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Human Settlement Management Institute (HUDCO), New Delhi,
India



Institute for Housing and Urban Development Studies, Rotterdam,
The Netherlands.

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CAPACITY BUILDING FOR THE URBAN ENVIRONMENT

A Comparative Research, Training and Experience Exchange Project

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URBAN ENVIRONMENTAL MANAGEMENT THE INDIAN EXPERIENCE

Edited by

BN Singh
Shipra Maitra
Rajiv Sharma

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Human Settlement Management Institute (HUDCO), New Delhi, India.



Institute for Housing and Urban Development Studies, Rotterdam, The Netherlands

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ABOUT THE PROJECT

The Human Settlement Management Institute (HSMI) of HUDCO, New Delhi in collaboration with Institute of Housing and Urban Development Studies (IHS), Rotterdam initiated in October, 1994 the Government of Netherlands assisted collaborative research project "Capacity Building for the Urban Environment: A Comparative Research, Training and Experience Exchange".

The two main objectives of the project are the development of National Capacity Building Strategies to improve the urban environmental management in India and review and sharing of international experiences.

The focus of the project is on capacity building at the local level. With this end in view, ten examples of "best practices" of urban environmental management were taken up for study and research by various lead research institutions, based on which an outline of National Capacity Building Strategies to improve the urban environment have been formulated and developed under the project for wider dissemination.

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Foreword

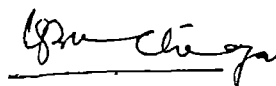
The present volume is a collection of ten working papers based on the report on ten best practices in urban environmental management in India. The case studies help in identifying and prioritising the urban environmental issues and involvement of stakeholders. They also analyse the institutional setting for urban environmental management focussing on key actors, management functions and coordination and decision making in inter-sectoral perspective under a legal and regulatory framework. The studies deal with partnerships-CBOs, NGOs, private sector enterprises, local, state and central governments. Gender concerns of urban environmental management have been given special focus. Lessons and experiences drawn out of the case studied have contributed towards developing capacity building strategies for the urban environmental management.

The volume is the outcome of a collaborative research project between HSMI, New Delhi, and IHS, Rotterdam, culminating into the research studies by lead research institutions on ten identified best practices. HSMI has edited the document for a comparative experience exchange, with similar projects in Peru, Bolivia and Senegal. It is hoped that the document will contribute in sharing knowledge and experience about urban environmental concerns.

This initiative could not have succeeded without the Dutch financial support extended through IHS, Rotterdam. IHS played a pivotal role by collaborating with HSMI in launching of this project and bringing it to this stage.

The current trend in India is to focus on management of urban environment which is a new concern attracting attention due to the prospect of India's entering the next century with more than 300 million urban population. This requires making cities the focus of urban environmental management. But there is a large gap between the responsibilities given to city, municipal and local governments, to provide basic infrastructure and services to the people within their boundaries and the resources, trained personnel and powers available to them to permit them to do so. Without proper institutional capacity building, the local bodies cannot gear up to the formidable tasks assigned to them. The involvement of the stakeholders as well as other citizens also are equally important for developing proper partnerships in the management of urban environment. It is hoped that the contribution made by the researchers will provide valuable inputs in the task of capacity building at the local level.

The project upon which the document is based represents a new phase in the activities of HSMI of HUDCO and research support by IHS, Rotterdam. It is hoped that this document will contribute to the understanding and hence solutions to the problems of urban environmental management besetting our urban areas.



KK Bhatnagar
Chairman & Managing Director, HUDCO

New Delhi
May, 1996



Preface

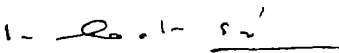
This document, an edited version of Working Papers, provides a general overview of some of the most important urban environmental issues now affecting India. The papers present the outcome of research studies undertaken to document individually main aspects of ten selected cases which have proven successful in the sphere of urban environmental management. The document has been designed to provide a context and perspective providing urban environmental issues which most clearly impinge on the preparation of Local Agenda 21. The analysis presented in the document should be of interest to a much wider audience than those directly involved in the cases studied.

The successful completion of this document is a result of contributions made by many individuals and institutions. First and foremost has been the support extended to us by ten research institutions. The principal researchers were: Shri RM Kapoor, Times Research Foundation, Calcutta; Dr. Dinesh Mehta, National Institute of Urban Affairs, New Delhi; Dr. Yogesh Kumar, Development Associates, Lucknow; Dr. Bindeshwar Pathak, Sulabh International Institute of Technical Research and Training, New Delhi, Shri JC Kala, Ministry of Environment and Forests, New Delhi; Dr. K. Vijaya Lakshmi, Development Alternatives, New Delhi; Dr. PK Saha, Institute of Wetland Management and Ecological Design, Calcutta; Shri GS Gill, City and Industrial Development Corporation, Mumbai and Shri Himanshu Parikh, Ahmedabad. The seriousness with which they completed the studies, the analysis of the case studies they provided characterise the high quality of the results. We are grateful to the principal researchers, their associates and the institutions for their contributions.

We are indebted to the members of Project Advisory Committee (PAC) - Shri KK Bhatnagar, CMD, HUDCO, Shri AP Sinha, Joint Secretary, Ministry of Urban Affairs and Employment, Dr. S Maudgal, Senior Adviser, Ministry of Environment and Forests, Dr. PS Rana, Executive Director (Infrastructure), Dr. Kulwant Singh, Executive Director, HSMI and Shri BN Singh, Project Coordinator-who were kind enough to come together at short notices during the entire project period in providing directions to this Project. Shri KK Bhatnagar, CMD, HUDCO as Chairman of PAC, whose dynamic leadership, close monitoring and able guidance made the completion of the tasks within stipulated time frame. Dr. Florian Steinberg, Project Leader, Indian Human Settlement Programme was also involved with the research study process and made significant contribution in going through the draft and making valuable suggestions for its finalisation. Our appreciation goes to the participants of Expert Group Meetings and National Forum, the Discussants and the Experts, without whose willing contributions and inputs, the document could not have been completed.

We also thank all organisations related to this project for extending all possible support and facilities for carrying out research studies. The secretarial assistance of T Balaji and Mohinder Singh cannot be under-valued in this whole exercise. Finally, the contributions and sustained efforts made by the project team comprising Shri BN Singh, Project Coordinator, Dr. Shipra Maitra, Research Coordinator and Shri Rajiv Sharma, Project Associate and Training Co-ordinator are acknowledged in bringing this document to this shape.

New Delhi
May, 1996


Dr. Kulwant Singh
Executive Director, HSMI



Contributors

The Times Research Foundation, Calcutta

The Times Research Foundation (TRF) was set up in 1979 with a large endowment from Bennett, Coleman & Co Ltd., publishers of The Times of India and its allied newspapers and periodicals. TRF undertakes, promotes and coordinates research in all aspects of urban affairs including economic structure of cities, local government, municipal finance, urban legislation, urban planning, infrastructure development, housing, transport and urban environmental management.

Research Team

Shri R M Kapoor, Chief, Urban Studies Centre
Shri P K Ghosh, Specialist Consultant (Legislation)
Shri P B Anand, Research Fellow

National Institute of Urban Affairs, New Delhi

The National Institute of Urban Affairs (NIUA) was set up in 1976 as an autonomous organisation for carrying out research in urban development, and is involved in the collection, processing, storing and dissemination of information regarding urban local bodies, their functioning, management, finance, development programmes and personnel training. The NIUA regularly interacts with national and international agencies.

Research Team

Dr Dinesh Mehta, Director
Dr Souro D. Joardar, Professor
Ms Usha Ragupathi, Associate Professor
Dr. Madhusree Mazumdar, Senior Research Officer
Shri E B.V Kumar, Research Associate
Ms Virmi Bazaz, Research Associate

Development Associates, Lucknow

Development Associates (DA) is a consultancy organisation which has been formed with the aim to strengthen institutions and organisation; specially those engaged in community development, livelihood generation and infrastructure promotion programmes. It assists to foster programmes of social development undertaking specific assignments.

Research Team

Dr. Yogesh Kumar
Shri Nabarun Ray Chaudhuri
Shri Kushal Neogi

Sulabh International Institute of Technical Research and Training, New Delhi.

Sulabh International Institute of Technical Research and Training is a voluntary social organisation registered under the Societies Registration Act of 1860

Salient areas of technical research are in alternative sources of energy, sanitation and pollution control with emphasis on low-cost technology, improvement in design of individual and community toilets for wider acceptability, and waste management with emphasis on waste recycling and resource recovery. In addition, it provides training in sanitation, water supply, primary health care, waste management, renewal energy technology etc. and integrated rural development aspects as well.

Research Team

Dr Bindesshwar Pathak, Project Director
Shri A K Roy, Principal Advisor

Prof Bakshi D Sinha, Senior Advisor

Shri K.N. Gupta, Advisor
Shri P.S.K. Menon, Advisor
Shri D P. Singhal, Director (SIITRAT)
Dr. P.K. Jha, Technical Director (SIITRAT)
Shri R.M.P. Sinha, Team Coordinator

Human Settlement Management Institute /HUDCO-Waste Management Cell of UIFW

The Human Settlement Management Institute is the Research and Training Division of the Housing and Urban Development Corporation (HUDCO) established to promote applied research and provide training support for professional involved in the planning and development of human settlements.

Waste Management Cell of Urban Infrastructure Finance Wing (UIFW) of HUDCO deals with waste management aspects of domestic and industrial wastes including resource recovery and recycling. It provides programme development as well as programme support comprising a broad range of activities such as financing of viable waste management projects, providing management support, networking of expertise, creating a data base through documentation, identification of constraints and formulation of guidelines, evolving suitable integrated waste management packages etc.

Research Team

Shri BN Singh, Project Coordinator
Dr. NB Mazumdar
Shri Rajiv Sharma, Project Associate

The team was assisted by the following four Research Associates who collected data and provided analytical framework for the study:

Ms. Preeti Pethe for Bombay and Pune
Shri Tarush Chandra for Ahmedabad and Rajkot
Ms. Shalaja R for Bangalore
Ms. Shyamala Krishna for Madras

Ministry of Environment and Forests; New Delhi

The Ministry of Environment and Forests is the nodal agency in the administrative structure of the Central Government, for planning, promotion and coordination of environmental and forestry programmes. The main activities of the Ministry are. conservation and survey of flora, fauna, forests and wildlife, prevention and control of pollution, afforestation and regeneration of degraded areas and protection of environment.

Research Team

Shri JC Kala, Joint Secretary, GPD
Shri K Mohan, Adviser, GPD
Shri B Sikka, Joint Director, GPD
Shri JC Gambhir, Consultant

Development Alternatives, New Delhi

Development Alternatives is an organisation with a mission to sustainable development through appropriate technology, institutional design and environmental management. It promotes and design low-cost techniques of environmental management. It experiments in self sustaining, low cost commercial operations to meet the needs of poor.

Research Team

Dr Vijaya Lakshmi
Shri P Ratna Prasad

Institute of Wetland Management and Ecological Design, Calcutta

Institute of Wetland Management and Ecological Design Calcutta (IW MED) was established in 1986 by the Government of

West Bengal to study different aspects of the wetland intimately. IW MED has completed different projects on wetlands and prepared baseline data for further study.

Research Team

Shri Kalyan Biswas, Principal Secretary, Department of Forests and Environment
Prof Mohit Bhattacharya, Adviser
Dr. Pujushkanti Saha, Director and Principal Resercher
Dr Netai Kundu, Research Associate
Dr. Sunita Chandra, Project Scientist
Shri Krishnendu Basak, Project Scientist

City and Industrial Development Corporation, Mumbai

CIDCO was registered as a fully owned State Government Company under Indian Companies Act on the 17th March 1970 for the purpose of planning and development of Navi Mumbai (New Bombay) Following the recommendations of the regional plan by Bombay Metropolitan Regional Planning Board in January 1970, it was designated as 'New Town Development Authority' under Maharashtra Regional Town Planning Act, 1968 for planning and development of Navi Mumbai. CIDCO has been able to generate its own resources through planning, effective management and using land as a resource.

Research Team

Shri GS Gill, Jt. Managing Director
Shri A Bhattacharya, Chief Economist
Ms Uma Adusumilli, Senior Planner

Shri Himanshu Parikh, Ahmedabad

Himanshu Parikh is a Consulting Engineer engaged in providing innovative and low cost engineering solutions for the city level waste management practices, amongst other consultancy assignments. The thrust of his work has been on the redevelopment and integration of slums in the city fabric popularly known as "Slum Networking". He is now extending his ideas in other cities. In this process, his area of work focusses on developing linkages beyond physical improvements with communities, financial institutions and industries.

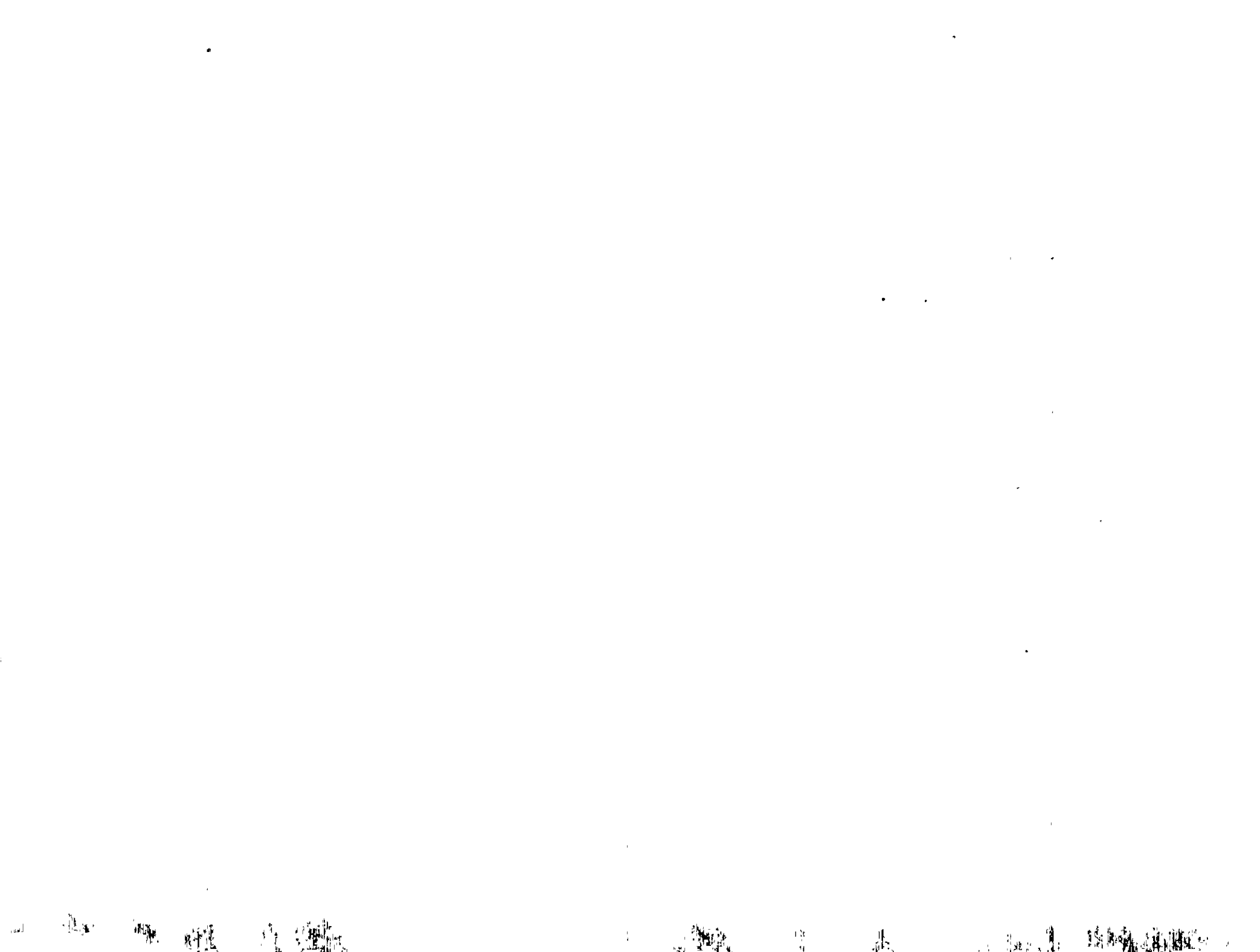
Abbreviations

| | | | |
|-------|--------------------------------------------------|---------|-----------------------------------------------------------|
| AET | Adult Education Teacher | EWS | Economically Weaker Section |
| AIDS | Acquired Immune Deficiency Syndrome | FWWB | Friends of Women's World Bank |
| ALOs | Area Level Organisations | GAP | Ganga Action Plan |
| AMC | Ahmedabad Municipal Corporation | GF | Garbage Farm |
| ANM | Auxiliary Nurse Midwives | GPD | Ganga Project Directorate |
| APMC | Agriculture Produce Market Committee | GRASP | Garbage recycling and segregation programme |
| AWW | Anganwadi Workers | GRUH | Gujarat Rural and Urban Housing |
| AYBI | Association of Youth for Better India | HDFC | Housing Development and Finance Corporation |
| BCC | Baroda Citizens Council | HQ | Head Quarters |
| BIMA | Bombay iron & Steel Merchants' | HSMI | Human Settlement Management Institute |
| BMC | Bombay Municipal Corporation | HUDCO | Housing and Urban Development Corporation |
| BMC | Baroda Municipal Corporation | ICDP | The Ganga Institutional and Community Development Project |
| BMRDA | Bombay Metropolitan Region Development Authority | ICDS | Integrated Child Development Scheme |
| BOD | Biological Oxygen Demand | IDA | Indore Development Authority |
| BOT | Build, Operate and Transfer | IDP | Indo-Dutch Project |
| BPMCA | Bombay Provincial Municipal Corporation Act | IHS | Institute for Housing and Urban Development Studies |
| CAA | Constitution Amendment Act | IDSMT | Integrated Development of Small and Medium Towns |
| CBO | Community Based Organisation | ILFS | Infrastructure leasing and Financing Services |
| CD | Community Development | INORA | Institute of Natural organic Agriculture |
| COD | Chemical Oxygen Demand | IRCON | Indian Rail Construction Company |
| CHW | Community Health Workers | IUCN | International Union of Conservation of Nature |
| CIDCO | City & Industrial Development Corporation | IWMED | Institute of Wetland Management & Ecological Design |
| CLRI | Central Leather Research Institute | JNN | Jeevan Nirvaha Niketan |
| CMC | Computer Maintenance Corporation | KAP | Knowledge, Attitudes, Practices |
| CPCB | Central Pollution Control Board | Kcal/Kg | Kilo calories per kilogram |
| CSLA | Community Savings and Loan Association | KISS | Keep it separate sir |
| CV | Community Volunteer | KJS | Kanpur Jal Sansthan |
| CW | Community Worker | KKPKP | Kagad Kanch Patra Kashtakari Panchayat |
| DMOH | Deputy Medical Officer of Health | Km. | Kilometre |
| DO | Dissolved Oxygen | | |
| DST | Department of Science and Technology | | |
| EIUS | Environmental Improvement of Urban Slums | | |
| ESI | Employees Scheme for Insurance | | |
| ETP | Effluent Treatment Plant | | |

| | | | |
|-------|------------------------------------------------|-------------|-----------------------------------------------|
| KNM | Kanpur Nagar Mahapalika | PMC | Pune Municipal Corporation |
| KWHR | Kilowatt Hour | PMP | Private Medical Practitioner |
| LCS | Low Cost Sanitation | PST | Primary School Teacher |
| LPCD | Litres per Capita per Day | PUBLIC | People United for Better Living in Calcutta |
| MCGB | Municipal Corporation of Greater Bombay | PWD | Public Works Department |
| MEIP | Metropolitan Environment Improvement Programme | RCV | Resident Community Volunteer |
| MIDC | Maharashtra Industrial Development Corporation | RMC | Rajkot Municipal Corporation |
| MIS | Management Information System | Rs. (Rupee) | Indian Currency (1\$ = Rs. 35) |
| MLA | Member of Legislative Assembly | SEWA | Self Employment Women's Association |
| MLD | Million Litres per Day | SH | State Highway |
| MMA | Madras Municipal Corporation | SHNDT | Shirmati Nathibai Damodar Thackersey |
| MPCB | Maharashtra Pollution Control | SPARC | Society for Promotion of Area Resource Centre |
| MSEB | Maharashtra State Electricity Board | STW | Sewage Treated Fishery |
| MT | Metric Tonnes | SWM | Solid waste management |
| MTNL | Mahanagar Telephone Nigam Limited | TBA | Traditional Birth Attendant |
| MWSSB | Maharashtra Water Supply & Sewage Board | TBIA | Thane-Belapur Industrie's Association |
| NCR | National Capital Region | TPD | Tonnes per day |
| NGO | Non-Governmental Organisations | TPH | Tonnes per hour |
| NH | National Highway | TPS | Town Planning Scheme |
| NIMBY | Not in my backyard | UASB | Upflow Anaerobic Sludge Blanket |
| NMMC | Navi Mumbai Municipal Corporation, | UBSP | Urban Basic Services for Poor |
| NPK | Nitrogen Phosphorous Pottasium fertilizer | UCD | Urban Community Development |
| NRAP | National River Action Plan | UIFW | Urban Infrastructure Finance Wing |
| NRCP | National River Conservation Programme | ULC | Urban Land Ceiling Act |
| NRY | Nehru Rojgar Yojna | UNDP | United Nations Development Programme |
| NSCC | National Society for Clean City | UNICEF | United Nations Children's Fund |
| O & M | Operation and Maintenance | UPIN | Uttar-Pradesh Jal Nigam |
| ODA | Overseas Development Administration | UPSPCB | Uttar Pradesh State Pollution Control Board |
| ORS | Oral Rehydration Solution | WMC | Waste Management Cell |
| PAP | Project Affected Person | YES | Your Environmental Standards |
| PCMC | Pimpri Chinchwad Municipal Corporation | YUVA | Youth for unity and voluntary action |

Glossary of Local Terms

| | | | |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------------------------------------------------------------------------------------------------------------------------|
| Anganwadi | Kindergarten | Kachrawali | Woman waste picker |
| Bagdi | A low caste group in the Scheduled caste category. They are mainly engaged in cultivation and fishing. | Khadki | Traditional street |
| Balnicketan | Primary School | Kutchra | Temporary |
| Balwadi | Pre-primary school | Mahila | Women |
| Basti | Slum | Mandal | Group |
| Bheri | Fish pond (fresh water) where different types of carps are usually bred and reared. | Matsyajibi | Fisherman (matsya = fish; jibi = livelihood). |
| Boro | A variety of spring paddy, usually harvested before the cultivation of Aman paddy and grown in highland areas with the help of irrigation. | Mazdoor Samiti | A labourer's organisation (mazdoor = labour, samiti = organisation). |
| Chawl | Industrial tenement street | Mehendi | Henna |
| Cottah | A unit for the measurement of land. 1 cottah is equivalent to about 720 sq. feet. | Mouza | Revenue village unit |
| Dau | Midwives | Nallah | Natural drainage course, river |
| Dhoba | A low-caste community-washermen by occupation. | Napit | A low caste community - barber by occupation. |
| Gobar | Cow dung | Nona Bheri | Fish pond (nona = saline water). Here, mainly the culture of such fish species as Chingri, Bhargar, Parse etc. are carried out. |
| Gramin | Village | Padmaraj | A sub-caste belonging to the Scheduled Caste category |
| Indira Mohila Yojana | A programme for the upliftment of the women's lot named after Indira Gandhi (ex-Prime Minister of India). | Rabari | Shepherd |
| Jhil/Jheel | A vast expanse of waterbody, usually more than 2.5 ha. in areas. It is highly endowed with nutrients, sediments, macrophytes etc. | Rahdiwala | Petty traders of recyclable wastes |
| | | Rojgar | Employment |
| | | Sangh | Group |
| | | Sona | A chemical fertiliser. |
| | | Vikas | Development |
| | | Yojana | Policy/programme |



LOCATION OF STUDY TOWNS





Power to the People — The Local Government Context

Times Research Foundation, Calcutta

THE FRAMEWORK FOR ANALYSIS

ITS SEVERAL DIMENSIONS

This research study on Democratic Decentralization of Local Governments in India examines the several issues involved in the following contexts

- (1) capacity building at local level for sustainable human settlements
- (2) the Habitat II concerns
- (3) decentralization and its various manifestations
- (4) the initiative for spreading local democracy in India
- (5) promotion of people-centred environmentalism
- (6) gender awareness
- (7) preparing for transition — the HRD agenda.

Since the principal focus of this study is on the epoch-making reform in the Indian Constitution whereby local governments in India, both rural and urban, have been accorded a Constitutional status, the various provisions of the Constitution (Seventy-fourth Amendment) Act, 1992 relating to Municipalities and their impact on governance and urban environment management which, in turn, would influence the quality of life in the urban centres of India, have been examined

SUSTAINABLE HUMAN SETTLEMENTS

FROM VANCOUVER AND RIO TO ISTANBUL

While the June 1976 Habitat I Conference in Vancouver concerned itself mostly with issues related to housing and the Earth Summit at Rio in 1992 was devoted to ecosystems and consideration of the risks of global environmental deterioration, the Habitat II City Summit at Istanbul is expected to deal with several cross-sectoral issues including, among others, governance, environment management, shelter provision, transport, communication and poverty alleviation, through gender-sensitive eyes

GOVERNANCE — THE KEY ISSUE

This study, however, aims to present the thesis that among the several initiatives with possible impacts on sustainable human settlements, governance through responsive and responsible local governments provides the common denominator for reforms in all other areas which may have an impact on the quality of life in human settlements, urban and rural alike.

PEOPLE-ORIENTED ENVIRONMENTALISM

Environmentally speaking, this study emphasizes the fact that, in to-day's context, the sphere of urban development extends beyond the supply of urban infrastructure which conventionally includes water supply, housing, transport, etc. The study further points out that investment on infrastructure development alone has not, and does not, make a sustainable city

The study stresses on the point that sustainable cities require the management of urban environment and an understanding of the linkages among infrastructure, productivity, poverty and environmental health also.

GENDER AWARENESS

A gender perspective is also among the new concerns for Habitat II. This is so because only a gender-friendly environment can provide the components a household needs to ensure an optimum level of living

The definition of optimum obviously differs in each society, but there are some universally accepted components which are recognized as basic human needs — food, shelter, clean water and air, safety, education and economic security

Since in a larger part, the responsibilities for family needs continue to fall on women, the study points out that a gender-friendly environment means a women-friendly environment

REPLICABILITY

As a matter of fact, inasmuch as the Government of India chose to amend the Indian Constitution itself shows that this may be among the best examples anywhere in the world for any reform initiative related to sustainable human settlements. This initiative,

for sure, aims to strengthen and spread local democracy, to ensure local fiscal autonomy and lays appropriate emphasis on decentralization of local government functions having due regard to the new imperatives for urban environment management. This would become obvious from the analysis which follows

THE HABITAT II CONCERNS

MICHAEL COHEN ON CHALLENGE OF ISTANBUL

However, to begin with, it is important to take a global view of the urgent concerns which may dominate the City Summit agenda.

In this regard, no better statement can be made beyond what has been recently documented by Michael Cohen² of The World Bank. After examining the legacy of Vancouver, Cohen summarizes the changed global context thus :

“In contrast to the relative stability of the 1970s, the past 20 years have witnessed momentous change. Predominantly rural countries have experienced rapid and sustained urban growth whereby large cities have continued to expand their populations and territories and secondary cities and towns have mushroomed. Economically, the 1980s were a decade of debt and adjustment in Latin America and Africa resulting in lowered expectations for the future. In contrast, East Asian economies prospered at unprecedented rates. Politically, the developing countries of Africa and Asia have gone through their first generation of post-independence political leadership, and Latin America has shed its military dictatorships for democratic regimes.

At the end of the 1980s, the Berlin Wall was torn down and the Soviet Union collapsed, leading to the birth of new European and Asian states that are now facing the challenge of economic transition and the construction of market economies. By 1992, the world's leaders had been alerted to the risks of global environmental deterioration at the Rio Summit and their citizens were mobilized at the local, provincial, and national levels to address these issues.”

Regarding the challenge of Istanbul, Cohen observes that:

“Within this context of economic and political change, the challenge of Habitat II is to convince the world's political leaders of the importance of urban issues in achieving global and national development objectives. Appreciation of the role

of cities must go beyond ministries of housing to reach presidents, prime ministers, and ministers of finance to assert the need for effective public policies and resources to be mobilized to address the urban agenda. Habitat II must bring together the two definitions of the word “habitat”: at Vancouver in 1976, it referred to human settlements i.e., people in cities, and in Rio 1992 “habitat” referred to ecosystems. The Istanbul conference must integrate these two different discourses and concerns people and natural resources.”

Cohen's views regarding the four new imperatives are .

1. The economic performance of cities will determine the economic prospects of nations. If urban areas already account for at least 50 percent of GDP in all countries — upto 75 percent in Latin America and more in industrialized Europe and North America — it is evident that efficient cities are critical to generating economic growth required for future prosperity.
2. Urban economic performance and environmental quality are mutually interdependent. If urban air, water and land are degraded, it will be impossible for people to remain healthy and productive over time. There is a need to affirm “the human face of the urban environment” through “people-centered environmentalism.”
3. The reduction of poverty will be impossible without generating jobs and incomes in urban areas. This applies to both absolute poverty — decrease of incomes and calories below acceptable thresholds — as well as relative poverty and increasing inequality.
4. The crisis of governance in most countries can only be resolved through wider local participation at the urban and community level. The process of political decentralization, already advanced in some countries, must continue and transform the current weak governance of cities into more accountable and transparent processes of administration and participation.

The Habitat II Conference, therefore, must create political space for mobilization of national, regional, local, and community actors to contribute to finding locally appropriate solutions for the problems listed above.

This study aims to demonstrate as to how the Indian initiative in democratic decentralization addresses the various concerns highlighted by Cohen.

ALTERNATIVE FORMS OF DECENTRALIZATION

CLASSIC TYPOLOGY

D. Rodinelli¹⁰ distinguishes between four different types of decentralization all of which represent some form of transfer of power from higher to lower levels of government. A distinction is made because they have different characteristics and different policy implications. The four types are .

- (1) Political decentralization
- (2) Spatial decentralization
- (3) Administrative decentralization, and
- (4) Privatization and market decentralization.

According to him, administrative decentralization, in turn, has three forms, namely, deconcentration, delegation and devolution.

On the various typologies of decentralization, Rodinelli has the following to say .

Political decentralization gives more political power for decision-making to citizens or their elected representatives and is usually associated with representative government, citizen participation and democratization.

Spatial decentralization is a process of diffusing urban population and economic activities geographically among settlements of different sizes. It aims to build the capacity of public and private organizations in secondary cities and towns to raise their own revenues to acquire the services, facilities and productive activities needed for economic development.

Administrative decentralization implies the transfer of responsibility for planning, management and the raising and allocation of resources from the central government and its agencies to field units of government agencies, subordinate units or levels of government, semi-autonomous public authorities or corporations, area-wide, regional or functional authorities or non-governmental private or voluntary organizations.

Deconcentration, the weakest form of decentralization, is the redistribution of decision-making authority and financial and management responsibility for providing urban services and infrastructure among different levels within the central government.

Delegation implies that central ministries transfer responsibility for decision-making and administration to semi-autonomous organizations not wholly controlled by the central government, but ultimately accountable to it.

Devolution transfers responsibility for services to municipalities that elect their own mayors and councils, raise their own revenue, and have independent authority to make investment decisions.

Privatization and market decentralization is the process of creating conditions in which goods and services are provided by market mechanisms primarily through the revealed preferences of individuals.

In the current Indian context, political decentralization and devolution form a part of the scheme of the Constitutional reforms while spatial decentralization and market decentralization are implied in an indirect manner.

EVALUATION OF DECENTRALIZATION POLICIES

For the purpose of policy analysis, Rodinelli³ has proposed a framework involving six steps for evaluation of decentralization policies and identified a variety of criteria to determine the degree to which decentralization contributes to achieve political objectives, increases administrative effectiveness, promotes economic and managerial efficiency, promotes greater financial self-reliance among local groups and organizations, increases government and private sector responsibility to the diverse needs and demands of the urban population, and contributes to the productivity and efficiency of the urban economy.

The political, economic and social dimensions of decentralization policies need to be evaluated in these contexts and this has been attempted in this study in relation to the Indian initiative.

INTERNATIONAL EXPERIENCE

Bill Dillinger⁴ points out that political decentralization is a widespread phenomenon. Out of the 75 developing and transitional countries with populations over five million, all but twelve claim to have transferred some political power to local units of government. The form and extent of decentralization, however, varies.

In parts of Africa, national governments are creating local political entities in territories that were formerly solely under the administration of central government. In Eastern Europe, what were formerly local administrative units of central government have been transformed into separate political entities, with leadership chosen by local election rather than by appointment through the party structure. In Latin America, similarly, decentralization has meant a shift from centrally appointed mayors to mayors chosen by election.

PHILIPPINES LOCAL GOVERNMENT CODE OF 1991

In Asia, in the words of President Corazon C. Aquino³ of the Philippines, "the approval of the Local Government Code of 1991 marks the high point in our effort to strengthen democracy and attain a sustainable development. The new law lays

down the policies that seek to institutionalize democracy at the local level".

The Declaration of Policy under section 2 and the Operative Principles of Decentralization under section 3 clearly enunciate the basic principles underlying the 1991 Code:

Section 2. Declaration of Policy. 5 - (a) It is hereby declared the policy of the State that the territorial and political subdivisions of the State shall enjoy genuine and meaningful local autonomy to enable them to attain their fullest development as self-reliant communities and make them more effective partners in the attainment of national goals. Toward this end, the State shall provide for a more responsive and accountable local government structure instituted through a system of decentralization whereby local government units shall be given more powers, authority, responsibilities and resources. The process of decentralization shall proceed from the national government to the local government units.

(b) It is also the policy of the State to ensure the accountability of local government units through the institution of effective mechanisms of recall, initiative and referendum.

(c) It is likewise the policy of the State to require all national agencies and offices to conduct periodic consultations with appropriate local government units, non-governmental and people's organizations and other concerned sectors of the community before any project or program is implemented in their respective jurisdictions.

Section 3 Operative Principles of Decentralization 5 - The formulation and implementation of policies and measures on local autonomy shall be guided by the following operative principles:

(a) There shall be an effective allocation among the different local government units of their respective powers, functions, responsibilities and resources.

(b) There shall be established in every local government unit an accountable, efficient, and dynamic organizational structure and operating mechanism that will meet the priority needs and service requirements of its communities;

(c) Subject to civil service law, rules and regulations, local officials and employees paid wholly or mainly from local funds shall be appointed

or removed, according to merit and fitness, by the appropriate appointing authority;

(d) The vesting of duty, responsibility and accountability in local government units shall be accompanied with provision for reasonably adequate resources to discharge their powers and effectively carry out their functions; hence, they shall have the power to create and broaden their own sources of revenue and the right to a just share in national taxes and an equitable share in the proceeds of the utilization and development of the national wealth within their respective areas;

(e) Provinces with respect to component cities and municipalities, and cities and municipalities with respect to component barangays, shall ensure that the acts of their component units are within the scope of their prescribed powers and functions;

(f) Local government units may group themselves, consolidate or coordinate their efforts, services and resources for purposes commonly beneficial to them;

(g) The capabilities of local government units, especially the municipalities and barangays, shall be enhanced by providing them with opportunities to participate actively in the implementation of national programs and projects,

(h) There shall be a continuing mechanism to enhance local autonomy not only by legislative enabling acts but also by administrative and organizational reforms;

(i) Local government units shall share with the national government the responsibilities in the management and maintenance of ecological balance within their territorial jurisdiction, subject to the provisions of this Code and national policies;

(j) Effective mechanism for ensuring the accountability of local government units to their respective constituents shall be strengthened in order to upgrade continually the quality of local leadership;

(k) The realization of local autonomy shall be facilitated through improved coordination of national government policies and programs and extension of adequate technical and material assistance to less developed and deserving local government units;

(l) The participation of the private sector in local governance, particularly in the delivery of basic

services, shall be encouraged to ensure the viability of local autonomy as an alternative strategy for sustainable development; and

(m) The national government shall ensure that decentralization contributes to the continuing improvement of the performance of local government units and the quality of community life

Provisions of sub-clause (i) of section 3 are noteworthy for a clear-cut statement regarding the roles and responsibilities of local governments and national government for management and maintenance of ecological balance within the territorial jurisdictions

LOCAL AGENDA 21 AND THE LOCAL GOVERNMENT NEXUS

THE LISBON PROTOCOL

On May 1, 1995, the Secretary-General of Habitat II, Dr. Wally N'Dow, officially handed over signed copies of what has become known as the Lisbon Protocol to the representatives of international associations of local authorities, committing them to undertake major roles in national level preparations for Habitat II, in the deliberations at the City Summit, and in the follow-up of the Habitat II Conference

This protocol was inspired by a call from Dr. Boutros Boutros-Ghali¹, Secretary General of the United Nations, delivered at the first Preparatory Committee meeting, at Geneva, when he stated

“Because so many of the problems and solutions being addressed by Agenda 21 have their roots in local activities, the participation and cooperation of local authorities will be a determining factor in fulfilling its objective. Local authorities construct, operate and maintain economic, social and environmental infrastructure, oversee planning processes, establish local environmental policies and regulations and assist in implementing national and subnational environmental policies. As the level of governance closest to the people, they play a vital role in education, mobilizing and responding to the public to promote sustainable development.”

Dr. N'Dow called the local authorities the real captains of human settlements and a *sine qua non* for Habitat II.

THE CONSTITUTIONAL REFORM OF LOCAL GOVERNMENTS IN INDIA

The fact that much before the preparations for Habitat II commenced in India, a bold initiative had already been under-

taken to strengthen local governments, both rural and urban, demonstrates the foresight of the Indian Government to meet the challenges of Habitat II.

The Indian initiative relating to Municipalities reached a climax on June 1, 1993, when the Constitution (Seventy-fourth Amendment) Act, 1992, came into force. This Act accorded Constitutional status to municipal governments in India

For the sake of historical record, it may be stated here that the first initiative for democratic decentralization of local governments in India was taken in August 1989 by the late Prime Minister Rajiv Gandhi⁵ who was committed to vest power in the only place where power rightfully belongs in a democracy, that is, in the hands of the people

The major objectives which the 74th Constitution Amendment Act has aimed to achieve are as follows:

- (1) its political context whereby Municipalities shall be constituted on the basis of predefined criteria for municipalization and not merely on political considerations

Also, whereby duly elected governments, with due representation of the weaker sections from among the Scheduled Castes, the Scheduled Tribes and the backward classes shall be installed at the helm of civic affairs, and State Government's control shall be limited, with specified powers for dissolution, and the condition that no elected body shall be superseded for any period more than six months

- (2) its empowerment of women whereby one-third of the seats in any Municipality, including those of the offices of Mayors, shall be reserved for women
- (3) its new perspective of the functional domain of the Municipalities as suggested in the Twelfth Schedule
- (4) its emphasis on strengthening local fiscal autonomy whereby upon the recommendations of State Finance Commissions which would be Constitutional authorities, principles shall be enunciated for tax assignments, sharing of taxes and grants-in-aid
- (5) its emphasis on urban environment management in addition to urban management
- (6) its precondition that people's representatives would have a full say in all planning matters, and
- (7) a new focus on development planning as against land use planning which shall also aim to integrate the rural and urban development plans in any district or metropolitan area

For further decentralization of urban functions, the Amendment Act also provides that the State Legislature may, by law, make provisions for constituting Wards Committees in the territorial area of any Municipality having a population of three hundred thousand or more.

It also provides that the Legislature may, by law, endow the Municipalities with such powers and authority as may be necessary to enable them to function as institutions of self-government and to perform such functions as may be specified in the law.

CONFORMITY LEGISLATION

In view of a requirement under the 74th Constitution Amendment Act, the State Governments in India passed the conformity legislation by May 31, 1994, to ensure that the provisions of the existing municipal laws in the respective States were not repugnant to the Constitutional provisions.

SPREADING LOCAL DEMOCRACY IN INDIA — THE POLITICAL CONTEXT

ITS VARIOUS DIMENSIONS

Specification of the territorial jurisdictions of Municipalities based on newly defined criteria for municipalization, and in cities with population of three hundred thousand or more, constitution of Wards Committees involving the people's representatives, installation of representative local governments at the helm of civic affairs, reservation of seats for women besides the other identified groups from among the weaker sections, regularity of elections, limited control by State Governments and specified powers for dissolution, are among the salient features of the Constitution (Seventy-fourth Amendment) Act, 1992, in so far as political decentralization is concerned.

THE MUNICIPAL AREAS

TERRITORIAL JURISDICTIONS OF MUNICIPALITIES

In a departure from erstwhile practices whereby Municipalities used to be constituted without reference to any specified criteria and, in many cases, these used to be constituted mostly on political considerations, the amended Constitution requires that municipal areas shall be declared having regard to the population of the area, the density of population therein, the revenue generated for local administration, the percentage of employment in non-agricultural activities, the economic importance or such other factors as may be specified by the State Government by public notification for this purpose.

This arrangement, in a way, relates to spatial decentralization of the urban areas in any State.

In this regard, it is to be noted that according to the 1991 Census, there were 3,592 urban local bodies in India of which 55 were Municipal Corporations and 1,290 were designated as Municipalities. Another 253 were governed by Municipal Boards and 213 were listed as Municipal Committees. In addition, there were several other types of local bodies such as City Municipal Committees, Town Municipal Committees, Town Panchayats, Notified Area Committees and Cantonment Boards. Table 1.1 presents data relating to the same.

According to the present scheme of things, there are some States which have only one type of urban local body while there are others which have two, three and even four types of such bodies. Table 1.2 presents the data on population ranges for the various types of urban local bodies.

It may be noted that under the new Constitutional provisions, delimitation exercises for classification of the existing municipalities into the proposed three types will have to be conducted with due regard to the existence of numerous local bodies of various types. This may involve fixation of new boundaries of the existing local bodies and redrawing of the municipal maps in India, with attendant political implications.

It may be noted that until and unless very careful provisions are made in municipal laws, many industrial areas in the country may remain beyond municipal boundaries, depriving the Municipalities of major revenue sources, while they may have to cater to the commuter population therefrom.

The point needs to be emphasized that preparatory administrative work is absolutely essential before the legislative intentions on the criteria for municipalization are conceived.

METROPOLITAN AREAS

Besides delimiting "larger urban areas", "smaller urban areas" and "transitional areas", for which Municipal Corporations, Municipal Councils and Nagar Panchayats, respectively, will be constituted, it will be necessary to delimit, for the first time, "Metropolitan areas", also.

A "Metropolitan area" means an area having a population of one million or more. A "Metropolitan area" may fall entirely within the limits of one district, or parts of it may fall within the limits of one district, or parts of it may fall within the limits of more than one (contiguous) districts. It may consist of two or more Municipalities or Panchayats or other contiguous areas. Which area fulfilling the aforesaid criteria should be constituted as a "Metropolitan area" has been left to be specified by the Governor by public notification.

Obviously, the intention is to recognize the fact that a larger geographical area comprising two or more Municipalities or Panchayats requiring coordinated spatial planning owing to the existing common social characteristics and economic linkages and integrated development of infrastructure including sharing

of physical and natural resources including rivers, sub-soil water, etc., should be formally constituted as a single integrated unit for socio-economic planning.

Normally, a "Metropolitan area" will be an area which will have at its nerve centres two or more "larger urban areas"/ "smaller urban areas" together with their contiguous hinterland comprising Panchayats all of which taken together can be considered to be integrated with one another by discernible socio-economic and infrastructure linkages and mutually sustaining relationships

CONSTITUTION AND GOVERNMENT

COMPOSITION OF MUNICIPALITIES

The amended Constitution, provides that all the seats in a Municipality shall be filled by persons chosen by direct election from the territorial constituencies in the Municipal area and for this purpose each Municipal area shall be divided into territorial constituencies to be known as "wards".

MUNICIPAL AUTHORITIES

The fact that the political power shall henceforth vest with the people's representatives and not with the municipal bureaucracy is dealt with in the Constitution as follows :

Subject to the provisions of this Constitution, the Legislature of State may, by law, endow, -

- (a) The Municipalities with such powers and authority as may be necessary to enable them to function as institutions of self-government and such law may contain provision for the devolution of powers and responsibilities upon Municipalities, subject to such conditions as may be specified therein, with respect to -
 - (i) the preparation of plans for economic development and social justice,
 - (ii) the performance of functions and the implementation of schemes as may be entrusted to them including those in relation to the matters listed in the Twelfth Schedule;
- (b) the Committees with such powers and authority as may be necessary to enable them to carry out the responsibilities conferred upon them including those in relation to the matters listed in the Twelfth Schedule

Though the Constitution is silent on the question of appointment of a political executive, the intention is clear that the members shall be vested with powers and authority for democratic functioning. In some States, the proposed Municipal Authorities would include the Corporation/the Council, the Standing Committee and the Mayor

A comparative analysis of the present situation based on the provisions of the Bombay Municipal Corporation Act, 1888; the Bombay Provincial Municipal Corporation Act, 1949; the Karnataka Municipal Corporations Act, 1976; and the Calcutta Municipal Corporation Act, 1980, shows that except for Calcutta, the Mayor is not designated among the Municipal Authorities whereas under the Bombay, Karnataka and Hyderabad Municipal Corporation Acts, the Municipal

Commissioners are the Municipal Authorities besides the Corporations and the Standing Committees (see Table 1.3)

The 1980 Calcutta Act is unique in the country inasmuch as it provides for a full-time political executive consisting of elected members in the style of a Mayor-in-Council. Under this Act, the Corporation, the Mayor-in-Council and the Mayor constitute the trinity of the Municipal Authorities and the Municipal Commissioner, though endowed with several statutory and regulatory powers, is not a Municipal Authority. The Act provides that the executive power of the Corporation shall vest in the Mayor-in-Council.

WARDS COMMITTEES

There is a mandatory provision for the constitution of Wards Committees in Municipalities having a population of three hundred thousand or more. The Article also empowers the Legislature of a State to make, by law, provisions with respect to -

- (1) the composition and territorial area of a Wards Committee, and
- (2) the manner in which the seats in the Wards Committee shall be filled.

It also states that a member of a Municipality representing a ward within the territorial area of the Wards Committee shall be a member of that Committee.

This is an example of administrative decentralization through devolution of municipal functions to a field level Committee.

TERM OF OFFICE AND ELECTIONS

The amended Constitution provides that unless sooner dissolved under any law for the time being in force, every Municipality shall continue for five years from the date of appointment for its first meeting and no longer. It also provides that a Municipality shall be given a reasonable opportunity of being heard before dissolution.

This further provides that an election to constitute a Municipality shall be completed before the expiry of its term of office or before the expiry of a period of six months from the date of its dissolution.

STATE ELECTION COMMISSION

The amended Constitution, provides that the superintendence, direction and control of the preparation of electoral rolls for, and the conduct of, all elections to the Municipalities shall be vested in the State Election Commission which shall be common both to the Panchayats and the Municipalities.

