazardous hospital waste (segregated at source) from all hospitals, nursing homes, laboratories and clinics in Calcutta. For the transportation of hospital waste from the site, special types of trucks, which are fully covered and locked, are used. CMC has also taken adequate steps for the collection and safe disposal of amputated human body parts. Such waste is specially packed in polythene bags at source and transferred to the Hind burial ground where it is buried. For the purpose of disposal, an exclusive disposal ground with sanitary landfilling and leachate collection system has been prepared. There is a separate approach road for vehicles carrying hospital waste which leads directly to the chamber where such waste is dumped.

CMC has introduced charges for throwing garbage on street from 1st January 1997. Under this system, any person dropping garbage on the street is made to pay a minimum charge. CMC has also introduced an incentive system for drivers transporting waste. In addition to their salaries, drivers are paid an extra amount per tonne of garbage if the quantity transported exceeds 12 tons.

Surat

A series of initiatives were undertaken by Surat Municipal Corporation (SMC) at the time of plague in 1994. In SMC, improving the administration of solid waste management seems to be the key to bringing about significant change in service delivery and, hence, urban environment.

All zonal chiefs and zonal officers, deputy medical officers (health), deputy engineers, and other staff visit the field daily. They all are provided with mobile phones/ wireless sets for communication. A meeting of all the concerned officials is held daily, even on holidays. All zonal chiefs and divisional heads participate in the meeting and joint decisions are taken on various matters. Planning for system upgradation is done regularly and there is experience sharing amongst officials.

SMC has introduced a system of levying administrative charges on those who litter the streets or dispose of the waste on the streets after the street cleaning is over. The administrative charges are recovered on the spot from the defaulter. Within the first few months of the drive, more than Rs. One crore was recovered by way of administrative charges and the city got disciplined through these enforcement measures.

SMC has set up a complaint redressal system in place. All complaints receive a white or a red card which entitles them to an answer detailing action taken or to be taken. SMC has also set up a grievance redressal system. Citizens can launch complaints on pagers. Development of an automated complaint lodging and monitoring system is also being undertaken.

A review of the service in the selected cities indicates that:

- a) Most of the municipal bodies do primary collection only from streets. Door to door collection of waste is generally not undertaken by local governments. However, some cities are making attempts to collect domestic waste from doorstep mainly with the assistance of NGOs.
- b) Waste collection mechanisms are being improved through provision of technically improved collection vehicles. In some cities, along with the introduction of improved systems, training is also provided to the staff to maintain efficiency levels.
- c) The use of private sector in transportation of waste is becoming common.
- d) Composting of waste at the household and neighbourhood levels is increasing due to the involvement of NGOs. Local governments are also making efforts to involve private firms in setting up composting plants to take care of waste.

- e) Public awareness and education is becoming an important aspect of solid waste management. The realisation that public cooperation will go a long way in improving the service has led to greater focus on this aspect.

The initiatives, some of which could be termed as best practices, indicate that local governments are making conscious efforts to improve the service either through their own efforts or with the involvement of NGOs and the private sector.

The service in the selected cities can be stated to be satisfactory to good. This is mainly based on the waste collection efficiency of local governments. Each of the selected cities has taken initiatives to improve the service by introducing some changes. The summary tables (Tables 13 and 14) give the comparative picture of solid waste management in the selected cities.

Local governments need to strengthen the institutional capacity to handle the service. Skill upgradation on a continuous basis should form a part of their strategy. Local governments should encourage redesigning of equipment to suit the needs of the local situation and induct appropriate technology. Financing new requirements poses a major challenge to initiating improvements to this service. This could be overcome by involving private sector in different stages of this service, especially for resource recovery and final disposal. Local governments should also take steps to implement the legal provisions under the respective Municipal Acts to seek compliance in order to keep cities clean and healthy.

There is a need for local governments to prepare a solid waste management plan which would assist the officials in taking decisions regarding the service. There is also a great need to set up a management information system for this service which would not only help in getting a feedback on service levels but would also help in monitoring and planning for its improvement.

Table 13: Comparative Solid Waste Management Scenario in Selected Cities, 1998

| Item | Ahmedabad | Bangalore | Calcutta | Surat |
|---------------------------------|------------------|------------------|-----------------|--------------|
| Population (1991) | 2,876,710 | 2,660,088 | 4,399,819 | 1,498,817 |
| Area (sq.km) (1991) | 186.78 | 125.90 | 185.00 | 111.16 |
| Density (persons/sq.km.) (1991) | 15,402 | 21,129 | 23,783 | 13,483 |
| % Slum population | 40 | 15 | 40 | 40 |
| Solid waste generated (MT/day) | 1710 | 2,500 | 2,500 | 900 |
| Solid waste collected (MT/ day) | 1219 | 1,700 | 1,625 | 850 |
| Collection efficiency (%) | 71 | 68 | 65 | 95 |
| Number of street sweepers | 6,000 | 11,331 | 13,000 | 4,886 |
| Number of disposal sites | 7 | 7 | 5 | 3 |

Table 14: Improvement Initiatives in Selected Cities

| Ahmedabad | Bangalore | Calcutta | Surat |
|---|---|--|---|
| <p>Primary Collection and Storage</p> <ul style="list-style-type: none"> ▪ Introduction of house to house collection system ▪ Introduction of community bins for hutments and chawls ▪ Special scheme for cleansing hutments, private chawls and housing societies ▪ Introduction of litter bins ▪ Introduction of metallic containers for storage ▪ Mobile waste collection system in congested areas | <p>Door-to-Door Collection and Public Awareness</p> <ul style="list-style-type: none"> ▪ Sadashiv Nagar Welfare Forum ▪ Ragpickers Education and Development Scheme (REDS) ▪ Civic Amenities and Cultural Association, Indira Nagar ▪ Acts Trust <p>Collection and Neighborhood Disposal</p> <ul style="list-style-type: none"> ▪ Centre for Environment Education (CEE) ▪ Mythri Sarva Seva Samithi (MSSS) | <p>Collection, Transportation and Disposal of Waste</p> <ul style="list-style-type: none"> ▪ Street sweeping and collection of domestic/ commercial waste ▪ System of group work ▪ Hospital waste management ▪ Public relations survey ▪ Charges for throwing garbage on street ▪ Contracting ▪ Incentive to drivers | <p>Collection of Waste and Improvements in Management</p> <ul style="list-style-type: none"> ▪ Collection of waste ▪ Levying of administrative charges ▪ Complaint redressal system ▪ Grievance redressal system ▪ Private sector involvement |
| <p>Transportation of Solid Waste</p> <ul style="list-style-type: none"> ▪ Changing the design of handcarts ▪ Transportation of waste in closed metallic containers <p>Resource Utilisation, Recovery and Recycling</p> | | | |

Source : (i) Data on Population, Area and Density for 4 cities are obtained from the Census of India, 1991 (op.cit).
(ii) Data on daily commuters, slum population and the different parameters of solid waste have been collected from the records of municipal corporations in the 4 cities and by holding discussions with the concerned municipal officials.