DIRECTION AND CONTROL

Although there are no Constitutional provisions relating to the role of the State Government in matters of direction and control, the following powers are generally incorporated in the municipal laws for this purpose .

- (1) to require production of documents
- (2) to depute any of its officers to inspect or examine any department, office, service, work or property of a Municipality
- (3) to annul any proceeding or resolution or order of a Municipality on the following grounds, within fifteen days of the receipt thereof, after giving the Municipality an opportunity of being heard -
 - (a) that it is in excess of the power conferred by the Act or the rules made thereunder, or against any direction of the Government, or
 - (b) that it is likely to cause waste or damage to property of the Municipality; or
 - (c) that it is likely to lead to a breach of peace or encourage lawlessness by causing injury or annoyance to any class of persons;
- (4) to issue directions and policy guidelines not inconsistent with the provisions of the Act as it may consider necessary.

From the above, it would be noticed that adequate provisions have been made for empowerment of the people's representatives for managing the civic affairs and limiting the interventions by the State Governments to the minimum degree possible.

EMPOWERMENT OF WOMEN

MOVING TOWARDS A GENDERED CITY

In preparation for the Fourth World Conference on Women, at Beijing, Catalina Hinchey Trujillo¹², Co-ordinator of the Women in Human Settlements Development Programme at UNCHS has opined as follows .

"A gender-sensitive approach to human settlement development would take into account the different activities, roles, access to and control over

resources of men and women, in varying national and local contexts, at particular points in time. This approach helps to ensure that targeting is appropriate to the needs of men and women respectively and facilitates the active involvement of women and men in the development process. While making interventions more effective and efficient, this approach can promote equity between men and women by promoting equal benefits from development."

Regarding empowerments of women, she observed that

"There is a tendency among men, and some women, to feel threatened by the use of expressions such as the 'empowerment of women' The fear seems to be that empowering women means giving them control over others (men). Implicit are two assumptions : first, that power equals control and second, that power is finite and, therefore, if there is more power for women there will be less power for men. Both these assumptions are questionable."

She concludes that Power can be conceived differently : increasing personal power to act effectively, but not at the expense or control of others.

RESERVATIONS FOR WOMEN UNDER THE 74TH AMENDMENT ACT

Due to the national policy for assigning equal status to women, besides the reservations for Scheduled Castes, Scheduled Tribes and backward classes, the amended Constitution, makes elaborate provisions for reservation of seats for women in Municipalities .

It is believed that by including women in the power hierarchy of the elected local governments in India, step one has been taken to ensure that women can play their rightful roles in the development process. It is too early, however, to assess the impact of this bold initiative. However, it can be easily conjectured that local government is one area where participation by women would make an important difference as the government at this level deals mostly with the quality of life issues — an area which is most relevant to women's role in any society

MUNICIPAL FUNCTIONS AND THEIR FINANCIAL IMPLICATIONS

THE CONSTITUTIONAL PROVISIONS

It is well known that both in a federal set up and in a unitary State where local government is formally subordinate to Central Government, the national constitutions determine the functional jurisdictions of the various levels of Governments. At

times, local bodies are entrusted with functional responsibilities through State level executive decisions also.

Under the Constitution of India, the legislative field is divided between the Central and State Governments and there are three legislative lists. The entries in the three legislative lists delimit the areas of legislative competence of Parliament and the State Legislatures. Entries in the legislative lists are not sources of legislative power but are merely topics for legislation.

Unlike the functional jurisdictions of the States which follow a Constitutional delimitation, the functional domain of local bodies in India, including municipal governments, is derived from the responsibilities which are delegated by the States to the Municipalities, through legislation.

It is for the Legislature of a State to decide as to which powers and authority it may devolve on a Municipality.

The newly inserted Twelfth Schedule in the Constitution lists the following functions .

- (1) Urban planning including town planning;
- (2) Regulation of land use and construction of buildings;
- (3) Planning for economic and social development;
- (4) Roads and bridges;
- (5) Water supply for domestic, industrial and commercial purposes;
- (6) Public health, sanitation, conservancy and solid waste management,
- (7) Fire services,
- (8) Urban forestry, protection of the environment and promotion of ecological aspects;
- (9) Safeguarding the interests of weaker sections of society, including the handicapped and mentally retarded;
- (10) Slum improvement and upgradation;
- (11) Urban poverty alleviation;
- (12) Provision of urban amenities and facilities such as parks, gardens, playgrounds,
- (13) Promotion of cultural, educational and aesthetic aspects,
- (14) Burials and burial grounds, cremations, cremation grounds and electric crematoriums;

- (15) Cattle pounds; prevention of cruelty to animals,
- (16) Vital statistics including registration of births and deaths;
- (17) Public amenities including street lighting, parking lots, bus stops and public conveniences;
- (18) Regulation of slaughter houses and tanneries

The matters listed in the Twelfth Schedule and the corresponding entries in List II and List III in the Seventh Schedule to the Constitution are mentioned in Table 1.4

Incidentally, traffic engineering and traffic infrastructure development do not find any mention in the Twelfth Schedule even though traffic management has emerged as an urgent concern in Indian cities.

THE EXISTING SCENARIO

Most of the existing municipal laws in India cover the functional domain of Municipalities in terms of obligatory and discretionary functions

THE INSTITUTIONAL ARRANGEMENTS

It may also be pointed out that presently different institutional arrangements exist for performance of urban functions including those for supply of central and local public goods and services. There are some functions including water supply, sewerage and drainage, solid waste management, sanitation, road maintenance, street lighting, maintenance of public parks and libraries, public health, etc., which are traditionally performed by the Municipalities. There are some functions which are of a concurrent nature — being performed both by State Governments as well as the municipal bodies. For some functions, State Governments have created para-statal agencies and in the case of some functions which, strictly speaking, fall within the functional domain of higher levels of government, the Municipalities have been assigned the roles. Such functions are hereinafter referred to as Agency Functions.

FUNCTIONAL ASSIGNMENTS TO MUNICIPALITIES

Even though the proposed functions of the local bodies are not mandatory, in the conformity legislation in the States of Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Maharashtra, Orissa, Punjab and Rajasthan initiatives have been taken for making marginal amendments in the lists of municipal functions specified in the municipal laws in these States.

However, much more needs to be done in this regard, particularly, with regard to establishing the functional linkages between poverty, productivity, infrastructure and urban environment.

ASSIGNMENTS TO PARA-STATAL AGENCIES

At times, certain functions are transferred to public corporations, particularly if these have a commercial bias. Issues of affordability of the resultant services by the urban poor and the hesitant measures of Governments to underwrite the needed subsidies often plague the economic operations of such corporations. Cross-subsidies have to be managed by such bodies themselves.

Of late, there is great emphasis on private sector participation in the delivery of urban services. This, however, is conditioned by the profit motives of the private enterprises. Even in this case, the question of the access of the services to the urban poor would merit consideration.

For the performance of certain roles, there may be nationwide or statewide economies of scale which local governments cannot realize and national, state or regional level agencies must intervene. In such cases, considerations of political expediency often influence what is otherwise technically feasible and economically viable.

AGENCY FUNCTIONS

In addition, there are some functions which fall in the category of agency functions and are best performed by the lower levels of Governments, on behalf of the others.

In this regard, it has been argued that it is convenient for some national functions to be administered locally under the auspices of elected local representatives. In some cases where national policy issues are of paramount importance, Central Governments may control a service very considerably, but in its administration still wish to involve elected members who are more responsive to the local views. Primary education and poverty alleviation programmes are among the several examples of such functions.

Failures of Central or State Governments to underwrite the costs for providing such agency services often mars, not only the delivery of such services, but delivery of others also which get affected by sharing of the scarce available local resources.

THE ISSUES ARISING

Speaking strictly in terms of allocation of functions to various levels of Government or types of organizations, the central issues beyond who does what, pertain to :

- the multiplicity of organizations being involved in the delivery of the same service
- the less than the needed levels of coordination, and
- the manner in which financing is done.

To be efficient, distribution of functions at various levels, obviously, cannot be divorced from such considerations.

DEVOLUTION OF FUNCTIONS — SOME NEW CONSIDERATIONS

In India, any number of studies on municipal finances reveal the mismatch between the expenditure responsibility and revenue authority of the Municipalities.

This may be due to the fact that in the assignment of the obligatory and discretionary functions in the erstwhile municipal laws in India, some of which were framed more than a century ago, economic principles were never taken into account. The result is that despite huge deficits, there are Municipalities which run medical colleges even though this function is not strictly within the domain of any local government. It also needs to be appreciated that even now a beginning cannot be made on a clean slate.

In any financial arrangement, it may be noted that both the revenue account and capital account needs would have to be kept in view.

NEW CATEGORIES OF MUNICIPAL FUNCTIONS

The various functions which a Municipality, at any chosen level, may have to perform may be classified in terms of the following categories :

- (1) Essential municipal functions or core functions
- (2) Environment management functions
- (3) Planning functions
- (4) Other functions.

The paragraphs hereinafter deal with the characteristics of the various categories of functions.

ESSENTIAL MUNICIPAL FUNCTIONS

For the selection of essential municipal functions, of the 18 items listed in the amended Constitution and with due regard to the existing provisions in the municipal laws in various States, a question has been posed at various fora, including the meetings of State Finance Commissions, whether the following may be considered as essential municipal functions

- (1) Regulation of land use and construction of buildings
- (2) Roads and bridges
- (3) Water supply for domestic, industrial and commercial purposes
- (4) Public health, sanitation, conservancy and solid waste management (item 6)

- (5) Provision of urban amenities and facilities such as parks, gardens, playgrounds
- (6) Burials and burial grounds, cremations, cremation grounds and electric crematoriums
- (7) Cattle pounds, prevention of cruelty to animals
- (8) Vital statistics including registration of births and deaths
- (9) Public amenities including street lighting, parking lots, bus stops and public
- (10) Regulation of slaughter houses and tanneries

A Municipality, as is well known, functions both as a government and as a utility organization. The question is posed, therefore, whether the above mentioned functions relating to statutory and regulatory controls, on the one hand, and to provision of civic services, on the other, may be easily seen to fall within the functional domain of the Municipalities ?

ENVIRONMENT MANAGEMENT FUNCTIONS

In the case of urban forestry, protection of the environment and promotion of ecological aspects, the issues would have to be resolved in two contexts. Firstly, with regard to the role of the existing State Environment Agencies, what roles may be assigned to the Municipalities? Secondly, what should be the differentiation in the roles assigned to the different levels of Municipalities, namely, the Municipal Corporations, the Municipal Councils and the Nagar Panchayats? Both the "organizational" and "fiscal" strengths of the relevant levels of municipal bodies would have to be kept in view in any analysis of the subject

PLANNING FUNCTIONS

Regarding planning functions, it must be noted that the 74th Constitution Amendment Act envisages a much larger concept for planning than what is covered under the conventional Town and Country Planning Acts in the States.

The specifications relating to preparation of plans for economic development and social justice, urban planning including town planning, slum improvement and upgradation under item 10, safeguarding the interests of weaker sections of society including the handicapped and the mentally retarded and urban poverty alleviation have elevated the planning concept to the level of development planning rather than land use planning only.

The question here is whether the Municipalities at any level which are mostly involved in fire fighting operations on a day-to-day basis, can handle such elaborate planning functions ?

The existence of professionally managed Planning and Development Authorities would also have to be kept in view while

delineating the responsibilities for planning functions among the Municipalities and such Authorities. The question is : can Development Authorities which are already in place be wished away ?

The roles of the people's representatives in having a say in policy matters related to planning will also have to be seriously considered.

OTHER FUNCTIONS

Of the remaining functions, namely, fire services and promotion of cultural, educational and aesthetic aspects, depending upon the State policies and traditions, these could be among the agency functions implying thereby that these may be performed locally but their costs may be underwritten by the higher levels of Government. Alternatively, these may be listed as municipal functions.

FINANCIAL IMPLICATIONS OF FUNCTIONAL ASSIGNMENTS

Policy level analysis of the issues pertaining to functional assignments to Municipalities and the financial implications thereof has become urgent in view of several considerations relating to the following .

- (1) the demand and supply of municipal services
- (2) the institutional issues and alternative approaches for service delivery
- (3) the expenditure norms having regard to the technology options and the levels of services
- (4) the territorial issues
- (5) the regional and national roles of local governments
- (6) the interventions by the State Governments
- (7) the revenue capacity and the revenue efforts of the Municipalities
- (8) the financial management capacity of the Municipalities
- (9) the commitments of National and State Governments, and
- (10) the issues of accountability.

DEMAND AND SUPPLY OF MUNICIPAL SERVICES

In this regard, it is noteworthy that -

- (i) due to the demographic pressures, on the one hand, and even the marginally improving living standards, on the other, the demands for urban services are

- steadily increasing. Paradoxically, however, due to resource constraints, deficits in available urban infrastructure are also increasing day by day;
- (ii) effectiveness of delivery of urban services is further hampered by inadequate management expertise consistent with the complexities of the diverse operations. Low levels of salary and prestige of local government employees also act as a constraint for attracting personnel with the appropriate skills;
 - (iii) there is inequitable distribution of the available services among the different segments of population and the poorer sections which comprise nearly half of the total urban population in most cities hardly benefit from the available urban services,
 - (iv) the prevalence of large populations in any city at or below the median income level militates against raising demands even where services are provided;
 - (v) new capital projects for extension of services to the unserved areas and uncovered population groups enjoy low priorities as larger proportions of available resources go into current expenditures — to meet the maintenance costs of existing services which keep on mounting due to inflationary pressures, and
 - (vi) the resource requirements have not been matched by increased public revenues, not only because of the limited economic bases of most of the cities, but because there often exists a fundamental imbalance between the revenue authority and the expenditure responsibility assigned in municipal laws for supplying urban public services
- (4) higher level investment decisions are made without regard to the capacity or willingness of local governments to maintain the assets so created
 - (5) local inability to maintain the state-built infrastructure results in its premature deterioration
 - (6) local failure to recover investment costs requires increasing outlays of state/central finances, and
 - (7) investment decisions being divested from local governments, political accountability becomes greatly diffused

Also, by assigning commercially viable functions to public sector corporations or the private sector, another issue arises as to how should Municipalities be compensated for the supply of services to the urban poor — in other words, who should subsidize such services.

A question may well be posed whether the State Governments should have the responsibility for underwriting all the subsidy costs ?

EXPENDITURE NORMS, TECHNOLOGY OPTIONS AND LEVELS OF SERVICES

Various committees and agencies including the Central Public Health and Environmental Engineering Organization, the Zakaria Committee on Augmentation of Financial Resources of Urban Local Bodies, the Town and Country Planning Organization and the Planning Commission have been concerned about issues related to expenditure norms, technology options and the affordable levels of services, at least for the core municipal functions.

The State Finance Commissions constituted under the 74th Constitution Amendment Act are presently examining the relevant factors based on consideration of fiscal capacity of the local bodies and the users, topography and geology of the settlements concerned, past history of infrastructure development, population size and other economic and political factors

Financial requirements, even for minimum levels of services, both on the capital and O&M accounts, are enormous and need scrutiny, statewide and municipalitywise. New initiatives are required for mobilizing the required resources

The central issue, however, revolves around cost recovery, at least, from those who have the capacity to pay. Among other considerations, political will at all the levels would be necessary if any breakthrough is to be achieved.

TERRITORIAL ISSUES

An issue of a different nature confronts several Municipalities in whose case municipalization was done purely on political

INSTITUTIONAL ISSUES AND ALTERNATIVE APPROACHES FOR SERVICE DELIVERY

Regarding institutional issues and the alternative approaches for service delivery, it is to be noted that Central and State Governments have responded to the imbalances between revenue authority and expenditure responsibility by creating autonomous agencies at the national, state, regional or local levels. This has led to numerous adverse consequences, namely

- (1) the construction of urban infrastructure and its operation and maintenance being generally the responsibilities of different levels of governments or different agencies, their roles are not clearly defined nor institutionally coordinated
- (2) responsibility of urban infrastructure investments being diffused among many government agencies, the ad-hoc division of functions works poorly
- (3) physical coordination of investments of various state agencies and local governments poses difficulties

considerations — without regard to the economic viability of a Municipality so created

The issue, therefore, is that in any State should the present opportunity not be exploited to remedy such situations by amalgamation with other financially viable Municipalities or should the state resort to demunicipalization which has its political ramifications

Another issue of territorial character is the non-inclusion of the urbanizing fringes within the boundaries of adjoining municipal areas over long periods of time irrespective of the fact that the human settlements in such fringes draw heavily upon the municipal services, from such areas without paying for the same. The issue is who should pay for such services and whether the State Government may consider underwriting the costs involved through transfers.

An issue which will assume critical dimensions with the implementation of the provisions of Article 243Q relating to exclusion of "industrial townships" from municipal areas will be as to how and by whom the trans-municipal functions for servicing such areas would be provided for. This proviso makes no provisions for specification of the terms and conditions under which the industrial townships may be excluded from any municipal area. Also, incidentally, since these areas will no longer be within the municipal areas, the issue is as to how would the powers of taxation as also for performance of statutory and regulatory functions such as of sanction of building plans be exercised and how would the costs thereof be recovered?

REGIONAL AND NATIONAL ROLES

By commissioning the Mega-Cities Projects in a number of metropolitan cities, Government of India has, indirectly, recognized a fact that several cities, in addition to their strictly local roles, also play regional and national roles.

The point to be noted here is that while metropolitan cities, undoubtedly, play larger regional and national roles, even small towns can play such roles. The issue, therefore, revolves around the financing of the special requirements of towns and cities for playing roles which are strictly not local, — such as provision of link roads to the nearby port in the case of a mining town catering to exports.

STATE GOVERNMENT'S INTERVENTIONS

A question also needs to be raised about the role of the State Governments in interfering in matters related to the functional domain of the Municipalities beyond what is enacted by the State Legislatures.

Even in the existing municipal laws, there are any number of examples of State Government's interventions which would not be consistent with the basic spirit of the Constitution (Seventy-fourth Amendment) Act, 1992.

REVENUE CAPACITY AND REVENUE EFFORTS

In the matters of revenue capacity and revenue efforts, the following considerations prevail:

- (1) In the present scheme of things, local governments are saddled with the weakest revenue instruments, yields from which do not grow in line with increasing population or incomes
- (2) Borrowing from external sources has not been possible to the degree desired due to general capital shortage, the lack of developed capital markets and the poor debt servicing capacity of local governments
- (3) The grants-in-aid and transfer mechanisms adopted in response to such situations and even otherwise have not worked well due to the ad hoc nature of allocations and volatile and uncertain support, and
- (4) Despite all the above factors, analysis has often not been done to establish whether it is the local government revenue capacity or its revenue effort which constitutes the real limiting factor.

FINANCIAL MANAGEMENT

Regarding financial management, the important considerations are :

- (1) Even in crisis management situations, the bias more often has been towards resource mobilization and less towards efficient management of existing resources,
- (2) Effective fiscal management is handicapped by a number of technical, institutional and political issues, including:
 - (a) use of inordinately high and often unaffordable standards for the services provided
 - (b) reliance on imported technologies which are not in tune with the locally available operational and maintenance skills, and
 - (c) over-staffing, mostly due to political considerations.
- (3) Poor financial practices also affect fiscal planning and management as is illustrated below
 - (a) the cost implications of long-term physical development plans are rarely worked out to provide a basis for projecting capital and current account expenditures resulting from the implementation of the physical plans
 - (b) annual municipal budgets frequently neglect to account fully for planned capital spending

- (c) local accounting procedures are complicated by cumbersome, incomplete, and delayed budgeting and financial reporting
- (d) failure to effectively monitor cash flows leads to unrealistic revenue projections and expenditure commitments
- (e) since local governments frequently encounter serious cash flow problems, they find themselves operating without sufficient operational capital and therefore often have to make ad hoc and costly adjustments in expenditure programs or resort to using loan funds to finance recurrent expenditures
- (f) lack of competent and independent auditors further hampers the maintenance of reliable accounts, and
- (g) the imbalance between expenditure responsibility and revenue authority by itself induces questionable financial practices.

NATIONAL AND STATE LEVEL COMMITMENTS

As regards commitments of Central and State Governments, it is to be noted that the management maladies at the local government level apart, the root of many urban fiscal problems may be found in the way local government matters and urban finance questions are handled at the national or state levels. For one thing, the urban sector enjoys only residual claims in national budgets.

Also, more often than not, state authorities in the discharge of their supervisory, control and restraint functions do stifle and inhibit local initiatives designed to grapple with the urban finance impasse

ACCOUNTABILITY

Another important issue relates to the diffusion of political and administrative accountability under the existing arrangements.

In this connection, a point has been made that the amended Constitution specifies whether the functions assigned to the Municipalities shall be categorized as "obligatory" or "discretionary" functions

It has been further argued that specification of obligatory duties in any Municipality may imply that -

- (1) the Municipality shall make adequate or reasonable provisions from its own funds for the performance or discharge of these obligatory duties, and
- (2) the Municipality shall itself perform or discharge these obligatory duties entirely on its own, i.e. departmentally.

The question is whether the present opportunity should not be

utilized to precisely define matters related to the functional domain of Governments at the three levels in the law so that these are based on well conceived principles and policies.

In this regard, it may be pointed out that the Courts have interpreted that a provision in a municipal law casting, on the one hand, an "obligatory duty" on a Municipality confers, on the other hand, a "right" on citizens to demand that the Municipality shall necessarily perform that duty and allocate and spend out of its funds an adequate amount for the performance and discharge of such an obligatory duty.

An incidental issue which may be raised here is that essentially being a unit of democratically elected local self-government, should a Municipality not have the inherent power or discretion to decide the inter se priority of the various duties cast upon it and should it also not decide whether or not and to what extent funds may be provided out of the resources at its disposal for the performance of a particular duty.

It has been argued that the term "self-government" will lose its true meaning if a similar power or discretion is denied to a Municipality to decide the inter se priority amongst various duties cast upon it and whether or not to allocate funds, and, if so, to what extent, for the performance of any particular duty.

It may be pointed out that the Central and State Governments do have such an inherent power/discretion. Furthermore, there are no laws laying down the "obligatory" and "discretionary" duties of the Governments at the Central and the State levels

Another issue in this regard is whether devoid of any binding as may be specified by a State Legislature, the Municipalities may, due to populist tendencies, overlook or underplay their roles with regard to provision of essential municipal services and prefer organizing, say, musical extravaganzas to solid waste management. Each State Government would have to consider this aspect with due regard to the history and experience in the State and ensure the political accountability in this regard too.

SUMMING UP

Against the backdrop of such paradoxical situations, it is imperative that policy interventions duly supported by legislative reforms are urgently considered and speedily adopted, keeping in view that urbanization trends cannot be reversed and the emerging problems must be tackled forthwith, lest they reach unmanageable dimensions.

ENSURING LOCAL FISCAL AUTONOMY AND ROLES OF STATE FINANCE COMMISSIONS

INTER-GOVERNMENTAL FISCAL RELATIONS — THE VARIOUS CONTEXTS

To be relevant, inter-governmental fiscal relations between State

Governments and Municipalities in India must be examined in the following contexts :

- the existing Constitutional and legal frameworks
- the current functional and territorial jurisdictions of the various levels of local Governments
- the devolution of powers for resource mobilization at various levels of Governments
- the fiscal transfer mechanisms between various levels of Governments and the institutional context thereof
- the powers and policies for controls as exercised by the higher levels of Governments.

One basic issue is whether the allocation of financial powers and responsibilities is consistent with the territorial and functional jurisdictions and responsibilities as per the existing Constitutional/legal frameworks. In other words, the question is whether for any given level of government, there is a mismatch between expenditure responsibility and revenue authority.

If the logic of the politically popular concept of local autonomy is extended to local fiscal autonomy also, the separation of taxation and resource mobilization powers should be such that local governments should be able to generate enough resources, both for their recurrent and developmental needs.

The questions remain whether State Governments genuinely wish to reduce the financial dependence of local bodies and, if so, what fiscal instruments they are willing to share.

Given the observed centralization of tax powers and decentralization of expenditure responsibilities, it is, however, necessary to identify some new fiscal equations.

To the extent that limitations exist in the municipal fiscal base and higher levels of governments may consider it inadvisable to part with any major productive tax instruments for exploitation by local bodies, arrangements for fiscal transfers from higher levels of governments would become unavoidable to support the municipal budgets. The question, then arises as to how effectively are these transfers affected ?

As is well known, so far as the Centre-State fiscal relations are concerned, in India the Constitution provides the needed framework in the form of the Central Finance Commission. The 74th Constitution Amendment Act has now led to the setting up of State Finance Commissions too and much hope now lies on how successfully these Commissions would be able to discharge their roles and responsibilities.

GRANTS BY STATE GOVERNMENTS

From the study of available information, it is noted that as of now, the grants by the State Governments to the Municipalities

are not based on any specific principle. Mostly, grants are on an ad hoc basis as would be obvious from the following.:

- (1) In Maharashtra, the list of grants include dearness allowance grant, entertainment tax grant, land revenue and non-agricultural assessment tax grant, vehicle tax grant, pilgrim tax grant, stamp duty grant, minor mineral grant, road grant and profession tax grant.
- (2) In Karnataka, there are grants in lieu of profession tax, octroi and under the Karnataka Entertainment Tax Act, 1958 and the Karnataka Motor Vehicles Act, 1957.
- (3) In Andhra Pradesh, grants-in-aid include proceeds from entertainment tax, surcharge on stamp duty and compensation under profession tax.
- (4) In Punjab, no grant-in-aid is being given by the State Government to the Municipalities to meet any revenue deficit.

However, since 1991-92, grants-in-aid to urban local bodies are routed through the District Planning Boards for specific development projects. The amount of grant in any year depends on the State Government's resource position. There are no predetermined criteria although generally efforts are made to provide maximum possible funds for development schemes of the Municipalities.

The practice of the State Government advancing loans to the Municipalities in Punjab has been given up and the Municipalities have to arrange institutional finance for which State Government guarantees are available on approved schemes

In addition, funds are released to all States for centrally sponsored schemes such as the Nehru Rojgar Yojana, Urban Basic Services for the Poor and Intensive Development of Small and Medium Towns and the Scheme of Environmental Improvement of Urban Slums.

CONSTITUTION OF STATE FINANCE COMMISSIONS

The Constitution (Seventy-fourth Amendment) Act, 1992, provides for setting up of a State Finance Commission in each State which shall be common both to the Panchayats and the Municipalities.

The Commissions shall review the financial position of both the Panchayats and the Municipalities and make recommendations as to the principles which should govern

- (i) the distribution between the State and the Municipalities of the net proceeds of taxes, duties, tolls and fees leviable by the State, which may be divided between

them and the allocation between the Municipalities at all levels of their respective shares of such proceeds;

- (ii) the determination of the taxes, duties, tolls and fees which may be assigned to, or appropriated by, the Municipalities,
- (iii) the grant-in-aid to the Municipalities from the Consolidated Fund of the State

ROLE OF STATE FINANCE COMMISSIONS

Just as in Centre-State fiscal relations, the point needs to be stressed that even in State-Municipal relations, the lower levels of governments should not be required to depend on the whims of the higher levels of governments for their financial needs. Whatever they get must come to them through either Constitutional rights or through the dictates of the Legislatures or on the basis of clear-cut policies which, in the light of the possible internal revenues, should match the expenditure responsibilities with appropriate fiscal transfers. Such transfers would, undoubtedly, include the assigned revenues and shared taxes, capital and revenue grants and development finance.

The other important considerations are :

- (1) Fiscal policies should clearly identify and specify the taxes and other receipts which would be assigned for the urban sector and which would constitute the divisible pool
- (2) Devolution of funds should be made systematic and predictable from the point of view of the recipients
- (3) Simultaneously, the distributional aspects should also be clearly specified, and the gap filling approach usually adopted should be protected to ensure that the more efficient are not penalized at the cost of others whose efforts may lag far behind their capacities for self-help.
- (4) In these distributional approaches, equalization slants should also not have outright sway over the areas which contribute more to the divisible pools. The needy elements can, however, be protected through safety-nets
- (5) Careful assessments are unavoidable to identify the needs for capital grants which can make some essential but expensive infrastructure schemes affordable.
- (6) Revenue grants also have a role to play inasmuch as there may be gaps even after the local resources have been fully exploited. Revenue grants may also be essential to match the maintenance responsibilities for new investments.

TOWARDS A NATIONAL CONSENSUS OF STATE FINANCE COMMISSIONS

Since their inception, the State Finance Commissions have met on four occasions in order to develop a national consensus on various issues. The broad conclusions arrived at the last meeting which was held at New Delhi, on November 3-4, 1995 were as follows :

- (1) Regarding the functional domain of the municipalities, the broad consensus was on the same lines as discussed under the marginal titles on Essential Municipal Functions, Environment Management Functions and Planning Functions.

It was also proposed that a list of Agency Functions may be identified. Such functions may be performed by the local bodies, but their costs should be totally underwritten by the State Governments.

These Agency Functions could include protection of environment and promotion of ecological aspects, safeguarding the interests of weaker sections of society, including the handicapped and the mentally retarded; urban poverty alleviation, promotion of cultural, educational and aesthetic aspects, primary education and primary health care.

- (2) Regarding principles for municipal tax assignments, it was proposed that :
 - (a) local taxes should be linked to the economic base, immobile factors of production and property
 - (b) benefit taxes and user charges should be used as extensively as possible
 - (c) the tax base should be easily identifiable and buoyant
 - (d) tax yield should be stable and predictable over time and should not be susceptible to cyclical fluctuations
 - (e) taxes should be perceived to be reasonably fair by the tax payers
 - (f) taxes should be easy to administer and their incidence should be transparent.
- (3) The following taxes were considered for assignment to municipalities:
 - (a) property tax
 - (b) vacant land tax

- (c) profession tax
 - (d) entertainment tax
 - (e) advertisement tax
- (4) It was suggested that shared taxes may include the following
- (a) motor vehicle tax
 - (b) stamp duty, and
 - (c) in case of non-octroi States, share in sales taxes
- (5) Regarding grants, based on the premise that these should be kept to the minimum, it was proposed that:
- (a) per capita health grant may be made to meet primary health cost based on State level standards
 - (b) per capita education grant be made to meet primary education expenditure based on pre-determined State norms
 - (c) slum upgradation grant may be made on a per capita basis.
- (6) To take care of fiscal disparities between municipalities on various accounts, it was proposed that a Municipal Equalisation Fund may be set up.
- (7) It was also suggested that a Municipal Development Fund may be set up, for financing the capital requirements for remunerative projects or projects with a potential for cost recovery.

Based on the above mentioned proposals, it was left to each State Finance Commission to consider and decide the options which would suit its own requirements.

The question, however, remains as to how far the State Finance Commissions would succeed in responding to the genuine aspirations of the local bodies in India.

In this context, a reference to the Constituent Assembly debates relating to the setting up of the Central Finance Commission, made in the Report of the Expert Committee on Financial Provisions of Union Constitution is relevant:

“The problem before us is how to transfer from the Centre to the Provinces, sufficient amount which, while not placing too great a strain on the Centre, would provide adequate resources for the inauguration of useful schemes of welfare and development by the Provinces. While the Centre, on its present basis, may not be in a position to part with substantial sums, we feel that with the resolution of its temporary difficulties and

improvement in its tax administration, together with levy and collection of taxes evaded in the past, it can with no serious risk to its own budget, part with sizable sums every year . . .

We have already referred to the need for Provinces having clear priorities as between contending demands for money and have no doubt that the Provinces in the earlier years utilized the additional resources now placed at their disposal by concentrating on schemes that would add to the productive capacity of the country and consequently the income of the people and thus enable the Provinces to embark on future schemes of reform and development.”

The case in State-Municipalities fiscal relationship cannot be much different.

IMPLEMENTATION OF RECOMMENDATIONS OF FINANCE COMMISSIONS

Lastly, a point may be made regarding the acceptance and implementation of the recommendations of the State Finance Commissions by the State Governments. In this respect, due regard may be given to the recommendations of the Expert Committee referred to above which emphasized upon the binding nature of the recommendations of a Finance Commission and its role as an arbitrator.

The Government of India has established a healthy tradition in accepting the Finance Commission Reports, more or less in toto, and the State Governments would do well to follow in its footsteps.

MUNICIPAL FINANCE

The amended Constitution provides that the Legislature of a State may, by law, -

- (a) authorise a Municipality to levy, collect and appropriate such taxes, duties, tolls and fees in accordance with such procedure and subject to such limits;
- (b) assign to a Municipality such taxes, duties, tolls and fees levied and collected by the State Government for such purposes and subject to such conditions and limits;
- (c) provide for making such grants-in-aid to the Municipalities from the Consolidated Fund of the State; and
- (d) provide for constitution of such Funds for crediting all moneys received, respectively, by or on behalf of the Municipalities and also for the withdrawal of such moneys therefrom, as may be specified in law

REVENUE STRUCTURE OF LOCAL GOVERNMENTS

Local governments depend upon three local sources and two external sources for their revenue requirements. These are:

- locally raised taxes
- user charges
- other non-tax revenues from performance of statutory and regulatory functions and from commercial ventures
- borrowings
- transfers from higher levels of government including shared taxes and grants-in-aid.

The proper mix of the internal and external revenues and break-up thereof can be determined only in city-specific situations — keeping in view the Constitutional and legislative provisions, the political-socio-economic environments, the local attitudes and the traditions in the matters of allocation of financial responsibilities as also the institutional set up for mobilization of the resources.

Certain policy postulates, however, provide the common denominator and however analyzed separately.

THE URBAN CONTEXT OF TAXATION

Besides the economic objectives that they serve, taxes play an important role in financing the activities of various levels of governments — and particularly for state and local governments which, unlike the national governments, do not have the unlimited powers to borrow from central banks, and must rely on taxation and other sources of finance.

For any country, at any given time, the existing Constitutional and legislative arrangements determine the tax jurisdictions and limitations so far as various levels of government are concerned. Any unsatisfactory arrangements can be corrected only through Constitutional or legislative reforms, as the case may be.

Viewed from the municipal context, the basic problem lies in the pre-emption of the more buoyant and cost-effective tax instruments by higher levels of government with the result that local governments have to rely on less productive and costlier-to-administer taxes.

The taxes which can be identified for having been exploited for the purpose of local governments, irrespective of the levels at which these are administered, can be classified into the following categories .

- (1) land-based taxes including taxes on government properties

- (2) taxes related to services
- (3) taxes on entry or exit of passengers, goods or services
- (4) taxes on business, professions and entertainment
- (5) taxes with a registration bias, and
- (6) development levies.

The practice of 'piggy-backing' local taxes on national or state taxes appears to exist in some of the developing countries. This is a form of shared taxation in which surcharges are placed on national or state taxes. The advantages are that a portion of the local revenue gets linked to the more buoyant tax sources; and, of course, there are substantial savings in administration of such taxes.

Choice of Tax Instruments

In determining the taxation domains of various levels of Government, having regard to the Theory of Fiscal Federalism, the first task revolves around the choice of tax instruments which any Municipality may exploit

As is well known, the tax instruments so chosen will have to meet the criteria of equity, elasticity and cost effectiveness. Another important consideration would be to ensure regular incomes as in the case of octroi

In this regard, it is essential that both the land-based and non-land based tax instruments are considered. In the Indian context, where property tax and the service taxes (which are mostly levied on the same base as for property tax), have continued to enjoy a dominant place. Since there are on-and-off political pressures for abolition of octroi, it is all the more urgent that the scope of exploitation of other non-land based taxes is fully explored.

In the case of non-land based taxes, namely, taxes on professions, trades, callings and employments, taxes related to motorised vehicles, advertisement taxes, entertainment taxes and environment taxes, analysis needs to be made of the appropriate level of government at which these may be levied.

In this connection, an urgent concern in the larger municipal areas has been to ensure some levies on the day time populations, that is, the commuters. The question is whether the professions, trades, callings and employments tax can be exclusively assigned to the Municipalities to provide a buoyant source of revenue to recover the costs of services provided to the commuters ? If not, other tax instrument which can help satisfy this objective need to be considered.

In this regard, it is noteworthy that due to the enhancement of the limits under Article 276 of the Constitution, the potential for this tax has improved substantially. Besides, this instrument

has a direct correlation with economic activities which are strictly of a local nature.

Correlated to the principles that exploitation of civic infrastructure and sub-soils in municipal areas should require imposition of corresponding tax or fees burdens, the issue raised is whether all or any of the automobile related taxes, such as taxes on motor vehicles, taxes on petroleum products, water charges for consumption of water for washing of motor vehicles (a new levy introduced in Calcutta), or a street tax (a new levy in Bombay) may be included within the taxing jurisdictions of the Municipalities

Another issue for consideration is to identify the tax instruments for which the powers for levy and collection of taxes may be assigned to the State Governments but whose proceeds should be fully assigned to Municipalities, perhaps on a differential basis in relation to the proposed 3-tiers of Municipalities, namely, Municipal Corporations, Municipal Councils and Nagar Panchayats. The fire tax and the environment tax may be considered in this category

Also, tax instruments which may be exploited by the State Governments, part of the proceeds of which may be retained by the State Governments and part may be shared with the Municipalities and the Nagar Panchayats need appropriate attention. The 'piggy back' taxes, if any, would surely belong to this category

OPTIMUM EXPLOITATION OF TAX INSTRUMENTS

The basic issues for the fullest possible exploitation of the chosen tax instruments are :

- lack of local autonomy
- multiplicity of taxing agencies
- technical problems associated with the taxation system itself and its assessment procedures
- popular resistance due to some irritants in tax administration
- cost effectiveness of tax instruments
- incompetent and inadequate taxation machinery, and
- much less than the billed collections.

As to the lack of local autonomy, a reference can be made to the property tax itself which is among the most potent local tax instruments

It has been observed that in most municipal laws in India, tax rates, assessment procedures and institutional arrangements for assessment are all determined by higher levels of governments

— usually on the basis of standards which apply to all local authorities governed by the respective States

There are instances also of different levels of government levying different taxes on the same base — such as Calcutta Municipal Corporation's levy of property tax; State Government's levy of land tax and multi-storeyed building tax, and the Central Government taxes on income, wealth and estate duty, on the same property.

In terms of the technical problems associated with assessment procedures, the best example is of the property tax itself in which case the rent-based-rateable-valuation system is handicapped due to numerous in-built defects such as ceilings on property valuations due to rent control laws, obsolescence of properties, long term tenancies, etc.

Problems of another nature can be cited for inadequate property tax burdens on the non-residential assesseees who, undoubtedly, place proportionately much larger burdens on civic services, but for which there is no quid pro quo by way of user charges.

Administration cost is an important consideration in evaluating tax instruments. There is evidence in some cases of the collection costs consuming 30-40 per cent of the yields of some of the local taxes. Any tax whose administration cost exceeds, say, 5-10 per cent of the total collections should not pass the test of cost-effectiveness.

Another problem in the field of tax administration relates to the fact that, with the possible exception of property taxes and octroi, most of the other taxes, though collected from urban areas, are not clearly earmarked for the urban sector. The result is that there is no vested interest for enhancing their yields, as there is an uncertainty as to who would be the beneficiaries. Unfortunately, this is not done even in the context of shared taxes which may be collected by national or state governments and assigned to local governments, either partially or fully. In many cases, it is not even known as to which are the assigned taxes.

For effective tax management, Lethbridge, Linn and Whitehead⁹ have suggested that various tax instruments employed in any city should be fully evaluated, both in comparative and specific terms. It has been pointed out that there is wide scope for tax reforms in several areas such as:

- choice of tax instruments
- their assignment to various levels of government
- basic concepts of taxation, namely, tax base, tax incidence and liability thereof, rate structures, assessment procedures, taxation of privileged assesseees*, etc.

* in Calcutta, the Port Trust enjoys special privileges for property tax purposes. However, even the commercial tenants of Port Trust properties also enjoy the same privileges which can never be the intention. Calcutta Corporation's own tenants pay no taxes at all.

- structure of the tax administration and its administrative practices, and
- management ethos behind the entire system.

Such evaluations are unavoidable if the focus of the proposed policies and reforms has to be sharp

THE CASE FOR PROPERTY TAX REFORMS IN INDIA

As is well known, property tax, besides octroi wherever it is levied, is the mainstay of municipal finances in India. However, various studies have established the fact that property tax is not being exploited to its full potential. This is due to several factors, namely, defective rent-based valuation system, inequitable rate structures, lavish exemptions and the absence of tax mapping. These issues are examined hereinafter.

The Basis for Determining Annual Values

At present, property tax is levied in terms of the rent-based valuation system

As to the tax base, recent judgements⁷ of the Supreme Court whereby the civic authorities are required to assess annual values for the levy of property tax on the basis of fair rents as determined under the relevant Rent Control Acts, irrespective of whether a fair rent has been determined by a Rent Control Court or not, have given a major jolt to the revenue aspirations of the local bodies in India

The cumulative effects of the shortcomings of the tax base and the administration of the rent-based system have resulted in inequitable distribution of the tax burdens between individual assesseees (old versus new tenants in the same premises, different apartments in the same buildings, some on the same floors, for identical uses), old and new constructions (for identical uses, in the same vicinity), and between assesseees in different geographic areas in the city (high priced inner city areas versus newly developed areas and urbanizing fringes). When viewed in terms of the levels of civic services in different areas, this effect becomes all the more pronounced with the highly serviced inner city areas getting away with lower tax burdens whereas the inadequately serviced fringes attract higher taxes.

The most startling aspect is that the more affluent sections and the non-residential sector, with a much larger capacity to pay, have succeeded in exploiting, through corrupt practices or otherwise, the weaknesses of the present system so that it would not be wrong to surmise that in many situations, the poorer sections of population and low profile areas subsidize the wealthier sections of the population and the affluent neighbourhoods

Leaving aside the short term reforms for improving the administrative efficiency of the rent-based rateable valuation system, basically two approaches have been advocated for meaningful long term reforms :

- (1) According to one school, the remedy lies in reforms in rent control laws so that fair rents determined under the same are more realistic in the current contexts**.
- (2) The other approach advocates delinking property tax from the rental value concept and imposition of taxes based on determinable unit area annual values and area measurements having regard to location, structural characteristics, age of building, building characteristics, use characteristics and access to civic services.

The Andhra Pradesh Government has amended the Hyderabad Municipal Corporations Act, 1955, and the Andhra Pradesh Municipalities Act, 1965, by the Andhra Pradesh Municipal Laws (Amendment) Act, 1989, and has notified the Hyderabad Municipal Corporations (Assessment of Property Tax) Rules, 1990. The amendments are on the lines of the second approach referred to above.

The Zones/Sub-zones and the rates for various Circles/Divisions, as finalized after initial notification and hearing of objections, have also been published.

Features of a new system designed by R.M. Kapoor and P K Ghosh⁸ have been highlighted in a paper titled "Composite Area Linked System for Property Tax Reform in India "

P.K. Ghosh⁶ has prepared a model draft legislation based on this system and has also examined its Constitutional validity. The basic concerns which led to the design of this system are

- (1) whether the reform proposals can overlook the critical needs to ensure that the high priced inner city areas are adequately taxed, the new entrants in the housing market are reasonably taxed and the distortions due to unequal tax burdens on equally placed assesseees (such as disproportionate tax burden for addition of two rooms in any existing residential premises) are removed
- (2) whether the use of discretionary powers could be limited to groups rather than individuals which will enable a systems approach for management of corrupt practices
- (3) whether, at the policy level, the Municipalities may consider as to how the entire tax burden in any

** The reforms in the Delhi Rent Control Act whereby new properties and properties fetching rent of Rs. 3,500 or more per month will no longer be subject control do not help in boosting civic revenues as bulk of the old high priced inner city properties would continue to be assessed at very low rateable values based on fair rents fixed long time ago as these properties would still be covered by the Rent Control laws.

municipal area may be apportioned among the residential and non-residential assesses which is not possible under the present system, and

- (4) whether the savings in premises-wise assessments can be overlooked, which would result due to a change over to the area-based system where the unit area values of lands and buildings would be determined by a Municipal Valuation Committee and self assessment would be possible

The Constitutional and legal validity of this system having been examined by the Union Law Ministry, it awaits a field trial in real life conditions before it is universally adopted.

INSTITUTIONAL ARRANGEMENTS

The point to be considered here is whether quasi-judicial Municipal Valuation Committees and Municipal Assessment Tribunals may be provided for in the municipal laws so that the opportunities for contesting the valuations are reduced and the consequent litigation and social costs are also reduced, an indirect benefit being timely payment of the municipal dues

TRANSPARENCY OF MUNICIPAL ASSESSMENTS

It may be considered whether the final municipal assessment lists are published and freely sold at reasonable prices so that the assesses have ready access to information on the assessments of the neighbouring premises which may help in checking corrupt practices

Sub-section (5) of section 191 of the Calcutta Municipal Corporation Act, 1980, is relevant in this regard:

- “(5) The Municipal Assessment Book may be printed and published for every ward of the Corporation and made available for sale to the public in such form and in such manner as may be prescribed:

Provided that the publication shall not be kept pending for any cases in respect of which any objection or appeal has been filed under section 188 or section 189 ”

RATE STRUCTURES AND RATES

Four different systems can be highlighted as in vogue in different States in India, namely

- (1) a uniform rate of tax irrespective of the valuations (as in Bombay),
- (2) a progressive rate on the same basis as used for income tax purposes (as in Delhi),

- (3) a progressive rate based on a slab system, with built-in defects, as is in vogue in Hyderabad, Ahmedabad and formerly in Calcutta, and

- (4) a straight line system wherein the rates at the lowest and highest valuation limits are specified in the law and the rates at intermediate valuations are determined on the basis of a straight line formula (as in force in Calcutta now).

Of the four systems listed above, the system adopted in Hyderabad Municipal Corporation has a built-in defect on the basis of which, within a given slab range, the per cent tax demand instead of remaining constant. In other words, the incremental tax demand for increase in annual values over various valuation ranges is erratic and irregular

Another question is whether uniform rates should be specified irrespective of the valuations, without regard to equity principles, or whether rates should be progressive, the tax demands on higher valuation properties being progressively higher

Regarding the choice of a slab system, barring the system used under the Hyderabad Municipal Corporation Act (the built-in defects of which have been mentioned), both the Income Tax formula approach and the Straight Line System ensure progression in tax demands. However, it may be pointed out that the Straight Line System eliminates two ad hoc decisions which are necessary under the Income Tax System, namely, where the slabs should be split and what should be the progression in the various slab ranges ?

EXEMPTIONS

It is noteworthy that, in general, besides the exemptions for properties of Diplomatic or Consular Missions, properties used for charitable purposes, excluding those parts used for commercial purposes, and for burning ghats, crematoria and so on, the laws exempt only such properties where the tax yields may be lower than the estimated collection costs.

In Punjab, however, self-occupied houses built on an area measuring upto 250 square yards under Notified Area Committees and Class II and Class III Municipal Committees are also exempted from payment of property tax

It is obvious that in each city-specific situation, the provisions for granting exemptions need to be critically reviewed and transparency needs to be introduced by publishing the exemption lists.

LIABILITY TO PAY

Inasmuch as municipal taxes are levied to mobilize resources for performance of duties under the municipal laws and not for

taxing the incomes from properties, the issue may be raised whether the occupiers, whether owners or tenants, should not be liable to pay taxes.

For administrative purposes, it may be desirable to fix the liability on the owners. However, as has been done in section 194 of the Calcutta Municipal Corporation Act, 1980, the tax burden can be shared between the owners and the occupiers. In the case of non-residential premises, it can be assigned to the occupiers only.

TAX MAPPING

An issue is raised as to how it can be ensured that all the likely assesses of the municipal taxes are borne on the municipal registers.

Considering that the conventional approaches for tax mapping based on field surveys are extremely cumbersome and time consuming, Times Research Foundation (TRF) has proposed a Unique Premises Numbering System which can help, provided such premises numbers are used for specifying the address used by any citizen for all statutory and regulatory purposes as also while applying for services such as of electricity, telephone, gas, etc. This system is under active consideration by some State Governments.

TAX ADMINISTRATION

Inasmuch as tax demands remain constant over the period of validity of given valuation cycles, the issue is raised whether this opportunity should not be exploited to introduce reforms in billing.

Also, in the matter of recovery of taxes, the issue is whether the interest charged for delayed payments should not be correlated to the bank rates, thereby ensuring that intentional defaults are eliminated. Also, the question is whether there should be other penalties too?

In cities where electricity is among the municipal services, disconnection of electric supply for non-payment of municipal dues is possible. The question is whether to manage the critical problems due to poor collection performance; other approaches could be followed which would ensure compliance in timely settlement of municipal dues.

ROLE OF CITIES IN MANAGEMENT OF URBAN ENVIRONMENT IN INDIA

THE ENVIRONMENTAL CONCERNS

In the closing decade of the Twentieth Century, issues related to environmental pollution have become so critical that besides the legislatures and the executive wings at all levels of

Government, even the judiciary is seized of the need for concrete and urgent actions.

In the Indian context, the Supreme Court remarked that in India, as elsewhere in the world, uncontrolled growth and the consequent environmental deterioration are fast approaching menacing proportions and all Indian cities are afflicted with this problem.

The Supreme Court added that the environmental question has become urgent and it has to be properly understood and squarely met by man.

Evolution of Constitutional Reforms on Environment in India

It is noteworthy that till 1976, there was no Constitutional requirement in India to protect and improve the environment.

In the year 1976, the Constitution of India was amended by the Constitution (Forty-second Amendment) Act, 1976. By this Amendment Act, a new Article was inserted in the Constitution which provides :

"The State shall endeavour to protect and improve the environment and to safeguard the forests and wild life of the country."

Realizing that people's participation and social consciousness is the driving force for the prevention of pollution and environmental literacy of the general masses is an imperative need, the Constitution also mentions certain fundamental duties of the Indian citizens. Thus, it is stated that

"it shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wild life and to have compassion for living creatures."

The subject matter of urban forestry, protection of the environment and promotion of ecological aspects have, however, been added by the Constitution (Seventy-fourth Amendment) Act, 1992.

It may, thus, be seen that urban development which basically involves supply of urban infrastructure is no longer enough for promoting sustainable cities. On the other hand, there has to be a new concern for urban environment management with due understanding of the linkages between infrastructure, productivity, poverty and environmental health.

The 74th Constitution Amendment implies as much by the inclusion of the following entries under the Twelfth Schedule:

- (1) Planning of economic and social development (item 3 of the Twelfth Schedule)

- (2) Water supply for domestic, industrial and commercial purposes (item 5)
- (3) Public health, sanitation, conservancy and solid waste management (item 6)
- (4) Urban forestry, protection of the environment and promotion of ecological aspects (item 8)
- (5) Safeguarding the interests of weaker sections of society, including the handicapped and mentally retarded (item 9), and
- (6) Slum improvement and upgradation (item 10).

It is in the above mentioned Constitutional context that the role of cities in management of urban environment in India needs to be examined

LOCAL AUTHORITIES' INITIATIVE IN SUPPORT OF AGENDA 21

The following observations in Chapter 28 of Agenda 21 of the Rio World Conference on Environment and Development need to be taken note of to specify local authorities' initiatives in support of Agenda 21.

PROGRAMME AREA

Basis for Action

28.1 Because so many of the problems and solutions being addressed by Agenda 21 have their roots in local activities, the participation and cooperation of local authorities will be a determining factor in fulfilling its objectives. Local authorities construct, operate and maintain economic, social and environmental infrastructure, oversee planning processes, establish local environmental policies and regulations, and assist in implementing national and sub-national environmental policies. As the level of governance closest to the people, they play a vital role in educating, mobilizing and responding to the public to promote sustainable development.

Activities

28.3 Each local authority should enter into a dialogue with its citizens, local organizations and private enterprises and adopt "a local Agenda 21". Through consultation and consensus-building, local authorities would learn from citizens and from local, civic, community, business and industrial organizations and acquire the information needed for formulating the best strategies. The process of consultation would increase household awareness of sustainable development is-

ues. Local authority programmes, policies, laws and regulations to achieve Agenda 21 objectives would be assessed and modified, based on local programmes adopted. Strategies could also be used in supporting proposals for local, national, regional and international funding

NATIONAL STRATEGY FOR WIDER REPLICATION

Operationalizing the Local Agenda 21 would involve actions on several fronts, namely :

- (1) legislative reforms in central laws on environment and state laws governing planning and development and municipal administration (Table 1.5 for Central and State Acts related to environment)
- (2) institutional reforms with a view to define the organizational hierarchy in matters of urban environment management, coordination of roles of various agencies and for ensuring public participation
- (3) re-definition of the functional domains of various agencies involved in urban environment management with a focus on monitoring of pollution levels and for undertaking health risk assessments
- (4) training and human resource development with a view to meet the new challenges on this front.

CENTRAL ACTS ON ENVIRONMENTAL ASPECTS

The principal laws on environmental protection in India, as enacted by Parliament, are :

- (1) the Water (Prevention and Control of Pollution) Act, 1974
- (2) the Air (Prevention and Control of Pollution) Act, 1981, and
- (3) the Environment (Protection) Act, 1986.

The Water (Prevention and Control of Pollution) Act, 1974, was passed on the basis of the resolutions passed by all the Houses of the Legislatures of the States of Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Rajasthan, Tripura and West Bengal, to provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water.

The Air (Prevention and Control of Pollution) Act, 1981, and the Environment (Protection) Act, 1986, were passed for implementing the decisions taken at the June 1972 Stockholm Conference on Human Settlements.

State Government Laws

The planning and development legislation in various States would require modifications to achieve the following ends :

- (1) to establish a linkage between the planning procedures and implementation mechanisms and the factors which contribute to settlement change
- (2) to devise settlement and neighbourhood plans which lead to resource-efficient and affordable transport and infrastructure patterns
- (3) to establish the coordination mechanism involving planning and development authorities and urban local bodies
- (4) to redefine development controls and modify the regulatory framework.

MUNICIPAL LAWS

The municipal laws would need to be revised with a view to provide for the following :

- (1) the new role of local governments in management of urban environment
- (2) the new imperatives for measuring quality of living and work environment
- (3) the new responsibilities for monitoring of pollution levels and for undertaking health risk assessments, and
- (4) the involvement of community based organizations.

LOCAL AGENDA FOR URBAN ENVIRONMENT MANAGEMENT

While planning for the local agenda for urban environment management, the following well known positions need to be reiterated

- (1) urban environment management tasks should be appreciated in terms of the linkages between the city economy, infrastructure, productivity, poverty and environmental health
- (2) it should be noted that today's cities are net consumers of natural resources and exporters of wastes
- (3) environmental degradation in any city affects the poor and other vulnerable groups the most, including the children, and
- (4) many of the environmental damages are of an irreversible nature.

The objectives for environment management at the local level may include the following:

- (1) preparation of environmental management strategy and action plan
- (2) carrying out of studies on vulnerability and risk assessment
- (3) establishing adequate institutional and regulatory framework to plan and implement the environmental management plan
- (4) enhancing the capability of the concerned agencies for better management of the environment, and
- (5) research and training activities to better equip the municipal personnel for realization of the above mentioned objectives.

To sum up, the responsibilities for management of urban environment would have to be shared between the Central and State agencies and the local governments would have to be assigned roles which are consistent with their technical, managerial, organizational and fiscal capacities.

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TABLE 1.1

URBAN LOCAL BODIES IN INDIA, 1991

| | Municipal Corporation | Municipal Council | Municipal Committee | Municipal Board | Municipality | City Municipal Committee | Town Municipal Committee | Township | Town Area Committee | Town/ Nagar Panchayat | Village Mandal Panchayat | Notified Area Committee | Cantonment | Others | Total |
|-------------------|-----------------------|-------------------|---------------------|-----------------|--------------|--------------------------|--------------------------|----------|---------------------|-----------------------|--------------------------|-------------------------|------------|----------|-------|
| Andhra Pradesh | 3 | - | - | - | 109 | - | - | - | - | 141 | - | 2 | 1 | 8 | 264 |
| Assam | 1 | - | - | 24 | - | - | 49 | - | - | - | - | - | - | - | 74 |
| Bihar | 6 | - | - | - | 70 | - | - | - | - | - | - | 92 | 2 | - | 170 |
| Goa | - | 13 | - | - | - | - | - | - | - | - | - | - | - | - | 13 |
| Gujarat | 6 | - | - | - | 62 | - | - | - | - | 100 | 79 | 10 | 1 | - | 258 |
| Haryana | - | - | 81 | - | - | - | - | - | - | - | - | - | 1 | 1 | 85 |
| Himachal Pradesh | 1 | - | 19 | - | - | - | - | - | - | - | - | 30 | 7 | - | 57 |
| Karnataka | 6 | - | - | - | - | 20 | 136 | - | - | - | 56 | 14 | 1 | 2 | 235 |
| Kerala | 3 | - | - | - | 61 | - | - | 2 | - | - | - | - | 1 | - | 67 |
| Madhya Pradesh | - | - | 17 | - | 357 | - | - | - | - | - | - | 7 | 5 | - | 386 |
| Maharashtra | 11 | - | - | - | 227 | - | - | - | - | - | - | - | 7 | 2 | 247 |
| Orissa | - | - | - | - | 30 | - | - | - | - | - | - | 72 | - | - | 102 |
| Punjab | 3 | - | 95 | - | - | - | - | - | - | - | - | 11 | 3 | - | 112 |
| Rajasthan | - | 19 | - | - | 168 | - | - | - | - | - | - | 5 | 1 | - | 193 |
| Tamil Nadu | 3 | - | - | - | 98 | - | - | 8 | - | 212 | 119 | - | 2 | 10 (PTS) | 452 |
| Uttar Pradesh | 8 | - | - | 228 | - | - | - | - | 418 | - | - | 33 | 22 | - | 709 |
| West Bengal | 3 | - | - | - | 95 | - | - | - | - | - | - | 10 | 1 | - | 109 |
| Delhi | 1 | - | 1 | - | - | - | - | - | - | - | - | - | 1 | - | 3 |
| Andaman & Nicobar | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | 1 |
| Chandigarh | - | - | - | - | - | - | - | - | - | - | - | 1 | - | 1 | 2 |
| Pondicherry | - | - | - | - | 4 | - | - | - | - | - | - | - | - | - | 4 |

| | Municipal Corporation | Municipal Council | Municipal Committee | Municipal Board | Municipality | City Municipal Committee | Town Municipal Committee | Township | Town Area Committee | Town/Nagar Panchayat | Village Mandal Panchayat | Notified Area Committee | Cantonment | Others | Total |
|--------------|-----------------------|-------------------|---------------------|-----------------|--------------|--------------------------|--------------------------|-----------|---------------------|----------------------|--------------------------|-------------------------|------------|-----------|-------------|
| Manipur | - | - | - | - | 7 | - | - | - | - | - | - | 21 | - | - | 28 |
| Meghalaya | - | - | - | - | 1 | - | - | - | - | - | - | - | 1 | - | 2 |
| Sikkim | - | - | - | - | - | - | - | - | 7 | - | - | - | - | - | 7 |
| Tripura | - | - | - | - | 1 | - | - | - | - | - | - | 11 | - | - | 12 |
| Total | 55 | 32 | 213 | 253 | 1290 | 20 | 185 | 10 | 425 | 453 | 254 | 319 | 57 | 26 | 3592 |

TABLE 1.2

**URBAN LOCAL BODIES IN INDIA
VARIOUS TYPES AND SIZE RANGES**

| Type of Local Body | Total Number in India | Biggest Such Local Body 1991 | | Smallest Such Local Body 1991 | |
|----------------------------|--------------------------|------------------------------------|------------|---------------------------------|------------|
| | | City | Population | City | Population |
| Municipal Corporation | 55 | Greater Bombay (Maharashtra) | 99,09,547 | Simla (Himachal Pradesh) | 81,463 |
| Municipal Council | 32 | Jaipur (Rajasthan) | 14,54,678 | Sangat (Punjab) | 2,731 |
| Municipal Committee | 213 | New Delhi | 2,94,149 | Nainadeir (Himachal Pradesh) | 868 |
| Municipal Board | 253 | Ghaziabad (Uttar Pradesh) | 4,60,949 | Dogadda (Uttar Pradesh) | 2,436 |
| Municipality | 1,290 | Guntur (Andhra Pradesh) | 4,71,020 | Chikhaldara (Maharashtra) | 2,791 |
| City Municipal Committee | 20 | Davangere (Karnataka) | 2,65,971 | Karwar (Karnataka) | 51,011 |
| Town (Municipal) Committee | 185 | Harihar (Karnataka) | 66,600 | Mahur (Assam) | 2,213 |
| Township | 10 | Ambattur (Tamil Nadu) | 2,23,332 | Kuttalam (Tamil Nadu) | 2,840 |
| Town Area Committee | 425 | Loni (Uttar Pradesh) | 36,607 | Rudra Prayag (Uttar Pradesh) | 1,542 |
| Town/Nagar Panchayat | 453 | Mandamarri (Andhra Pradesh) | 66,057 | Kodlipet (Karnataka) | 2,179 |
| Panchayat Township | 10 | Valparai City (Tamil Nadu) | 1,06,289 | Sankar Nagar (Tamil Nadu) | 4,542 |
| Village/Mandal Panchayat | 254 | Seelanayakkanpatti (Tamil Nadu) | 30,852 | Pettai (Tamil Nadu) | 952 |
| Notified Area Committee | 319 | Jamshedpur (Bihar) | 4,61,212 | Gangotri (Uttar Pradesh) | 128 |
| Cantonment | 57 | Secunderabad (Andhra Pradesh) | 1,67,461 | Dalhouse (Himachal Pradesh) | 1,744 |

TABLE 1.3
MUNICIPAL AUTHORITIES AS DEFINED IN
VARIOUS MUNICIPAL ACTS IN INDIA

| Sl No. | The Municipal Authorities | The Bombay Municipal Corporation Act, 1888 (Section 4) | The Bombay Provincial Municipal Corporations Act, 1949 (Section 4) | The Karnataka Municipal Corporations Act, 1976 (Section 6) | The Hyderabad Municipal Corporations Act, 1955 (Section 4) | The Calcutta Municipal Corporation Act, 1980 (Section 3) |
|--------|------------------------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------|
| 1. | The Corporation | - | - | - | - | - |
| 2. | The Standing Committee | - | - | - | - | * |
| 3. | The Commissioner | - | * | - | - | * |
| 4. | The Mayor | * | * | * | * | - |
| 5. | The Mayor-in-Council | * | * | * | * | - |
| 6. | An Improvement Committee | - | * | * | * | * |
| 7. | A Electric Supply & Transport Committee | - | * | * | * | * |
| 8. | A General Manager of the Electric Supply & Transport Undertaking | - | * | * | * | * |
| 9. | Corporation Establishing or Acquiring a Transport Undertaking | * | - | * | * | * |
| 10. | A Transport Committee | * | - | * | * | * |
| 11. | A Transport Manager | * | - | * | * | * |
| 12. | An Education Committee - specified in the Act. | - | * | * | * | * |

* not specified

TABLE 1.4

**TWELFTH SCHEDULE AND
THE CORRESPONDING ENTRIES IN
LIST II AND LIST III IN THE SEVENTH SCHEDULE TO
THE CONSTITUTION OF INDIA**

| Sl. No | Items in the Twelfth Schedule | Entries in the Lists II and III of the Seventh Schedule |
|--------|---------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| 1 | Urban Planning and town planning | Entry 18 of List II Entry 20 of List III |
| 2. | Regulation of land-use and construction of buildings | Entry 18 of List II Entry 20 of List III |
| 3. | Planning for economic and social development | Entry 20 of List III |
| 4. | Roads and bridges | Entry 13 of List II |
| 5. | Water supply for domestic, industrial and commercial purposes | Entry 17 of List II |
| 6. | Public health, sanitation, conservancy and solid waste management | Entry 6 of List II |
| 7. | Fire Services | Entry 6 of List II |
| 8. | Urban forestry, protection of environment and promotion of ecological aspects | Entry 17 of List II |
| 9. | Safeguarding the interests of the weaker sections of society, including the handicapped and mentally retarded | Entry 9 of List II Entry 16 of List III |
| 10. | Slum improvement and upgradation | Entry 6 of List II |
| 11 | Urban poverty alleviation | Entry 11 of List III |
| 12. | Provision for urban amenities and facilities such as parks, gardens and playgrounds | Entry 18 of List II Entry 20 of List III |

| | | |
|-----|---------------------------------------------------------------------------------------------|---------------------------------------------------|
| 13 | Promotion of cultural, educational and aesthetic aspects | Entries 12, 33 of List II Entry 25 of List III |
| 14. | Burials and burial grounds; cremations, cremation grounds and electric crematoriums | Entry 10 of List II |
| 15. | Cattle pounds, prevention of cruelty to animals | Entry 15 of List II Entry 17 of List III |
| 16. | Vital statistics including registration of births and deaths | Entry 30 of List III |
| 17. | Public amenities including street lighting, parking lots, bus stops and public conveniences | Entry 5 of List II Entry 20 of List III |
| 18. | Regulation of slaughter houses and tanneries | Entry 15 of List II |

TABLE 1.5

LIST OF SELECTED CENTRAL AND STATE ACTS RELATED TO ENVIRONMENT

Central Laws**A. Water pollution**

1. The River Board Act, 1956
2. The Merchant Shipping (Amendment) Act, 1970

B. Air Pollution

3. The Indian Boiler's Act, 1923
4. The factories Act, 1948
5. The Industries (Development and Regulation) Act, 1951
6. The Mines and Minerals (Regulation and Development) Act, 1947.

C. Radiation

7. The Atomic Energy Act, 1962
8. Radiation Protection Rules, 1971

D. Pesticides

9. The Insecticide Act, 1968
10. The Factories Act, 1948
11. The Poison Act, 1919

E. Others

12. The Indian Fisheries Act, 1897
 13. The Urban Land (Ceiling and Regulation) Act, 1976
 14. The Ancient Monument and Archaeological Sites and Remains Act, 1958
-

State Laws

A. Water Pollution

1. Orissa River Pollution Prevention Act, 1953
2. Maharashtra Prevention of Water Pollution Act, 1969

B. Smoke Control

- 3 The Bengal Smoke Nuisance Act, 1905
4. The Gujarat Smoke Nuisance Act, 1963
5. The Bombay Smoke Nuisance Act, 1912

C. Pest Control

6. The Andhra Pradesh Agricultural Pest and Disease Act, 1919
7. The Assam Agricultural Pests and Disease Act, 1954
8. The Uttar Pradesh Agricultural Disease and Pests Act, 1954
9. The Mysore Destructive Insects and Pests Act, 1917
10. The Kerala Agricultural Pests and Disease Act, 1958

D. Land Utilization and Land Improvement

11. The Andhra Pradesh Improvement Scheme Act, 1949
 12. The Acquisition of Land for Flood Control and Prevention of Erosion Act, 1955
 13. The Bihar Waste Lands (Reclamation, Cultivation and Improvement) Act, 1946
 14. The Delhi Restriction of Uses of Land Act, 1964.
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Carrying Capacity Based Regional Planning

National Institute of Urban Affairs, New Delhi

INTRODUCTION: OBJECTIVE AND SCOPE OF THE STUDY

The carrying capacity based approach to planning is both a concept and a tool towards sustainable development of human settlements. The improvement and long term sustenance of the quality of life in our human settlements is a critical issue facing urban and regional planners and policymakers today in the wake of the severe environmental degradation of air, water and land. Depletion of environmental resources, inadequate infrastructure and social amenities as well as inadequate and inappropriate institutions to tackle such problems have led to further deterioration of environmental qualities of human settlements. The pervading lack of awareness of urban environmental issues and concerns amongst not only the general populace but also the urban managers in India may frustrate our efforts towards sustainable developments of our cities. The need for urgent development of policies and action programmes towards sustainable development of human settlement have been brought into sharp focus through the Agenda 21 of the UNCED. Despite being one of the most populated countries with severe urban environmental problems amongst the signatories of Agenda 21, India is yet to operationalise the agenda at its country level.

The very concept of carrying capacity based planning is new in India, not to speak of the availability of tools and techniques to operationalise the concept at the level of urban and regional planning. Therefore, research of the nature of the present study which aims to define the concept of carrying capacity based urban and regional planning and to develop a methodology to operationalise such a planning approach cannot be more useful and timely.

The methodology developed in this study incorporates tools and techniques of assessment of various supportive and assimilative capacities of urban environmental resources and of decision-making based on these carrying capacities, demonstrating the applications of the same in the Indian urban context, such as in the case of the National Capital Region of Delhi. Furthermore, the study leads to ways and means of implementation of the concepts and methods of carrying capacity based planning through institutional restructuring and capacity building at the local level.

WHAT IS CARRYING CAPACITY BASED PLANNING? : DEFINITION AND CONCEPTS

The notion of "carrying capacity" refers intrinsically to the

finite capacity or the limitation of the natural environment both as a reservoir of resources to support human consumption and as a sink to assimilate the residuals or wastes. Thus carrying capacity based planning needs to deal with the management of the "throughput", that is, the size and nature of human activities leading to resource consumption and waste generation, as well as the supportive resource base and the assimilative capacities of the environment. In other words, the planning approach may require optimization of human demands in relation to manageable supply of environmental resources.

The idea of natural carrying capacity or environmental limits to growth is not new in scientific disciplines, especially cybernetics, demography and bio-science. As early as in the eighteenth century, Verhulst attempted to derive a logistic population growth curve that approached its asymptote after initial increase, indicating limiting biological and economic factors in the environment (Bishop et al, 1974:). Food resource had been the critical factor in the well known Malthusian concept of natural carrying capacity which may lead to sudden and dramatic crash in exponential population growths. Lotka (1925) and Volterra (1926) developed logistic population growth curves that would have upper bounds owing to density dependent negative feedbacks resulting from resource depletion, disease, predation and so on. Population density dependent carrying capacity has been the premise also in the practice of forest and animal resource management, where the maximization of "sustained yield" of lumber harvest or cattle population is linked to the capacities of regeneration of resources to support such yields.

The qualitative factor of life has also been linked to the notion of carrying capacity more recently. For instance, Ackerman (1959) attempted to measure it not in terms of the quantity or size alone, but also the "standard of living", incorporating various technological, institutional and economic aspects of the population. Colhoun (1973) linked social pathology or "behavioral sink" in animal population with carrying capacity in terms of space reaching its limit.

However, the concern for environmental carrying capacity is relatively recent among planners and economists. Computer modelling of global growth scenarios in the seventies stretched the concept of carrying capacity to a notion of "limits to growth" (Meadows et al 1972) that was akin to environmental determinism forecasting doom. This nevertheless raised storms of controversy as to the so-called "limits", especially in terms of population growth, for later forecasts indicated sharp differ-

ences among world countries in sustaining population growth (FAO/HASA, 1987). Furthermore, the notion of limits of population growth and resources is challenged in the light of technological progress as well as market forces that tend to balance demands and supply of resources (Kahn, 1982; Kirchner et al 1985; Simon, 1981).

More recent contentions favour sustenance of optimal economic growth (rather than limiting growth) through management of environmental resources and constraints, in order to enhance quality of life, including pollution abatement (Balwin, 1994; Beckerman, 1992; Scott, 1994; World Bank, 1992). At the same time, the 'business as usual' scenario of unabated exponential population growth, consumption of non-renewable resources and pollution is rejected. Thus carrying capacity based planning endeavors to maintain on a sustained basis a balance between the growing demands for human economic activities and concomitant consumptions of natural resources on one hand and the supply of various environmental resources to meet such demands, on the other.

CARRYING CAPACITY BASED APPROACH IN THE CONTEXT OF URBAN PLANNING AND DEVELOPMENT

Deriving from the above concept, the thrust of carrying capacity based urban planning is towards management of the demands for various regional and local environmental resources required to sustain the desired economic activities and quality of life across urban areas and the supply of such environmental resources within their regenerative capacities. This should translate into policies, strategies and action plans at the local level towards augmentation and sustenance of urban environmental resources in term of their supportive and assimilative capacities on one hand and the size, nature and distribution of urban-economic activities and their concomitant demands on these environmental capacities, on the other (see also Figure 2.1).

While urban centres, especially large cities are increasingly assuming the role of engines of the country's economic growth, their demands for natural and 'human' or social resources, such as land, housing, water, energy and other required infrastructure and institutions as well as their pollution generation are often stressing their environmental settings beyond their capacities to supply economic resources and assimilate urban wastes, resulting in degradation of the quality of life in the cities.

IS THE TRADITIONAL URBAN AND REGIONAL PLANNING APPROACH CAPABLE OF FACING THE ABOVE TASK?

Conventional urban planning as represented, for instance, through preparation of master plans or so-called comprehensive plans is deterministic in its concerns for size and efficient distribution of urban activities and infrastructure rarely questioning the probability of achieving the goals within the resources and environmental constraints of any given setting. "Dianopolis"

and "Ecumenopolis", for instance, are extreme models of urban plan and regional urbanization based on assumptions of unlimited growth possibilities. Although economic and social improvements in the human environment are focussed in the traditional urban planning approach, the ecological system that provides necessary natural resource support and waste assimilation to achieve such economic and social goals are not equally examined. The carrying capacity based urban planning approach, on the other hand, requires the development of a procedure and analytical mechanism that will reconcile the varied social expectations in the human environment and the quality and stability of the natural environment. It relies on the emerging thesis that growth and environmental conservation across urban settings are complementary rather than conflicting goals.

However, the similarity between traditional planning and carrying capacity based approach lies in the normative and rhetorical aspects of any democratic planning process which should be participatory and interactive in nature. Reconciliation of varied socio-economic goals and ecological imperatives in any given urban settings as required in the carrying capacity based planning necessitates resolution of conflicts and tradeoffs among development alternatives to converge on socially and economically viable and environmentally sound decisions. Bishop (1974) thus emphasizes that carrying capacity based planning should be a dynamic "planner-decisionmaker-public" interactive process rather than a model to generate "a plan". To this extent, any pluralistic planning should reconcile among a plethora of values, be they economic, social or ecological in nature through a process of interaction where rhetoric is integral to the art of suasion.

THE ELEMENTS OF CARRYING CAPACITY BASED PLANNING PROCESS

The elements of carrying capacity based planning process have been summarized in Figure 2.1. Urban developmental policies and actions are directed to output socio-economic goods and services for betterment of the quality of life of the population in a city or a region. Such actions in turn will put demands on various supportive and assimilative capacities of the setting. The supply of such carrying capacity depends on various economic, infrastructural and institutional resources of the setting as well as waste assimilative capacities of the air, water, land/soil and biological components of its environment. Carrying capacity based planning is directed towards the management of these supply-demand gaps or the "Carrying Capacity Differential" (Bishop et al, 1974). Thus the process, in essence, implies:

- Estimation of various supportive and assimilative capacity dimensions and impacts thereon of alternative developmental actions across an urban or regional setting through a set of carrying capacity indicators or indices.
- Development of strategies toward carrying capacity demand and supply side, management to deal with

such impacts, including tradeoffs among alternative developmental activities and concomitant resource allocations, technology, and institutional arrangements towards environmental control and resource management.

The methodological implication for operationalising the above process has been elaborated in the following chapters. The concept of "relative carrying capacity" of urban centres or parts of a region may be useful in developing strategies towards spatial allocation of activities and resources, especially across large urban regions with competing centres (such as the National Capital Region of Delhi). Different urban centres may be compared in terms of their carrying capacity based development potentials

ASSESSMENT OF ENVIRONMENTAL CARRYING CAPACITIES OF URBAN AREAS

DIMENSIONS OF CARRYING CAPACITY: URBAN ENVIRONMENTAL COMPONENTS AND RESOURCES

An urban environment needs to have capacities to assimilate, that is, to manage and recycle, various wastes - air, water, land and noise pollution - generated by its population and economic activities. It also requires capacities in terms of various natural and socio-economic resources and infrastructure, namely, land, water, energy, transport, social amenities, economic base and institutions to support its population and economic activities. Thus the two broad dimensions of environmental carrying capacities of urban areas may be categorized in terms of its:

- waste assimilative capacities;
- carrying capacities in respect of various environmental resources and infrastructure.

Several recent studies on urban indicators and environmental management help to identify the specific environmental components and resources in respect of which carrying capacities of an urban area need to be assessed. The following research studies have been considered in the identification of the set of urban environmental resources as well as the indicators (see following pages) for assessment of their carrying capacities:

- Urban policy goals and indicators developed by the UNCHS
- Resource classification developed in the Carrying Capacity Based Developmental Planning by the National Environmental Engineering Research Institute (NEERI).
- The environmental concerns and the urban environmental indicators proposed by the OECD.
- The urban environmental issues (problem areas) and urban environmental indicators developed by Leitman for Urban Management Programme of World Bank.

Through a comparative analysis of case studies across seven developing countries of Asia, Europe and Latin America,

Leitman has been able to group the major urban environmental problems into 13 areas which can be linked specifically to the waste assimilative capacities of air, water, land, biological and cross-media components of the urban environment. Interestingly, noise pollution or the acoustic environment of cities has not been identified as a major environmental problem area

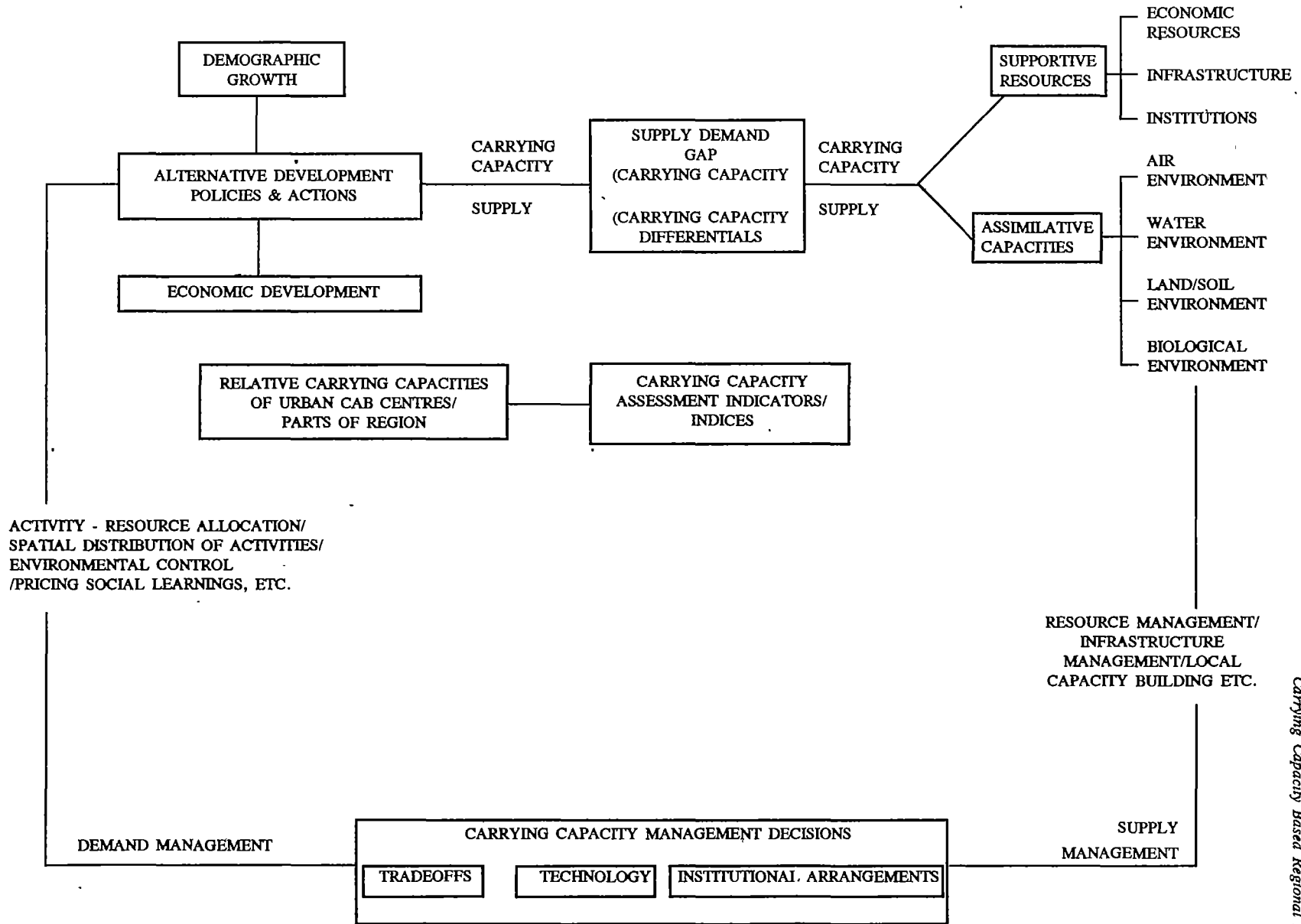
Resource classification is helpful for inventory of the existing resource base of an urban region and analyzing impacts thereon of development scenarios. National Environmental Engineering Research Institute's classification of regional resources helps to identify the various environmental components in respect of which carrying capacity assessments are important for sustainable development of the city. Again, this resource classification identifies the air, water, land and biological resources, economic resources for urban industrial activities, organizational/institutional resources for both economic development and urban amenities and infrastructure, industrial technological base and urban infrastructure and social amenities resources.

The Organization for Economic Cooperation and Development (OECD) developed a set of environmental concerns in 1978 along with their indicators which focusses on the urban environmental components of housing urban services, specifically, commercial, health, educational, recreational, transportation and protective services; employment, which has been considered as the key concern in respect of urban economy; air, water and acoustic environments; urban solid and hazardous waste management; and land quality and urban landscape which refers specifically to conservation, open spaces and landscape amenity. Although social and cultural concerns have also been listed, the list does not articulate any specification for this component.

The United Nations Centre for Human Settlements (UNCHS) has developed two sets of indicators: "urban indicators" and "housing indicators", where the enlisting of policy goals helps to identify different urban environmental components for planning and development purposes. The urban indicators, organised into five different modules, focus on the environmental components of the urban economy, specifically, poverty, employment and productivity; life quality of population in term of life expectancy, infant mortality, literacy, health, education and social integration; urban utilities and services, namely, water, sewage, electricity, telephone; transportation infrastructure; and local government institutional resources. The housing indicators deal specifically with various policy goals for housing development.

The urban environmental indicators developed by Leitman for the World Bank UMP Project on Rapid urban Environmental Assessment are organised under four modules covering demographic characteristics of population, growth rate, density, life expectancy, infant mortality and economic status; natural environment including its biological component; land characteristic in terms of drainage and topography and climate; urban landuse; air quality and energy use in terms of pollution emission, energy consumption and pollution control mechanism; water resources and supply and waste generation and management.

Figure 2.1 : Elements of Carrying Capacity Based Planning Process



While varying in their scope and specific objectives, the above studies on classification of environmental issues and concerns, policy goals, resources and indicators help to identify a comprehensive set of universally applicable urban environmental resources, for assessment of their carrying capacities, Figure - 2 shows the proposed set of environmental components/resources constituting the carrying capacities of urban areas. The assimilative and supportive carrying capacity components are defined in the figure

Furthermore, a set of carrying capacity criteria has been identified to define the carrying capacities of these environmental resources. In other words, what does carrying capacity in respect of each of these urban environmental resources mean? The criteria serve as environmental policy goals for sustaining these environmental resources to support urban population and economic activities. The criteria are related to norms or standards of supply and demand or requirements of these environmental resources in an urban area. The development of indicators and parameters for assessment of carrying capacities of the environmental resources follows from these criteria or policy goals.

CARRYING CAPACITY INDICATORS FOR URBAN ENVIRONMENTAL RESOURCES

Indicators are measures of the status or the changes thereof for any environmental dimension. In this study, indicators have been developed to assess the carrying capacities of various environmental resources in terms of sustaining the quality of life and the needs and demands of population and economic activities for these resources across an urban area. As mentioned earlier several recent studies have attempted to develop indicators for measurement of various urban environmental dimension. The objectives behind development of such indicator measures vary and the arrays reflect different sets of environmental issues, concerns or components, albeit with overlaps or commonalities. In essence, the indicators developed under the above studies help to measure various existing demographic characteristics and socio-economic qualities of urban life and the existing status of various natural as well as man-made urban amenities and resources. While none of these arrays of indicators may be directly applicable to measure carrying capacities of the set of urban environmental resources identified in this study (see Figure 2.2) several indicators across the arrays are helpful as parameters of carrying capacity measures in respect of several specific resources.

The carrying capacity indicators developed in this study to estimate capacities in respect of the various identified urban environmental resources are shown in Table 2.1 along with their respective parameters and procedure for measurement. Grouped under five different modules, the carrying capacity indicators constitute:

Module A : Waste assimilative capacity indicators for air, water, land/soil, biological and acoustic environmental components of the urban area.

Module B : Supportive capacity indicators for land, housing and various social amenity resources of the urban area.

Module C : Supportive capacity indicators for transportation infrastructure facilitating regional and internal accessibilities and communication infrastructure for the urban area.

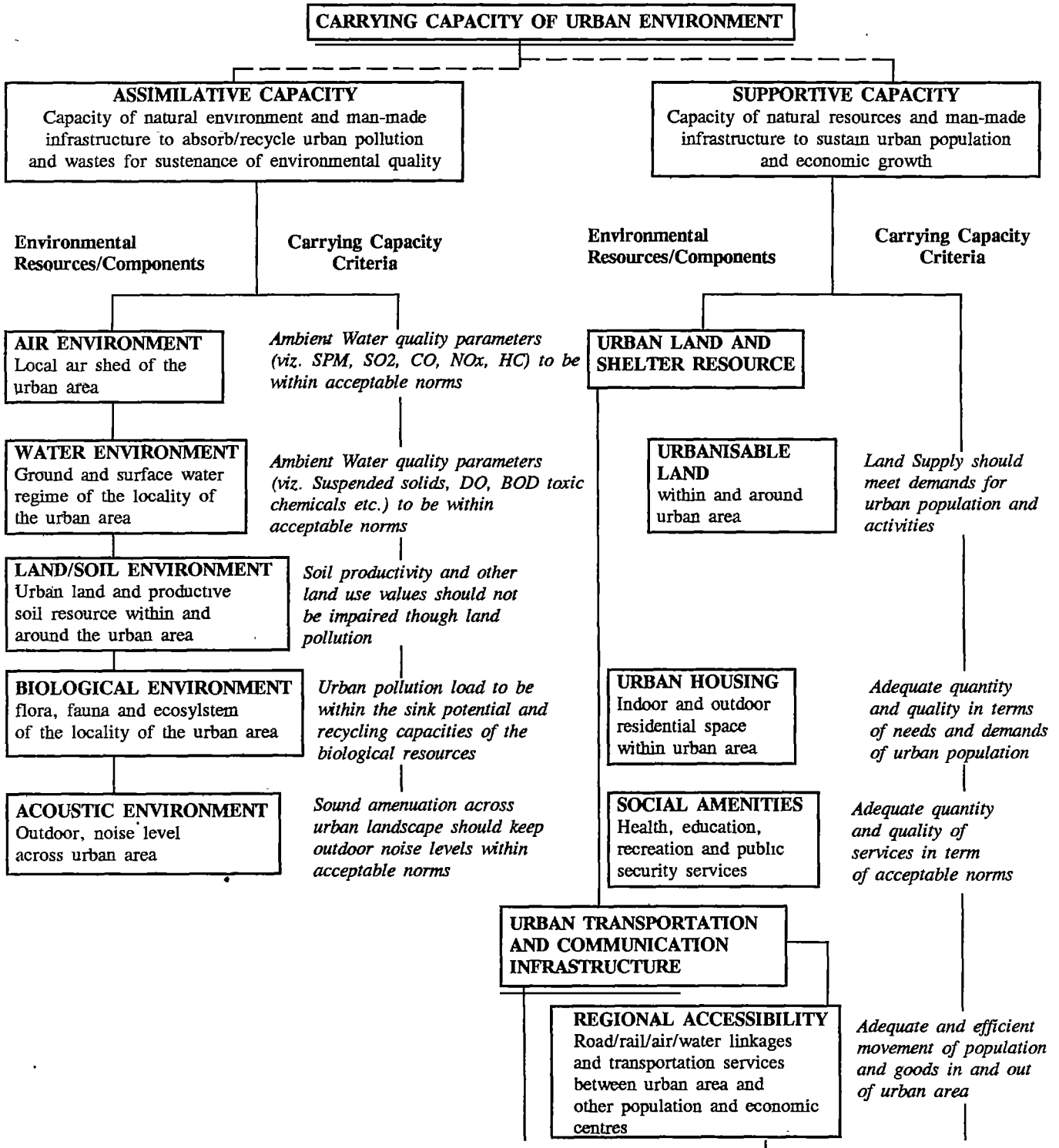
Module D : Supportive capacity indicators of urban utilities, namely, water supply, sanitation and energy supply for the urban area.

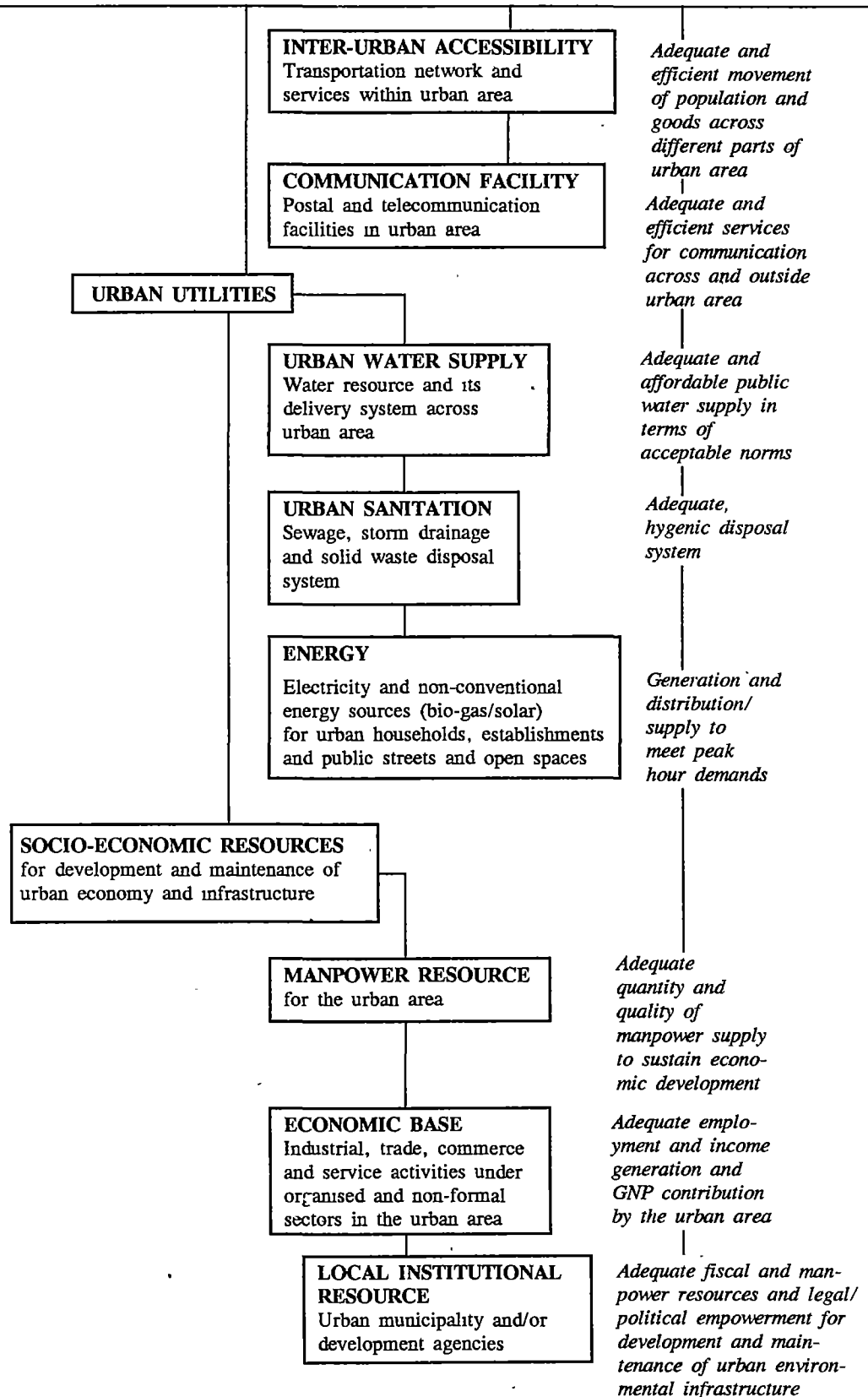
Module E : Socio-economic capacity indicators of manpower resources, economic base and local institutional resources of the urban area.

- An attempt has been made to develop multiple indicator measures for the different environmental resources. Often - arbitrary selection of a single value to represent a complex environmental concern has been criticized in the past (Leitman, 1993, p2) as limitations in numbers of variables may fail to present a complete picture of the environmental issue.
- Indicators have been developed to assess resource capacities in both quantitative and qualitative terms
- The quantitative measures of several supportive resource capacity indicators are related to population size. In other words, their capacities are measured in term of the size of population these resources are capable of supporting; for instance, urban land resource, housing stock, occupancy rate in housing, household amenities, outdoor living space, extent of slumming, amount of health, educational, recreational and public security facilities, commercial resources, such as, postal and telephone services, installed capacities of water supply, sanitation and power generation, manpower supply and literacy rate, income and employment generation in urban economy and income, expenditure and manpower capacity of urban local bodies can be related to their population support capacities.
- The waste assimilative capacity indicators deal with natural assimilation of pollution through ventilation, dilution/absorption or sink potentials of urban airsheds, water regimes, soil environment and biological resource as well as waste management capacities of man made infrastructure, through emission controls, waste water treatment, solid waste management, noise control and attenuation methods.
- Stress Indicators: Various indicators may help to indicate the population and activity pressure or stress on urban infrastructure resources and indirectly measure their capacities.
- Existing levels of air pollution emissions, waste water discharge, solid waste disposal and noise levels across

Figure 2.2

ENVIRONMENTAL COMPONENTS/RESOURCES CONSTITUTING CARRYING CAPACITY OF URBAN AREAS





urban areas may indicate stresses on the assimilative capacities of air, water, land, biological and acoustic environments.

In respect of supportive resources:

- "Slumming" in the cities indicates stress on shelter quantity and quality indirectly measuring the demand-supply gap for a section of the population or insufficient carrying capacity in respect of shelter resources.
- Both "accident rate" and "vehicle density" in urban areas indicate stress on urban transportation network and services or deficiency in the carrying capacity
- Surrogate Indicators Surrogate measures are useful especially when the necessary information on estimation parameters for the carrying capacity indicator are difficult to obtain. These have been shown in parentheses in the Table 2.1 The stress indicators also provide surrogate measures in terms of deficiencies in capacities

Estimation of Carrying Capacity Indicators

Several carrying capacity indicators are measurable against existing Standards or Norms:

- Standards are applicable for assimilative capacity measures in respect of ambient air and water quality parameters and acceptable noise levels for urban landuses. In the Indian context, air, water and noise quality standards are developed through several environmental legislations and implemented through the central as well as local or state pollution control boards.
- The Planning Commission and several national level commissions in India have attempted from time to time to develop norms or acceptable standards in respect of several urban infrastructure and services, especially those related to public health, such as water supply, sanitation, health facilities, and so forth, against whom capacity indicators may be measured.
- Capacity norms for transportation infrastructure and services may be available through state public works departments and highway and railway authorities in India in terms of lane capacities, right of ways of highways and urban roads and chartered numbers of trains for different classes of railway lines .
- Similarly, various other individual public authorities or departments responsible for planning and development of individual social infrastructure, such as central and state health departments, education departments, and postal and telephone authorities, may have their own norms for capacities of such infrastructure in terms of space requirement, numbers or frequencies, personnel requirements and so forth in relation to the population size the infrastructure should serve.

Relative Measures: Carrying capacity estimate of urban areas should be viewed more in relative rather than absolute terms.

For, locally applicable standards or norms are not available for various estimation parameters whereby absolute measures of capacities can be worked out. Furthermore, socio-economic and physical factors determining parameters for capacity estimation of different urban social resources such as housing space, level of social amenities, urban land resource, etc., may vary across urban areas, regions and nations and therefore, universal standards are not applicable. For instance, it is difficult, if not futile, to develop absolute measures or universal standards in respect of urban gross densities, net densities of residential areas, occupancy rates in housing, outdoor recreation space or even maximum levels of domestic water and energy supply, for the requirements for such social resources vary widely with income, lifestyle and culture and even city size.

While there is the need for development of local norms for social resources applicable across homogenous societies or populations, relative measures of carrying capacities of urban entities may be an useful approach for decision making in urban environmental planning and management. Each of the carrying capacity indicators developed may be used to compare among urban areas at sub-regional, regional, sub-national or national level. National level indicators are available for some resources, such as national average urban housing index, average adult literacy rate in cities, against which the capacity of a particular urban areas may be measured. More useful comparisons may be made through indicators for classified cities, such as cities of similar population size or function "Relative Carrying Capacities" of urban areas analysed at the level of defined planning regions (such as the NCR of Delhi) will be useful to develop spatial strategies for allocation of population, activities and resources across the region towards sustainable development as well as plans for environmental management of individual urban areas in relation to their respective carrying capacities.

Estimation of "Hot-Spots": Hotspots may be identified as locations or resources with critical deficiency in assimilative or supportive carrying capacities. For instance, a particular city in a region may be a hotspot in terms of air assimilative capacity in a region; a particular stretch of river may be a hotspot in term of water assimilation capacity, a city or tahsil or district may be a hotspot in terms of supportive water resources. The carrying capacity of a particular location is determined, more often than not, by its capacity in terms of the most limiting resource to support human quality of life; for instance, water or energy may be the most critical resource for many regions, such as the NCR. Estimation of hotspots within a city or across a region is therefore necessary, in order to identify priority among environmental concerns or to prepare plans for carrying capacity management on a priority basis. Estimation, again, may be made in absolute (where absolute measures/standards are available) or relative terms.

Setting Priority and Building Overall Index of Carrying Capacity

Deriving an aggregative measure of environmental carrying

capacity for an urban area poses the vexing question of setting priorities among environmental concerns and assigning "weights" to these as well as to the various indicators or their measures. Single environmental index have been developed in impact assessment studies through multi-dimensional scaling, such as the Batle-Columbus Environmental Quality Index. Also the quality of life measure has been advocated as a measure of human carrying capacity (eg. Bishop, 1974: 32). The NEERI (1994) has attempted to develop a holistic measure of quality of life built upon economic, social and biological needs of a population as advocated by Maslow (1954).

Spatial context of carrying capacity indicators

The indicators developed here are intended to measure carrying capacities in respect of resources that support the population and activities of a particular urban area. While some such resources may be available within the statutory spatial jurisdiction of the urban area, various others, especially natural resources such as air, water or land and even social resources such as regional transportation links energy sources, transcend typical urban spatial boundaries. Thus the information base and parameters for assessment of carrying capacities lie both within and outside the urban limit. Furthermore, various environmental information are often available at aggregate levels, that is, at the level of blocks, tehsils, districts or even sub-regions. For instance, motor vehicle registration data are available at District/sub district levels; natural land classification data, water resource data, etc., may be available at block/tahsil level - which poses difficulties in spatial resolution for analysis (The various sources of information base for individual indicator measures have been identified in Table 2.1).

When the carrying capacity of an urban areas is dependent largely on environmental resources in "distant" locations, the urban area is said to have "Appropriated Carrying Capacity" (viz, Rees, 1972, Whitney, 1990). Water supply, energy supply or even manpower supply are common example of environmental resources which an urban area may appropriate. Appropriated carrying capacities may be analysed through input-output of goods, services, migration, etc. between the urban area under study and the "distant" places or regions

Urban Information System for Carrying Capacity Assessment

The specific parameters and information base necessary for estimation of individual carrying capacity indicators are outlined in Table 2.1 which may be helpful in developing a global urban information system for carrying capacity assessment for use at local municipal and regional levels, with periodical data update.

CASE STUDIES OF USE OF CARRYING CAPACITY INDICATORS

Waste Assimilative Capacities of the National Capital Region (NCR) of Delhi

Several indicators developed in this study can be applied to assess the assimilative capacities of air, water, acoustic, land

and biological resources of the entire region as well as NCR cities, especially Delhi, using the data generated through a joint collaborative study on Carrying Capacity Based Development Planning for the NCR

Supportive Carrying Capacities of NCR Cities

Several indicator measures of carrying capacities of various supportive resources have been applied across several cities of the NCR. Such comparative analysis is helpful towards objective assessment of growth or development potentials of urban centres across a region in order to develop strategies for future urbanisation based on carrying capacities of urban environmental resources. Besides Delhi, several Class I cities (1991) within Delhi Metropolitan Area (DMA) and among the "priority towns" outside DMA identified as future growth centres by the Regional Plan-2001 of the National Capital Region Planning Board (NCRPB) have used for this application

Obviously all the assessment indicators developed in the study could not be used and only those for which information for most of the cities are readily available have been selected. Further, data gaps exist even across the selected indicators. Nevertheless, the NCR case study in illustrative of the use of both assimilative and supportive carrying capacity measures is urban and regional planning. The conclusions from the relative carrying capacity assessment of the urban areas have been summarised under Box Item 1 which may be helpful in developing scenarios for urban development across NCR.

FUTURE URBAN DEVELOPMENT SCENARIO FOR NCR

POLICIES AND OBJECTIVES

The analysis of relative carrying capacities and demographic and economic growth indicators for Delhi and other major urban centres (Class I cities) of NCR leads us to critical policy implications in respect of the future spatial distribution of urban population, economic activities, environmental infrastructure and investment across the NCR.

- In case decentralisation and equitable distribution of population and industrial activities across the region's major growth centres are envisaged in future (as recommended in the Regional Plan 2001) large scale investments in the development of urban environmental infrastructure may be necessary over a wide spatial area, especially the so-called "priority" cities.
- Economic imperatives and available infrastructure base may dictate a faster growth in and around Delhi, across the DMA cities rather than "priority" cities, at least in the short or middle run future
- In view of the relatively low carrying capacities as well as economic development across many outlying cities, a phased development policy may be followed, whereby economic resources may be generated capitalising on the relatively developed infrastructure, land resources and industrial programmes of cities close to

Box Item 1: Relative Carrying Capacities of Delhi vis-a-vis other Major Cities of NCR.

A critical regional planning issue that may emerge from the comparative analysis of NCR cities is that the so-called "priority" cities that have been assigned population in excess of their projected populations in the Regional Plan-2001 tend to have less carrying capacities in respect of most of the supportive resources than Delhi and the DMA cities.

- The land-man ratios of Delhi and the DMA cities of NOIDA, Faridabad and Gurgaon and Sonapat are more than most outlying cities and NCT Delhi has a larger amount of potential urbanisable land than the tahsils of most other cities. The DMA cities and Sonapat together have much larger population holding capacity (in terms of Density Norm) than the outlying cities. Alwar, with its large amount of "rocky" and "waste" lands in the tahsil is however an exception among the priority cities.
- Delhi ranks sixth among the cities in terms of housing index and is superior to most cities also in terms of quality of housing that is, proportion of "pucca" houses as well as extent of slums. The outlying cities of Bulandshahr, Hapur and Meerut tend to have a far worse housing situation than Delhi and DMA cities.
- The DMA cities and especially NOIDA have clearly better water supply infrastructure than the priority cities both in terms of area and population coverage and in terms of levels of supply. The utilizable ground water supply is however much better in the U.P. sub-region (viz. Meerut and Bulandshahr tahsils/blocks) than Haryana and Rajasthan sub-region. NCT Delhi's groundwater supply is more than most other cities although salinity condition prevails. However, the Yamuna River stretches along Delhi and DMA tends to be a hot spot in terms of pollution load.
- The DMA cities of NOIDA and Ghaziabad appear to have much better sanitation than the priority cities of Hapur, Bulandshahr and Panipat and Alwar.
- Delhi and the DMA cities of Ghaziabad and Gurgaon have considerably less supply-demand gap in power than Meerut, Panipat, Sonapat and Hapur.
- Delhi is the hub of the regional transportation network in the region and is much better linked in terms of regional bus service than other cities. The internal road length density is also far superior. The DMA cities in general and Ghaziabad in particular has greater regional road linkages than the outlying cities. Alwar tends to have the worst regional accessibility. Although Bulandshahr and Hapur have high densities of internal road network, the actual volume capacities of road networks of these old cities are likely to be very low owing to their narrow roads, organic pattern and poor geometry.

In terms of economic base, the sub-regional level data on per capita industrial value added and estimated employment are not very useful in comparing cities, particularly because of the large rural population base across sub regions, especially Rajasthan. District level information on numbers of large, medium and small-scale units and citywise total investments in the unorganised sector provide surrogate indicators of the existing industrial economy of the cities. The DMA cities of Gurgaon, Faridabad, Ghaziabad and NOIDA have better economic base as well as future industrialization programme (especially Gurgaon and NOIDA) than priority towns.

- The Assimilative Capacity Studies indicates that air pollution stress, in terms of emission and estimated ground level concentration, Delhi is a "hotspot". The stress is generally higher across DMA towns than the priority towns. Higher industrial activities as well as vehicular volumes across the DMA are obvious reasons for the higher stress.

Although this case study of relative carrying capacity of urban environments has not been comprehensive on account of non-availability of information on various carrying capacity indicators, it nevertheless is able to raise policy implications in future spatial distribution of population, activities, resource and investments. The two critical implications might be:

- * In case decentralisation and equitable distribution of population and industrial activities across the regionals major growth centres are envisaged in future (as in the case of the Regional Plan-2001) large-scale investments on development of urban environmental infrastructure may be necessary over a wide spatial area especially the outlying "priority" cities.
- * Economic imperatives as well as infrastructure base may dictate faster growth in and around Delhi, that is, across the DMA cities than the "priority" cities at least in the immediate future.

Delhi in the short and middle run future. This may be utilised for more intensive investments on infrastructure and industrial development across the outlying cities later to fulfill the long term objective of equitable distribution of quality of life and goods and services across the region.

Several policy objectives may be derived from the assimilative and supportive capacities of the region and parts thereof:

- Demand and supply managements are imperative in respect of the critical resources of the region, specially water. While Delhi and Rajasthan Sub-region and

Alwar area require immediate urban water resource management plans, demand management may be emphasized especially in Delhi.

- Delhi and the DMA area may be considered as "Hotspots" in term of air assimilative capacities. While industrial pollution control is imperative across DMA cities of Ghaziabad, Faridabad and NOIDA, Delhi requires effective transportation management towards environmental control
- Different political and economic opportunities given in terms of initiatives, policies and programmes of urban industrial developments of different states should be optimally utilised in the immediate and middle run future for the allocation of population and activities across the region. Especially, the governmental policy initiatives towards industrial development in NOIDA and Gurgaon and should be exploited to the fullest extent.
- Institutional capacity building is imperative in the supply and demand management of urban environmental infrastructure, especially with regard to municipal financial strengthening. While more information base is required in respect of capacities of local bodies, urban local financial resource strengthening appears to be a critical issue especially for the UP sub-region

Urban Population Distribution and Growth Strategies

- If the present growth trend of Delhi is continued, its urban population will be over 25 million by 2021 A.D. Even if 50 percent of NCT Delhi's agricultural land is urbanised, the gross urban density may rise to 280 ppa. At the same time, the class I DMA and outlying cities will be able to accommodate their own growth (considering current growth trend) in 2021 only at an average gross density of 160 ppha which is the average density of Asian cities.
- In light of the above growth trends and the relative carrying capacities of various urban centres several alternative scenarios should be considered:
 - A. Urban-industrial infrastructure development across medium (viz Class II) as well as small towns
 - B. Development of Counter Magnets outside the NCR
 - C. Densification and physical expansion of selected major cities (Class I).
- Densification is a realistic short term alternative for several cities including Delhi which are have relatively low land-man ratios and high population holding capacities, at least to remove the density anomalies across cities of NCR. Densification efforts may be

vigorously pursued especially across Faridabad and NOIDA. In Ghaziabad, scope for densification may exist in the Shahibabad area; in Gurgaon, in the new HUDA lands; in Delhi, in the North-West, Trans Yamuna and South Delhi areas and in Meerut, in the peripheral new housing and industrial areas.

- Significant physical expansion of the urban limit may be proposed in the case of the large cities which are suffering from low land-man ratio and moderate to high growth rates and population densities wherever potential urbanisable lands are available in their immediate vicinities. Among the Class I cities, Hapur and Panipat are the two most appropriate cases where planned urban expansions may be followed in the short to middle run future. On the other hand, Meerut, NOIDA and Faridabad are cases where physical expansion should be discouraged since they have large population holding capacities within their urban limits.
- Information base on the carrying capacities of lower order centres, specifically the Class II and III towns of NCR need to be developed in order to assess the relative growth potentials of these centres. However on the basis of population, regional linkages and sub-regional data on land and economic resources, several priority centres of future growth may be identified; namely: Khurja, Sikandarabad, Gulacchi, Gurumukteswar, Muradnagar, Baghpat, Sardhana, Loni and Barout of the U.P. Sub-region; Samalkha, Gohana, Bahadurgarh, Jhajjar, Dharuhera and Sohana of the Haryana Sub-Region and Khairthal and even smaller centres like Bhiwadi, Tijara and Behror in Rajasthan
- Sub-centre Development. A limited number of Class I cities apparently have prospects for development as strong regional sub centres to counterbalance the growth of Delhi and DMA in the short and middle run future.
 - * Meerut should be encouraged to develop as a strong sub-centre on a priority basis capitalising on its regional linkage both within (especially Delhi, Ghaziabad, Hapur, Bulandshahr, etc.) and outside the NCR, existing base of small scale industries and trade and commerce and other supportive capacities, especially in term of land, housing and water resources. Furthermore, its relatively high air assimilative capacity may allow for expansion of manufacturing activities. Meerut's growth may reduce future out-migration from U.P. sub region to Delhi and DMA. However, Meerut's power supply situation requires immediate attention towards improvement. Meerut has an "additional population holding capacity" of approx 1.5 million in the short term future. Further population may be accommodated, primarily through densification of its urban

lands beyond the old city core as well as long term urban renewal of its old city core.

- * Alwar has a strong industrial base and the high air and noise assimilative capacities of this centre should be an impetus towards strengthening industrial activities. Furthermore, relatively high supportive capacities in terms of land, housing and internal road network render Alwar a favourable candidate for sub-centre development at least in the middle run future. By virtue of its geographical location, a strong sub centre at Alwar has potential to act as a countermagnet within the NCR. However, the most critical issue in respect of growth and capacity development of Alwar is further development of its highway and railway linkages, especially with Delhi, Gurgaon, Rewari and Rohtak. Although the additional population holding capacity of Alwar remains low in the immediate future (approx 0.5 million), with further industrialisation, expansion of its urban limit and augmentation of water resources, the city may accommodate a much higher population in the long term future.
- * Most other large outlying cities of NCR have much less economic and demographic growth prospects and relatively lower carrying capacities than the above two cases. In the long run, however, a balanced regional growth may be attempted through focussing investments in other outlying parts, specifically, the south west, west or north-western parts of the NCR.

Bulandshahr-Khurja highway and railway corridor may have long term prospects for development as a sub-centre on the basis of its regional accessibility, high assimilative capacities and high to moderate water and energy resources. Furthermore, the economic growth prospects of Bulandshahr (especially in agro-based industries and agro-services) are moderately high. However, massive investments may be envisaged in development of urban land resources, housing, road network and other infrastructure in order to render Bulandshahr as a strong sub centre in the long term future. Large scale land acquisition for future urban expansion, with due regard to conservation of its agriculturally productive lands may be an immediate strategy towards this end.

Among the large outlying cities of Haryana sub-region, Rohtak and Panipat may be competing centres as future candidates for growth centre development. Rohtak, however, has a slight edge over the latter in term of carrying capacities, especially water resources, urban land resource, social amenities like educational institutions and urban utilities.

REGIONAL LANDUSE POLICIES

- Strategies towards agricultural land conservation vis-a-vis urban growth need to be worked out carefully,

especially for Delhi, Bulandshahr-Khurja, Hapur and Alwar.

- Captive forestry for forest based industries should be encouraged in Bulandshahr-Khurja, Gurgaon, South Delhi and Faridabad areas.
- Natural resource based recreation development should be encouraged along ridge area of Rajasthan sub-region and Gurgaon and South Delhi areas, riparian land of Yamuna and natural lakes of Rajasthan and Haryana sub-regions.
- Green belts, social forestry and public outdoor spaces should characterise recharge zones, natural drainage areas, steep slopes and water bodies. In Delhi, especially, this refers to the Yamuna River banks, lands along major drains and the ridge areas. Furthermore, all national highways as well as important state highway links, such as SH-27, SH-45, SH-10, SH-13, SH-28, etc. should have as much as possible green belt planting.

REGIONAL TRANSPORTATION

- Orbital highway linkage development to reduce future nodality of Delhi and increase inter-dependencies among large outlying growth centres, especially Meerut, Hapur, Bulandshahr, Khurja, Rewari, Rohtak and Sonipat. Specifically, the following linkages should be developed on priority basis:
 - * Widening of SH-10 and G.T. Road augmenting Meerut-Hapur-Bulandshahr-Khurja access.
 - * Widening of SH-15 between Rohtak-Rewari
 - * Widening of SH-13 between Gurgaon-Sohna-Alwar
 - * Development of State highway between Meerut-Baghpat-Sonipat
- Highway accessibility among several DMA cities may be taken up in the immediate future; specifically:
 - * Ghaziabad-NOIDA-Faridabad Expressway
 - * Flyover NH-2 near Baderpur crossing to augment NOIDA-Faridabad-Gurgaon access
 - * Development of old Mehrauli Road to augment Faridabad-Gurgaon Access.
- Bypasses on NH2 near Ghaziabad and SH 45 near Modinagar will improve accessibility of Meerut with respect to Delhi and Ghaziabad.
- In the long run, strong highway and railway links should be developed between Faridabad and Bulandshahr with bridges over Yamuna.
- Capacity development of the following railway links on priority base:

- * Development of State highway between Meerut-Baghpat-Sonapat
- * Link between Gurgaon and the Delhi-Avoiding-Line Loop (D.A.L.) to augment railway access among DMA cities of Gurgaon, Faridabad and Ghaziabad.
- * Meerut-Hapur link
- * Hapur-Bulandshahr-Khurja link.
- Augmentation of municipal solid waste collection system, especially for Meerut, Gurgaon, Delhi and Faridabad.
- Augmentation of sewerage and sewage treatment, especially in Meerut and Gurgaon
- Augmentation of power supply especially in Faridabad, Ghaziabad, NOIDA and Meerut

WATER RESOURCE MANAGEMENT

- There should be proper harvesting of monsoon discharge in the Yamuna R. as well as harvesting of rain water, especially in Delhi, Faridabad-Gurgaon and Alwar through development of reservoir sites, tanks, small lakes and roof top harvesting.
- Old stream like Barapula and the Ridge-Stream should be revived
- Afforestation across the Ridge and along Yamuna and Sahini Rivers and nullahs and lakes. Ground water recharge potential of Alwar Tahsil and district should be augmented through afforestation.
- Early implementation of the schemes on tubewells, pumping, water treatment plants and other water management projects in the various major cities, viz NOIDA, Ghaziabad, Meerut, Faridabad, Gurgaon and Alwar.
- Maintenance of municipal water pipes and mains may lead to conservation of municipal water supply to the tune of 30%.
- Demand management through rationalisation of water rates, prohibition of extensive private gardening practices, mandatory water recycling in large commercial and industrial enterprises and accounting for private bore wells, especially in Delhi and cities of Rajasthan and Haryana sub-regions.
- Development of ECO-Parks for modified wetland method of municipal sewage treatment and recycling of water for irrigation, especially near around Delhi and large cities of U P. and Haryana Sub-Regions, viz, Bulandshahr, Khurja, Meerut and Rohtak.
- Construction and expansion of dams in the Tehri Garhwal region for water supply to NCR should not be implemented until schemes are developed for conservation of the ecological system in the region, rehabilitation of people who may be uprooted and management of waste water resulting from increased irrigation

OTHER URBAN UTILITIES AND SERVICES

- Augmentation of social amenities in all DMA cities on priority basis.

URBAN FORM

- Urban sprawl is to be restrained in all large cities (half-a-million and above) with compact residential development and high net densities.
- Vigorous housing and land supply policy is necessary, especially for Delhi and the deficient cities such as Hapur and Bulandshahr. Strategies for private and cooperative sector investment in housing including slum improvement and L.I.G. and EWS housing is essential in light of inadequate housing supply through the public sector. Slum rehabilitation to release the supply of prime lands for various urban uses should be taken up on a priority basis. Effective rent control, urban land ceiling and land acquisition regulations should augment land and housing supply and discourage vacancy rate in housing.
- Urban renewal may be necessary across several large, old cities viz Bulandshahr, Hapur, Meerut and Panipat to improve internal road network and augment infrastructure and density development.
- Early implementation of Mass Rapid Transit System in Delhi is necessary. Intra-city bus system should be developed in all major cities, especially, Faridabad, Gurgaon, Noida and Meerut on a priority basis and should be a regular feature for all cities with future population of 10 lakhs and above.
- Water sensitive urban design process should be encouraged in Delhi and major cities of Rajasthan and Haryana sub-region, especially Alwar and Panipat. This should include waste water treatment and recycling of domestic water for agriculture and urban horticulture, conservation of surface water bodies and use of catchments of rainwater in tanks, ponds, depressions and even rooftops in dwelling units
- Energy conserving urban forms should be encouraged through effective building layouts and orientation, compact forms, restricted vehicular access and extensive pedestrian paths and bikeways, use of proper building material and development of community based solid waste recycling, bio-gas and solar and wind energy development.

TABLE 2.1
INDICATORS AND ESTIMATIONS OF URBAN ENVIRONMENTAL CARRYING CAPACITIES
Module A: Waste Assimilative Capacities of Urban Environment

CARRYING CAPACITY INDICATORS FOR ENVIRONMENTAL COMPONENTS/RESOURCES

AIR ENVIRONMENT

INDICATOR 1

Natural assimilation:

Ventilation of pollutants in m^2/S in the local air shed during lowest windflow seasons and times of the day.

INDICATOR 2

Emission control Air pollutant emissions in kg/hr from point, line and area sources in the urban area.

INDICATOR 3

Cross media transfer from air to land/water, especially of dust particles and acid rain.

(Monthly rainfall in mm)

WATER ENVIRONMENT

INDICATOR 4

Natural assimilation :

Maximum pollutant load of the critical water quality parameters (viz. BOD, DO, TOXIC chemicals, etc.) that can be discharged into the local water shed without impairing water quality for designated urban uses

INDICATOR 5

Emission control:

Installed capacities in MLD of waste water treatment facilities as proportion of waste water generation in the urban area in term of

- (a) Municipal sewage treatment plants
- (b) Industrial waste water treatment/ recycling plants.

LAND/SOIL ENVIRONMENT

INDICATOR 6

Natural assimilation

Bio-degradation rate of solid wastes in local soil

CARRYING CAPACITY ESTIMATION PARAMETERS

● Assimilation potential of air shed is estimated as the ventilation coefficient (VC) for the area which indicates both horizontal and vertical mixing. VC is estimated from meteorological data on Mixing Height and Mean Wind Speed for different seasons and hours. Ground level concentrations (GLC) of pollutants across an urban region may be predicted on the basis of VC, wind directions and actual emissions from different sources.

● Emissions from: Point sources will depend on the numbers, types, production capacities, raw materials and process and stack emission control of air polluting industries; Line sources will depend on the number and composition of motor vehicles and their fuel use/combustion process and emission control and Area sources will depend on the population size, household, and domestic combustion across the urban area.

● Air to land/water transfer will depend on local precipitation level and its seasonal variation in relation to air pollution load in the local air shed. Rainfall may be a surrogate indicator generally across Indian urban areas which will indicate air to land/water transfer capacity.

● Dilution of critical air quality parameters at the most polluted stretches of important waterways in the urban region during lowest flow period may be predicted/simulated on the basis of their hydrological conditions.

● Waste water discharge across the urban area and its impact on the water quality of critical stretches of urban waterways will determine the most critical stretches of urban waterways.

● Hydro-geomorphological condition of the urban region in terms of delineation of watershed, drainage channels, ground water aquifer and soil drainage regime will determine the surface and ground water qualities in relation to waste water discharge.

● Waste water discharge in waterbodies from area sources will depend on population size, households and sewerage system and point sources will depend on number, production capacities, raw materials and process and effluent control of industrial units.

Degradation in soil depends on their bio-chemical and physical properties, especially the presence of micro-organisms as well as the class of solid wastes, i.e., biodegradable/non biodegradable and movable/immovable wastes.

● Solid waste generation from area sources depends on population size and expenditure pattern; point sources depend on number, production capacities, raw materials and process and solid waste management of industrial/commercial establishments generating solid wastes.

INDICATOR 7

Solid Waste Management:

Installed capacities of

- 7.1 Municipal solid waste collection in gms per unit population
- 7.2 Municipal solid waste collection as a percentage of generation in MTD
- 7.3 Garbage disposal site in Ha/10000 persons
- 7.4 Municipal/industrial solid waste treatment/recycling plant in MTD per 10,000 population

BIOLOGICAL ENVIRONMENT**INDICATOR 8**

Diversity and stability of the ecosystem in the urban region

(Types and densities of flora and fauna)

INDICATOR 9

Air pollution sink potential of land vegetation in the urban region

(Types and densities of vegetation)

INDICATOR 10

Bio-degradation and nutrient uptake rates in the aquatic ecosystem in the urban region (marshlands, lakes, ponds, rivers and marine ecosystems)

ACOUSTIC ENVIRONMENT**INDICATOR 11**

Sound attenuation in DBA through open air media across the urban area

(% Open space and vegetation density)

INDICATOR 12

Sound attenuation in DBA at critical point and line sources of noise across the urban area

(Presence/absence of control installation and legislations)

- Municipal solid waste collection will depend on manpower, transport facilities and the size, frequency and location of waste collector bins across the urban area
- The location of the garbage disposal site in relation to inhabited areas of the city will determine the qualitative dimension of its carrying capacity
- Recycling may augment capacity in respect of energy and socio-economic (employment, income, etc.) resources.

- A relatively mature, diverse and stable ecosystem will withstand better environmental impacts than a fragile system. Ecological parameters, especially available biomass, productivity, energy flow and food-web relationship and state of ecological succession in the region will indicate the relative stability of the ecosystem. In turn these will depend on the species diversity of flora, fauna, micro-organisms, etc.

- Sink potential index of individual plant species will depend on the size and frequency of stomata which vary with species density of vegetation and species types in the region will determine the overall assimilative capacity of the land vegetation.

- Natural waste water recycling in water through bio-degradation and nutrient uptake depends on micro-organism, aquatic vegetation, fishes, etc. Waste water load will affect water quality especially DO level which in turn will affect water ecosystem. Physical conditions, i.e., hydrological conditions, temperature and sunlight will influence water quality as well as bio-degradation process

- The % noise saturation index of towns in leq used by NEERI (1994) only shows existing status in terms of proportion of ambient noise standards (CBCB) in the observed Ldn in DBA and not assimilative capacities of alternators.

- Parameters affecting open air distances between noisy and silent zones, viz density, landuse zoning, building setbacks, etc. as well as sound buffers in open space, especially density and type of vegetation and other landscape buffers, viz. berms, walls, screens, etc., at critical noise sources, viz. roads, and highways, factory sites, etc. will determine the media absorption.

- Noise levels from line sources will depend on the volume and composition of traffic along major roads and point sources on location and types of industrial establishments and community noise sources, viz. loud speaker. Noise control at source will depend on (a) legislation viz. silence and noise zoning, road speed limits, time zoning of industrial operations, etc. and (b) control installation viz. enclosures, mufflers, screens, etc.

MODULE B : SUPPORTIVE CAPACITIES OF URBAN LAND AND SHELTER RESOURCES

CARRYING CAPACITY INDICATORS

URBAN LAND RESOURCES

INDICATOR 13

Population holding capacity of developed land within urban area in terms of acceptable gross density/land-man ratio. (Land-man ratio/gross density)

INDICATOR 14

Suitable land for physical expansion of the urban area in hectares/sq.kms (Vacant land, "waste land", etc. in the block/tehsil of the urban area)

HOUSING

INDICATOR 15

Census housing index:
Ratio of existing housing stock per thousand households

INDICATOR 16

Rate of housing supply No. of housing units constructed and transferred to users per year

INDICATOR 17

Occupancy rate Average floor area per person (or person per room) in housing units.

INDICATOR 18

Permanent structures: Percentage of housing units with Structural stability of 20 years under normal maintenance (% Census "pucca" houses)

INDICATOR 19

Household amenities. Percentage of housing units with

- 19.1 Municipal water supply
- 19.2 Electricity and
- 19.3 Sanitary latrine having municipal

CARRYING CAPACITY ESTIMATION PARAMETERS

- Developed urban land commonly refers to the urban statutory limit including municipal limits and other notified areas connected with offsite networks of utilities and services, but should exclude prime agricultural and rural lands and natural lands that need to be conserved and/or used for special purposes, viz. forests, marshlands, hills, rivers and lakes, etc.

- For gross densities or land-man ratio there are no absolute norms; but planning norms should be developed based on local consideration as well as comparison with other cities Opportunities for capacity augmentation through densification/infilling will depend on landuses, vacant land availability, land development costs and regulations specifically, sub-division, F.A.R. and building regulations as well as urban renewal.

- Land suitability for urban expansion need to take into account:

- * Physical constraints and natural barriers, viz. topography, soil, natural drain water bodies
- * Growth trend and desirable directions of growth of the urban area.
- * Conservation of surrounding productive lands, viz., good agricultural soil, aquifer recharge zones, etc.

- Land classification data may be available at the level of tehsil and district where the urban area is located. When detailed information on land types in the immediate surroundings are unavailable classified data at tehsil level developed through satellite imageries and/or land records may indicate the types and amounts of land potentially available for future urban expansions.

- Housing index measures deficiencies/surplus in the existing housing stock Comparison with other urban areas and the national average Index (eg. 980 in Census of India, 1991) will indicate the relative carrying capacity of the urban area

- The rate may be measured through annual records of public agencies, co-operative societies, company housing records, municipal housing plan section and mutation records, Registrar's deed records, etc. Capacity will be determined by the rate of housing supply in excess of household growth rate.

- Measured by: Covered Area in Housing Stock

(No. of Households-Houseless Households) x AV.H/Hold-size.

Capacity is determined by occupancy rate in excess of acceptable norm.

- Census data on frequency distributions of "pucca", "kutcha" and "semi-pucca" units and wall and roof Materials will provide surrogate measures of structural stability "pucca" may be considered as permanent structure.

- No. of Census households with water tap/electricity/toilet

- No. of domestic customerd (Metres) of electricity boards/corporations and Metered Water tax payers are alternative data source

Sewerage/community septic tank connections

INDICATOR 20

Outdoor living space · Percentage of households in residential areas of having net densities less than acceptable maximum standard.

(Av Net residential density in the urban area)

- Net densities may be computed at housing cluster or neighbourhood level including areas under local access roads, paths, children's park and common utility areas, but excluding collector and arterial roads and higher order community facility areas. Difference between existing and acceptable net density will indicate surplus/deficiency in capacity. In the absence of detailed information, average residential net density of urban area may be a surrogate measure.

INDICATOR 21

(Stress Indicator)

Extent of slums. Percentage of urban population living in recognized slums

- Local authorities make official declaration of slum areas from time to time, but agency differences may exist in slum definition and data on slum units. Census notified slums may be one measure.

SOCIAL AMENITIES

INDICATOR 22

No. of medical beds per 1000 persons (in hospitals, clinics, dispensaries, etc.)

- District census publishes information on health, educational and recreational/cultural facilities for individual urban areas which may be supplemented by departmental records, municipal statistics and other sources. Census information is available on numbers of social facilities of different types which may be used as surrogate for room or space capacities.

INDICATOR 23

No. of doctors per 1000 persons

- Levels of educational, health and recreational facilities vary with city size. Indicators of higher order facilities, such as, colleges and technical institutions should be considered for large urban areas.

INDICATOR 24

School capacity: class room capacity (in no. of students) per 1000 persons in

24.1 Primary schools

24.2 Secondary schools

24.3 High schools

(No. of schools per 1000 or lakh population)

- Public outdoor recreational space complements private outdoor space and open spaces within housing areas. Municipal records of areas of parks and gardens is one source.

- Although there is no universal space standard for most of these facilities, locally acceptable norms and comparative analysis may be applied to determine relative carrying capacities of urban areas.

INDICATOR 25

Outdoor recreational space: area under parks and playgrounds (in M² or hectare) per 1000 persons

- Various norms and standards for educational and health amenities have been developed by Indian agencies which may be used to assess surplus/deficient capacities of urban area.

INDICATOR 26

Indoor recreational space: No. of seats memberships in cinema/theater/auditorium/clubs per 1000 persons

INDICATOR 27

Public security: Size of police force per 10,000 persons

(No. of recorded thefts/robbery and other crimes per 10,000 persons)

- Crime rate may vary with city size, economic activities and population characteristics. Existing crime rate may be a surrogate indicator of capacity of security services.

MODULE C: SUPPORTIVE CAPACITIES OF URBAN TRANSPORTATION AND COMMUNICATION INFRASTRUCTURE

CARRYING CAPACITY INDICATORS

REGIONAL ACCESSIBILITY

INDICATOR 28

No. of highways and railway lines linking the urban area

INDICATOR 29

Highway link capacity: cumulative right of ways (R.O.Ws) or No. of lanes of all highway links to the urban area.
(Peak hour traffic volumes)

INDICATOR 30

Railway line capacity No. of chartered Up and Down trains in the railway sections linking the urban area

INDICATOR 31

Regional bus service.

- 31.1 Daily regional bus trips to and from the urban area.
- 31.2 No. of major urban centres as destination points of bus service from the urban area.

INTRA-URBAN ACCESSIBILITY

INDICATOR 32

Extent of road network: Total road area as percentage of total land area of urban area in sqkms/Ha

INDICATOR 33

Surfaced road length in km in the urban area

- 33.1 Per sqkms/ha of urban land area
- 33.2 Per 1000 urban population

INDICATOR 34

Planned road capacity in terms of cumulative R.O.W in meters/No. of lanes in urban roads of different hierarchies, viz.

- 34.1 Arterial roads
 - 34.2 Sub-arterial roads
 - 34.3 Collector roads
 - 34.4 Local access roads
- (Peak hour traffic volumes)

INDICATOR 35

Public bus service capacity: Total no. of bus routes x frequencies of service

INDICATOR 36

MRTS capacity No. of seats/passenger

CARRYING CAPACITY ESTIMATION PARAMETERS

- Highway and railway links will indicate the relative nodality and accessibility of the urban area with respect to other centres or any given region.

- Designated highway capacities are often reduced through encroachments upon ROWs near or inside urban areas.

- Peak hour traffic counts in passenger car units (PCUs) on highways at cordon points along peripheries of the city and the city centre may surrogate actual capacities in term of traffic flow and also indicate difference with designed capacity. Traffic volume capacities can be measured against standard ROWs of different road classes and normal speed limits.

- No. of trains actually operating will indicate surplus/deficiency in chartered capacity.

- No. of destination points (major urban areas) will indicate the regional nodality of the urban area.

- Total road surface in relation to the city size is a general indicator of its capacity to support movement. Although there is no universal standard, comparison with other cities will indicate relative carrying capacity.

- Published information on road lengths may be useful surrogate indicator of capacity when information on road widths or area are not available

- Traffic flow capacity of the urban area and connectivity among its different parts depend on the extent of road network, their levels of hierarchy and R.O.W. or lane capacities. Peak hour traffic count surrogates actual capacity and indicates difference with designed capacity.

- Public Works Departments and Local/Municipal bodies on information sources

- Difference between operating and designed frequencies and total and operating bus fleets will indicate idle capacity of bus and MRTS.

- Only very large Indian cities have local bus services, but regional buses also serve local bus passenger movements. Information sources are the public and private bus companies.

capacity x frequency of service

INDICATOR 37 (Stress Indicator)

Average peak hour journey speed 11 Km/h between city centre and periphery along different directions

37.1 By car

37.2 By bus

(Peak hour traffic volumes along major arterials)

INDICATOR 38 (Stress Indicator)

No. of traffic accidents per year

38.1 Per 1000 vehicles

38.2 Per unit road length

INDICATOR 39 (Stress Indicator)

Vehicle density. No. of registered vehicles per unit of road area (sq. kms)/road lengths (kms)

● The indicator is applicable in special cases of large cities when the facility exists

● Journey speed will indicate relative congestion and stress on road capacity. Average journey speed may be measured through sample survey of vehicles and total time and route followed for different major routes/directions.

● Traffic accident counts indicate effects on capacities of road congestion, design of road system (conflicts, road engineering and geometry) and traffic control service.

● Vehicle density will surrogate planned volume capacity of roads in PCU under normal speed limits based on road widths or No. of lanes. However, existing registered vehicle data are generally aggregated at district/sub district rather than urban area level. Further, urban roads carry vehicles registered in other locations/districts.

COMMUNICATION FACILITY

INDICATOR 40

Density of communication services. No. of urban population served per unit of

40.1 Post and telegraph office

40.2 Telephone line

Source: Post and Telegraph Department at City/district headquarters.

MODULE D : SUPPORTIVE CAPACITIES OF URBAN UTILITIES

CARRYING CAPACITY INDICATORS

WATER SUPPLY

INDICATOR 41

Distance in kms of urban area from water source: main water line length from city centre to main pumping station/water works.

INDICATOR 42

Utilizable water in MCM/Y for the urban area in

42.1 Rivers/lakes/reservoirs

42.2 Ground water aquifers

INDICATOR 43

Water quality parameters in relation to prescribed norms for designated water use for the urban area in

43.1 Rivers/lakes/reservoirs

43.2 Ground water aquifers

INDICATOR 44

Installed capacity of public water works, including treatment plant capacity (if any),

CARRYING CAPACITY ESTIMATION PARAMETERS

● Capacity will reduce with distance owing to pipeline and pumping costs for transporting water

● Quantity and quality of ground and surface water available for the urban area will depend on various hydro-geomorphological characteristics of the watershed where the ground and surface water bodies are located, specifically, precipitation rate, topography and natural drainage, soil and rate of recharge of ground water, distribution and depth of ground water aquifers, hydrology and flow in rivers, streams, etc., discharge from dams/reservoirs or waterworks into rivers, streams, lakes and wastewater discharge across the watershed

● Tehsil/Block level data on groundwater are usually available which may be used for the urban area.

● CPCB prescribes norms/standards for different water quality parameters, i.e., DO, BOD, coliforms, dissolved solids, etc., for different classes of water use. Existing water quality of surface and ground water sources for the urban area can be measured against these standards.

● Difference between installed plant capacity and actual supply in LPCD will indicate capacity utilization and maintenance problems, viz leakage. Actual supply

in LPCD

INDICATOR 45

Coverage of public water supply network as percentage of :

- 45.1 Urban population
- 45.2 Urban land area

SANITATION

INDICATOR 46

Percentage of urban population served by sanitary latrines connected to :

- 46.1 Municipal sewerage system
- 46.2 Public septic tanks
- 46.3 Private septic tank

(See also INDICATOR 19)

SEE INDICATOR 5

(Sewage/waste water treatment plant capacity)

SEE INDICATOR 7

(Solid waste management capacity)

ENERGY

INDICATOR 47

Installed capacities of power plants in KWH per 1000 urban population supplying electricity to the urban area.

INDICATOR 48

Power supply as percentage of peak hour power requirement or demand in MU.

SEE ALSO INDICATOR 19

(Percentage housing units/population with electricity)

NON-CONVENTIONAL ENERGY DEVELOPMENT

INDICATOR 49

Installed capacity of non-conventional energy

sources in urban area in

- 49.1 Bio-gas plants in BTU/KWH per 10,000 persons.
- 49.2 Solar panels in M² Per 10,000 persons

to households and local public water taps will depend on capacities of local water reservoirs, pumping rate and water pressure in the mains. Difference between actual supply in LPCD and prescribed norms will indicate surplus/deficient capacity of public water supply.

- Coverage of public supply network may be estimated on the basis of no. of water connections to lots/housing units (see INDICATOR 19) and no. of public taps/tubewells per unit population according to acceptable norms/standard. No. of water meters will be applicable where the system exists. Distribution layout of installed water mains and branches and local reservoirs and pumping stations across the city will provide the land coverage of public water supply.

- No. of sewerage system connections will indicate higher sewage disposal capacity than other systems in term of technology.

- Capacity will depend on generation in local plants of urban electricity supply corporation and /or state electricity boards as well as their power purchase from outside grids for supply to the urban area. Difference between installed capacities and plant generator will indicate idle capacities of plants.

- Power requirement should be based on acceptable consumption norm per capita. Actual consumption may not indicate requirement in case of power failure. Actual Supply level at different location of urban power grid may indicate distribution system capacity discounting loss, leakage, pilferage, etc

- These energy sources have little application to date in Indian cities and therefore the indicator may have limited application at present, but future situation may change.

- Bio-gas plants or energy generation from domestic wastes, hospital wastes may be installed at community level within residential neighborhoods and at special waste generation sites, viz. hospitals, hostels, hotels, etc. Capacity may be measured in term of MT of wastes handled, cubic meter of gas generation or BTU/KWH of heat/electricity supply.

- Solar panels may be installed at building roof tops for water/space heating and electricity generation using photo-voltaic cells. Depending upon location and climate of the urban area, capacity estimate may be made on the basis of sq.metre of solar panel installed.

MODULE E: SUPPORTIVE CAPACITIES OF SOCIO - ECONOMIC RESOURCES

CARRYING CAPACITY INDICATORS

MANPOWER RESOURCE

INDICATOR 50

Labour force Total and as percentage of urban population for

- 50.1 Male
- 50.2 Female

INDICATOR 51

Participation rate Workers population ratio (%)

- 51.1 Main workers
- 51.2 Marginal workers

INDICATOR 52

Adult literacy rate adult literates as percentage of population for

- 52.1 Male
- 52.2 Female

ECONOMIC BASE

INDICATOR 53

Annual value added per capita urban population in industrial economy for

- 53.1 Large and medium sector units
- 53.2 Small scale industries units
- 53.3 Unorganised sector units
- 53.4 Commercial establishments

INDICATOR 54

Ratio of Employed (in Different Urban Sectors) and Total Urban Population

LOCAL INSTITUTIONAL RESOURCE

INDICATOR 55

Annual revenue income of local bodies per capita urban population

INDICATOR 56

Annual expenditure, excluding debt service and Salary expenditure of local bodies per capita urban population

INDICATOR 57

No of employee in local bodies per 1000 urban population

INDICATOR 58

Political and legal autonomy of urban local bodies under state legislation for

- 1 Setting revenue rates
- 2 Development control

CARRYING CAPACITY ESTIMATION PARAMETERS

- Existing and potential future labour force will be constituted by the legal working age group population which may be estimated from the frequency distribution and natural growth and migration trends of population by age-sex groups. Difference between labour force and employment generation in the urban economy will indicate surplus/deficient capacity of urban man power vis-a-vis economic base

- Published data on participation rate indicates the trend in labour force utilization

- Literacy rate indicates availability of skilled vis-a-vis unskilled manpower.

- Classification of establishments should be made on the basis of NIC or similar national classification system.

- Location/region specific input-output analysis may be necessary estimate location and sector specific outputs, value added, employment, etc.

- Published census data on urban workers in different sector should be complemented with information from other secondary sources. Estimation of employment generation is required through studies as different urban economic sectors.

- Income from taxes, fees, octroi, lease, rent and sale and interests should indicate the financial capacity of the municipality. Income from grants and loans are not true indicators of capacity.

- Expenditure on capital heads and costs of urban services, viz water supply, road maintenance, garbage disposal, street lighting, operation of educational and health services, etc. will indicate the spending capacity of local bodies.

- Municipal yearbooks and statistical often provide sources of information on municipal income, expenditure, employment, etc.

- Urban municipalities are governed by state municipal acts which vary from state to state. The relative flexibility under state acts in respect of municipal authorities, power to set revenue rates and for development control functions will provide the relative legal and fiscal autonomy of local bodies. For instance, the range between maximum and minimum municipal tax limits vary across states, large cities/metropolises (like Bombay or Calcutta) may be governed under separate acts etc.

METHODOLOGY AND TOOLS FOR WIDER APPLICATION OF CARRYING BASED PLANNING

Urban Environmental Assessment

Very little information is readily available on environmental conditions, the interaction between urban development and ecosystems, or the managerial setting for responding to environmental problems. As a result, much of what has been done until now has not been very useful to those who are in a position to take action.

In order to provide information to urban managers, planners and others, rapid urban environmental assessment is necessary. A three step process has been developed (by Josef Leitmann) for this. a) completion of a data questionnaire on urban environmental indicators; b) preparation of an urban environmental profile, and c) discussion of the results through a series of consultations.

With the help of such environmental assessments, environmental management strategy and plan can be prepared.

Environmental Consultations

It is recognized that urban environments cannot be improved without constituencies that demand environmental quality and are willing to pay for it. This requires appropriate tools and instruments which could be used for communicating information on environmental status and problems to all stakeholders

in the city. The stakeholders with respect to urban environment will include environmental protection agencies, planning agencies, local government, politicians, sectoral agencies, NGOs, private and informal enterprises, concerned residents and community based organizations, and news media.

The effectiveness of environmental decision making requires sustained participation of all the stakeholders. This process of consultations can be organized collectively with the entire group as well as individually with different groups. To facilitate such consultations tools such as environmental maps can be used which will give a profile of environmental problems in a given area and will help in preparation of an action plan for the area.

Environmental Mapping

Knowledge is the first step towards action. Therefore, it is important to provide appropriate and adequate information to all concerned for timely action. However, information provided should be such that it is easily comprehensible and sufficiently detailed in order to make it useful. For instance, while aggregate data at the city level can indicate the status of urban environment, dis-aggregated data is required for a complete understanding of intra-city differences in environment. Mapping is a useful tool to indicate the environmental differences within cities. Local environmental planning is possible only with such dis-aggregate information base. Mapping clearly brings into focus not only the difference in environmental quality in different parts of the city but also makes city-wide environmental monitoring possible. Table 3 lists the environmental resources/ components, parameters for mapping and inferences for evolving local agenda.

TABLE 2.2

URBAN ENVIRONMENTAL MAPPING AND INFERENCES FOR LOCAL AGENDA

| Environmental resources/ Components | Parameters for mapping | Inferences for evolving local agenda |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Population | <ul style="list-style-type: none"> * Population density in different wards of the city * Population changes in different wards over past decades * Number of households and sex-ratio in each ward | Indicates areas requiring de-densification and densification. Highlights needs for improving/strengthening social infrastructure. |
| Housing | <ul style="list-style-type: none"> * Number of dwelling units in each ward * Dwelling conditions (kutch/pucca) - ward-wise * Number of persons per room - ward-wise * Location and number of slums * Level of services in slums (per capita availability) | Highlights availability of housing, (surface/ground), including community crowding and living conditions. Indicates slums requiring services or improvement in services |

| Environmental resources/ Components | Parameters for Mapping | Inferences for evolving local agenda |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Water Supply | <ul style="list-style-type: none"> * Average house rents and land prices in different areas/ wards of the city * Housing supply by government/ public/ private sector in the city * Sources of water supply based sources (hand pumps, wells) * Location and capacity of water treatment plants * Average per capita supply (at city level and in different wards) * Areas in the city facing acute shortage of water and with poor quality of drinking water * Total supply and consumption of water for different uses in all the zones/wards of the city * Water supply network showing trunk lines, distribution lines etc. * Zone-wise/ward-wise number of connections (for each type of use) | <p>Indicates spatial availability and quality of potable water in the city. Highlights areas having higher levels of water consumption and requiring conservation measures. This can give an indication of population that a city can support for sustainable development</p> |
| Sewerage and Drainage | <ul style="list-style-type: none"> * Location and capacity of sewage treatment plants * Zone-wise/ward-wise number of individual connections, number of public latrines in each slum/community group * Sewerage network in the city * Topographical map of the city depicting prominent water logged areas and all the open drains | <p>Suggests areas in the city requiring sanitation facilities like public latrines, septic tanks etc. and drainage facilities. Discharge of untreated sewage create unhygienic conditions affecting the health of urban citizens.</p> |
| Solid Waste | <ul style="list-style-type: none"> * Total and per capita generation and collection of solid waste - ward-wise/ zone-wise * Collection and disposal of hazardous industrial waste, hospital waste, abattoir waste etc. * Location of landfill sites - filled, existing and proposed * Areas not covered by the service | <p>Highlights areas with poor waste collection facilities. Indicates where hazardous industrial waste and hospital wastes are disposed and the measures that can be taken to deal with such wastes.</p> |
| Transport | <ul style="list-style-type: none"> * Peak hour traffic volume on major roads * Accidents on major roads * Accident prone areas and bottlenecks on different corridors * Routes of public transport | <p>Identifies roads requiring widening and/ or better traffic management and suggests the need for remedial measures in different parts of the city.</p> |
| Green Spaces | <ul style="list-style-type: none"> * Location and area of forests, public parks and other green spaces in the city * Temporal variations in the green cover of the city | <p>Indicates action required for saving trees and preserving open spaces in different areas of the city.</p> |
| Air Quality | <ul style="list-style-type: none"> * Ambient air quality in the city (at different monitoring stations) * Prevailing wind direction & areas affected by industrial air pollution. | <p>Delineation of areas exceeding 'prescribed' air quality standards. Measures to reduce air pollution menace on polluted corridors and use of appropriate technology to reduce industrial air pollution.</p> |

| Environmental resources/ Components | Parameters for Mapping | Inferences for evolving local agenda |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Acoustic Environment | <ul style="list-style-type: none"> * Ambient noise levels in commercial, industrial and residential areas and near hospitals * Peak hour noise levels at major road intersections | Helps to identify the causes of noise pollution in different areas and to evolve measures for reducing them. |
| Water Quality | <ul style="list-style-type: none"> * BOD and DO values for all drains, stream or river passing through the city * Quantity and quality of water discharged from industrial and commercial areas. | Indicates measures required to tackle water pollution. water pollution |

Note . The parameters mentioned here are indicative only. Depending on the type of city and its urban environmental problems, there may be a need to emphasize one or more parameters in detail or add new parameters.

Maps give the spatial distribution of infrastructure and services and indicate areas with urban environmental problems. These maps are accompanied by text which analyze the problems and also give additional data regarding the parameters indicated above

Use of Maps for Consultations

Urban environmental maps are useful for analyzing the problems of the city at the aggregate as well as dis-aggregate level. A few maps are appended here as examples. Agencies involved in dealing with city level problems can use the maps to understand the macro situation and devise strategies to deal with the problems. At the community level, residents can identify the major problems facing them and find ways to overcome them. They can be helped in this process by the NGOs

For instance, map 1.1 indicating the location of landfill sites in Delhi clearly shows that the existing sites are already filled or have very little life left. The future sites are all located to the south of the city and are very far from present dense habitation. This would mean that transportation of solid waste for final disposal in the future will be very costly. The city authorities must, therefore, consider all the options for dealing with city wastes at site or within the city itself. This would also involve seeking cooperation of the city residents.

Similarly, map 1.2 indicating ambient noise levels shows that even in residential areas the ambient noise levels are above the prescribed standards. The authorities as well as the public at large can come together to plan strategies to improve the situation.

With the help of urban environmental assessment reports and urban environmental maps it is possible to involve all stakeholders, in whatever capacity, to plan, prepare and implement action plans at the local level

Action at the City Level:

The average quality of life which a city offers, depends upon

the type of infrastructure that is being provided by the local/state governments, and the nature of the assimilative capacity a city has, to endure the population pressure. This "carrying capacity" of a city also depends upon the efficiency of the management institutions, including the use of effective technology to monitor development and maintenance. With intra-city variations in infrastructure, the carrying capacity or the quality of life also differs within a city.

Provision of urban environmental resources, whether natural or man-made, requires careful planning and administration. Very often difficulties arise when existing organisations create multiple jurisdictions which overlap each other, instead of integrating and coordinating their tasks. While such administrative duplications need corrections, there are often gaps in planning that needs to be bridged to bring in efficiency. Fragmented institutional arrangements often appear to be the root cause of ineffective application. However, considering the magnitude of the task, provision and management of urban environmental infrastructure is really a challenging task.

As cities grow, there is need to reinforce infrastructure with time. The built structure of a city is influenced by the physical, human and financial resources available; while the assimilative capacity is determined by the existing natural resources such as air, water, land, forests, etc. A symbiotic relationship exists among all these natural and man-made resources and the generation of employment, financial resources and economic development. A good assessment of the carrying capacity is the right mix of the assimilative and the supportive capacities, which put together gives a holistic picture of what is necessary for a city or a region. A plan for action at the city level has to be framed within the context of managing the environmental and economic consequences of development policies. Such a framework has to take cognizance of the existing institutional framework.

Apart from the regular legislative and institutional arrangements available in India at National, State and local level, many transitory or special purpose institutions have also been set up to cater to short term and/or special requirements, like

the Central Ganga Authority (1985), the National Waste Land Development Board (1985) and so on. Mention should be made here of the innumerable Non-Governmental Organisations (NGOs) that are coming up to fill in administrative/management gaps, and to act as pressure groups. In fact, the Ministry of Environment and Forest has already established a cell (1992) to help non-governmental agencies to implement at the grassroots level.

Even though many provision have been made to improve environment, proper co-ordination at the local level does not take place. Each agency caters only to its sectoral requirements. It does not knit into each other to take care of the overall development. As a result, management gaps have developed, with certain functional areas totally neglected. Also, most of the agencies have a dominating central sanction, so that local level problems are ignored. This institutional arrangement needs to be altered to introduce environment protection at the grassroots level.

The mandate of the Rio Conference to "think globally but act locally" is being taken very seriously in many countries to fill in the gap between planning and implementation. Local Agenda 21 initiatives have been introduced in many cities with a variety of community-based approaches to analyse environmental issues. For example, the International Council for Local Environmental Initiatives operates by prioritizing issues that need attention. Faced with overwhelming problems and expectations, as well as diminishing resources with increasing population, selection of issues become strategic for environmental improvement while promoting economic development. A variety of tools and methods are available to identify, critically analyse, and prioritise the problems and issues which will focus on action planning. Increasingly, planners have begun to understand the benefits of participatory and community-based approaches. Experience has shown that problem-ranking is strongly influenced by people's perception, as well as by hard scientific data. Participatory processes in planning are, therefore, becoming very popular.

Proposed Action Planning at the Local Level

The magnitude of the task demands systematic management procedures and institutions to be introduced at all levels of administration for an Integrated Urban Environment Management and Area Development Strategy. The principles followed should be:

- to create awareness in the local government and among people about environmental problems and responsibilities;
- to upgrade the capability of the local government;
- to train technical and administrative staff for environment management; and

- to encourage partnerships between local authorities, the community, and the private sector.

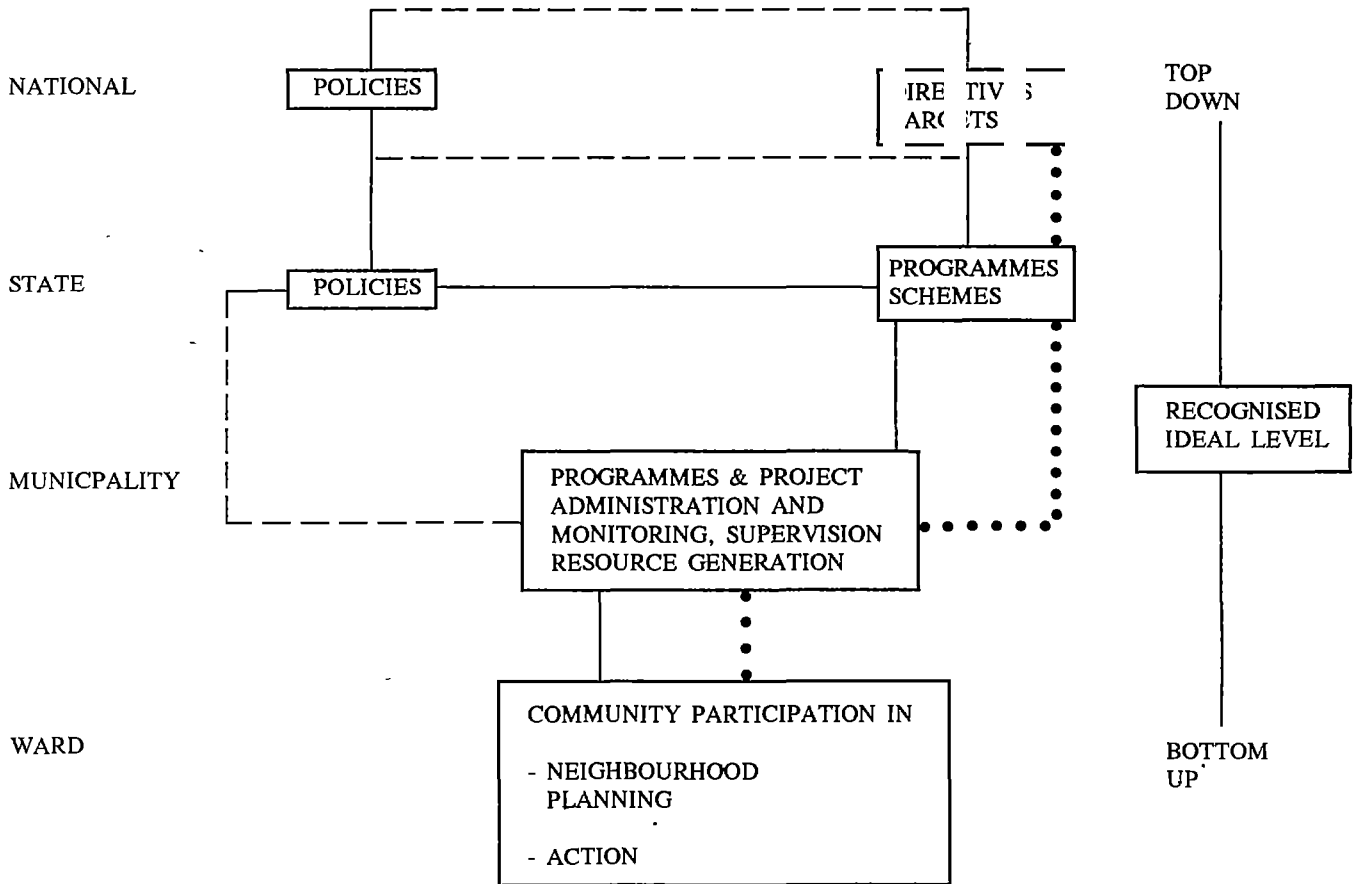
The steps/ stages for local management should be to:

- prioritize issues that need attention (identify cause and effect);
- relate issues to national development (social, economic) policies;
- seek political consent,
- locate areas of Action Plans (for specific issues),
- approach community groups for planning, administration, monitoring, implementation (i.e. institutionalise community participation) which would lead to empowering people;
- define Action Plan details linking policy, resource management (budgeting cost recovery) administrative levels, organisational management, community participation framework, strategy for action,
- train people (local/administrative) for new technological and management practices and with regard to the link between the brown and the green agenda, between supportive and assimilative function;
- develop monitoring cells to guide/control/estimate Action Plan;
- develop Information System for efficiency in monitoring;
- link monitoring at different levels of administration;
- evaluate performance, results, gaps to be bridged and Plans to be improved;
- suggest solutions to fill in gaps in Action Plan,
- feed back revisions/modifications at all levels of administration for re-orienting management procedures

The ideal level for action would be the municipal authority level, which is the elected body at the local level. The municipality should be connected to the line agencies of the State to obtain funds and to relate local development to the State's economic development (flow chart). However, intra-city action plans will have to be worked out at the Ward Committee level, which will have to be done through community participation. This aspect of local level planning has already been given a political sanction through the Seventy-fourth Amendment Act. Care should be taken not to multiply the implementing and planning agencies/ organisations, but to strengthen the

Fig. 2.3

INTEGRATION OF URBAN ENVIRONMENT MANAGEMENT



— — — Legislative Implications

———— Ideological Flows

..... Financial Flows

- Research & Technological Innovatives can not only affect the policies and programmes at national and state level but also at municipal levels as the latter is empowered to prepare Development Plan.
- Private sector has to come in via change of policies at central and state level only.

existing institutions in operation as far as possible, as drastic changes will only delay matters. However, local level organisations will have to be set up if it is absolutely necessary.

The administrative structure for efficient local area management should be a hierarchical system that would distribute work evenly, to reach all areas of the city. The nature of the tasks to be performed within a city demands attention at different administrative levels - the neighbourhood, wards, zones, planning divisions, and the city as a whole. This is because needs vary with area and the order of the function. At the neighbourhood level, local area problems need to be solved quickly. This can be done by the Residents Association. However, in larger areas/ planning divisions/ wards, networking of the neighbourhoods is required. In fact, the scale of operation increases with the order of hierarchy and the area to be served. While at the local level on-the-spot solutions are sought, at the upper levels administrative integration is required. Activities which cannot be done at the local level need to be handled at higher levels. Thus the number of levels in the hierarchy would depend upon the size of the area and the magnitude of population to be managed/administered. At the

local level, action plans will have to be formulated for integrated area development. Whereas, priority sectors should be identified at the Ward Committee level that would have the political support, as envisaged by the Seventy-Fourth Amendment Act.

A pyramidal structure of administration and management (which is not very uncommon) is the ideal institutional framework to be developed for local level implementation within a city. Lessons could be learnt from the Urban Basic Services for the Poor (UBSP) programme. Capacity - building for the different levels of management should be done as per requirements.

Implementation will have to be linked to the hierarchical level. Resource generation should be done keeping in mind the activities to be carried out. However, disbursement of funds to lower levels should be routed through the municipality, so that there is no overlapping of jurisdictions and repetition of work. Each organisation's responsibilities should be well defined and clear-cut directions should be given. Links between the different levels of the management system should be well established and fool-proof.

ACTION AT INTRA-CITY LEVELS

| Intra-city Levels | Actions to be taken | Agencies for Action Planning | Strengthening of Institutions |
|----------------------------|----------------------------------------------------------------------|-----------------------------------|---------------------------------------------------------------------------------------------------------------------|
| City | Economic dev., coordination of Infrastructure Management | State Departments, Municipalities | Policy formulation Resource generation, Manpower Planning, Strategy formulation, Legislative reforms Political will |
| Planning Divisions | Sectoral dev., Landuse dev., Special-purpose Infrastructure | State depts., Dev. Authorities | Technical dev., Capacity - building |
| Wards | Local Action Plans, Area Infrastructure dev. | Ward Committees | Popular Participation, Area dev., self sufficiency in Management and Implementation |
| Residential Neighbourhoods | Area Specific Infrastructural and Social Dev., Employment generation | Resident's Associations | Local participation to cater to daily requirements, Initiation of Low Cost Methods of Maintenance. |

Maximum attention should be given to the strengthening of the local government and institutionalising community participation. Legislations and policies will have to be introduced for action.

Involving the community serves two purposes - (1) that people themselves make an effort towards prevention/control of environmental degradation and (2) that people's participation is the

best way to learn about problems that need correction. It also generates within people a sense of responsibility towards the environment. For, however much the government might want to improve the environment, controls can be incorporated only through the community's awareness. Consciousness of the community will also make the government vigilant over environmental issues, which until now have often been neglected. There is a need to educate people on environmental issues and

problems at all levels of the society. Bringing awareness (to people) can be done by introducing

- special courses on environment in the universities, educational institutions and grassroots agencies (like the Schools of Planning, University Departments, Neighbourhood Associations, etc) to bring home to citizens the importance of a good and healthy life;
- development of Environment Management Information System to help to create greater awareness among the people through multimedia, and to encourage research to evolve better management procedures and technological improvements. A wider dissemination of data and management/technological methods will help to solve existing problems and to plan well;
- training of officials for improved management and monitoring of environmental standards (at all levels of administration/ operation).

Action at the District Level

An aspect of development which has been hitherto ignored in the study of carrying capacity of regions, is rural-urban linkages and the steps to be taken in developing an integrated urban and rural administrative and management structure. An example of this can be cited from the National Capital Regions' (NCR) Plan, where even though the focus was on integrating urban and rural development of the Region, efforts had not been made to suggest institutional development for the rural areas. Perhaps this can be augmented through the District Planning process

Two types of planning are required for regional development-settlement (point locations) and spatial (area development). At the settlement level there will have to be clear directions to integrate the overall economic development of the region with the local area scenario. Whereas, at the spatial level, the objectives will have to be sustained local area development. Further integration will have to be done between the settlements and their surrounding areas. An organisational structure will have to be worked out to support regional development, in which the different levels will have to have discreet jurisdictions. However, settlement planning will have to be linked to its rural hinterland

As mentioned above, the Seventy-fourth Amendment has suggested the setting up of District Planning Committees (DPCs) for the preparation of draft Development Plans (for the district) to be forwarded to the State governments, which in turn would consolidate them into State Plans. It is also advised that Metropolitan areas should have Metropolitan Planning Committees

Even though District Plans can be consolidated into State Plans, action will have to be taken at the district level itself. Suggestions would be to act at the local (village or mandal- which is a cluster of villages) level. But the ideal administrative unit

would be the district administration, where settlement planning (both urban and rural) could be coordinated within districts, as also with the line agencies. Metropolitan areas, however, would require special attention, as functions of such cities are very different from other urban areas. Care should be taken to systematically merge metropolitan management with the neighbouring regions. Often different states may have to co-ordinate their planning for management of such large cities, as has been the case with the National Capital Region in India.

Strengthening of Institutions:

Carrying capacity is a concept of self-reliance. The idea is to sustain development within the (re)generative capabilities of natural and man made resources in a given area. The aim should, therefore, be two-fold:

- to develop an administrative and management structure that would be able to implement what has been planned, so as to reach to all sections of the society, and to all parts of the city both vertically and horizontally, and that
- all implementing agencies should be competent enough to carry out their tasks smoothly, without depending on too many external factors or organisations. The aim should be to develop a self-reliant method by which requirements of cities can be met with from within, keeping in mind the objectives of democracy, which is by the people, for the people- a thrust which of late, has been realised to be the most effective form of local area management and implementation. However, integration of the different levels of management within the city will have to follow subsequently.

To bring to fruition what is being planned or propagated, the following steps/measures need to be taken:

- to set up self-reliant institutions for efficient implementation;
- to develop an organisational structure that would reach to all parts of the city and to all sections of the society;
- integrate institutions/organisations so as to link activities of different types and levels. The tasks should be well defined for each agency to avoid duplication and confusion;
- nodal agencies, if constituted, should be given the powers to persuade the different components of the planning regions to perform;
- priorities of the regional plans should be integrated with the interests of the constituent states. Well-defined partnerships should be formed, instead of thrusting a plan from above. This would help to avoid conflicting political issues;

- all concerned sectors or government departments will have to focus on the planning region irrespective of their individual tasks. For example, the Ministry of Surface Transport will have to take care of the development of highways connected to the planning region, on a priority basis,
 - appropriate legislations will have to be enacted to integrate to all implementing agencies for a particular task. So far state and central enactments are supplementary, and not complementary to each other;
 - community participation will have to be institutionalised by incorporating clear directives for the community in each planning process, and at all levels, wherever community participation is required;
 - to make each institution or organisation self-reliant, manpower planning and development of personnel is a must. This might include technical training to improve expertise;
 - a sharing of tasks and resources is also required through public, private and community partnerships. While certain services can only be provided by public agencies, the cost should be recovered from the users for using them;
 - resource mobilisation for projects will have to be done through the introduction of financial instruments in the market. Lessons for this can be drawn from countries that have already introduced such methods of operation,
 - introduce different partnership methods for implementation (BOO, BOT etc.) depending upon requirements;
 - introduce Management Information System as a ready reckoner for action and research;
 - decentralise action for easy implementation, and local area advantages,
 - capacity-building for each institution.
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3

NGOs/Civic Societies and Urban Environmental Advocacy

Development Associates, Lucknow

INTRODUCTION

India is gradually becoming more and more urbanised and according to the 1991 Census, about 26.13 percent people live in urban areas. With the rapid expansion in urban growth, its management is increasingly becoming a challenge. Where there is unplanned urban growth, the environment of the cities and towns is most significantly affected. The drainage, sewage disposal, growing slum areas, industrial pollution and solid waste create major environmental hazards lowering the quality of life in these cities and towns. To cope with these growing demands and with urban explosion, urban bodies as well as concerned departments find themselves constrained in terms of resources and manpower. Many a time, even with sufficient resources, the planning and implementation of programmes become target oriented without taking into consideration the needs of the people. This overall situation leads to apathy and indifference not only from the municipal corporation but also from the residents of the city/town.

In this deadlock situation, the role of NGOs/civic societies becomes important to identify the issues of concern and to organise people to affect the centres of power for designing programmes and policies in favour of the people. The NGOs in such cases represent the interests of the most affected and the oppressed. The advocacy therefore, in the context of the urban environment becomes imperative and relevant.

There are several examples of effective and successful advocacy where a group of people or organisations have made institutionalised and sustained efforts to bring about changes in projects and policies. This study undertakes detailed research on urban environmental advocacy in the context of NGOs and civic society in India.

OBJECTIVES OF THE STUDY

The study aims at highlighting the best practices of advocacy related to various skills and systems developed by the NGOs involved in it. The following objectives were framed.

- To develop a critical understanding of the role and relevance of advocacy in general and with particular reference to environmental-development work within the urban context

- To assess its potentials and limitations as a strategic instrument, understanding the specific requirements and challenges within the local, regional and national context.
- To generate deeper understanding of the skills and systems effectively used by the NGOs/civic society in meaningfully intervening in the policy processes.

It was also decided that the study should be based on the case study method where selected relevant experiences should be documented in a process oriented manner. These case studies should be analysed to draw lessons to fulfill the objectives of the study.

GUIDELINES FOR BUILDING CASE STUDIES

It was decided that the study should build case studies around urban advocacy experiences. The case studies should highlight the following information, dynamics and processes:

- i) The general background and history of the issues on which the case study is based. The background of the organisation and that of the people mainly involved. Key actors related to region, demography, ecology, culture and other developmental factors.
- ii) Analysis of the socio-economic context and political environment in which the advocacy process was initiated. Major implications of the environment on the effectiveness of the advocacy.
- iii) Objectives, strategies, and tactics used - main turning points in the work, the roles of the people/communities - whether there was secretariat of any kind and if so its role -difficulties and how they were handled. Whether objectives or tactics changed over time.
- iv) The involvement in decision making and the actual advocacy, of people whose interests were being represented - their social composition (caste, class, ethnicity, gender) and what role this played, the responsibilities given to/taken by them, the dynamics of their relationship with the organisation, and their relation with other organisations for example, state or national level federations, the impact of their involvement in the organisations.

- v) The role of the advocacy of women, in particular in the organisation, within the communities. The impact/influence of this participation, on the work, on the women, in the organisation. Whether any special attention was given to this or is being given since then, perhaps as a result of this experience.
- vi) The relationship of these efforts to other related initiatives in the district/state/ region/country. Was this relationship responsible for the work being started, or did it come later? How was/is coordination done? Benefits of association - difficulties experienced, and how these were overcome.
- vii) The main positive outcomes/impact/gains of the advocacy work, for the communities/people whose interests were represented. How have they built on the gains? What were the benefits for other sections? The main negative outcomes, if any. The main factors behind the positive and the negative outcomes.
- viii) Critical analysis of the instruments used for advocacy and their relevance and effectiveness in local and wider context.
- ix) The main constraints and contradictions experienced by the communities/organisations. How were these overcome?
- x) Analysis of the main lessons from the advocacy experience. What are the main prerequisites for effective urban environmental advocacy? Was the advocacy process sustainable? What are the elements of replicability of such experiences - across regions and issues?

RESEARCH QUESTIONS FOR GENERALISATION

On the basis of the detailed case studies documented on three experiences, it would be pertinent to analyse these case studies to answer some of the research questions in a comparative framework in the following manner:

- What was the level of advocacy - geographical spread vis-a-vis the hierarchy of the centre of power?
- How was the advocacy managed in terms of skills and systems used?
- What are the elements of best practices?
- What was the impact of advocacy with special reference to sustainability elements and potential for scaling up/replicability?
- What are the potential areas of capacity building in the area of effective urban environmental advocacy?

- What kind of national level strategy can be adopted for strengthening NGOs/civic society involved in such processes?

The methodology adopted for the research study is primarily based on the case study method. Therefore, considering the objectives set for the study, identification of three important experiences was important where advocacy in an urban environmental context has been a major focus. Therefore, various journals and issue based magazines were reviewed in important libraries of the country and professionals actively involved in urban issues or advocacy were consulted.

The following considerations were made to identify suitable cases for indepth documentation of the advocacy processes

LISTING OF AVAILABLE EXPERIENCES IN URBAN ENVIRONMENT ADVOCACY

In order to identify representative and suitable case studies for the research study initially listing of all possible urban environmental advocacy related experiences was undertaken. These experiences were classified as related to urban waste management, protection of natural resources, environmental pollution, civic rights and such others. These experiences are put in a matrix to understand the actors involved in the advocacy process namely, NGOs, citizens' groups, government functionaries/departments, professionals, scientists, activists and so forth. The matrix was extended to keep variables on geographical diversity, level of advocacy and its impact.

CHOICE OF ADVOCACY EXPERIENCE

Looking at the matrix of available experiences in urban environmental advocacy it was realised that there is a concentration of experiences in natural resource management, protection of green cover, some on the city/solid sewage waste management and recently on growing chemical pollution in the industrial towns/cities. Moreover, going through the experiences it was also realised that many of the experiences have very little element of advocacy and that too in a nascent stage. Moreover, a couple of them have taken such controversial positions that these would not be relevant for meaningful comparison and analysis.

The choice of experiences for documentation was also tested on the involvement of non-government organisations (NGOs) and various other representatives of civic society. It was also decided to take only those examples where institutionalised efforts of advocacy have been taken. Therefore, many of the experiences were individual initiatives which could not be converted into any institutional arrangement and hence were not considered for documentation for detailed case studies.

The following broad criteria were agreed upon:

- the experience should highlight any urban issue and should have used a mature form of advocacy for protest;

- the stakeholders in the advocacy process should be the affected people. The people involved with it should have organised themselves around an institution, that is, the efforts should be more institutionalised rather than personalised;
- the experience should not have become controversial taking a certain position which might affect the analysis of the study, and
- the experiences should have potential for reflecting best practices and lessons for building strategy for capacity building of NGOs on urban environmental issues in a national perspective.

RATIONALE FOR SELECTION OF CASES

Based on the criteria mentioned earlier, the following three cases were finalised for detailed documentation:

- Clean Ganga Campaign in Varanasi
- Save Shahpura Lake Campaign in Bhopal
- Mudrialy Fishermen's Cooperative Society in Calcutta

The case studies indeed suffer the limitation of not being a perfect choice, however, the best care has been taken to make these cases as much representative of urban environmental advocacy processes in India as possible.

The case study on Clean Ganga Campaign in Varanasi is one of the well known examples of people's concern on the sewage management and cleanliness of the city of Varanasi. The key strength of the experience lies in the fact that a set of professionals, scientists and engineers highlighted the issue on empirical evidences that the pollution in the Ganga near the city of Varanasi was attaining an alarming level owing to poor sewage and solid waste management systems within the city. Moreover, the advocacy was taken up to the Prime Minister's office keeping the religious sentiments associated with the river to ensure priority of the issue in the national development planning

The second case study selected for detailed documentation highlights the issue of protection of natural resources in urban areas and its implication on the city environment. Shahpura lake is one of the natural lakes of Bhopal town. Bhopal has a sizable number of lakes and more than 50 percent of the drinking water is supplied through these lakes in Bhopal city. The major strength of the experience is that three NGOs having specialisation in different areas worked in a networking relationship to advocate the issue of the deteriorating condition of the lake. The civic society that is, the citizens of Bhopal were the affected people as well as the major force for advocacy instruments. The experience has been successful as the lake has been improved by the government. There is another inter-

esting dimension in this case study that the Ministry of Environment and various other government departments favoured the advocacy issue.

BROAD GUIDELINES TO DEVELOP CASE STUDIES

1. Background information
 - The context of the issue
 - Organisation's background
 - Rationale for its involvement on the issue
2. People in the advocacy process
 - The affected communities
 - The sections who have been opposed
 - The target group in advocacy and level of operation with the power centres.
3. Strategies
 - Objectives set for the advocacy
 - Rationale for moving into the advocacy
 - Pressure building tactics
 - Networking arrangements
 - Details of the secretariat and its *modus operandi*
 - Structure of decision-making
 - Women's role in advocacy
4. Outcome and impact
 - The degree of impact at the local and wider level
 - The major negative and positive factors affecting advocacy.
 - The elements of success and failures
 - Major constraints and contradictions
5. Elements of sustainability and replicability
 - The advocacy process was internally or externally managed.
 - The perspective of advocacy was narrow or broad-based
 - The expertise utilised was available within or requested from other organisation.
 - Has the experiment been attempted anywhere else using similar advocacy design?

The third case study of Mudrialy Fishermen's Cooperative Society in Calcutta is selected as the key strength of the advocacy is the fact that the affected people the poor, illiterate and oppressed fishermen are at the centre of the advocacy. The individual efforts of a scientist cum engineer concerned with the issue of wetlands were institutionalised in the form of a cooperative of the fishermen. The cooperative is handling the issue of protection of wetlands as well as their livelihood in an organised manner. The experience highlights the combination of various favourable/unfavourable forces placing fishermen and the issue of wetlands at the centre. The experience has been acclaimed and won international recognition for its effective management of

advocacy processes. Moreover the State Department of Fisheries was also a stakeholder in the advocacy process in favour of the fishermen which is a unique feature of the experience.

DOCUMENTATION OF OTHER EXPERIENCES OF URBAN ENVIRONMENT ADVOCACY

In order to have more diverse experiential data base in urban environmental advocacy, eleven more experiences have been documented. These cases represent geographical issues and organisational diversity. A case of EXCEL Industries from the corporate sector has been documented which reflects their relevance in urban waste management. These experiences have been documented in brief with the primary objective to enrich the data base for developing a strategy of capacity building and institutional strengthening for government and non-government organisations involved in urban issues for taking up advocacy roles more effectively.

CONCEPTUAL FRAMEWORK OF ADVOCACY IN URBAN ENVIRONMENT

CONTEXT OF ADVOCACY IN CIVIL SOCIETIES

The concept of civil society in the interactive model with market and state deals in articulating development goals in social, economic and political terms (Brown and Tandon, 1994). As defined by Alan Wolfe (1991), the 'civil society' is the arena for social development. The civil society in its broader sense is the families, neighbourhoods, voluntary organisations, unions, cultural groups and spontaneous grassroots movements. The crucial characteristic of civil society is that it is manageable, available to ordinary people and part of everyday life.

Historically, social movements have provided mechanisms for participation in civic and political life that foster consciousness and enable expression and pursuit of community interests in many ways. Therefore, a large base of associations and organisations that represent diverse interests, social movements can elaborate the institutional base of civil society.

Non-governmental organisations (NGOs) constitute a critical component of civil society as they have in general supported the marginalised communities in their efforts to improve the economic, social, ecological and political conditions under which people live. With their growing experiences and credibility in development and environmental work, many are adding formal policy influence to their agenda.

The NGOs have played various roles in getting involved in policy issues at different levels. Some NGOs have played innovators' roles creating new programmes or development concepts that have subsequently been adopted by government agencies. The other set of NGOs has adopted the role of watchdogs monitoring formulation and implementation of government policies to safeguard the interests of grassroots groups. There are some NGOs which have provided catalytic

bridges in promoting cross sectional cooperation on intractable problems.

Therefore, these NGOs and other popular organisations have identified several interrelated goals and priorities. Strategically these organisations attempt to introduce change in detrimental governmental policies, use grassroots experiences and innovations as the basis for improved policies and strengthen local capacities and structures for ongoing public participation. The strategies also change with the change in political, social or economic structure at the macro level.

CONCEPTUAL UNDERSTANDING OF ADVOCACY

Through advocacy NGOs attempt to build on the new possibilities for citizens' participation when governments also become more pluralistic. Broadly, NGOs in advocacy "help give voice to those who have been historically marginalised and provide them with a crucial vehicle for exercising their rights and holding government accountable".¹ Therefore the role of NGOs is crucial in strengthening democracy and the skills of citizenship essential to healthy societies. Advocacy can be also defined as "an organised sustained campaign by a section of civil society to get their interests represented and addressed to the power centres in society subject to changes in public policy or changes in practice or projects".²

The three basic ways through which NGOs and other actors of civil society attempt to influence policies to affect civil society and government accountability are.

- Educating citizens on important civic issues and ways to access political systems
- Building a stronger institutional base of civil society
- Providing mechanisms for participation and policy change especially for less represented sections

When groups do not succeed in getting desired legislation passed or policies changed, their advocacy efforts may still help consolidate or strengthen NGOs and grassroots institutions and increase the stocks of "social capital".³

STAKEHOLDERS AND PARTNERS IN ADVOCACY

In influencing policies at various levels for affecting power centres, NGOs and people's organisations (POs) work in different areas and target varieties of players for advocacy and influence. The coalition and partnership of various actors in favour or against the issues/politics also influence the process of advocacy significantly. Therefore, the rate of success or achievement largely depends on the combination of stakeholders namely, NGOs with the support of the government, NGOs with like-minded national and international organisations and NGOs with the public at large and influential citizens.

The interest groups in advocacy related to the power structure are the executive, legislature/parliament, judiciary, ministries, local officials and sometimes the police. The arena outside government involves such actors as NGOs, popular organisations, influential citizens or power brokers, religious authorities, the public at large, the media, business and academics. At the international level, there is another set of players namely international NGOs and the federation of POs, donor governments and world bodies such as the UN as well as multinational business interests.

However, the issue remains crucial in advocacy as to how best the powerless groups that is, the affected people should interact with elite policy players. The issue also remains open as to who legitimises the middle class that is, the articulate class to advocate on behalf of the poor and the oppressed. The processes documented in the case study are indicative of such issues.

ADVOCACY IN URBAN ENVIRONMENTAL CONTEXT

The focus of advocacy in India has remained on issues primarily important in the rural context. The issues pertinent to the urban context are gradually being raised by a cross section of civil society; however, the advocacy efforts to highlight such issues are still in their nascent stage. The majority of experiences which have used some degree of advocacy revolve around solid waste management, environmental pollution, forest/green cover, degradation in cities and around and human settlement issues. The case studies prepared under the report also reflect this kind of trend of concentration of advocacy efforts on these issues.

Nevertheless, advocacy in the urban environmental context is increasingly becoming a relevant and effective instrument for NGOs and civil society. The people's groups and citizens' councils are becoming more organised to identify issues of concerns and build strategy for advocating on such issues at various levels of power centres. Efforts are getting more on building organised efforts around institutions, NGOs and structured secretariat for advocacy.

UNDERSTANDING ON BEST PRACTICES IN URBAN ENVIRONMENTAL ADVOCACY

"Best Practices" is primarily a term used in industries for quality management. The best practices, therefore, are the changes in production management or the introduction of new systems in the existing production system that would result in more efficient and effective output. The best practices relate to a healthy and encouraging work environment and monitoring system that enhance productivity and quality of output.

In urban environmental advocacy processes, also the "best practices" are the strategic elements in organising the people, use of instruments, scientific knowledge and vision for sustainability and replicability. In advocacy, many a time consciously or unconsciously we find that a large number of

organizations adopt various best practices to make their process more effective within the given socio-economic and political environment. There are certain changes introduced to accelerate the pressure on the bureaucracy or to sustain the interest of the people on the issue. These best practices are critical in making any process effective.

Analysis of these elements of the best practices will be useful for designing a capacity building strategy based on the participatory approach of sharing and learning. The study is an attempt in this direction, therefore, the case studies have been documented in such a manner that they reflect the strategic elements as well as the best practices.

CASE STUDIES ON URBAN ENVIRONMENTAL ADVOCACY

The three case studies documented here are on urban environmental advocacy processes. The first case study is about the 'Swachh Ganga Abhiyan' or 'Clean Ganga Campaign' in the holy city of Varanasi. Varanasi is an old religious centre of the Hindus where a large number of people come everyday to bathe in the holy river Ganga. The sewage system of the city could not cope with the expansion of the city boundaries and population. As a result of that, the pollution level in the river near Varanasi has become alarmingly high. The Sankat Mochan Foundation under the leadership of a few scientists and engineers of Benaras Hindu University (BHU), highlighted the issue taking it up to the highest centre of power and the introduction of Ganga Action Plan (GAP) is considered to be significantly influenced by the efforts of the Sankat Mochan Foundation. It was realised by the Foundation that Phase I was more of a target oriented project. The Foundation therefore, is still active in ensuring that the second phase of the GAP is properly planned and implemented.

The second case study deals with the advocacy process undertaken around the deteriorating condition of Shahpura Lake in Bhopal. Bhopal is a city of lakes and these lakes have a major impact on the environment of the city. After the 'Mass Fish Kills' in the lake owing to high BOD level, the citizens of Bhopal along with the Bhopal unit of the Youth Hostel Association of India (YHAI), National Centre for Human Settlement and Environment (NCHSE) and the Society for Environmental Conservation (SEC) initiated a process of protest and demonstration by starting to clean the lake with their own efforts. This questioned the accountability of the Bhopal Municipal Authority towards people in making the city environmentally sound. The concerned departments and state level bureaucracy constituted a coordination committee. The lake has been improved due to these efforts and the active involvement of the government, NGOs and people in the process.

The third case study is related to the one of the finest wetlands in Calcutta as an indigenous system of waste recycling. Gradually, the wetlands are shrinking in size and the government,

private contractors are taking away parts of the wetlands for construction of housing colonies and industrial complexes. This process has been intervened in by People United for Better Living in Calcutta (PUBLIC) filing a public interest litigation case with the High Court and the court has provided a permanent stay prohibiting any further construction on the wetlands. Within the issue of wetlands, a cooperative society of the fishermen's known as Mudialy Fishermen's Cooperative Society has been formed where various interesting experiments of waste recycling and improving the yield from pisciculture have been attempted. The society operates on the leased land of the Calcutta Port Trust (CPT) and CPT wants to take back their land. The protection of wetlands and this unique experience of recycling of waste and pisciculture in that water for the livelihood for more than 250 fishermen becomes very important. The advocacy is being taken up by the MFCs with the support of Dr. D Ghosh and a forum of NGOs.

CASE STUDY I

CLEAN GANGA CAMPAIGN IN VARANASI

BACKGROUND

The Ganga, the most sacred and important river of India, is regarded as the cradle of Indian civilisation. Several pilgrim centres including Varanasi, earlier known as Kashi, have existed on its banks for centuries. Millions of Indians take a holy dip in the river Ganga during religious festivals at Varanasi. The importance of Ganga water is not only written in Hindu scriptures, even for Emperor Akbar, the Ganga was "the water of immortality"

The Ganga starts from Gangotri in the Himalayas and travels 2,525 km. long and joins the Bay of Bengal at Ganga Sagar. It passes through 29 Class I towns with a population of more than one lakh, 23 Class II towns with a population between one lakh and 50 thousand and about 48 towns having less than 50 thousand population.

Alarming Levels of Pollution in Ganga

The pollution of the Ganga at Varanasi owing to sewage disposal has been over 85 percent of the total pollution discharged by the city into the river. The city has been discharging about 125 million litres per day (mld) of waste water in the Ganga with discharge points located all along the river, many of them close to the important bathing Ghats. Cremation of a large number of dead bodies (about 40,000 annually) and disposal of human and animal carcasses into the river are extremely disturbing to the pilgrims and tourists. The actual contribution of such pollution inclusive of industrial pollution is far less than the sewage pollution. However, as a combined result of the above factors, the biochemical oxygen demand (BOD) values near the city bank continued to be very high indicating high pollution in the Ganga.

Genesis of Swachh Ganga Campaign

The Swachh Ganga Campaign was initiated in 1982 by Dr. Veer Bhadra Mishra, Professor of Hydraulic Engineering at the Banaras Hindu University and Mahant of the Sankat Mochan temple.

Dr. Mishra initiated this campaign at his own level in 1975 when he noticed during his own ritual bathing everyday in the Ganga, that the visible pollution of the Ganga was increasing. He published an article in a national Hindi magazine *Dinamaan* on the increasing pollution level in the Ganga and its consequences on Varanasi. This article generated sufficient interest among people and on the warm public response, he published many other articles in newspapers and magazines.

Over the years, it was realised by Dr. Mishra that a more institutionalised approach would be needed to channelise energies to make it a national level issue. Therefore, in June 1982, the Sankat Mochan Foundation was registered as a non-profit organisation.

With the registration of Sankat Mochan Foundation, a formal memorandum was submitted to the then Prime Minister Mrs. Indira Gandhi, outlining the problems and suggesting possible solutions.

In November, 1982, at a formal gathering of the residents of Banaras, concerned with the environment, the Swachh Ganga Abhiyan or Clean Ganga Campaign was announced to be coordinated by Dr. SN Upadhyay, a Professor of Chemical Engineering at BHU under the aegis of the Sankat Mochan Foundation.

Major Objectives of Sankat Mochan Foundation

The Sankat Mochan Foundation aims to study the water resource management problems of the Ganga basin with emphasis on the study of the problems of the Ganga at Varanasi. The Foundation also provides all possible help and cooperation to other individuals and organisations engaged in such studies.

The objectives of the Sankat Mochan Foundation are focused on improving the condition of the Ganga. The following are the major functions:

- i) To restore and preserve the Ganga by alleviating its fast deteriorating condition
- ii) To promote education and health care programmes for the less privileged members of the society.
- iii) To maintain and encourage the age old culture and religious traditions of the ancient city of Varanasi.

Pre-Ganga Action Plan Activities

With the beginning of GAP, the focus of the Swachh Ganga Campaign changed. Earlier it had no interactions with the government, however, in changed roles, it became a public interest watch dog besides creating awareness among people for a clean Ganga.

Components of Ganga Action Plan

The Ganga Action Plan was launched nation-wide to cover almost all cities and towns starting from Hardwar in Uttar Pradesh to Calcutta in West Bengal. The primary concern of the GAP was to reduce the pollution load on the river by almost 75 percent controlling by the discharge of sewage/sullage into the river. It also aimed at establishing self sustaining treatment plants.

Therefore, the following components were determined for the GAP

- Renovation (cleaning/desilting/repairing) of existing trunk sewers and outfalls to prevent the overflow of sewage into the Ganga.
- Construction of interceptors to divert the flow of sewage and other liquid wastes away from the Ganga.
- Renovation of existing sewage pumping stations and sewage treatment plants and installation of new sewage treatment plants to recover the maximum possible resources, especially energy to operate the pumping and treatment plants, and derive the maximum possible revenue to cover at least the operation and maintenance cost of these plants.
- Arrangements for bringing human and animal wastes from locations proximate to the sewage/sullage digesters for sanitary disposal and production in energy and manure.
- Providing sullage or sewage pumping stations at the outfall points of open drains, to divert the discharge from the river into the nearest sewers and treatment plants.
- Alternative arrangements to prevent discharge of animal wastes from cattle sheds located on the river banks
- Low cost sanitation schemes in areas adjoining the river to reduce or prevent the flow of human wastes into the river.
- Biological conservation measures based on proven techniques for purification of streams.

- Pilot projects to establish cost effective systems for diversion of wastes now flowing into the river, their treatment and resource recovery.
- Pilot projects to establish feasibility of technology application in the treatment of wastes and resources/energy recovery.

Strategic Elements of Clean Ganga Campaign

i) Strong Team of Professionals/Specialists

It was realised by the Sankat Mochan Foundation that in order to convince people with scientific facts that the Ganga water is becoming polluted, there is a need to conduct studies on water quality utilising the expertise in the field. Therefore, Professor S.N. Upadhyay, Chemical Engineering, BHU, took a lead to conduct a number of studies. Similarly, Dr. S.K. Mishra, Reader in Civil Engineering, IT BHU was also actively involved to understand possibilities by physical interventions to suggest sewerage disposal possibilities. There were a number of other professionals, academicians who joined the campaign to strengthen its research/study base.

ii) Awareness Programmes on Ganga

Clean Ganga Campaign also emphasised the involvement of people in the movement. Several cultural programmes inviting renowned artistes, local folk singers and others were involved to perform for the Clean Ganga Campaign. The purpose of the awareness drive was to involve people with the movement without showing disrespect to their sentiments associated with the Ganga.

School children were also involved by providing them environmental education and organising painting competitions, plays, awareness camps to sensitise them on environmental aspects related to the Ganga and also in a broader context.

iii) Network of Like-minded People and Volunteers

The Clean Ganga Campaign has also involved a large number of like-minded people as the Ganga is very closely and emotionally associated with the largest religious community of India. Various eminent political leaders, academicians, environmentalists, advocates and young artistes also associated themselves with the campaign.

A large number of university students, youth and scientists who were sensitive to environmental issues sentimentally attached with the Ganga formed the team of volunteers to strengthen the campaign.

With the help of these volunteers a human chain of more than 2,000 people around the ghats was prepared as a symbol to protect the Ganga on 4 June 1993 a day before the international Environmental Day.

iv) National/International Networking for Highlighting the Issue

Many of the active workers of the Ganga Campaign being faculty members of the Banaras Hindu University (BHU), their relationship with the academicians in the West were helpful in highlighting the issue at the international level. In Australia and the US people sensitised to environmental issues formed a group named "Friends of the Ganges". With a membership of more than 100 people, they were writing articles on the Ganga Campaign in newspapers, journals and also influencing the media to provide coverage on the issue. The BBC had also prepared a documentary film on the campaign.

Phase II of the Ganga Action Plan

With the experiences of the implementation of the Ganga Action Plan Phase I, started in 1986, Sankat Mochan Foundation, the secretariat of the Clean Ganga Campaign was realising difficulties in implementation of the interventions and government's rigid systems of operation. It was also being realised that the approach of the departments, involvement in GAP is primarily to achieve targets rather than actually involving themselves for the cause.

In order to prove the achievements, false data on low levels of contamination in Ganga were being provided. As a result the Sankat Mochan Foundation/Clean Ganga Campaign raised questions on the approach, intervention and data provided by the Ganga Project Directorate (GPD).

The advocacy took a different turn as the Clean Ganga Campaign decided to involve itself more actively in the planning process of Phase II of the Ganga Action Plan. The Sankat Mochan Foundation submitted a memorandum to the government for properly planning Phase II of GAP.

Strategy for Advocacy for Phase II of Ganga Action Plan

i) Studies on the Status and Impact of GAP interventions in Varanasi

In order to convince the authorities that the GAP Phase I had not been able to deliver whatever was expected out of it, various studies were conducted on the sewerage treatment plants, water quality, civil engineering interventions.

The Sankat Mochan Foundation (SMF) had also prepared a note on the comparative advantages of various technologies available for sewage treatment in the world and their relevance and utility in the context of India. The Foundation also suggested that the oxidation pond system or AIPS STP would be the most appropriate technology.

SMF also developed a design for gravity-flow interceptors sewer along the "Panch Koshi Parikrama" which will not require pumping thus minimising the running and maintenance cost of the system.

SMF also requested Dr. Karan Singh as Chairman of People's Commission on Environment and Development India, Delhi to organise a public hearing on Environment and Development at Varanasi. On 8 November 1994 at Tulsi Ghat the People's Commission on Environmental Development India organised the 22nd public hearing on Swachh Ganga Abhiyan. SMF prepared three research papers and presented them during this public hearing. The paper of Dr. VB Mishra was entitled as "Varanasi Ganga Action Plan Phase I and its Impact on Pollution Abatement of Ganga and its Ongoing Effect on City of Varanasi". SK Mishra presented a paper entitled "Unplanned Urban Development Along Ganga Upstream of Varanasi as a New Source of Ganga Water Pollution" and SN Upadhyay worked out a paper entitled "Ganga Action Plan Phase II for Varanasi Some Issues". These papers contained analyses of the data on Ganga pollution and suggested alternatives for improvements utilising their technical and professional knowledge.

ii) International Seminar on Pollution Control in River Cities of India

Realising the need to broadbase the movement as well as to involve more professionals in this Campaign, SMF organised a Seminar during 14-17 January, 1992 on "Pollution Control in River Cities of India - A Case Study of Ganga" at Varanasi. It was jointly supported by the Ministry of Environment and USAID. A number of national and international experts on the environment participated in this Seminar and it was realised that the Campaign secretariat should have a well equipped laboratory to monitor the level of contamination in the Ganga at various points on certain selected indicators. This would also cross check the authenticity of data being provided by GPD as the levels of pollution.

iii) Establishment of a Sophisticated Lab at Tulsi Ghat

SMF explored possibilities of funding and ultimately with the financial help of the Swedish Society for Nature Conservation (SMF) of Sweden, a well equipped laboratory has been established. There are competent people to handle the equipments and also to analyse data on the pollution levels of the Ganga on a 24 hour basis. These reports are provided to GPD and GPD also considers these data more authentic and reliable.

iv) Clear Goal and Concrete Proposal for Phase II

SMF also formulated a clear mission with the clear goal that not a single drop of untreated sewage should go into the Ganga water in Varanasi. These research findings and suggested approach for Phase II planning were provided to all possible levels within the government, concerned departments and the media. Professor Veer Bhadra Mishra of SMF in various steering committee meetings/Taskforce meetings influenced the concerned authorities to prepare a more locally adaptable plan utilising experiences of the organisations actively involved in the Clean Ganga Campaign.

Major Area of Concerns of the Movement

The core team of the Clean Ganga Campaign feels that SMF has not been able to undertake proper documentation of the movement process, various dynamics and their impact. This could not be done primarily due to their part-time involvement with the movement as all the leaders are faculty members at BHU. However, they have spent sleepless nights and sacrificed their free hours/ weekends to support the movement. The SMF is dominated by engineers and scientists with fewer of social scientists, therefore, there was less emphasis on the documentation of various important socio-political processes.

SMF could not also strategically use the press to influence the government during the first phase of implementation. Moreover, lack of skills to handle government departments for building pressure on them for delivering the goods, resulted in less effective use of the advocacy processes.

Perspective for Future

SMF envisages the need for making the movement more community based involving people from the villages which have been affected by the interventions of GAP. The villages which are getting insufficiently treated effluent for agricultural use are finding significant increase in health problems primarily related to renal disorders. One of the studies has reflected that Kamauli is the worst affected village having a population of more than 5000 persons. SMF has started organising clinics in the affected villages involving doctors from the medical college of BHU.

SMF also plans to start training programmes on environmental issues for the youth to build human resources for the movement. The children of the schools and university students are encouraged to undertake studies on various issues of the Ganga.

SMF has not yet properly planned its activity expansion plan and long term strategy to provide a sustainable base to the campaign, however, seriously concerned with such issues.

CASE STUDY - II

SAVE SHAHPURA LAKE CAMPAIGN IN BHOPAL

Background

Bhopal has several lakes which constitute precious environmental wealth in and around the city. The major lake, the upper lake in the city spreads in about 32 sq km of area which has a history of existence for more than a thousand years. This upper lake is said to have been constructed by King Bhoj. It supplies about 75 percent of the drinking water of the city. There is a lower lake, which is smaller than the upper lake, existing in the middle of the town, which was constructed by the Nawab of Bhopal, Dost Mohammed Khan about 200 years ago. There are several other lakes in the city and one of the

important lakes in the modern extension of Bhopal area is known as Shahpura Lake.

Rapid urbanisation, deteriorating civic amenities, increasing sewerage disposal in the lakes and a decreasing catchment area owing to privatisation of high priced land near the lakes and many other factors are contributing to the deteriorating conditions of the lake in terms of water quality, aquatic life and recharge capacity.

Mass Fish Kill in Shahpura Lake

On the 10 June 1991, thousands of fish died in Shahpura Lake because of high degree of contamination and low oxygen level. It was reported that the level of oxygen decreased to .5 mg. per litre as against the normal level of 4 to 7 mg per litre. Several local newspapers carried this news and the major reason for depletion in oxygen level was heavy growth of the water hyacinth (Jal kumbhi) in the lake.

Save Shahpura Lake Campaign

Considering the deteriorating condition of the lake some of the progressive organisations initiated the process of investigation of the case of Mass Fish Kill as well as to build a campaign which was later known as Save Shahpura Lake campaign.

The Save Shahpura Lake was the campaign of the citizens of Bhopal who were concerned about the protection of the natural wealth of the city for its environmental protection.

The lead role in the movement was played by the Bhopal Unit of Youth Hostel Association of India (YHAI) and Society for Environmental Conservation, a voluntary group focusing on youth action in development. Moreover the National Centre for Human Settlements and Environment (NCHSE) provided critical institutional support with their credibility and skills in urban development as an anchor for the activities planned under the Save Shahpura Lake campaign.

The Youth Hostel Association of India is a secular non-governmental organisation involved in the promotion of a spirit of adventure and development of a close relationship with nature among the youth of this country. It has its unit in Bhopal which was the nodal agency for the Save Shahpura Lake campaign. Members of the Youth Hostel particularly the Secretary played an organising role in the campaign.

The Society for Environmental Conservation is also a registered NGO primarily concerned with the issues of environment. The Society has got a few young scientists of the Bhopal University particularly in the area of limnology, therefore, their expertise was utilised for conducting scientific studies related to the ecology of the lake and its surroundings. Moreover, the activities of the Society were also supporting the campaign to mobilise people from the neighbourhood localities of the Shahpura Lake.

The National Centre for Human Settlements and Environmental (NCHSE) is also an NGO which is headed by an eminent regional planner and retired civil servant Mr. MN Buch. The NCHSE is also conducting studies on urban issues and supporting the government in proper urban planning. NCHSE has a team of experienced professionals, therefore NCHSE provided leadership to the Save Shahpura Lake campaign.

The Save Shahpura Lake campaign started taking an organised form soon after the news of 10 May 1992 regarding mass fish kill in the lake. The above three organisations played a crucial role in this Shahpura Lake campaign and the major strategic elements of advocacy can be presented in the following manner

Understanding of the Context

The organisations involved in the Save Shahpura Lake campaign realised that clear cut understanding of the context and issues related to the degradation of the lake need to be properly developed. It was realised that the private contractors in real estate were getting interested in the land around the lake as it was freehold land and high priced because of its proximity to the lake. The contractors of Public Health Engineering Department (PHED) were also not removing the water hyacinth from the pond completely because of their vested interest in getting the contract every year. Moreover, any integrated intervention for the improvement of the lake will require coordination of a set of organisations/departments, therefore, it will not happen in the natural course of urban development. This analysis was helpful for mobilising the people in the surrounding areas.

Study of the Limnological Status of Shahpura Lake

The Society for Environment Conservation (SEC) was requested to conduct a study on the limnological status of the lake so that people could be sensitised by placing the facts in front of them. One of the members of the SEC, an expert in limnology conducted this study. The study analysed the factors that resulted in the mass fish kill on the 10 May, 1991 to reveal the facts of the ecological degradation of the lake to sensitise the bureaucrats and citizens of Bhopal.

Survey of the Lake to Determine Sources of Contamination

Similarly a joint team of the three organisations surveyed the lake and its surrounding to suggest necessary interventions for improving the situation

The team surveyed the periphery of the lake and the nallah through which the catchment water flows inside the lake. The waste water discharge points were also visited

It was observed that water hyacinth has covered almost three-fourths of the lake, though it was removed last year. The drainage water was discharged directly in the lake from the

Shahpura (Manisha Market) side, from 1100 quarters through the campus of Champion School and EPCO and Pollution Board Campus. The major flow of waste water and pollutants is through the nallah, which is flowing across Panchsheel Nagar and slums located near Arera Petrol Pump.

A sewage line passes nearby the Champion School and waste water is pumped across Shahpura Hills from a pumping station located near PHED pumping station. The team also observed highly polluted and stinking water near the sewage line, which was perhaps leaking from the line and this water was flowing into the lake. It also revealed the fact that this was the area where the mass fish kill had occurred. Therefore, the possibility of death of the fish from contamination of water rather than depletion of oxygen was not ruled out.

Awareness Among People Regarding Environmental Issues of the Lake

The secretariat of the campaign utilised the local media to highlight various aspects of Shahpura Lake and its deteriorating conditions. Moreover, some articles were also published during that time on the broader issues of environment to protect the other lakes of Bhopal.

The young activists made friends with the journalists who are also sensitive to the issues regarding protection of the lake. These journalists not only brought out a series of articles on the Shahpura Lake in the vernacular but also forwarded articles to the national newspapers in English such as *National Mail*, *Free Press*, *Indian Express*.

This regular publication of articles on environmental issues of the lake and their impact on urban life started sensitising people and prepared them to get involved in some action to protect the lake. The secretariat of the Save Shahpura Lake campaign was made known to the citizens of Bhopal and a number of organisations.

People's Movement and Voluntary Action at the Lake.

After sufficient preparations and meetings with the important citizens of the city, bureaucrats, academicians, professionals, the residents of Arera Colony, Bharat Nagar and other neighbouring colonies of Shahpura Lake were contacted. A public request was issued in the form of a letter to the citizens of Bhopal, informing them about the campaign.

It was decided that on 9 November 1991 the first among the series of lake cleaning operations would be started at 08:00 am at Shahpura Lake to remove hyacinth growing wildly in the lake. Some of the important schools of Bhopal were also contacted and the students were briefed about the environmental issues related to the ponds. The principals of these schools were requested to provide the support of the students for removing hyacinths in the pond.

The campaign also considered it important that weekends should be utilised to invite people on the lake to demonstrate their protest to the indifference of the government as well as to remove the hyacinth growth from the pond.

In a couple of weeks about 140 volunteers removed about 6 tonnes of hyacinth and more than a thousand citizens reached the lake at that time and signed in support of the campaign. Many important citizens including the Chief Secretary and Commissioner of Bhopal Nagar Nigam also participated in the processes.

This was the turning point when senior officials started thinking of saving the lake through more concrete plans and programmes.

Coordination Committee on Shahpura Lake Improvement

The Chairman, Madhya Pradesh Pollution Control Board, Bhopal formed the coordination committee for ensuring cleaning of the lake and determining improvements for its environmental protection.

The Environment Protection and Coordination Committee (EPCO) of the Ministry of Environment played a key role to look into environmental issues more closely and carefully. Moreover, within the given committee promoted by the government, the NGO representation from the campaign was also ensured of the effectiveness of the coordination committee.

Sustained Campaign of the Save Shahpura Lake

In spite of the government's decision for the improvement of the lake, the secretariat of the campaign decided to continue with the demonstration by the citizens. The support provided by the government and the cooperation of the people strengthened the campaign. This citizen-government partnership was a crucial decision which accelerated the progress of work considerably.

Major Impact of the Campaign

Within six months of the campaign EPCO and PHED initiated activities on a war footing. The lake was cleaned removing the hyacinth by putting to work about 100 labour and 10 boats. The coordination committee was responsible for monitoring the progress of activities as well as to ensure coordination among various departments.

The secretariat of the Save Shahpura Lake had also submitted a plan for the protection and beautification of the surroundings. This people's plan was adopted by EPCO and the organisation prepared technical drawings to develop the surroundings around the lake.

PHED also took measures to tap various drains contaminating the water of the pond. On the major drain connected to the pond, a natural sand filtration plant was setup to minimise

mixing of polluted water in the pond. Various other measures to control pollution are being undertaken by EPCO.

Major Concern of the Save Shahpura Lake Campaign

It seems that the organisations worked together only for the above issue and objective and soon after the fulfillment of the objective, the organisations have ceased to operate in coordination to raise various other issues of urban environmental concern and with the gradually declining rate of progress of the improvement. The secretariat of Save Shahpura Lake again requested a people's demonstration on the lake, which has not materialised as yet.

It is mentioned by the representatives of the campaign that with the success of the campaign various tensions, conflicts and differences started primarily regarding sharing the credit of success. This ultimately resulted in weak coordination and long-term perspective planning for the movement.

CASE STUDY III

MUDIALY FISHERMEN'S COOPERATIVE SOCIETY IN CALCUTTA

Background

The East Calcutta Wetlands cover an area of about 12,000 acres (47 sq km.) in the east and south eastern fringes of the Calcutta Metropolitan city. The wetlands which are formally defined as areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish, or salty including marine water, the depth of which at low tide does not exceed six metres. Consisting of low lying areas that are either inundated or saturated by water for varying periods of time they form a unique ecosystem, unmatched in utility and natural resources. Wetlands improve water quality, reduce floods and storm damage and provide important fish and wildlife habitats and support agricultural and fishing activities.

The importance of wetlands has been recognised internationally. As many as 47 countries have now joined the 1971 Ramsar Convention for Wetlands Conservation, and India is one of them. The wetlands of East Calcutta serve the following purposes:

- acting as a receptacle for solid wastes
- proving a spill basin for water run-off from rains and storms
- functioning as a natural sewage treatment plant - recycling the liquid effluent into clear water
- acting as the lung of the town by generating oxygen through its plant life

The Importance of Wetlands as a Natural Sewage Treatment Plant for the City of Calcutta

The East Calcutta marshes constitute the largest and finest traditional sewage and waste disposal system in the world. A third of the city's sewage ended up in this region to be processed in the most indigenous ways. Almost 7,5000 acres of wetlands are taken up by sewage fed fishponds or bheris. Each year these fisheries produce about 7,500 tonnes of fish. While some of the sewage goes straight to the bheris, some is detained for use by the garbage farms - where it is irrigated with sewage water to become a fertile substrate for vegetable production.

Diminishing Size of the Wetlands - Its Consequences

Over the years, the East Calcutta wetlands have diminished in size. From the total area of over 20,000 acres (81 sq.km.) in 1945, the wetlands have shrunk drastically to less than 12,000 acres (47 sq km) today. During the 1960s a large part of it (approximately 6,000 acres) was lost to the Salt Lake housing scheme and in 1969 many fish ponds were drained and converted into paddy fields. The increasing pressure on housing in the city has led to an unprecedented rush towards further reclamation of wetlands. The building of the Eastern Metropolitan Bypass during the 1980s subsequently brought the wetlands within close reach of land promoters/real estate developers who are all eager to turn these wetlands into housing schemes.

The Genesis of the Advocacy Campaign - "Save Calcutta Wetlands"

The need and importance of the East Calcutta wetlands has already been felt by many environmentalist groups and other concerned individuals. An article titled 'Sewage Nightmare - Calcutta in Eco-Peril' in *India Today* (Jan 1992) suggested that if the East Calcutta marshes were developed for building or parts were turned into a trade fair park and zoo as the state government evidently wished to under its Master Plan, the city has no choice but to be smothered in its own sewage.

The other consequences are/will be:

- increased incidence of flooding by rains
- drop in fish and vegetable supply and consequently rise in prices
- displacement of labour connected with these activities
- worsening drainage condition.

The Instruments of Advocacy - the People and the Institution Involved

Dr Drubajoti Ghosh the then Director of the Institute of Wetland Management and Ecological Design, Calcutta has been taking interest in the wetland issues right from the 1980s. He has not only attempted to understand the system of waste recycling but also tried to interlink it with the socio-economic milieu of the

people who were living there for their sustenance. As an expert in environmental engineering with a concern for the environment. Dr. Ghosh has undertaken several studies and published a number of research articles. Dr. Ghosh has done his best to establish the significance of the East Calcutta marshes not only in the regional perspective but also at the national and international level. The first of his many reports (mainly written on the nature and process of recycling sewage treatment) came out in 1981, and by 1995 he had mapped the entire area. For almost ten years, Dr. Ghosh had fought a lone battle within the municipal administration calling for the authorities to recognise the marshes as a waste recycling region.

In the process Dr. Ghosh realised that the fishermen of the wetlands were the most vulnerable community as they were shifting away for small monetary attraction, yet being deprived of their livelihood. Dr. Ghosh initiated organising these fishermen primarily to make them understand their stake on the wetlands and the implications of leaving their land or pond which has provided them long with their livelihood.

The lone battle of Dr. Ghosh has been joined by many environmentalist groups and other NGOs, who also started vocalising against this systematic encroachment on the wetlands. In February, 1992 an organisation called PUBLIC (People United for Better Living in Calcutta) filed a writ petition in the High Court to halt any further "development" of the wetlands. The judge passed an interim order prohibiting any changes in land use while the court duly considered the issues in detail. Nine months later the order was made permanent. Based on the above judgement the Calcutta Metropolitan District Authority introduced a new legislation in which it affirmed that it is necessary to preserve the entire (Calcutta) wetlands so that it may function as a waste recycling region. It is also necessary to control undesirable building activities in these areas.

The Case of Mudialy Fishermen's Cooperative Society (MFCS)

The case of Mudialy Fishermen's Cooperative Society is an example set up by the people of the wetlands and a successful prototype built up by Dr. Ghosh's experiment on recycled sewage water for aquaculture which highlights the importance of these wetlands and all its major issues. This also sets an example of a group of fishermen whose endeavour epitomizes their struggle for existence and the use of local indigenous technology, to treat the waste into products. This case has been in the centre of the advocacy for wetland issues and often quoted as a successful example.

The formation of the Mudialy Fishermen's Cooperative Society goes way back to 1961 when six poor fishermen families at the instance of the Calcutta Port Trust (CPT) formed the Mudialy Fishermen's Cooperative Society (MFCS) with 53 members and became the lease holders of 200 hectares of wetlands from CPT for developing waste water based pisciculture. These families, have shifted from Amta area of Howrah to this wetlands

almost over a century ago in search of a livelihood since they got evicted owing to the drying up of the Damodar Canal. At that point of time they were not at all concerned about their environment but struggled for existence in the wetland covered with garbage and the scattering of shallow ponds which just supports subsistence level fishing. The concept of organising a *samity* or a society was inculcated right back in 1950-56, when these six families approached the Calcutta Port Trust and asked for a lease on the wetlands. In 1952, they were given a three year lease for a fee of 16,000 rupees. They started to develop the area in a modest way. But during 1957, the lease deal changed and was handed over to an influential landowner. With a lot of perseverance and hardship they were able to buy back the lease again in 1960. Ever since then the CPT had been regularly updating the contract on a half yearly or yearly basis and had never agreed on a long term lease. At present they have more than 250 members in the society.

The struggle for the Mudraly Fishermen was not only restricted to the extension of the lease but also to adjust against the huge toxic and organic waste of the industrial effluent and domestic sewage which were being dumped in this wetland every day.

In the case of Mudraly Fishermen's Cooperative Society (MFCS), the fishermen are at present fighting eviction by the Calcutta Port Trust (CPT), the owners of the land, who now want to develop the land for real estate and other industrial use. Over the past few years, the CPT has been able to nibble away portions of the marshes, converting some areas into industrial sites and using other parts for dumping of wastes. Between 1960 and 1980, the wetlands in this area shrunk from 250 hectares to 80 hectares.

People's Participation in Building Up the Environment and Using the Waste

At present MFCS covers around 50 hectares of eight beautiful small lakes surrounding a 15 hectare nature park in the South-West industrial zone of the city, where the garbage dump of the city of joy is encroaching the marshy wetlands every day. The adjacent Sonepur Canal empties 25 million litres of industrial waste from the adjacent factories and domestic sewage in this wetland every day.

It was basically in 1966 when for the first time, the proposal to use sewage water for fish breeding was placed before the fishermen of the MFCS by the dynamic and committed Chief Executive Officer Mr. Mukut Roy Chowdhary who has been deputed to MFCS from the Government of West Bengal fisheries department. The concept of Mr. Chowdhary to explore the treatment of sewage and industrial effluent and recycle it for the fish ponds was experimented upon at first by the bonafide fishermen who were thoroughly skeptical about this idea. But through motivation and thanks to their perseverance and patience the experiment of breeding fish in sewage water paid off. The profit of the cooperative jumped almost five times in the following year. Since then there was no turning back. The

members not only learnt how to skillfully trap the rich organic nutrients of sewage to enrich the pond water but also knew how to filter and recycle the 25 million litres of effluent and sewage through indigenously designed sludge tanks and filtering culverts with the help of purifying plants and wild weeds. This vegetation not only absorbs the heavy metal portion of the effluent but also allows the sludge to settle in the deep culvert. The toxicity level of the water through this indigenous process is reported to have come down from 250 BOD to 15 BOD (biological oxygen demand - an indicator of toxic/pollution level). This system according to Dr. Ghosh, has an outstanding environmental significance. It thwarts the so called universal choice of expensive mechanical sewage treatment plants as a sanitation technology option.

This was an interesting turning point to the struggle as with the increase in profits in the society, they got more cohesively organised as a team to fight against their eviction and encroachment on wetlands.

The Issue of MFCS - Their Fight Against Eviction

But these fishermen's optimism about the future is somewhat tempered by a sense of insecurity. During November, 1992 the Calcutta Port Trust (CPT) the landowner of the Mudraly Wetlands, had made plain its intention to evict the fishermen and fill in the wetlands to make way for warehouse, container parks, truck terminals and other dockland paraphernalia. In 1991, the CPT has renewed the lease of the land to MFCS with a conditionality of 25 percent increase of the lease amount every year. The society argued against this which they thought to be grossly unfair and refused to pay them. During June 1992, CPT had issued an eviction notice which asked the fishermen to vacate the 80 hectares of the leased wetland by 23 July 1992.

On 22 July 1992, the MFCS, to whom the Fisheries Department of the state government had given strong backing, applied to the High Court for a stay order. The Fisheries Department even suggested that it should take the wetlands over from CPC. The judge granted the stay order and the matter is still *sub-judice* till date.

Strategy Adopted and Networking

In its future strategy the MFCS has adopted the following action:

- Mass awareness generation and advocacy/campaign for the importance of wetlands in its surrounding area as well as among the general residents of Calcutta.
- Awareness creation and networking with the similar interest groups by organising seminars and workshops highlighting the wetland issue and the role of the nature park.

- To integrate the advocacy for the wetlands with the theme of Environment, World Wetland issues by celebrating World Wetland Day, Earth Day, World Environmental Day and so on at their nature park along with school children, environmentalists, NGOs and individuals with similar interests.

Following this pursuit, during April 1993 (04/04/1993) a convention was held at the MFCS nature/eco park by a coordination body of 36 organisations mainly involved in science and environment activities, to discuss and highlight the proposed closedown of MFCS by CPT. The participants of the convention had made up a bill of resolutions, and forwarded it to the Government of West Bengal and CPT. The Paschim Banga Vigyan Mancha and Vigyan Jatha (an apex body of the science and environmental groups) are the leading organisations who spearhead the campaign and are the most important instruments for their advocacy. Meanwhile, the good work of MFCS has been recognised throughout the state and the Government of West Bengal identified MFCS as a model fisheries cooperative. To ease matters for MFCS, the government requested CPT to hand over the 80 hectares of the wetland to them which they would in turn give to MFCS, under a long term lease.

Not only the local government, but also the environmentalist groups informed the CPT about the laudable activities of MFCS with regard to waste treatment and conservation of natural environment in that area and requested them to review their case.

Organisational Setup, its Role in Maintaining the Sustainability of the Movement

The MFCS as mentioned earlier, started with six board members and 53 associate members in 1961 and now has more than 250 members and 483 workers. The society is very much organised with a democratic set up. All its affairs, right from day to day chores to accounting are managed by the members and all its problems are being sorted out in a participatory manner. But again like most organisations, only about one fifth of the members played an active role in determining the society's future. The rest just 'chip in'. The women counterparts of the members also have very little or no say in the running of its affairs.

There are about 14-15 women members in the society at present. As stated above, these members have little say in the society's affairs. They are mainly involved in cleaning the nature park, clearing the weeds from the fields, taking care of the plantation. Some of them have been trained to run poultry farms and one of them also helps in the daily accounting of the society.

Though most of these members are illiterate and only a handful of them have formal literacy, with the help of Dr. Ghosh and Mr. Roy Chowdhary they are at present well versed about their work, its environmental importance and future impact. While scientific knowledge has been imparted by both these people,

their sheer struggle for sustenance has empowered them to fight for their own issues. As the whole issue of wetlands was being advocated initially by Dr. Ghosh and later on joined in by various individuals and organisations, which have utilised their skills to highlight their case, they did not build enough skills and systems within the cooperative to continue with the struggle. The lack of in-house capacities is now being the major hurdle for the sustainability of the campaign.

In recent years, it has been observed that in their dealings with the press, the Mudialy Fishermen have shown sufficient capability and the majority of the public is impressed by their achievements.

Advocacy Management and Sustainability

The MFCS has maintained a good rapport with the press and with their nature/eco park, they are maintaining a good and important relationship with the people. They are not only organising seminars/workshops by different environment groups/NGOs at their nature park but also promoting eco-tourism at this park for interested people/students. They are also conducting field training programmes in environmental management with the help of Dr. Ghosh and Paschim Bangal Bigan Mancha and Vigyan Jatha (a forum of West Bengal science clubs/organisations) etc. Every year they are organising the state level wetland day celebration on 16 June at their park along with the fisheries department of West Bengal. This meet enables the MFCS members to voice their views in front of several NGOs, individuals, government officials and media persons which helps them in their campaign. Furthermore, with the help of pamphlets, posters, documentary film (a film directed by Sudipto Sen - *The Other Wealth*) etc., the MFCS members have managed to keep afloat their struggle.

In 1992, the case of Mudialy has been highlighted in a paper on Calcutta wetlands presented at the Ramsar Convention which has been instrumental in making the Government of West Bengal move a petition to the Union Government for the inclusion of East Calcutta wetlands in a Ramsar list of wetlands of international significance.

The MFCS has also been awarded the Indra Gandhi National Prize for Environment for the year 1993.

The success of the MFCS has also led to replicability of the Mudialy system in some more sites within the East Calcutta marshes - one of them being Purba Kali-kata Fishermen's Cooperative Society.

Thus, the MFCS has established itself as the unique success story which has a remarkable impact on the history and development of wetland marshes of Calcutta. The system of conversion and utilisation of sewage and organic waste for the production of fish and vegetables has its imperfections, however, Dr. Ghosh and Mukul Roy Chowdhary have played an important role in helping refine the indigenous technology in a big way.

COMPARATIVE ANALYSIS OF THE CASE STUDIES

The cases documented for the study reflect different kinds of processes related to advocacy. However, a comparative overview of the salient features of the case studies is presented in Table 3.1 along with detailed comparative analysis.

Objectives of the Advocacy

The objective of all the case studies was very clear and well defined as the campaign on Swachh Ganga decided that not a single drop of untreated sewage should go into the Ganga, to protect the city from the hazards of pollution and diseases. The Shahpura Lake campaign also had a clear objective of protecting the lake from the growing vested interests of the land mafia to capture precious land around the lake as well as to improve the ecological status of the lake. The advocacy objective in Mudialy Fishermen's Co-operative Society was primarily to protect such indigenous and unique wetlands as a system of recycling of waste as well as to ensure the livelihood of the fishermen.

Context of Advocacy

The context in which the advocacy has been placed is also quite important to understand its implications. The Clean Ganga Campaign in Varanasi finds itself in a religious-cultural milieu as Varanasi is one of the holy cities for Hindus. Therefore, it was felt that any campaign which did not respect the religious sentiments would not be effective. One can not expect to prevent the citizens of the city from taking a dip in the Ganga on scientific grounds that the river is polluted. The movement has to begin with respect to mother Ganga. Therefore, the Clean Ganga Campaign was based on maintaining the respect for the Ganga and Dr V.B. Mishra, the head of the Sankat Mochan Temple and Professor in Banaras Hindu University along with a few other professors of BHU took a leading role in the advocacy process.

In the Save Shahpura Lake campaign, the context was that the property dealers were gradually becoming more interested in grabbing the precious land around the lake which would have created environmental problems for the recharging capacity of the lake as well as the lake would have become more polluted. Moreover, it was also well understood that improvement in the lake will be possible only through co-coordinated efforts of various departments.

In Mudialy Fishermen's Co-operative Society also, the co-operative members were beginning to understand the growing interests of the Calcutta Post Trust for grabbing the wetland for developing it in an industrial complex for their own expansion plan. The government on the other hand showed little interest in protecting the wetlands, and in other wetland areas proposed several "development" plans to nibble away the already shrinking marshes. The implications of such initiatives were realised by the NGOs involved in the movement in terms of hazards of accumulation of waste in the absence of such a fine system of waste recycling in the wetlands.

Women's Role in the Advocacy Process

In all aspects of development we leave behind the women to manage their own chores, therefore, advocacy processes are no better examples of the situation. In advocacy or movement oriented programmes particularly, the women are either used as a protection wall to prevent atrocities of the bureaucracy/police or are kept at low decision making positions. It is commonly observed that in delivery oriented programmes provision of safe water and sanitation, education, income generation etc women's representation is fairly large. It is commonly observed that, in movement or advocacy oriented programmes which do not specifically focus on women, their active involvement is not significantly observed due to the very nature of their direct confrontation with the state power. However, these cases reflect certain elements of women's participation in the advocacy process.

In the Clean Ganga Campaign the core team at the Sankat Mochan Foundation is dominated by men. In this campaign, an old lady freedom fighter of the city provided leadership to the women's wing of the movement. However, various girls' schools were involved with the campaign and girl students of these schools were sensitised on various environmental issues. These girls in turn performed various cultural programmes such as dancing, painting, creative writing on the Clean Ganga Campaign for sensitising people on urban waste management issues, growing pollution in the Ganga and its impact on the city environment.

In the Save Shahpura Lake campaign also, the leadership was with the male youth under the guidance of senior male citizens of the city. However, when the campaign started demonstrations at the lake and involved school children for removing wildy growing hyacinth in the pond, a lady school teacher took the leadership in mobilising children from her own school as well as from other schools.

The then chief secretary, who was a woman, also provided full support for the cause and facilitated formation of a co-ordination committee to improve the surroundings of the lake.

In Mudialy Fishermen's Co-operative Society also the movement was visualised for the families of the fishermen rather than the fishermen alone. Therefore, women also participated in the process. The society has about 14 women members. Apart from helping in the maintenance of the nature park and taking care of the plantations, some of them are also involved in poultry farming and in maintaining the daily accounts. In PUBLIC and other organisations supporting protection of wetlands, a considerable number of women of various professions participated in the advocacy process.

Advocacy Processes and Instruments Used

The advocacy process in Save Shahpura Lake was initiated on the event of the "mass fish kill" in the lake which had aroused

the residents of the city to action. Whereas in the case of the Clean Ganga Campaign, gradually increasing visible pollution was alarming a number of people. The Foundation took a lead and published a few articles on the deteriorating condition of the Ganges in Varanasi.

In the case of Mudialy Fishermen's Co-operative Society also the process of advocacy for the protection of wetlands was started when people associated with the development of wetlands were able to understand the threat on these natural waste recycling systems, as, between 1960 and 1980, the wetlands decreased from 250 hectares to 80 hectares in the Mudialy area and from 18,000 hectares to 12,000 hectares for the overall wetland area of East Calcutta. It happened partly because of conversion of wetlands into housing colonies (e.g. Salt Lake) by the government and industrial sites by the Calcutta Port Trust Authority. The battle was started by Dr. Ghosh alone about a decade back to make the authorities realise the importance of wetlands for the sheer existence of the city.

In the Clean Ganga Campaign, the major instruments used to highlight the issue was to approach the highest centre of power that is, the Prime Minister with a memorandum to make the Ganga as a priority in development programmes. Moreover, at the local level, Clean Ganga Campaign organised a large number of activities with volunteers who also maintained pressure on the local bureaucracy and urban administration to ensure proper implementation of Phase I of GAP. The Regional Taskforce was an important platform where the campaign influenced various policy decisions and also the process of implementation.

In the Save Shahpura Lake campaign, the media became an important instrument to sensitise people and the administration on the growing hazards of pollution in the lake. Later, demonstrations on the lake and voluntary action for removing the hyacinth from the lake became a major strength of the movement. In the Coordination Committee, set up by the government on the lake, the secretariat played an important role to influence decisions in favour of the people and the lake.

Mudialy Fishermen's Co-operative Society realised that the forces having vested interests on the wetlands are many and they are powerful vis-a-vis the co-operative's strength which is not sufficient enough to organise protests against them. Therefore, MFCS requested support from Dr. Ghosh. Initially PUBLIC also supported them to file their case on the unlawful eviction notice issued by Calcutta Port Trust in the High Court. This external support was necessary for MFCS for maintaining pressure on the bureaucracy to protect the wetlands.

Major Factors in Promoting Advocacy

The advocacy processes that have been undergone in these experiences reflect certain positive and negative elements. Both sides of the coin have to be highlighted to build an objective understanding on the potential and limitations of advocacy.

Positive Factors

The positive factors that have emerged from the case studies in terms of advocacy management are the following:

- In the Clean Ganga Campaign, the Sankat Mochan Foundation functioned as a nodal organisation for the movement. It sustained its activities involving a large number of professionals and young volunteers. Moreover, the core group involved in this movement functioned as a team. The professionals in the field of hydrogeology and civil engineering were actively associated with the campaign.
- In the Save Shahpura Lake campaign, there was an involvement of a cross-section of people, scientists, professors, bureaucrats, executives in the public/private sector and youth. There were three organisations which provided an institutional base to the movement and the Youth Hostel functioned as the nodal NGO of the movement. The schools were strategically involved to make it a more people oriented campaign.
- The Mudialy Fishermen's Co-operative Society in Calcutta shows that initially Dr. Ghosh, the Ex-Executive Engineer of the CMWSA (Calcutta Metropolitan Water and Sanitation Authority) was the man behind experimenting in the wetlands to refine it as a system of waste recycling. Dr. Ghosh started the advocacy process alone to convince the government about its utility, thus stopping its further encroachment. Gradually, a large number of organisations joined the movement. Moreover, Mr. Roy Chowdhary who was assisting the co-operative on behalf of the Department of Fisheries also joined hands with the movement and took the initiative in developing various methods of pisciculture in the recycled water. This experiment linked these fishermen with the movement as it was a source of their livelihood.

Negative Factors

Some of the negative factors that have affected the advocacy to play its role at the optimum level are the following:

- In the Clean Ganga Campaign, the core team involved in advocacy functions supports it on a part-time basis as they are the faculty members of Banaras Hindu University (BHU). Moreover, the other volunteers associated with the movement are also providing their limited time owing to their own commitments. As a result, there is no long term planning for the movement. This part-time involvement has affected systematic follow-up on the issues and interventions related to Ganga Action Plan Phase I. The documentation within the secretariat of various processes is rather weak. The campaign could not

utilise the media to the fullest advantage as there appears tremendous reporting on the Ganga Action Plan, but there is very little coverage on the Clean Ganga Campaign

- In the Save Shahpura Lake campaign, the issue was broadbased namely, the protection of lakes. However, the focus remained restricted to only one single lake, Shahpura Lake. As a result, the campaign lost its momentum soon after the beginning of interventions on the lake under the direction of the government and Environmental Protection Co-ordination Organisation (EPCO). Moreover, the organisations concerned could not maintain good trust and co-ordination as for each one of them the credit for the action started by the campaign was becoming more important than the action itself
- In the Mudyaly Fishermen's Co-operative Society (MFCS) case it was realised that the movement was much dependent on a single instrument, the writ petition in the High Court. Moreover, there was more than enough dependence on individuals such as Dr. Ghosh and Mr. Chowdhary and organisations like PUBLIC, Paschim Banga Bigan Manch who were supporting the case on behalf of MFCS. Gradually, the differences with PUBLIC grew and affected the process to a great extent

ACHIEVEMENTS AND FAILURES

The achievements and failures of the three experiences can be expressed in the following manner:

Major Achievements

The major achievement of the Clean Ganga Campaign can be stated in terms of a national level programme known as the Ganga Action Plan. This plan proposed several measures for the Ganga near Varanasi and more particularly two sewage treatment plants were proposed for the city. The Foundation was represented in the Divisional Taskforce on the Ganga Action Plan headed by the Commissioner of Varanasi.

In the Save Shahpura Lake case, the campaign could bring about significant changes for the improvement of the lake. The co-ordination committee which was set up specifically for the Shahpura Lake developed a joint action programme involving various departments such as PHED, Fisheries, EPCO, Urban Development etc. and NGOs. The lake at present is clean and its surroundings are developed as a park for the citizens of Bhopal. The plan of interventions suggested by the secretariat of the campaign was accepted and incorporated in the proposal for improving Shahpura Lake.

The Mudyaly Fishermen's Co-operative is a unique example of livelihood creation out of recycled water. These ponds fetch

about 300 tonnes of fish every year. Besides, these wetlands produce large quantities of vegetables and forest products (like timber). The public interest litigation suit filed to protect the wetlands by prohibiting any further construction on the wetlands was decided in favour of the issue. The court ordered a permanent stay on any construction on the wetlands. It is a multipronged struggle and it at present continues with the support of many organisations. The proposed eviction of MFCS from the wetlands by the CPT is also under stay by the order of the High Court.

Major Failures

The major failures of the cases documented here can be presented in the following manner:

The major failure of the Clean Ganga Campaign can be mentioned in terms of its weak intervention by the campaign secretariat in getting Phase I of the Ganga Action Plan properly implemented. The campaign registered several complaints and protested to make it a people's programme, however, much change could not take place in the implementation process of Phase I.

Mr. M.C. Mehta filed a public interest litigation with the argument that Phase I of GAP could not deliver the goods, therefore, any activity under Phase II should be completely stopped. There was no coordination of Mr. M.C. Mehta with the Clean Ganga Campaign and Mr. Mehta argued the case on the basis of data he had collected himself. However, this writ favoured the campaign and the Clean Ganga Campaign took a different turn. The campaign was strengthened to prevent any action under Phase II of GAP and was actively involved in formulating Phase II of GAP.

The Save Ganga Campaign could not visualise its long term vision owing to the part-time involvement of the core team. Therefore, the secretariat and activities of the campaign reflected short-term planning of the campaign/Sankat Mochan Foundation.

The Save Shahpura Lake campaign could not follow up the corrective measures taken up by the concerned department, actively participating in the process. As a result, various measures related to control of flow of the waste water in the lake could not be fully controlled.

The campaign could not keep the issue of the improvement of the lakes in and around Bhopal alive, which should have been a broad mission of the campaign secretariat to sustain their activities for an environmentally cleaner and better Bhopal city.

The Mudyaly Fishermen's Co-operative Society could not build in-house capacities to carry on the movement. The organisations which were involved with the movement primarily utilised their skills to highlight the case of MFCS. However, no efforts have been made to build skills and systems within the co-operative to continue with the struggle. The threat and insecurity that the

wetlands can be at any time captured either by the Calcutta Port Trust or the government is still alive.

BEST PRACTICES EMERGING FROM CASES

Understanding of Environment

It is important that the organisations involved in urban environmental advocacy should understand the context and environment in which the advocacies are placed. It helps in making the effort relevant and understanding the dynamics and implications of it in a proper perspective.

In the Clean Ganga Campaign, understanding of the context and environment was much clearer in the minds of the leaders associated with it. The Ganga has a significant religious value for Hindus and Varanasi is an important sacred town for them. Therefore, the issue needed a relationship with the religious sentiments. The people of Varanasi were not prevented from bathing in the Ganga at Varanasi but were sensitised on the issue that our mother Ganga is getting polluted everyday and we have a responsibility to protect it from any further pollution. Therefore, the mass support in favour of the campaign could be organised. Various artistes who are sentimentally attached to the Ganga performed organised programmes with songs, plays and paintings. To initiate a process of sensitisation merely stating the fact that the Ganga is not pure therefore, nobody should bathe in it could not have generated enough support to make it a national level campaign.

In the Save Shahpura Lake case also the understanding of the environment was that the private contractors were getting interested in grabbing the land around the lake. Moreover, the government was not giving adequate attention to the improvement of the lake as it involves co-ordination of various departments. Therefore, involvement of citizens and resident bureaucrats in the process was imperative. As a result, the movement focussed its attention on organising demonstrations on the lake only on the weekends to gain support of a large number of middle class people mostly working with the government or employees in the public/private sector.

In the Mudialy Fishermen's Co-operative Society also, the people concerned with the environmental issues were understanding the decreasing size of the wetlands owing to construction of housing colonies and other developments. On the other hand, Calcutta Port Trust, which was leasing wetlands to the MFCS was extending the lease on half yearly/yearly basis to make them operate in complete insecurity. CPT was also interested in taking back their land realising the value of the land for themselves. Therefore, the concerned organisations were able to understand the context to protect the interests of MFCS as well as the wetlands.

People at the Centre

The case studies reflect the fact that in all the three experiences it was attempted to keep the affected people at the centre. In

the Clean Ganga Campaign, the citizens of the city who bathe in the river every day as part of their daily ritual, their attention had drawn through various cultural programmes to become part of the movement. However, active involvement and leadership remained with the core team constituted by a few scientists of the university and a group of volunteers from schools/universities and other professions.

In the Save Shahpura Lake campaign also the major concern for the protection of the lake was expressed by the voluntary agencies actively involved by highlighting the issue in the newspapers. Gradually, the residents living close to the lake were mobilised to take active part in the demonstrations. However, the major advocacy functions were performed by the secretariat and the professionals of the voluntary agencies.

The struggle for the protection of wetlands was initiated by a single person and carried out by him for at least ten years to convince the government about the importance of wetlands. Later PUBLIC also joined the advocacy at an institutional level by filing a court case in the High Court to protect these wetlands. With the growth of fish production and when the fishermen also convinced because of their stakes in the wetlands, it became a people's movement. In the Mudialy Fishermen's Co-operative Society case also, major advocacy functions were performed by outside organisations such as PUBLIC, Pashchim Bangal Bigan Manch and the West Bengal fisheries department. It is interesting to note that a government department also favoured the movements as their stakes were also involved in this issue.

Instruments of Advocacy

In the three selected cases documented here, there are certain instruments of advocacy which have been used either strategically or in the process of protest, based on the situations in which they found themselves.

In the Clean Ganga Campaign to highlight the issue and sensitise a large number of people, various activities such as, Kavi Sammelan, classical music programmes, performance by folk artistes were organised. It helped the movement get support from a large number of like-minded persons from various fields.

In terms of focus, the Clean Ganga Campaign forwarded its memorandum to the Prime Minister to highlight it as a national level issue. Moreover, alliances with various like-minded Ministers and leaders were sought in order to sustain the momentum of the protest at the government level. Mr. Digvijay Singh, the present Chief Minister of M.P. was one of the supporters of the campaign.

The campaign also capitalised on the relations with professionals and environmentalists known to Mr. VB Mishra, being a professor at the BHU. Therefore, various articles were published in international newspapers, journals and BBC also prepared a documentary film on the issue. The Friends of the

Ganga in Canada and Australia also sustained activities in favour of the campaign, highlighting the issue at the international and national levels

The local media/press was not strategically utilised; however, various articles/news items were published on the Ganga Action Plan but there was very little coverage on the Clean Ganga Campaign and its objectives. Local newspapers and other state level papers provided adequate coverage on the activities of the campaign.

The Clean Ganga Campaign also utilised their professional competencies of testing and interpreting various indicators reflecting the level of water pollution in the Ganga. These data questioned the interventions undertaken under GAP. The GPD after confrontation accepted the authenticity of the data provided by the campaign

In the Save Shahpura Lake case, the major instruments for highlighting the issue were to create friends in the press who could write articles on the deteriorating condition of the lake. These articles were published in vernacular as well as in national papers in English

The other instrument used by the campaign was to involve the local people and students to initiate weeding out the hyacinth on a voluntary basis. This demonstration of a large number of citizens cleaning the lake drew the attention of the local bureaucracy and a coordination committee was formed to ensure necessary corrective measures.

The Mudiya Fishermen's Cooperative Society primarily, depended on public interest litigation, therefore, a writ petition was filed in the High Court to prevent any further development. The MFCS has tried to maintain good relationship with the press and the people through their nature/eco-park. MFCS has not only organised seminars/workshops by different environmental groups/NGOs at the nature park but also promoted eco-tourism to sensitise people on environmental issues. Every year they organise state level wetlands day celebrations on 16 June at their park to voice their view in the presence of government officers/NGOs, individuals and media persons to sustain the issue.

Organisational Structure and Networking

All the three advocacy processes took place under certain organisational banners which has been considered as a major strength for institutionalising and sustaining the protest.

The Clean Ganga Campaign decided that the Sankat Mochan Foundation will be the secretariat of the campaign. A team of professionals was responsible for the overall management of the secretariat with clear-cut responsibilities. The secretariat created a team of volunteers who used to perform various functions related to the campaign. The major networking relationship has been with various departments involved in the implementation along with the Ganga Project Directorate.

In the Save Shahpura Lake campaign also, the Youth Hostel functioned as the secretariat of the campaign. The secretary of the Hostel along with a few active members managed correspondence, meetings and studies. The major networking relationship of the secretariat was with the other two organisations in Bhopal namely, the Society for Environmental Conservation and the National Centre for Human Settlements and Environment (NCHSE). The three organisations complemented each other. The campaign management and action programme were looked after by the youth hostel, technical studies were conducted by the Society for Environmental Conservation and NCHSE provided overall leadership and managed the bureaucracy in coordination meetings.

The Mudiya is a cooperative of fishermen therefore the organisational structure is established accordingly. However, the core team of MFCS maintains rapport with Dr. Ghosh for taking his help on the issue of wetlands and also for understanding technical issues. Mr. Roy Chowdhary is particularly deputed with the MFCS to help them improve pisciculture. The MFCS functions as a platform for various advocacy processes, therefore, it invites the forum of NGOs for discussion on the environmental issues. MFCS also invites the other fishermen from the wetlands either registered as a cooperative society or otherwise to share the concern as well as to broaden their base for effective advocacy.

SKILLS IN ADVOCACY

The skills in advocacy have various dimensions. In any advocacy doing skills, people related skills, knowledge related skills, system related skills; are essential. Some of the distinctive skills which are available in the experiences can be presented in the following manner:

Scientific Knowledge

In all the three experiences, there was a strong element of scientific knowledge which was used as a powerful instrument to reveal facts for the people as well as power centres.

In the Clean Ganga Campaign, there were three professors, Dr. VB Mishra, Dr. SN Upadhyay and Dr. SK Mishra who are specialists in hydraulic engineering, chemical engineering and civil engineering respectively. These members conducted various studies on water quality and pollution level and revealed various factors related to the deteriorating condition of the river. The Foundation is also skillfully managing a very sophisticated lab which provides accurate data on multiple indicators to measure the pollution level in the Ganges water. The data are analysed at the laboratory and also shared with the concerned authorities and departments.

In the Save Shahpura Lake campaign also, soon after the mass fish kill on 10 May 1992, the Society for Environmental Con-

servation conducted a study on the limnological status of the lake. The data and analysis were shared with the people and such scientific facts were helpful in mobilising the people. Similarly, NCHSE also constituted a team, which surveyed the surrounding areas and source of contamination. The survey report was helpful in drafting a charter of demands for its consideration by the government.

With the Mudialy Fishermen's Cooperative Society, two of the experts, Dr. Ghosh, Ex-Executive Engineer of CMWSA and Mr. Mukut Roy Chowdhary, government officials from the Department of Fisheries were associated, therefore, various technical reports on the mechanism of waste recycling by the wetlands were published. The scientific knowledge about toxicity, BOD context has been imparted to the MFCS members by them as well. The CPT asked NEERI to conduct a study on the toxic level in the water being used for the pisciculture and concluded that the fish of the MFCS were not fit for consumption due to high toxic level. The Secretary from the fisheries department quoted the same data of the NEERI and proved that the toxic level was within the permissible limit.

Media Management

The case studies developed on three different experiences do not reflect any specific focus on media management. However, the Save Shahpura Lake campaign consciously decided to use the media for highlighting the issue at the local level. The core group of the campaign identified their journalist friends and with their help expanded relationship with other journalists. In almost all Bhopal newspapers and those published in Madhya Pradesh there was regular reporting of developments of the campaign. The Save Shahpura Lake campaign also prepared more interesting articles on the lakes around Bhopal and highlighted the issues of concern in the national newspapers *Sunday Mail* and *Indian Express*.

The debate on the use of an insect that eats up the hyacinth was also carried out in the newspapers when the government decided to use a particular kind of fish which will eat up the hyacinth from the lake. The secretariat of the Save Shahpura Lake campaign opposed this genetically engineered micro-organism (GEMS) process and published several articles in the newspaper regarding its long term effects. The NCHSE took a lead role in pursuing the matter with the government. This helped in building a common understanding on the issue and finally government decided against the fish to control hyacinth growth.

In the Mudialy Fishermen's Cooperative Society case the major lead in publishing articles in newspapers was managed by the organisations involved with it such as, PUBLIC and the forum of NGOs. Gradually, the member of MFCS have also started dealing with the press to provide them scientific and truthful information to strengthen their fight over the issue. A documentary film *The Other Wealth* has been prepared by Sudipto Sen on MFCS recently.

Style of Organisation

It is also useful to understand the style of organisation of the three experiences. The Clean Ganga Campaign is operated through the Sankat Mochan Foundation which is a registered society. The secretariat has its own office with necessary arrangements for meetings. The water quality testing lab is also established near the office of the Foundation, therefore, the concerned members look after the activities of the Foundation as well as that of the lab. Because the laboratory demands regular monitoring of data, the core team members visit the laboratory and the Foundation everyday.

The team has a clear cut division of responsibilities. Mr. SN Upadhyay, who is a chemical engineer, looks after the laboratory for monitoring and analysing the data on the water samples collected from upstream and downstream at various points in a day regularly.

Prof. VB Mishra who is the leader of the group participates in meetings, prepares write-ups for circulation and publication. Prof. Upadhyay develops rapport with the experts, professionals, bureaucrats, politicians to utilise their services for the campaign.

Prof. SK Mishra is a civil engineer, therefore, all possible planning for interventions related to disposal of sewage downstream becomes his responsibility. The Clean Ganga Campaign suggested various alternative methods of sewage treatment conducting studies and surveys.

The arrangements at the Foundation in general are informal, however, great respect is given to Prof. VB Mishra as a teacher, leader and also as a Mahant or trustee of the Foundation. There are a few regular staff such as water analyst in the laboratory, otherwise most of the members associated with the campaign come over to the secretariat in the evenings. The motivation level of the volunteers and team workers is quite high. It was mentioned that often they had to spend sleepless nights to organise the activities of the campaign.

The Save Shahpura Lake campaign's secretariat was the Youth Hostel of Bhopal. The Youth Hostel itself is an organisation of volunteer members who are young and employed. All correspondence was initiated from the secretariat. The secretariat maintained proper files to keep the records of the letters issued/received as well as copies of the survey/technical reports and news clippings on Shahpura Lake.

The secretariat was primarily managed by one person Mr. Vivek Sharma who was the Secretary of the Youth Hostel and was an employee of the NCHSE. Mr. Sharma was also a close member of the Society for Environmental Conservation, therefore, could ensure coordination among the three organisations utilising their expertise in favour of the movement.

The style of operation of the secretariat was in the form of networking, expanding the base of volunteers in favour of the campaign.

The Mudialy Fishermen's Cooperative is an example of cooperative efforts where there are about 250 members and 483 workers. The workers of MFCS operate in a participatory and democratic manner.

However, the active role in this movement has been played by not more than one-fifth of the membership. The office of the cooperative maintains relationship with the outside NGOs/institutions on the issue of wetlands.

The MFCS members relate themselves very closely with Dr. Dhruvajoti Ghosh and Mukut Roy Chowdhary for any advice on technical issues on wetlands or organisational policy issues.

SYSTEM IN ADVOCACY

Systems in any sustained activity become important for enhancing efficiency as well as to become well equipped to face any kind of situation. Therefore, it would be relevant to analyse some of the systems organised under these experiences.

Data Management System

The data management of the Clean Ganga Campaign particularly related to water quality for a long period of time is a repository of information. This data base provides enormous potential for analysis of growing levels of pollution from various angles. The SMF also maintains data about its activities, visitors and major programmes organised etc. There is an annual report of the SMF for the year 1990 which provides details of the activities. There is a small library which keeps all related documents and reference materials.

The laboratory has been equipped with a computer, however, it has not been used for general day to day management. It is used for the water quality data storage and processing.

It is realised by the core team members that the campaign could not systematically document the processes, socio-political dynamics and role of the Swach Ganga Campaign. The system of data management also needs to be more scientific and properly organised.

The secretariat of the Save Shahpura Lake lived a very short life as after the takeover of the lake for improvement by the government, it ceased to operate. Therefore, the files related to the Save Shahpura Lake moved with the Secretary of the Youth Hostel. There is a record of the people who volunteered their services at the lake as a demonstration of protest, however, this record is also not systematically kept.

The Mudialy Fishermen's Cooperative Society keeps the data related to fish catch, sale and profits. They have also listed the total number and varieties of flora and fauna of their nature park. The other data pertaining to scientific/technical issues and other issues of wetlands are with Dr. Ghosh and Mr. Chowdhary. The NGOs involved with this movement also

maintain documentation regarding this issue. The information related to technical studies and various advocacy processes are maintained with Dr. Ghosh or is available with the forum of NGOs.

Organisational Management Systems

The organisational management systems in the cases of the Clean Ganga Campaign and Save Shahpura Lake are quite poor. This has happened primarily due to part-time involvement of the core team in the Clean Ganga Campaign (CGC) and short-term objective in the case of Save Shahpura Lake (SSL). There is no permanent staff in both the cases, therefore, there is limited vision for skills upgradation. There is no representation from the social science stream within the secretariat. The members of CGC had visited the wetlands of Calcutta and met Dr. D Ghosh to understand the possibility of its replication in Varanasi. Such exposure visits helped the team to broaden their knowledge base and perspective.

The CGC has a medium term plan to initiate training for schools, voluntary agencies on environmental issues; however, proper planning has not been done for that. Therefore, more organisation specific management systems will be necessary to run regular training programmes. Staffing, training and fund raising will become important areas of system development.

The Mudialy Fishermen's Cooperative Society largely focuses its management on fishing and related activities for their livelihood. The cooperative functions in a democratic manner; however, the elected executive members look after the administration and accounts.

Knowledge Related Systems

The knowledge related systems in advocacy would primarily mean that the secretariats of the campaigns could build a base of knowledge in a system which could be useful for any further study as well as to be used as an instrument in advocacy.

The Clean Ganga Campaign is a good example of maintaining knowledge related system. The Clean Ganga Campaign conducted various research studies on Ganga which were published and utilised to strengthen their stand on the issue. The Clean Ganga Campaign also organised national and international level seminars to share the knowledge as well as to get external insights on the issues. A number of eminent environmentalists, nuclear scientists and other professionals were invited to conduct studies or to interpret the data and studies conducted by the CGC. As a result of a strong knowledge related system CGC prepared a note on the technological options available around the world for sewage treatment and their viability in the local context and their cost effectiveness.

The Save Shahpura Lake campaign could also build a knowledge based system by inviting interested organisations to conduct studies on the status of the lake. Moreover, the Society for

Environmental Conservation had a team of experts in limnology, therefore, the system was established at that level. The society conducted various surveys on this lake as well as other lakes near Bhopal on diversified issues to broaden their knowledge base. One such study entitled "Hydrobiological Survey of Some Habitats of Migratory Wetland Birds in and around Bhopal" was conducted by the society on behalf of the MP Council of Science and Technology. Similarly, a couple of other studies on other aspects of the lake were conducted to strengthen their knowledge related system.

The knowledge related systems of Mudiya Fishermen's Cooperative are relatively action oriented. Mr. Mukul Roy Chowdhary developed an indigenous system for pisciculture utilising the recycled water, however, retaining rich nutrients for pisciculture. This method was found quite successful as the yield per hectare jumped almost five times. Dr. Ghosh conducted studies on the importance of the wetlands and recycling of the wastes and published technical papers on the wetlands' issues.

The MFCS fishermen are also well acquainted with the scientific knowledge of the toxicity level of the water, BOD content, and the indigenous methods of reducing/treating them, primarily owing to the efforts of Dr. Ghosh and Mr. Roy Chowdhary.

The MFCS members also invited several nature club/environmental groups to hold seminars/talks on the issues of wetlands and its eco-system. The West Bengal Science Forum is one of them. They also conduct eco-tourism, a familiarisation with the ecosystem and diversified flora and fauna of the wetlands for school children's nature clubs and interested individuals/institutions in their nature park.

SUSTAINABILITY AND REPLICABILITY ELEMENTS

The advocacy processes undertaken in these three experiences, also have some elements of sustainability and scaling up. Analysis of such elements will help develop more relevant programme design and support services to strengthen civil society movements in the urban context on a wider scale. Some of the elements have to be put under the following:

Issues and People's Role

In terms of the issues decided by the secretariats of movement have significant relevance in their local context. The issue of prevention of untreated sewage disposal into the Ganga near Varanasi has a specific relevance in the urban context considering a sizable number of citizens of Varanasi and a large number of religious tourists bath in the Ganga at Varanasi. The existing drainage and sewer disposal system are also need not only repair but major improvement to cater to the growing needs of the city and to provide a cleaner environment to the citizens of Varanasi.

The campaign has been able to involve a large number of

citizens of the city to take active part in the advocacy. Moreover, most of the important professionals, and eminent citizens of the town are associated with it. Therefore, the campaign has a strong element of sustainability as far as issue and people's role is concerned.

In the Save Shahpura Lake Campaign, the issue was local however, restricted to only one of the small lakes of the city. Moreover, the mission of the campaign was also limited, therefore, no strong elements of sustainability can be seen. The people who are most affected by the deteriorating condition of the lake were not at the centre, though they were a part of it. The advocacy process was primarily managed by the professionals of the three organisations actively involved in the campaign. Therefore, the whole campaign cannot be termed as a sound sustainable campaign.

The Mudiya Fishermen's Cooperative Society also has a very specific and clear issue that the wetlands should be protected for the city of Calcutta as well as for the livelihood of the fishermen associated with the wetlands.

It is true that the whole issue of protection of wetlands has been raised by concerned professionals particularly Mr. D Ghosh; however, the MFCS has provided strong support to them. This support provided adequate legitimacy to the movement and advocacy campaign. The movement has sustainable elements, however, the weak capacity of MFCS to handle complex issues related to advocacy prohibit the sustainability in terms of self reliance.

External or Internal Support Inputs

The nature of support provided to the movement also has a significant contribution for the sustainability of the campaign.

The Clean Ganga Campaign is largely dependent on internal human resources and competencies, however, many national and international experts have been associated with the movement. The financial resources running the campaign are from the funds provided by the Swedish Development Agency for the laboratory as well as donations provided to the Sankat Mochan Foundation by the well wishers. The campaign has been offered financial support from various donor agencies, however, as yet they have not accepted any other funds.

The external support to the campaign is primarily in terms of professional guidance and highlighting the issue at the international fora. This support complements the existing inhouse scientific skills available with the team of the Clean Ganga Campaign.

In the Save Shahpura Lake movement, the advocacy is dependent on the local resources for a very local level issue. However, the campaign utilised the professional services of various people from the town who are also residents of the city. The movement, therefore, is dependent more upon internal resources with

relatively small support from like-minded friends in the press, scientists or research scholars of the university.

Mudialy Fishermen's Cooperative Society (MFCS) is an example of external and internal support. The issue of wetlands protection has been raised by many environmentalists and action oriented organisations. However, the inner strength of the movement is the unity of the fishermen and their strong trust in their cooperative. Gradually, the core group members of the society are building their capacities for managing the media, research and the movement. The sustainability of the movement is largely constrained till the time the in-house capacity of the MFCS is built to manage the campaign.

Area Specific/Generalised Advocacy

The advocacy process in the Clean Ganga Campaign is area specific. However, it can have wider implications at the national level. As a result, the Ganga Action Plan does not pertain to Varanasi only but covers all possible cities and towns on the banks of the Ganges. The focus of the advocacy, however, is to ensure proper implementation of the GAP for Varanasi. The campaign representatives take active part in the Divisional Taskforce meetings.

The Save Shahpura Lake campaign has a very specific advocacy process which is limited around the lake of Shahpura. On the other hand, the advocacy processes related to MFCS are area specific, as the advocacy attempts to protect the wetlands of Calcutta. However, the advocacy has taken a national importance due to the issue of protection of a system of waste recycling that has a much broader concern in the urban context.

Potential for Replication

The potential for replication of all the three experiences can be assessed on the basis of the above analysis.

The issue of the Clean Ganga Campaign and Mudialy Fishermen's Cooperative Society have much wider implications for urban planning and management. These two experiences have a higher degree of sustainability, therefore they have strong potential for replicability. The issues dealt with in both the cases have wider implications of advocacy roles as they are influencing the power centres at a higher level namely, the central and state level structures of governance. The clarity of issues, combination of expertise and geographical specificity can be found in both the cases; however with macro issues, the potential for replication has its own limitation.

The potential of the advocacy process for replication in the case of Save Shahpura Lake is limited as it has weak sustainability elements. However, the issue that the lake should be protected and improved has a wider potential for replication for many other areas namely, improvement of parks, drainage system, garbage collection and disposal system etc. because of the very localised and specific nature of advocacy. The potential for

replication of the experience only for the improvement of lakes would be limited.

SOME OTHER EXPERIENCES OF URBAN ENVIRONMENTAL ADVOCACY

With the view to have more diversity of experience in urban environmental advocacy 11 more cases have been documented to build a national level strategy for capacity building and institutional strengthening. These experiences are very significant. However, these have been documented in brief focussing on the issue of advocacy, instruments of advocacy, people involved in the process, its impact vis-a-vis elements of sustainability and replicability.

SALIENT FEATURES OF THE ADVOCACY RELATED EXPERIENCES FOR PLANNING CAPACITY BUILDING STRATEGIES

The advocacy experiences of such NGOs/institutions represent an admixture of different approaches with varied instruments adapted in their advocacy campaign, with different organisational structures and process of networking. It also reflects the nature of skills in advocacy regarding scientific knowledge and establishing advocacy related systems by these organisations.

The tabular analysis of the eleven case studies presented in Table 3.3 highlights some of the above issues in terms of their effectiveness and weaknesses which furthermore can be substantiated in the findings of the detailed case studies in formulating the overall capacity building strategies.

Some of the salient features emerging out of analysis are given below:

The experiences reveal that a number of NGOs have their advocacy campaign limited to specific local issues (as in the case of Kalpavriksh, Exnora, Srishti, RBSS, WBTMU and Nirwana Hakk). Some other NGOs have a diversified range of advocacy issues which they are trying to address at the same time. While in the above mentioned examples, the understanding of the concept of advocacy is somewhat restricted to the campaigning movement, the remaining cases show a lack of proper integration of all the issues and the relevance. Therefore, such cases do not reflect a proper perspective on advocacy in relation with the total urban environmental development.

The processes/instruments of advocacy also vary from information dissemination and mass mobilisation through rallies, demonstrations etc. (e.g. case of RBSS, Nirwana Hakk, INTACH, Kalpavriksh) to filing public interest writ petition and litigation on the behalf of the affected groups (e.g. PUBLIC, INTACH, WBTMU) or through media campaigns like INTACH, WBTMU, RBSS and PUBLIC. While in almost all the cases the leadership of the campaign has been maintained by the concerned NGOs, only a few have reflected delegation of responsibility to the community vis-a-vis their empowerment so

as to give the advocacy campaign a sustainable character (like that of BCC, Exnora, Unnayan, Nirwana Hakk). The lack of proper efforts in building a second line of leadership and strengthening the local groups result in failures in sustainability as well as replicability. This is reflected in the case of Unnayan (Chinnamed Srmjibi Adhikar Samiti) whereas proper capacity building and training inputs contribute to the effectiveness as reflected in the cases of BCC (United Way, Exnora (Civic Exnora) and Nirvana Hakk Suraksha Samiti (Footpath Vasi Kruti Samiti)

While networking with other NGOs/institutions and forming a forum for a group effort in the advocacy campaign is reflected in the case of PUBLIC, INTACH, Kalpavriksh, Unnayan, BCC, Nirwana Hakk, Srishti and WBTMU which affected their success in sustainability as well as in their replicability, cases like Exnora and RBSS show relatively little interaction with the other like minded groups. Nevertheless, almost all of these cases reflect limited skills in managing advocacy effectively owing to their limited exposure and orientation.

Apart from a few cases like that of PUBLIC, INTACH, Unnayan, Srishti and Kalpavriksh, the other NGOs/institutions have not directly been involved in conducting or organising scientific research or using it for their advocacy. Thus, the basic strength of advocacy is not substantiated by ample scientific knowledge as reflected in several of their issues. Furthermore, the lack of sensitisation on people's knowledge as an important source of empowerment is also evident in the case of Exnora, Srishti, BBC, WBTMU. Managing or using the scientific knowledge and research findings for strengthening the advocacy is also an important factor which has also become evident from the above cases.

Similarly, the lack of advocacy related systems regarding formulation of documentation/information system base, proper organisational/institutional management, proper institutionalisation of the processes is evident in almost all the cases which further affected their advocacy process. Except that of PUBLIC, INTACH, Kalpavriksh, BCC and to some extent Unnayan, none of the other NGOs have been able to develop any substantial advocacy related systems. The need for the systems illustrated in the strategic planning in the pre-

vious chapter is further being substantiated by these above cases.

To summarise the analysis of such diverse experiences, the following can be mentioned:

- There is a need to build the perspective of NGOs involved in advocacy on relevance and effectiveness of such an important instrument of protest
- There is need to enhance capacities of the staff of the NGOs on various forms and instruments related to advocacy, movements and campaigns.
- The need for scientific research to strengthen the position taken up by the NGOs is an important area of sensitisation. It will help NGOs to either build internal capacities or look for meaningful collaboration with experts or organisations.
- Weak systems and poor data base also influence NGOs to play advocacy roles more effectively as most of the rich experience remains unutilised for strengthening their position or for its sharing with the other likeminded groups in a strategic networking relationship.

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TABLE 3.1

COMPARATIVE ANALYSIS OF THE CASE STUDIES

Clean Ganga Campaign, Varanasi

| OBJECTIVE OF THE ADVOCACY | CONTEXT OF ADVOCACY | ADVOCACY PROCESS/ INSTRUMENTS | FACTORS IN THE EFFECTIVENESS | |
|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | | POSITIVE | NEGATIVE |
| To prevent untreated sewage disposal in Ganga at Varanasi and proper management of sewage within the city. | Varanasi is an important religious city for Hindus. Thousands of residents and visitors bathe in the holy Ganga every day. Therefore, the secretariat demanded that untreated disposal of sewage in Ganga should be stopped. | <ul style="list-style-type: none"> ● Memorandum to the Prime Minister for providing high priority to Ganga cleaning. ● Awareness among citizens/ students on environmental issues/to broaden the base for movement. ● Technical studies on water quality. ● To challenge government's data on pollution levels in Ganga. ● Organised a public hearing on environment development at Varanasi. | <ul style="list-style-type: none"> ● Sustained activities through a large base of professionals/ volunteers. ● Secretariat functioned as a strong team. ● In-house expertise on water analysis, civil engineering and various other technical areas | <ul style="list-style-type: none"> ● Team of part-time workers restricts long term vision. ● Use of limited instruments of advocacy to highlight the issue. ● Poor documentation of process within the secretariat to be utilised for effective advocacy and experience sharing. |
| WOMEN'S ROLE | ACHIEVEMENTS | FAILURES | SUSTAINABILITY/ IMPACT | REPLICABILITY SCALING UP |
| There is a women's wing of the campaign and an old freedom fighter took the leadership. | <ul style="list-style-type: none"> ● Government announced GAP on the basis of memorandum submitted by the campaign secretariat. ● Questioned the authenticity of data on pollution in Ganga through their own data base. ● Planning for Phase II of GAP with the campaign secretariat for Varanasi. | <ul style="list-style-type: none"> ● Phase I could not be implemented properly even though the campaign was actively involved. ● Long term planning of the campaign could not emerge due to part-time involvement of team ● The campaign could not build a network of NGOs interested on this issue in or around Varanasi. | <ul style="list-style-type: none"> ● The campaign integrated people's participation in a highly target oriented Ganga Action Plan. ● The Phase II or GAP is being developed along with the campaign/SMF. ● More authentic data on the pollution in Ganga is being generated by the campaign. ● Involvement of local people and local resources highlights its sustainability. | <ul style="list-style-type: none"> ● The experiment has a high potential for replication in many other cities being covered under the GAP. |

| OBJECTIVE OF THE ADVOCACY | CONTEXT OF ADVOCACY | ADVOCACY PROCESS/ INSTRUMENTS | FACTORS IN THE EFFECTIVENESS | |
|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | | POSITIVE | NEGATIVE |
| To protect lake from pollution and convert its surroundings into a community recreation centre | Bhopal is a city of lakes therefore, the environment has a significant relationship with the condition of lakes. About 60% of the water supply is through the Upper lake of Bhopal. The growing negligence of the government for the maintenance of lakes and vested interests of the land brokers on the lands around the lake was the context to start the campaign. | <ul style="list-style-type: none"> ● Regular reporting in local newspaper on deteriorating conditions of the lake after the mass fish kill in Shahpur lake ● Demonstration of the citizens of the city on the lake and voluntary efforts to remove the hyacinth. ● Active participation in the co-ordination committee setup by the government on the lake improvement. | <ul style="list-style-type: none"> ● Involvement of cross-section of people – children, youth, bureaucrats, professionals ● Secretariat functioned in a networking relationship with other two NGOs ● Bureaucracy was approached at a very high level. i.e. Chief Secretary of MP was influenced to constitute a coordination committee. | <ul style="list-style-type: none"> ● Weak long-term plan as after improvement in the lake secretariat is nonexistent. ● Due to limited perspective, the advocacy could not bring sustainable change in the context of lake improvement in Bhopal. ● Internal tensions weakened coordination with the secretariat as each of the organisation wanted to steal the show. |

| WOMEN'S ROLE | ACHIEVEMENTS | FAILURES | SUBSTAINABILITY/ IMPACT | REPLICABILITY SCALING UP |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ● Women did not play a major role in the advocacy process. However, a lady teacher was actively involved in mobilising school children for demonstration and action on the lake. | <ul style="list-style-type: none"> ● The advocacy resulted in improvement in the lake as, it has been a good recreation centre for the people. ● Preventive measures have been taken up for not discharging untreated sewage into the lake. | <ul style="list-style-type: none"> ● The campaign could not follow up the corrective measures, therefore, many of the improvements are still pending. ● The movement was short sighted, therefore it lived a short life. There are endless urban environmental problems in the city to be highlighted by the campaign. | <ul style="list-style-type: none"> ● The major impact of the advocacy was that various concerned departments functioned in coordination and improved the lake in the short period of time. ● The people's plan was accepted by the EPCO and it was converted into a formal project. | <ul style="list-style-type: none"> ● The advocacy process has potential for replication in case of other lakes in Bhopal and many other cities in India. ● Higher degree of replicability of experiment is in case of area specific local problems and issues in urban context. |

| OBJECTIVE OF THE ADVOCACY | CONTEXT OF ADVOCACY | ADVOCACY PROCESS/ INSTRUMENTS | FACTORS IN THE EFFECTIVENESS | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | | POSITIVE | NEGATIVE |
| <ul style="list-style-type: none"> ● To protect the largest and finest indigenous sewage and waste treatment and disposal system. ● To protect livelihood of more than 250 fisherman families dependent on the wetlands. | <ul style="list-style-type: none"> ● The wetland are gradually being converted into housing colonies, industrial estates, therefore the natural waste disposal system is in danger. ● The Calcutta Port Trust also wants its leased land back given to the MFCS for the expansion of their own activities | <ul style="list-style-type: none"> ● Dr D Ghose, an ex-engineer with the CMWSA who was convinced on the relevance of the wetlands struggled alone with the municipal administration to get it recognised as a waste recycling region. ● PUBLIC, filed a writ petition for the prevention of any encroachment on the wetlands in Calcutta High Court. ● The fishermen were organised to understand their stakes on the wetlands and were organised as a co-operative. ● MFCS filed a writ petition in the High Court for their unlawful eviction proposed by Calcutta Port Trust. | <ul style="list-style-type: none"> ● A broad issue of wetlands has been taken up for advocacy ● Support of two resource persons who were experts in their area helped MFCS to take a stand on the issue. ● The affected people i.e. the fishermen are at the centre of advocacy | <ul style="list-style-type: none"> ● Due to weak organisational abilities of poor and illiterate fishermen, the dependence on PUBLIC or other voluntary agencies is high ● In the middle of advocacy, PUBLIC drifted away to provide support to MFCS ● The advocacy management remained in the hands of the two resource persons and the forum of NGOs supporting the issues. |
| WOMEN'S ROLE | ACHIEVEMENTS | FAILURES | SUSTAINABILITY/ IMPACT | REPLICABILITY SCALING UP |
| <ul style="list-style-type: none"> ● There are about 14 women members in the MFCS. Moreover, the focus is on the family, therefore, women take part in various activities related to management and movement. | <ul style="list-style-type: none"> ● Protection of wetlands from encroachment by the Government/private builders etc. ● Protection of a fine example of indigenous waste recycling and cooperative effort of livelihood generation for the fishermen from the CPT | <ul style="list-style-type: none"> ● MFCS could not build in-house capacity to carry on advocacy functions. ● The Organisational base of MFCS co-operatives has not been broadened to deal with the issue of the whole of east Calcutta wetlands effectively. | <ul style="list-style-type: none"> ● The experiment has various elements of sustainability as the local people and organisations are involved for the protection of wetlands. ● The major impact of the advocacy process has been that encroachment on wetlands is prohibited by the court order | <ul style="list-style-type: none"> ● Dr. D Ghosh has replicated the MFCS experiment in other parts of the wetland and trying to replicate it in other countries of south-east Asia. ● The information of a cooperative and the success of the MFCS has also inspired a number of fishermen in that region to form and make systematic cooperative movement. |

TABLE 3.2

SALIENT BEST PRACTICES FROM THE CASE STUDIES

| | TECHNOLOGICAL OPTIONS | SECRETARIAT ORGANISATION | SCIENTIFIC STUDIES | ADVOCACY INSTRUMENTS MEDIA MANAGEMENT | SKILLS/SYSTEMS |
|---------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CLEAN GANGA CAMPAIGN, VARANASI | The campaign undertook a through investigation of the available technologies in the world for sewage treatment and suggested alternatives for local adaptability and cost-effectiveness. | Sankat Mochan Foundation created a team of scientists and volunteers to strengthen the movement in an institutionalised manner. | The campaign maintained data on water pollution in a time series manner and questioned the authenticity of data of the Ganga Project Directorate | The campaign utilised the regional Taskforce as a forum to affect changes in the implementation. The international links were utilised to highlight the issue of advocacy at the global level. | <ul style="list-style-type: none"> ● Team of scientists expert in water-related issues and civil engineering aspects. ● Maintain a sophisticated lab for monitoring water quality. ● A small library and rich photo documentation of activities. |
| SHAH PURA LAKE CAMPAIGN, BHOPAL | The campaign prepared a people's plan for the improvement of lake and its surroundings. The plan was given the shape of a project by the EPCO. | Youth Hostel involved the other two organisations especialising the ecological studies and urban planning to strengthen the secretariat functions in a networking relationship. | The secretariat conducted scientific studies to determine the ecological loss in this natural lake and also identified the source of pollution to contradict government's findings on mass fish kill in the lake and work out more practical charter of demands. | The local as well as national newspapers were utilised to highlight the issue. Moreover, it involved eminent citizen viz. senior bureaucrats, scientists, executives etc. | <ul style="list-style-type: none"> ● Team of youth activities, scientist and urban planners in a combination of these organisations. ● Detailed documentation of the correspondences, research studies and status of interventions. |
| MUDIYALI FISHERMEN'S CO-OPERATIVE SOCIETY CALCUTTA | Dr. D. Ghosh and Mr. M. Roy Chaudhary provided alternatives for indigenous recycling of wastage and converting it into rich water for pisciculture in the wetlands. | The cooperative as a cohesive team of fishermen utilised the expert services of Dr. D. Ghosh and Mr. M. Roy Choudhary on the basis of their motivation and commitment for the cause. | Dr. Ghosh presented several papers on the system of waste recycling in the wetlands to make the authorities understand the utility of the wetlands. | Instrumentals used in the advocacy process is public interest litigation filed in the High Court to prevent any development on the wetlands. | <ul style="list-style-type: none"> ● Cooperative of fishermen are learning technical details from their resource persons who are competent in their area i.e. waste recycling and pisciculture. ● The systems on livelihood exist within the MFCs and on wetlands with the resource persons. |

TABLE 3.3

SALENT FEATURES OF THE OTHER EXPERIENCE IN URBAN ENVIRONMENTAL ADVOCACY

| FOCUS OF ADVOCACY/ ADVOCACY CASE | INSTRUMENTS IN ADVOCACY (Media Management/ Technological Options etc.) | ORGANISATIONAL STRUCTURE & NETWORKING | SKILLS IN ADVOCACY (Scientific Knowledge/System of the Organisation) |
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| <p>A. Protection of Environment/Eco System</p> <p>CASE I</p> <p>Urban Advocacy for East Calcutta Wetland - PUBLIC</p> | <ul style="list-style-type: none"> - Public interest writ petition filed by PUBLIC in the Calcutta High Court in February 1992. - The campaign undertook a through study on the importance of wetland and its impact on maintaining the ecological balance of the city. - Campaigning through media highlighting the importance of wetlands through articles reports as well as by issuing newsletters, pamphlets. - The advocacy campaign of PUBLIC is also based on mass mobilisation, awareness creation drive and celebrating Earth Day, Wetland day, Environment day etc. highlighting the issues of Wetland. | <ul style="list-style-type: none"> - PUBLIC is a forum of individuals/ professions concerned with environmental problems and its improvement. - PUBLIC maintains close contact with other NGOs and individuals and exchange ideas/views about the wetland issue. - The organisation also conducts workshop/seminar and touring of wetlands along with interested groups, individuals and concerned institutions like INTACH, USIS etc. | <ul style="list-style-type: none"> - The organisation maintains data, records on the physical coverage of the wetland, recent developments, scientific studies of wetland prepared by scientists like Dr Dhirubajyoti Ghosh etc. and other studies related to recycling and importance of wetland make the authorities understand its importance - The organisation also maintains a through data bank on the existing land use pattern, amount the toxic waste being recycled, nature of flora and fauna present etc. of the Calcutta wetlands. |
| <p>CASE II</p> <p>Save Delhi Ridge Forest Kalpavriksh</p> | <ul style="list-style-type: none"> - Started by an informal group of students and concerned individuals through a campaign. - The major strategy adopted by this group was information dissemination, lobbying as well as campaigning through slide shows, lectures, rallies, formation of nature clubs in the areas as well as in the schools and colleges | <ul style="list-style-type: none"> - The campaign was initially launched by a group of concerned individuals which includes a few college and school students. The amorphous group tuck together with more concerning like-minded people and formed the 'Kalpavriksha'. - The group has also interacted with the local political leader(s) and government official to promote their cause. | <ul style="list-style-type: none"> - School of Planning and Architecture (SPA), has made a detailed study on the land use pattern of the Ridge area which serves as a bench mark survey for the advocacy campaigners. - Kalpavriksha has also published several article including a well-researched document in a form of a booklet on the Ridge. |

| FOCUS OF ADVOCACY/ ADVOCACY CASE | INSTRUMENTS IN ADVOCACY (Media Management/ Technological Options etc.) | ORGANISATIONAL STRUCTURE & NETWORKING | SKILLS IN ADVOCACY (Scientific Knowledge/System of the Organisation) |
|----------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CASE III Environmental Impact of East Coast Road - INTACH | <ul style="list-style-type: none"> - Use of street plays, posters etc. communication strategy to highlight their issues - They also commissioned film/video clips and persuaded Doordarshan to telecast. - The group has been highlighting their cause through articles and other writeup through media which being favourable to this movement from the very beginning also helps in the advocacy process. | <ul style="list-style-type: none"> - Further networking with other organisation/NGOs having interest in environmental issues led to the formation of a NGO forum in 1990 to make the movement more systematic. - The forum has also sought corporate support which helps in meeting the financial expenditure of their campaign. - They persuaded the government to form a committee with the presentation from both the government and the public to draw a 'strategic planning for the Ridge. | <ul style="list-style-type: none"> - They published a citizens' action guide and a complete who's who on Delhi's administration concerned with this 'green' issue, and a complete directory on its urban planning and on the laws and action against environmental crimes |
| | <ul style="list-style-type: none"> - INTACH launched its advocacy against the proposed East Coast road (joining Madras with Pondicherry) initially by information dissemination to the people and conducting study on the proposed project. - They presented their report to the State High Way Department for relevant action but the concerned State Government(s) took no action over this issue. - INTACH joined hands with other NGOs and sought legal action through a writ petition. | <ul style="list-style-type: none"> - INTACH has been in the field of environmental advocacy and promoting its cause in almost every major state of this country. - Regarding this issue INTACH has interacted with the local NGOs like CAG and LRSA etc. to lead this protest movement. - A forum of NGOs/individuals etc. has been formed to continue with this campaign. | <ul style="list-style-type: none"> - INTACH has conducted an indepth study on the possible impact of this proposed project reviewing its viability, cost and social cost-benefit output. - The organisation also has come up with a number of write up/article in the media highlighting their cause. |

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| FOCUS OF ADVOCACY/ ADVOCACY CASE | INSTRUMENTS IN ADVOCACY (Media Management/ Technological Options etc.) | ORGANISATIONAL STRUCTURE & NETWORKING | SKILLS IN ADVOCACY (Scientific Knowledge/System of the Organisation) |
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| | <ul style="list-style-type: none"> - They formed a forum of like minded individual and NGOs to mobilise public opinion against this proposed highway. | | |
| <p>B. Solid Waste Management</p> <p>CASE I</p> <p>Garbage disposal and cleaner urban environmental - <i>Exnora</i></p> | <ul style="list-style-type: none"> - The advocacy campaign is based on awareness generation and creating a need to invest for a cleaner environment. - They emphasised on the formation of local 'self-help' groups in all the residential areas/slums for managing the participatory clean up of their surroundings. - They are also imparting training to the rag pickers and sweepers for sorting out the waste into recyclables, bio-degradable and non-degradable. | <ul style="list-style-type: none"> - The organisation is primarily managed by the Apex Body - The Mother Forum. - The local level management of each specified area is managed by the self-help group or the 'Civic Exnoras'. - This NGO has able to get corporate support in their endeavour and a part of their contingent expenditure is met by their financial support. - They maintained a good coordination with the concerned municipal authorities for the secondary collection of the garbage. | <ul style="list-style-type: none"> - No such scientific documentation/reports has been prepared by them. - Apart from their audits and accounting reports no other documentation is prepared by them. |
| <p>CASE II</p> <p>Experiments in garbage handling for a cleaner city by <i>Srishti</i>.</p> | <ul style="list-style-type: none"> - Initial survey of the areas and mass awareness drive for a cleaner city is the basic instruments of their advocacy campaign. - Their awareness generation drive involves door to door campaigning, meeting and awareness camps along with the residents and through media campaign. | <ul style="list-style-type: none"> - The programme is managed by the NGO's coordinating staffs with the help of the local resident group and identified nodal person. - They have joined hands with another NGO - 'Trees for life' and are promoting Vermicompost Bin' - to tackle the bio-degradable at the sources itself. | <ul style="list-style-type: none"> - <i>Srishti</i> has conducted a study on the nature and composition of the solid waste in some selected localities in Delhi, on the basis of which they have taken up their pilot project. - No other documents/scientific study has been conducted by them. |

| FOCUS OF ADVOCACY/ ADVOCACY CASE | INSTRUMENTS IN ADVOCACY (Media Management/ Technological Options etc.) | ORGANISATIONAL STRUCTURE & NETWORKING | SKILLS IN ADVOCACY (Scientific Knowledge/System of the Organisation) |
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| | <ul style="list-style-type: none"> - They also advocate through their door to door campaign regarding the separation of bio-degradable from the non-degradable waste. - They also promote the use of 'vermi-compost' bin to transform the bio-degradable into compost - The project works through a nodal person identified in that particular locality and a door to door garbage collection system funded by the resident themselves. - They are also imparting training to the garbage collectors to sort out the waste. | <ul style="list-style-type: none"> - They have also coordinated with the municipality for the secondary collection. | |
| <p>CASE III</p> <p>For a cleaner city - The experiments of Baroda Citizen Council (BCC)</p> | <ul style="list-style-type: none"> - The process of their campaign is based on awareness generation through mass campaign, door to door interaction and formation of a small local level societies/groups for participatory cleaning up the garbage and improve the environmental sanitation. | <ul style="list-style-type: none"> - The programme is run by a special cell of the council. - The local level management of the garbage collection, disposal and other activities are managed by the local societies. - Coordination with the municipalities to collect the primary refuse from the collection point. | <ul style="list-style-type: none"> - The citizens' council in their annual report gives the broad objective, area of work, coverage etc. in an informative way. - The BCC also maintains a data bank on several issues ranging from demography, social structure to the financing modalities of this project. |

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| FOCUS OF ADVOCACY/ ADVOCACY CASE | INSTRUMENTS IN ADVOCACY (Media Management/ Technological Options etc.) | ORGANISATIONAL STRUCTURE & NETWORKING | SKILLS IN ADVOCACY (Scientific Knowledge/System of the Organisation) |
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| | <ul style="list-style-type: none"> - Collection of the primary refuse from the households by the rag pickers and sweepers and after sorting out the recyclables, deposit them at places for secondary collection. | <ul style="list-style-type: none"> - They were able to get corporate/institutional donations to meet part of their infrastructural expenditure regarding this project - They also interacted with the media for highlighting their cause through reviews, reports and articles in the newspapers. | <ul style="list-style-type: none"> - The BCC also published several reports/study papers on their work regarding urban advocacy/environmental issues. |
| <p>CASE IV</p> <p>Garbage to fuel - Excell industries</p> | <ul style="list-style-type: none"> - Though this industry is not directly involved in the urban environmental advocacy but their work and technological option is actively helping/promoting the cause of urban environmental advocacy campaign regarding solid waste management. - The process of work of the industry is to develop a simple indigenous technology to convert garbage into fuel. | <ul style="list-style-type: none"> - The project is run by the biochemical division of the industrial group. - They closely coordinate with the municipalities for the regular and smooth supply of the garbage from the collection point to the recycling plant. | <ul style="list-style-type: none"> - The Bio-chemical division has developed their own methodology regarding composting the bio-degradable through both microbiological and other chemical action. - They have a research and development unit devoted to this project but since it is a business venture their knowledge is limited to the industry itself. |
| <p>C. Housing & Housing Rights</p> <p>CASE I</p> <p>Urban Advocacy for Human Settlement Rights - Unnayan</p> | <ul style="list-style-type: none"> - They formed a grassroots level organisation to fight for the settlement right of the labouring poors of the city. - Through this organisation Unnayan organised media campaign as well as rallies, campaign and presentation of information for wider dissemination. | <ul style="list-style-type: none"> - Unnayan formed a sister concern at the grassroots level to voice the problem of human settlement rights and eviction problem with the idea that the concept of advocacy being 'people oriented', the people will independently voice their own problem and follow-up the issues | <ul style="list-style-type: none"> - The organisation maintains a systematic data bank on various issues of urban/environmental advocacy They also published newsletter, articles on this topic. |

| FOCUS OF ADVOCACY/ ADVOCACY CASE | INSTRUMENTS IN ADVOCACY (Media Management/ Technological Options etc.) | ORGANISATIONAL STRUCTURE & NETWORKING | SKILLS IN ADVOCACY (Scientific Knowledge/System of the Organisation) |
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| <p>CASE II</p> <p>Movement on Housing Rights for slum dwellers - Nirwana Hakk Suraksha Samity (WHSS)</p> | <ul style="list-style-type: none"> - They highlighted this issue in the National Council for Housing Rights (NCHR) workshop at New Delhi and send their observation and recommendation to the Union Government for future implementation and modification of the Housing Policy for the target groups - Unnayan also facilitates/helps the effected target groups with legal and moral support in coordination with other NGOs and institutions. | <ul style="list-style-type: none"> - Unnayan also is interlinked with several NGO's/individuals and with the help of institution/NGO like APDR and local political institution like FORWARD Block, AITUC etc. to make a dent on the government eviction policy, through litigation and moral support to the effected groups. | <ul style="list-style-type: none"> - They maintain and provide documentation services on the various environmental issues through news clipping, library, audio visuals and publications. They also helps small groups/ NGOs on environmental documentation. - The organisation is also involved in areas like urban growth and its impact on the environment as well as pollution of the city. They have conducted and prepared several reports on this issues. |
| | <ul style="list-style-type: none"> - The organisation based its advocacy campaign on mass mobilisation and formation of local groups at the grassroot level. - They filed public interest writ petition against the demolition drive of the State Government at the High Court. - The adopted mass struggle including, dharna, hunger strike, morchas, rallies and demonstration. Their communication strategy also includes street plays and performances at public places. | <ul style="list-style-type: none"> - The organisation is a forum of 26 organisation working on housing rights/ eviction problems for the slum dwellers. - The forum also network with like-minded individuals, important personalities and local residents association to organise their struggle. | <ul style="list-style-type: none"> - No scientific documentation process being adopted by the forum as such, nor do they keep the routine record of their activities. - Apart from the media reports the organisation occasionally brings out posters and leaflets highlighting their cause |

| FOCUS OF ADVOCACY/ ADVOCACY CASE | INSTRUMENTS IN ADVOCACY (Media Management/ Technological Options etc.) | ORGANISATIONAL STRUCTURE & NETWORKING | SKILLS IN ADVOCACY (Scientific Knowledge/System of the Organisation) |
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| <p>D. Industrial/Environmental Pollution</p> <p>CASE I</p> <p>Environmental pollution of a Copper Plant at Ratnagiri - Ratnagiri Bachao Sangarsh Samity (RBSS)</p> | <ul style="list-style-type: none"> - The advocacy campaign is based on information dissemination and involve the local people to make it a non-partisan effort - The basic strategy of this campaign is protest, demonstration, rallies and mass petition to the State Government. - The involvement of media with this campaign is an important contributory factor for its success. The local newspaper highlights the cause through news and articles. | <ul style="list-style-type: none"> - The information of this forum is spontaneous and instigated by an Editor of an local newspaper and an local advocate. - This forum also networks with like-minded individuals, important local personalities, and local groups to organise the struggle. | <ul style="list-style-type: none"> - The Editor of the local daily makes a fact-finding study and evaluate its potentialities regarding environmental pollution and other hazards. - Since the whole advocacy campaign is very spontaneous, localised and based on a local issue, no such documentation or other scientific studies have been undertaken by this forum. Though, a number of scientific and other data have been collected by them for information dissemination and awareness generation campaign. |
| <p>CASE II</p> <p>Calcutta Tanneries Movement - West Bengal Tanneries Majdoor Union (MPTMU)</p> | <ul style="list-style-type: none"> - Their advocacy campaign is based on inter-personal interactions, groups demonstration, dharna, rallies and petitions. - They also highlighted their case regarding environmental improvement, need of basic services through media and also through video coverages etc. | <ul style="list-style-type: none"> - The WBTMU has been initially formed based on two major issues-to get the minimum wage and bonus for the tannery workers. - WBTMU in its advocacy campaign against the proposed shift of the Tannery has joined hand with several citizen group and NGO like Nagarik Manch, PUBLIC etc. and fighting against the shift of the factories. | <ul style="list-style-type: none"> - An study on the occupational health hazards of the tannery workers has been carried out by Dr. S. Das on the behalf of NMBC and submitted it to the Government Health Department. - Furthermore Dr. Das along with some environmentalist group tried to focus on these environmental hazards in these area through research work and media campaign. |

| FOCUS OF ADVOCACY/ ADVOCACY CASE | INSTRUMENTS IN ADVOCACY (Media Management/ Technological Options etc.) | ORGANISATIONAL STRUCTURE & NETWORKING | SKILLS IN ADVOCACY (Scientific Knowledge/System of the Organisation) |
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| CASE II | Calcutta Tanneries Movement - West Bengal Tanneries Majdoor/ Union (MPTMU) | | <ul style="list-style-type: none"> - The National Environmental Engineering Research Institute (NEERI) and Central Leather Research Institute (CLRI) has carried out several studies on the existing pollution/environmental hazard present in this area and their possible solution. - A study by UNDP has also been undertaken about the treatment of the chemical and other waste/effluent management of this area. - The WBTMU though it does not contribute any detailed reports or data base maintains a data bank/ from the secondary sources regarding this issue. |

Integrated Low Cost Sanitation : Indian Experiences

Sulabh International Institute of Technical Research and Training, New Delhi.

INTRODUCTION

Mahatma Gandhi initiated a mass movement for removal of untouchability and for upliftment of scheduled and backward caste communities, especially the scavengers at Godhra town, Gujarat in 1917. When India attained independence, provision for upliftment of the status of these communities was made in the Indian Constitution. Even then no worthwhile special schemes were taken up by any state in any substantial manner till the early eighties; only small provisions available under Backward class sector were utilized. Among the scheduled castes, scavengers were treated as untouchables as they carried human excreta manually after cleaning dry latrines and drains, as part of their traditional occupation. During the Fifth Five Year Plan period some schemes were formulated for scavengers but these did not have long term perspective. After setting up various commissions and committees for scavengers from 1949 onwards it was at the beginning of the Sixth Five Year Plan, a separate Centrally Sponsored Scheme of liberation of scavengers was introduced by the Ministry of Home Affairs, Government of India under the Protection of Civil Rights Act, 1955. This led to the conversion of dry latrines into pour-flush latrines and construction of new pour flush toilets with a view to promoting the scheme of liberation of scavengers and their dependents from their degrading occupation. The dedicated role played by Sulabh International Social Service Organisation (SISSO) for promotion of both the programmes during the decades of seventies and eighties are not only noteworthy but laudable. There are two NGOs, namely, Safai Vidyalaya and Gandhi Smarak Nidhi who have also contributed to the success of the programme, although their area of operation is limited to Gujarat and Maharashtra, whereas the scale of operation of Sulabh is not only throughout different States in India but also beyond national frontiers. The implementation of both the programmes, however, was taken up in a massive way by the Ministry of Welfare, Government of India. Subsequently, it was felt desirable to have co-ordinated approach, and thus Integrated Low Cost Sanitation and Scavengers Liberation Programmes were brought together from 1989-90 onwards under the Ministry of Urban Development (now named as Ministry of Urban Affairs and Employment) as the nodal agency for implementation of low cost sanitation programme and the Ministry of Welfare for liberation and rehabilitation of scavengers and their dependents. The financial pattern for the programme was also modified.

The broad objective of this study is to highlight important examples of urban environment management experiences of 'best practices' followed by the Sulabh International Social Service Organisation (SISSO) and other NGOs/voluntary organisations at micro levels, with people's participation, in implementation of integrated low cost sanitation-cum-scavengers liberation programme in different geo-physical and socio-economic conditions.

OBJECTIVES OF THE STUDY

- a) to study the status of scavengers, liberation, rehabilitation and training programme,
- b) to explain the need for an appropriate low-cost sanitation technology,
- c) to study socio-economic, techno-economic and socio-cultural aspects,
- d) to study gender issues : nature and extent of women's participation;
- e) to spell out the implementation strategies,
- f) to assess community involvement in adoption of low-cost sanitation technology;
- g) to identify potential for applicability to different situations and sustainability and replicability;
- h) to assess the role of Non-Governmental organisations (NGOs)/voluntary organisations for programme implementation;
- i) the role of government including local bodies as provider and facilitator; and
- j) to assess 'Capacity Building strategies' of local bodies for promotion of integrated low cost sanitation-cum-scavengers liberation programme.

THE EXPERIENCE

BASELINE SITUATION : AN OVERVIEW

The word environment has assumed a variety of meanings in today's development scenario. It would perhaps be appropriate

that one modestly clarifies what one is trying to assess in this study on integrated low-cost sanitation vis-a-vis capacity building for the urban environment. On the whole, the main components that would make a satisfactory sanitary urban environment would include latrines, sewerage, wastes disposal, drinking water systems and hygiene at household level. These essentials will have to be evaluated in terms of the reality that the dominant group that is served by low-cost sanitation in respect of twin pit pour flush (PF) latrines lives in slums or almost slum-like conditions. Further, the community toilet complexes with bathing, washing and urinal facilities also cater, especially in metropolises, to the needs of floating population represented by commuters. "Research", it has been well said, "nearly always raises more questions than it answers" (Social Change, March 92 Vol 22 No 1 Prodipto Roy et.al. Measuring Bustee Environment in Calcutta). The present study poses an important issue, namely, whether low-cost sanitation (LCS) programme would receive adequate attention in the present economic reform measures initiated by the Government of India, for the social cost involved is rather high. Unless this aspect is resolved in the interests of deprived sections of the country's population, the capacity building measures for upgrading urban environment will be seriously hampered.

It has been brought out in many studies eloquently that dry or bucket latrines constitute a threat to health and hygiene through neighbourhood environment pollution. Low cost sanitation

measures of a composite nature demonstrated by certain experiments by Sulabh International in Patna with functional and appropriate marketing and delivery system amply support the view that LCS is an answer to degrading urban environment.

The positive role of urbanisation is often over-shadowed by the evident deterioration in the physical environment and quality of life in the urban areas caused by "widening gap between demand and supply of essential services and infrastructure", laments the Eighth Five Year Plan document of the Planning Commission, Government of India. It has been officially admitted that the gap between demand and supply of infrastructural services has been continuously widening. The worst sufferers are the poor, whose access to basic services like drinking water, sanitation, education and health services is shrinking. The 1992-97 Eighth Five Year Plan document notes that "unabated growth of urban population has made the problems of urban housing more severe resulting in proliferation of slums and squatter settlements and decay of city environment". The two important schemes in operation to combat the problems are the Urban Basic Services Scheme (UBSS) and Environmental Improvement of Urban Slums (EIUS) in addition to Low Cost Sanitation Programme.

The physical achievement envisaged at the end of the Eighth Plan (1992-97) has been projected in the Plan document as :

| Item | Envisaged coverage as on 31.3.92 | | Expected coverage during Eighth Plan | Expected cumulative coverage at the end of the Eighth Plan | |
|--------------------|----------------------------------|------------|--------------------------------------|------------------------------------------------------------|------------|
| | Population (In million) | Percentage | | Population (In million) | Percentage |
| Urban Water Supply | 185.67 | 84.90 | 65.00 | 250.67 | 94.03 |
| Urban Sanitation | 104.76 | 47.90 | 80.00 | 184.76 | 69.31 |

Note Percentage is with respect to total projected urban population

Source : Table 13, p 384, Eighth Five Year Plan, Planning Commission, Government of India.

In earlier chapter paragraph continued below table.

An official report of HUDCO as of May 1995 provides details of LCS schemes sanctioned in different states covering 996 towns. It has been indicated that a total of 23.931 lakh¹ PF latrines have been approved through conversion of 13,58,747 dry latrines to PF toilets and construction of 10,34,155 new ones. It is reported that due to various problems in implementation physical achievements are not upto expectation. It is also indicated that (as at the end of May 1995) 84,932 scavengers are expected to be liberated enabling them to seek alternative dignified occupations.

¹ 10 lakh = One million

NATIONAL SCHEME OF SCAVENGERS LIBERATION AND REHABILITATION

The National Scheme of Scavengers Liberation and Rehabilitation was formulated by the Ministry of Welfare, government of India in 1991-92. The scheme has the following components:

- Time bound programme for identification of scavengers and their dependents and their aptitude for alternative trade through a survey.
- Training in identified trades for scavengers and their dependents at the nearest local training institutions/

centres of various departments of State and Central Government and non-government organisations.

- c) Rehabilitation of scavengers by providing subsidy, margin money loan and bank loan.

It is stated that under the National Scheme, the responsibility for rehabilitation of municipal scavengers in the service of local bodies is that of local bodies themselves. The scheme provides training to private scavengers and dependents of scavengers, community as a whole. In this context, an All-India survey was conducted by the Ministry of Welfare, Government of India to identify scavengers and their dependents. The state governments got the survey conducted to identify number of scavengers and their dependents for their training and rehabilitation. Statewise breakup of the stage of survey, number of scavengers identified, target for training and rehabilitation as well as release of funds by the Ministry of Welfare, Government of India from 1991-92 to 1994-95 was carried out in 20 states. It indicates that the survey is yet to be completed in Bihar, Gujarat, Karnataka, Uttar Pradesh and Nagaland. Till the beginning of 1994-95, about 7.20 lakhs scavengers have been identified in 20 States. The Ministry of Welfare, Government of India released Rs. 60.73 crore for training and rehabilitation of 15,578 beneficiaries in 1992-93. In 1993-94, Rs. 70.993 crore and in 1994-95, Rs. 13.80 crore have been released for training and rehabilitation of scavengers and their dependents.

The National Scheme has laid down a funding pattern for financial assistance for Self Employment. For example, for a project costing Rs. 50,000, the break-up would be Rs. 10,000 subsidy, Rs. 7,500 margin money loan from the State Scheduled Castes Development Corporation and Rs. 32,500 loan from the banks. It is estimated by the Ministry of Welfare, Government of India that average expenditure for providing training to each identified child/dependent might not be more than Rs. 500 which includes stipend of Rs. 150 per month. It is further stated that identified children/dependents of scavengers would be provided training in identified trades for one month to six months only. The entire expenditure for training would be borne by the Ministry of Welfare, Government of India.

SEWERAGE SYSTEM

In majority of the towns and cities in India, there exist more than 54 lakh insanitary latrines (commonly known as dry or bucket latrines).² These require the services of scavengers to maintain sanitation. This, they achieve by manually removing excreta and carrying it for disposal to far-off sites. There are also many households in towns/cities of the country which have no access to latrines at all and consequently they are compelled to defecate in open spaces thereby causing unhygienic environment, contributing to many water borne diseases like cholera,

typhoid, jaundice, polio, diarrhoea, dysentery, etc. In addition, to performing degrading jobs, scavengers are poor and socially suppressed. Further, the scavengers subject themselves to many serious health hazards. In brief, dry latrines cause immense damage to social fabric, environmental desirables and health standards.

Base-cum-Issues Paper of Ministry of Urban Affairs and Employment, Government of India (August 1994) for Habitat II United Nations Conference on Human Settlements describes the sanitation status in the country as under:

"The data on accessibility of the entire urban population to sewerage system are not available. However, according to estimate of the Planning Commission, hardly 20 per cent of urban population have access to flush arrangement connected to sewerage system, 14 per cent have access to water borne toilets connected to septic tanks, 33 per cent have bucket or dry latrines and the remaining 33 per cent do not have access to any facility whatsoever."

The analysis of accessibility to sewerage system according to income level indicates that the beneficiaries happen to be only the upper income groups. Urban poor and the low income group people hardly have accessibility to sewerage system. To quote from the report of the National Commission on Urbanisation (NCU). "If the water supply system is unequal and unjust being highly biased in favour of the rich, the sewerage system is even more unjust and even more highly biased in favour of the rich" (NCU Report 1988).

DRAINAGE SYSTEM

The analysis of drainage system also does not present a happy situation. The NIUA study reveals that out of 127 towns and cities which responded to the questionnaire of the study, the drainage system covered only about 66 per cent of urban population. Thus, a little more than one-third of urban population in the sample towns and cities are not serviced by drainage system (NIUA, 1989). In about one third of the urban centres more than 40 per cent of urban population was not being served by drainage system.

GARBAGE DISPOSAL

In India, on an average, the amount of solid waste generated varies from 300 to 500 grams per person per day and the density varies from 100 kg. per cu.m. to 600 kg. per cu.m. At this rate, the amount of solid waste generated in the towns and cities is tremendous. As against this, the management of solid waste disposal seems to be far from satisfactory. The situation is grim especially in the small and medium towns where there does not exist any rudiment of hygienic disposal system. The

² Report of the Task Force for tackling the problems of scavengers and suggesting measures to abolish scavenging with particular emphasis on their rehabilitation - Planning Commission, Government of India (1990-91)

NIUA study reveals that in the 153 sample towns, 27.5 per cent of the total waste generated remained uncollected and scattered on the streets (NIUA 1989). It further reveals that of the 153 responding towns and cities, 41 per cent had a refuse disposal level below the sample average of 72.5 per cent. In 12 urban centres, the level of uncollected waste was 50 per cent or even more"

It is generally felt that "at the planning level there is lack of understanding of what sanitation means as well as poor coordination" More specially, the Ministry of Urban Development, the main actor to achieve satisfactory level of sanitation in urban areas and the crucial agency to catalyse "capacity building for the urban environment" looks at the issue in narrow perspectives like sanitary latrines, the Ministry of Welfare in terms of only of rehabilitation of scavengers; the Ministry of Health looks into the health related problems of sanitation only and the Ministry of Non-Conventional Energy Sources considers using garbage for energy augmentation. The, more or less, parallel set-up in the State Governments does not view the issue of sanitation any differently. In between, some NGOs do their bit in their own way to tackle sanitation problems. What is lacking is responsible coordination and monitoring attuned to achieve results.

AN ACTION PLAN : INTEGRATED LOW COST SANITATION FOR LIBERATION OF SCAVENGERS SCHEME

Low Cost Sanitation facilities had been provided since the plan era through different schemes operated by different agencies like Ministry of Welfare (MOW), Ministry of Urban Development (MOUD),³ Housing & Urban Development Corporation (HUDCO), Ganga Action Plan, State Governments and local body agencies. Largely, these schemes have now been integrated into one scheme namely the 'Integrated Low Cost Sanitation for Liberation of Scavengers' as a part of the Action Plan of the Government of India, for elimination of manual scavenging by the end of Eighth Five Year Plan period. This scheme was introduced during the financial year 1988-89.

AIM OF THE PROGRAMME

The prime objective of the integrated programme is to completely eliminate manual scavenging practice due to usage of dry latrines or open defecation. A whole town approach is being followed by (a) conversion of the existing dry latrines into low cost pour flush twin pit latrines, (b) construction of new pour flush latrines, (c) providing community latrine facilities for those households where the provision of sanitation units is not possible due to space constraints or difficult soils, water table conditions or any other reasons.

FINANCIAL ASPECTS

The programme is financed by the Government of India, for

conversion/ construction of latrines upto plinth level, with a subsidy component from MOUD and with supplementary loan component from HUDCO.

The subsidy and loan rates are based on the beneficiary's income level. Subsidies are provided to Economically Weaker Sections (EWS) and Lower Income Group (LIG) only. For construction upto plinth HUDCO loan is available, the range varying from 50% for EWS category to 75% for HIG Category under normal housing norms. For community latrines, 90% of the cost is made available by HUDCO as loan to local bodies and the balance is met by the local bodies/State Governments. As the cost of construction of superstructure is not covered under the Integrated Low Cost Sanitation Programme, HUDCO has extended its normal programme of financing to cover this component as per the financing pattern for construction of houses for various categories.

ROLE OF NGOS IN IMPLEMENTATION OF THE PROGRAMME

- (a) NGOs play a vital role in implementation of Low Cost Sanitation-cum-Scavengers Liberation Programme involving identification of beneficiaries, motivation of the community to come forward for conversion of dry latrines/construction of new latrines, collection of beneficiaries, contribution and also educating the people to have a clean and hygienic environment and use of pour flush latrines apart from organising labour and materials for implementation of the programme.
- (b) Various methods are adopted for creating awareness among the community about the programme namely, motivation through house-to-house approach, printing of posters, pamphlets, cinema slides, drum beating, newspapers, etc. NGOs also print all necessary forms including agreement forms, etc.
- (c) The local bodies lay down the guidelines for execution of work, procurement of materials under the supervision of their officials, and thereafter release funds (subsidy and loan component) to the NGOs for implementation. The total amount of interest and principal payable by beneficiaries are worked out for recovery from beneficiaries along with property tax, in appropriate manner regularly by local bodies.

Periodical progress report is prepared by the NGOs and monitored by the local bodies for higher level formulations for mid-way corrections, if any, to achieve targets.

- (d) The scavengers liberated on completion of the scheme are invariably absorbed in the respective municipalities/local bodies as street sweepers, drain cleaners, gardeners, etc. For changing the designation of the scavengers, the local bodies take appropriate action to

³ Now named as Ministry of Urban Affairs and Employment

obtain approval of the competent authorities. The children/dependents of the scavengers and/or private scavengers are required to be trained/educated for alternate employment opportunities or self-employment and for this NGOs/Voluntary Organisations may be involved to upgrade the social status of scavengers. There are three important non-governmental organisations, apart from localised smaller ones, which have contributed reasonably well in implementing low-cost sanitation-cum-scavengers liberation programmes. They are (1) Sulabh International Social Service Organisation, Patna, Bihar (2) Safai Vidyalaya, Ahmedabad, Gujarat and (3) Gandhi Smarak Nidhi, Pune, Maharashtra.

Sulabh International Social Service Organisation (SISSO) as an NGO has brought about a revolutionary change in the movement of liberation, training and rehabilitation of scavengers and their dependents by implementation of low cost sanitation scheme through technological innovations. The scale of operation originating from Patna (Bihar) spread over not only in different states and union territories but also beyond the national frontiers. Whereas, the other important NGOs, namely, Safai Vidyalaya and Gandhi Smarak Nidhi restricted their area of operation to Gujarat and Maharashtra respectively. Sulabh has implemented the scheme of Low Cost Sanitation by conversion/construction of 730430 pour flush latrines and constructing 2879 community complexes, which are being operated and maintained by them on "pay and use" basis. In other words, about 10 million people every day (6 million from PF latrine and 4 million from community toilet complexes) are being benefited by using the services and facilities provided by Sulabh International in India. It is reported that by conversion of drylatrines and construction of community complexes as many as 37,000 scavengers have been relieved of scavenging work; 240 towns have been declared as scavenging free, 61 human excreta based bio-gas plants have been installed, and 3406 liberated children/dependents of scavengers have been trained in Sulabh Institutes at Delhi and Jambhul (Maharashtra) as well 312 children of scavengers are getting training in Sulabh Public School in Delhi and 96 in the Technical Training Centre in the main campus of Sulabh International, Delhi.

METHODOLOGY OF THE RESEARCH

The implementation of low cost sanitation scheme is being carried out by various non-government organisations (NGOs), local bodies and contractors. Among the NGOs, the scale of operation of the Sulabh International Social Service Organisation (SISSO) is spread throughout the country, while those of other NGOs/voluntary organisations have been limited and localised in only a few towns. Sulabh has implemented the

scheme of conversion/construction of PF latrines in households and is maintaining community toilet complexes in eighteen states and two union territories. So far, it has covered 1179 towns in these states and union territories.

SELECTION OF TOWNS/CITIES

It was decided that 50 percent of the states would be covered for household survey of individual household PF latrines and beneficiaries of community complexes. Accordingly, ten states were selected originally covering all the major zones of India - North, South, East, West and Central. From each state one town was then selected on purposive sampling basis.

The criteria chosen for selection of ten towns/cities were size of population, geographic distribution, size of sanitation aspects covered, physical and socio-cultural characteristics of the areas, etc. It was decided that selection of the towns should be such as might represent very large metropolitan cities as well as relatively smaller and medium size towns. Thus four metropolitan cities, namely, Hyderabad, Bangalore, Bombay and Madras having more than 25 lakh population, medium towns of Patna and Bhopal having 10 lakh population and four relatively smaller towns, Mirzapur, Ajmer, Puri and Jammu having less than 5 lakh population were selected. These towns/cities have heterogeneous character, differing not only in physical characteristics but also in socio-cultural characteristics. They belong to different linguistic, social and cultural regions. So far as physical characteristics of the towns/cities, they range from alluvial to sandy and rocky.

It was also decided that the selected towns/cities should be such as to cover both large and small scale sanitation measures. Therefore towns, namely, Jammu, Puri, Ajmer and Mirzapur with less than 20 community toilet complexes; five towns namely, Hyderabad, Patna, Bangalore, Madras and Bhopal with 20 to 39 complexes and Bombay with a large number of complexes (201) operated by Sulabh were selected. The main reason for selection of Bombay was to understand the various facets of management of city having a large number of community complexes catering to the needs of commuters, besides local beneficiaries.

SAMPLING PROCEDURE : HOUSEHOLD TOILETS

The sample size of beneficiaries of household toilets has been worked out on the basis of percentage of total number of household toilets converted/ constructed by the NGO in each selected town. It was decided that one and a half percent of sample beneficiaries will be interviewed with a minimum number of 100 in each town. In case the number of beneficiaries is less than 100 in any town, all beneficiaries will be interviewed. All these beneficiaries have been selected from east, west, north, south and central areas of each town.

The total number of beneficiaries in ten towns (excluding Bombay and Bangalore where household toilets have not been

converted/constructed by Sulabh) works out to 1196 only. But in some towns, the number of sample beneficiaries exceeded the required sample size. Thus, the total number marginally increased and 1208 beneficiaries have been interviewed against the target of 1196 beneficiaries (Refer Table 4.1).

SAMPLING PROCEDURE : COMMUNITY TOILET COMPLEXES

Selection of sample beneficiaries of community complexes have been done on the basis of purposive sampling. It was decided that the selection of community complexes in each town will be done on the basis of maximum number of visitors to the complex. Beneficiaries of community complexes were interviewed in these complexes from morning till evening. It was also decided that from each community complex at least 25 beneficiaries would be selected. Eighteen community complexes, out of a total number of 408, have been selected in ten towns, where the maximum number of people avail of toilet-cum-bath facilities. Out of 18, six community complexes have been selected from Bombay city alone, where large number of local people and commuters are availing of the facilities every day. Thus, the total sample of 468 beneficiaries have been interviewed as against the sample size target of 450 beneficiaries (Refer Table 4.1).

It may be added that sampling procedure adopted for additional five towns was the same, as for the ten towns studied earlier.

Thus for the second phase five towns, the total sample size for household toilet beneficiaries was 446 against which 441 schedules were administered. One community complex was selected in each of these five towns and from each complex 25 beneficiaries were selected. The total sample size for community complex beneficiaries was thus 125 and all were administered. The name of the towns selected, the name of the organisations involved in low cost sanitation scheme and the sample size are given in Table 4.1.

IMPACT AREAS AND ASSESSMENT : CASE STUDY OF SELECTED TOWNS

This section attempts to highlight briefly the geo-physical status, demographic characteristics, slum population, household toilets and community toilet complexes constructed by Sulabh and other NGOs, the survey findings, as well as assess the gap in toilet facilities in fourteen selected towns (Refer Tables 4.2 to 4.7)

1. HYDERABAD (ANDHRA PRADESH)

The city of Hyderabad is located near 17 degree north latitude and 78 degree east longitude and is spread over an area of 269 sq km. Elevated by about 536 metres above sea level, its soil is sandy and granite. It receives an average rainfall of 880 mm in a year. Potable water is available at a depth of 30 metres. Water level in summer/winter varies between 15 and 40 me-

tres. The city has a population of about 30 lakhs out of which about nine lakh people are residing in the slums which cover about 3.63 sq. km of area.

Before the introduction of LCS Programme in the city, there were about 3.5 lakh households, of which about 27% numbering 94395 did not have latrines in their houses. About 27% of the houses have sewer connection and about 46% are covered with septic tank or other water flush latrines.

Under the LCS Programme Sulabh started its operation in the city in 1986 and by the year 1990, it constructed 7402 household latrines and all of them are currently used. Later on other NGOs, namely, Urban Poor Society, Weaker Section Society and Urban Poor Syndicate have constructed/converted about 7300 PF latrines.

About 1873 scavengers were identified in the city of Hyderabad, 227 of them had received training in different trades. In all 466 scavengers had been liberated till August 1995.

There are 26 community toilet complexes located in different areas of Hyderabad city which were constructed and are being maintained by Sulabh. These complexes were constructed between 1986 and 1995. All of them have toilet facilities for both males and females though the number of toilets for males is more than those for females. There are altogether 165 units of toilet for males as against 70 for females. As for bathing facilities, there are 79 units for males as against 26 units for females, while there are 81 urinal facilities in 16 complexes for males as against two for females. The average number of daily users per complex works out to 1046 with a minimum of 200 and a maximum of 2500. The number of disabled persons and children visiting these complexes account for about 15 percent and 14 percent respectively. At each complex 4 to 6 social workers (caretakers and attendants), depending upon the size of the complex are deputed for the maintenance of the complex. They also collect service charge from the users. Only one complex located at Secunderabad Railway Station is being maintained by another NGO, the Lions Club. Apart from these, about 349 public toilets are being maintained by the Municipal Corporation.

About 1500 metric tons of solid waste is generated in the city everyday, of which only 1000 tons are sent to two land filling sites. Since only two thirds of the solid waste is cleared by the Municipal Corporation, about 500 tons are left unmanaged and cause nuisance, insanitation and environmental degradation in the city. About 522 million litres a day of waste water is being generated in the city of which only 140 million litres a day are collected for treatment and the rest flows through surface drains causing water pollution.

2. PATNA (BIHAR)

Patna stands on the bank of the river Ganga, covering an area of about 109.22 sq km. Its elevation above mean sea level is 53 metres and soil is alluvial. Good quality underground water

is available. The water table varies between 5 to 7 metres only. The water level settles between 5 to 12 metres. The city receives an average annual rainfall of 1154 mm. The city had a population of about 9 lakhs in 1991 and about 35% of them are slum dwellers. About eight per cent of the total area of the city is occupied by slums.

Prior to introduction of LCS Programme in the city, there were about 76000 households and about 22000 of them did not have any latrines in their houses. About 10,000 septic tank latrines were there and about 6000 households were covered by sewers.

During the period 1985-86 to 1987-88, a total number of 1465 scavengers (males 1266 and females 199) which include their dependents were liberated and imparted training in nine different trades (short hand, typing, carpentry, electrician, mechanic, leather goods, tailoring, cane-work and mason). There were about 900 scavengers working with the Corporation and all of them have been absorbed in the Corporation.

Sulabh started constructing household toilets in Patna in the year 1974 and upto the year 1987-88, 18235 households were covered. All the latrines are currently being used. No other organisation is active in providing PF latrines in the city.

There are 39 Sulabh operated community toilet complexes located in different areas under Patna Municipal Corporation. These community complexes were constructed between 1977 and 1984. The majority of complexes were constructed before 1980. As many as 24800 people are visiting these 39 complexes per day, of which 8272 (33.4 per cent) are women, 1575 (6.4 per cent) are children, 4745 (19.1 per cent) are disabled persons and 10208 (41.1 per cent) are adult males. All the complexes have toilet facilities; 510 units for males as against 73 units for females. Twenty complexes have 55 units of bathing facilities for males as against six for females with 18 bathing units. Twenty five complexes have 63 units for urinal facilities for males as against two complexes for females with seven units. The number of visitors to these complexes varies from 50 to 4000 per day. Comparatively, more people are availing of the facilities of community complexes located at Patna Railway Station, Patna Bus Stand and Gandhi Maidan.

Akhil Bhartiya Paryavaran and Gramin Vikas Sansthan, an NGO, has also constructed 39 community toilet complexes in the city.

Besides these, there are nearly 135 community complexes constructed and operated by the Municipal Corporation. All of them have been in a very dilapidated condition since long.

Management of solid waste in the city is the responsibility of the Corporation. The performance of the Corporation in regard to solid waste management is not satisfactory. About 1000 tons of garbage is generated in the city every day but only 300 tons is cleared. Participation of the local people in this activity is almost negligible.

At present Patna has two functional effluent treatment plants, where a part of the waste water of the city is managed properly. But in many parts of the city there is no proper system of waste water management. Moreover, the low lying areas of the city get flooded during the monsoon and create environmental pollution. Out of 141 million litres of generated sewage only 83.2 million litres per day are cleared. The 3 lakh cattle population mixes freely with the 10 lakh plus humans creating very difficult sanitary problems.

3. JAMMU (JAMMU AND KASHMIR)

Located near the 33rd north parallel and 75 degree east longitude and on the foothills of the Himalayas, Jammu is elevated by 450 metres above mean sea level and is spread over an area of 40 sq.km. Its thin layer of alluvial soil covers boulder conglomerate mixed with hard clay. Groundwater is available at a depth of six metres. The average annual rainfall in the city is about 1348 mm. Census was not conducted in Jammu and Kashmir in 1991. According to 1981 Census, the city had a population of about 2 lakh. Only three per cent of the people of the city reside in the slums which comprise 1.5 sq.km. area, which is about 3.75% of the total city area.

Prior to introduction of LCS in the city there were 35771 households of which 8700 houses had septic tank latrines, 17500 had dry or bucket latrines and 9571 houses had no latrines at all.

There were about 1054 scavengers in the city before the LCS programme started. Out of these 371 (146 males, 225 females) have been trained. Males were imparted training in computer courses and females in cutting and dress designing.

Sulabh started constructing household toilets in the city in the year 1984-85 and by the year 1990-91, 9258 households were covered. All the households are currently using the toilets.

There are eight Sulabh operated community toilet complexes in Jammu. Five of them were constructed during the last three to four years. All the eight complexes have toilet facilities for females. There are 53 units for toilet facilities for males as against 15 for females. As for bathing facilities, six complexes, having 21 units are for males as against two complexes with two units each for females. As for urinals, six complexes with 18 units are for males. The number of visitors to these eight complexes per day is 2372. The number of users for individual complex varies between 12 and 750. The disabled and children constitute a very small proportion of users - just a little over three per cent. The number of social workers attending a complex varies between two to five.

Solid waste in the city is collected and disposed of by the municipality and waste water is disposed of through open drains.

4. BANGALORE (KARNATAKA)

The city is located near the 13th parallel and the 78th east longitude, with an area of 225 sq.km. The elevation of the city

is 900 meters above mean sea level. The soil is a series of black cotton, red loam rocky gravel. It receives an annual average rainfall of 780 mm. The ground water levels are seven to eight metres and five to six metres during summer and winter, respectively. Water available here is potable but hard. According to the 1991 Census the city had a population of 26.6 lakh. About 13% of the city population is living in the slums, which occupy 6.7% of the city area.

In Bangalore, 2501 scavengers were identified of which 1307 were males and 1134 females. Among the liberated scavengers, 1367 (840 males and 527 females) are engaged in self employment and 421 are employed in different organisations.

There are 38 Sulabh operated community toilet complexes in different areas of Bangalore. These were constructed between 1982 and 1995. All the complexes have toilet facilities for males as well as for females. The number of units of toilet facilities for males in these complexes is 364 as against 217 for females. Out of the 38 complexes 37 complexes have 163 units of bathing facilities for males and 102 for females, 29 complexes have 183 units of urinals for males as against two complexes having one urinal facility each for females. The total number of persons visiting these complexes a day is around 27320. The users of individual complex per day varies between 5 to 3500. The average number of visitors works out to 719 per complex. The number of disabled persons visiting these complexes is two percent. Children also constitute two percent of users.

The number of social workers attending the complexes varies between one to eight on each for day to day maintenance as well as collection of service charges.

Nearly 63% area of the city has sewerage facilities and nearly 2130 tons of solid waste is generated. The responsibility for its collection and disposal is vested with the Municipal Corporation. But only 1800 tons of garbage is cleared by the Corporation. Out of 275 million litres of sewage generated in the city only 250 million litres are cleared. It is one of India's cleaner cities but with fast expansion of the city and migrants pouring in, it is becoming difficult for the Corporation to cope with the demand for services.

5. BHOPAL (MADHYA PRADESH)

The city is located near the intersection of 23rd north latitude and the 77th east longitude. It lies on the edge of Malwa Plateau and is elevated from mean sea level by about 460 metres. The city is spread over an area of 284.9 sq.km. Soil comprises a series of red stone, black trap and murrum, clay silt, lime stone and black cotton soil. Average rainfall over the city is about 1260 mm. The ground water level varies between three to eight metres. In 1991, the city had a population of 10.6 lakhs and about 23% of them live in the slums. The slums occupy 1.17 percent area of the city.

Before the LCS Programme started in the city in 1987, there were about 2.5 lakhs households. No data of the status of latrines in the town was available. However, rough assessment is that about 50,000 houses had dry/bucket latrines.

There were 17100 scavengers in the city of which 1624 have been rehabilitated. Of them 1811 have been trained in different trades.

Sulabh started constructing household toilets and community toilet complexes in 1986-87. It constructed 21558 household toilets and 38 community toilet complexes between 1987 and 1995. Other NGOs have constructed 14240 household toilets only between 1991 to 1995. There are 229 public toilets in the city, which are being operated and maintained by the Municipal Corporation.

Due to certain constraints, the entire town was not taken up for study. The universe was restricted to concentrated locality of slum area where 605 household toilets and four community toilet complexes exist. These household toilets and community complexes were constructed between 1986 and 1992. All the four complexes have toilet facilities for both males and females. The number of units of toilet facilities for males is 41 as against 34 for females. Similarly, all the complexes have bathing facilities for both males and females. The number of bathing units for males is 22 as against 20 for females. The two complexes have urinals for both males and females. The total number of units for males is nine as against two for females. The number of persons visiting these complexes is a little over 1000 per day with an average 250 visitors per complex. The proportion of disabled persons visiting these complexes is about four per cent and children about 19 percent.

Part of the town has sewerage. Major part of the old town is not covered, almost all the dry/bucket privies exist in this portion of the town. Bath room and kitchen waste water in unsewered areas is disposed of through surface drains. About 500 tons of solid waste is generated in the town. The Corporation has a fleet of vehicles and equipments for its transportation to disposal sites. A mechanical composting plant in collaboration with M.P. Agro Development Corporation has recently been installed, which takes care of 100 tons of solid waste. The remaining is disposed of by sanitary land fill system. The bucket/dry privies are cleaned by the privately employed scavengers. They carry the human excreta to collection depots from where it is transported to the trenching ground by the Municipal Corporation through tankers.

6. BOMBAY (MAHARASHTRA)

Bombay is located at the intersection of the 19th north latitude and 71st east longitude. The city has an area of 437.7 sq.km. The soil is predominantly black cotton. It receives an average annual rainfall of 1902 mm. The water level settles at about 7.6 metres during summer and at about six metres during winter. Water available below the ground is salty and sour. The city

had nearly ten million population in 1991. Forty-five percent of the city population is residing in the congested slums. The slum areas constitute only 45 percent of the city area.

As per the survey conducted by Mahatma Phule Backward Class Development and Finance Corporation, 21,631, Safai Karmacharis have been identified. Out of them 16 males and 10 females have received training in vocational trades such as computers, beauty parlour, photography and motor mechanic. The remaining 21,605 are reported to be employed either in the Municipal Corporation or other organisations.

It is reported that household toilets (PF latrine) have not been constructed in Bombay city at all.

There are as many as 201 community toilet complexes constructed and being maintained by Sulabh. Most of these complexes were constructed during the last five years. All complexes have toilet facilities for men with 1235 units. One hundred and ninety four complexes have toilet facilities for women with 725 units. Out of 201 community complexes, as many as 93 have bathing facilities for men with 148 units, 29 complexes have bathing facilities for women with 36 units. All the complexes have urinal facilities for males with 703 units. The total number of visitors to these complexes is 4.28 lakhs per day with an average of over 2000 per complex. About 3.5 percent visitors are disabled persons, 16 per cent are women. Five to six social workers attend to each complex.

About 5800 tons of garbage are generated in the city everyday, but the Municipal Corporation manages to collect only about 5000 tons for landfill and sundry purposes. Out of 1800 million litres of sewage generated a day, 1460 million litres are collected for treatment and the rest is discharged through drains into the Arabian sea.

7. PURI (ORISSA)

A small city on the shores of the Bay of Bengal, Puri has an area of only 16.84 sq.km. The average elevation of the city is about 12 meters above mean sea level. The city's soil is alluvial. It receives, on an average, a rainfall of 1352 mm in a year. Ground water is available at a depth of 9.14 metres. The water level in summer varies between six to twelve metres, while in winter it varies between three to eight metres. Water available here is slightly saline. In 1991, the city had about one lakh of population. More than 30% of the city population is living in slum areas which occupy 4.45% area of the city.

Before introduction of LCS, there were 14193 households in Puri of which 8145 had Dry latrines and 6048 had septic tanks.

In 1987, Sulabh started the work of household toilet construction and a total of 2064 households have been covered till date. No other organisation is engaged for household toilet construction.

Prior to the introduction of LCS Programme, there were 601 scavengers in the town. About 432 of them have been liberated and are working in different organisations. However, no training has been imparted to them.

There are only five Sulabh operated community toilet complexes in Puri town. They were constructed between 1985 and 1990. All the complexes have toilet facilities for both males and females. The number of units for toilet facilities in these five complexes for males is 51 as against 32 for females. All the complexes have bathing facilities for males and females and the number of units are 17 and five respectively. Only in three complexes urinal facilities are available for males while for females all complexes have this facility. The total number of visitors attending these complexes is 1875 with an average of 375 visitors per complex. A little over four per cent of the users are disabled persons and about three per cent are children. In each of these complexes there are four to five social workers attending to day to day maintenance and collection of service charges.

Apart from Sulabh, the Municipality is maintaining three community complexes and the facility can be used free of charge.

8. AJMER (RAJASTHAN)

Ajmer is located near the 26th north parallel and the 75th east longitude, surrounded by the hills around Pushkar in Aravalli range. The geology is that of Aravalli range. It is elevated from the sea level by about 870 metres. The city receives an average rainfall of 494 mm in a year. It has sandy and rocky soil. Ground water level varies between 60 and 90 metres. The area of the city is 241.6 sq km and the population as per the 1991 Census was 4.03 lakh. The proportion of slum population in the total population in the city is relatively low i.e. only 1.48 percent. Slums occupy 0.7 percent of the city area.

In Ajmer, there are 67455 households, of which 14179 (21%) households do not have any toilet facility as per 1991 census. As reported, neither the data of different types of latrines (including dry latrines) nor data on scavengers were made available by the concerned authorities prior to commencement of LCS programme.

Sulabh started constructing household latrines in the city in 1989-90 and by 1994-95, 23050 households have been covered.

There are seven Sulabh operated community toilet complexes in Ajmer town. These were constructed between 1988 and 1992. All the complexes have toilet and bathing facilities for both males and females. In these complexes, 80 units of toilet facilities and 34 bathing units for males exist, as against 35 and 22 respectively for females. As for urinals, all the complexes have this facility for males with 24 units as against one complex with two units for females. A total number of 1250 persons visit these complexes per day with an average of 180 persons per complex. The number of social workers per complex is six to eight.

About 200 mld of waste water generated in the city directly flows through surface drains to Anna Sagar channel causing water pollution. There is no sewerage system in the town.

About 250 metric tons of solid wastes are generated in the city every day of which collection and disposal responsibility is of municipality. It is disposed off as land fill at Makhpura near Dattavir, Vadirabad Road. The Municipality has a fleet of vehicles and equipment for its transportation to disposal site.

9. MADRAS (TAMIL NADU)

The fourth largest city in India, Madras is located near the intersection of 13th north latitude and the 80th east longitude and lay by the Bay of Bengal. Elevation rises as the distance from the sea shore increases. The higher elevation is seven metres above the mean sea level. Most of the localities are just at the sea level. The predominant soil is alluvial with scattered patches of gravel. The soil found in coastal areas is alluvial, gravel and sandy. Due to the proximity of the sea, the ground water level is one metre to five metres and water is saline. The city has an area of 571.93 sq.km. and the population was 38.41 lakhs in 1991. About 42 percent people live in slums covering 10.14 percent of total area of the city.

In 1990, Sulabh constructed 28 household latrines in the city. But one of the household latrines has been demolished for reconstruction and in another case the house has been demolished leaving the latrine intact. So, at present, 26 of them are being used.

As reported, survey for identification of scavengers was not carried out in Madras city because the Municipal Corporation took the stand that there were none in the category of scavengers and only sanitary workers were employed in the Corporation for cleaning streets, etc.

There are 86 Sulabh operated community toilet complexes in Madras city. Most of the complexes were constructed between 1990 and 1995. Out of 86 community complexes, 76 have altogether 509 units of toilets for men and remaining 10 complexes have no toilet facilities for men. In 73 community complexes there are 439 units of toilet facilities for women and the remaining 13 complexes have no toilet facilities for them. As for bathing facilities, 72 complexes have bathing facilities for men as well as women. The number of bathing units in these complexes are 132 for men and 122 for women. As for urinals, 22 complexes have 78 units for men and only three complexes with 15 units have urinal facilities for women. The total number of visitors to these complexes is about 56,000 per day with an average of 650 per complex. About nine percent of visitors are children. It is significant that 46 percent of the visitors are women. The number of social workers attending per complex is three to four.

About 2675 tons of garbage is generated in the city everyday

but only 2140 tons are cleared. Out of 250 million litres of sewage generated 238 million litres are collected. But millions of litres flow untreated into three waterways - Covum river, Adyar river and Buckingham canal. These stagnant channels of sewage on the river bank pose a major health hazard, exposing the slum dwellers to filariasis.

10. MIRZAPUR (UTTAR PRADESH)

Mirzapur is a small city situated in conjunction of the Gangetic plain of Uttar Pradesh and the Vindhyachal range. The soil is predominantly alluvial but silt, sandy loam and kankar are also found. Its elevation from mean sea level is 84.84 metres. Ground water is available at a depth of about 16 metres. Water level during the summer is 16 metres, while during the winter it is about 13 metres. Water is potable. The area of the city is 38.85 sq.km. and the population was 1.69 lakhs in 1991. About 41% of its population reside in slums which constitute about 23.8% of the total town area.

Prior to introduction of LCS, there were 20341 households in the town, of these only 1020 had septic tank latrines. The city had 10170 households with dry latrines while the rest did not have any toilet facility.

Sulabh started constructing household toilets in the city in the year 1988-89 and by the year 1993-94, 2878 of them were constructed. No other NGO was involved.

Before the introduction of LCS, there were 446 Municipal and 70 private scavengers in the town. The LCS in the town, resulted in the liberation of 115 scavengers. No training was given to them. Of the liberated scavengers, 32 are engaged in self employment, 53 are employed by the Municipality, six by Sulabh and the rest are employed by different organisations.

There are 19 Sulabh operated community toilet complexes in Mirzapur town. These complexes were constructed between 1992 and 1995. All these complexes have toilet and bathing facilities for males and females. There are altogether as many as 143 toilet units and 64 bathing units for males as against 138 and 38 respectively for females. Out of 19 complexes, only 17 have urinal facilities for males with two units at each. The total number of people visiting these complexes per day is around 6106 with an average of 321 per complex. Among the users eight per cent are disabled, 22 percent women and 24 percent children. The number of social workers attending the complexes for the maintenance and collection of service charge, varies from one to three per complex depending upon the number of units and users. No other NGO is involved in constructing and maintaining community complexes.

The town does not have sewerage system. Almost the entire town has open road side drains which carry the sullage to eight big covered drains leading to river Ganga. Solid waste is carried by sweepers through buckets or wheel barrows to the collection places from where it is carted outside the town for trenching or dumping in low lying areas for land fill.

11. GOPALGANJ (BIHAR)

A small town, in the gangetic plain of Bihar, Gopalganj has an area of about 11 sq.km. Alluvial formation in the area is about 20 metres. Good quality ground water is available at four to seven metres depth depending on the season. Average rainfall is about 1292 mm. It has a population of about 36000 of which about 6500 live in the slums. The slums are spread over about 1.26 sq. k.m, which is about 11.30% of the total area of the town.

The municipality had about 45 scavengers for servicing the dry latrines before the liberation programme started. About 36 scavengers have been liberated and absorbed in the municipality, but none of them are reported to be trained.

Prior to introduction of the low cost sanitation programme in 1984-85, there were about 4235 households. In about 1683 households, there were dry/bucket latrines, 1021 households were having different types of latrines and 1531 households had no toilet facility at all.

Initially, Sulabh International was nominated to implement the LCS programme and they converted/constructed 935 pour-flush latrines during 1984-86. About three years back, the State Government nominated another NGO known as International Institute of Sulabh System and they have converted/constructed 537 pour-flush latrine during 1992-95. In all 1472 pour flush latrines have been converted/constructed in the town.

There are only two community complexes (one more is under construction). The first is of pay and use type with eight toilets (6 males and 2 females) with one bath room and two urinals for males only. On an average about 300 male adults, 200 female adults and 15 children are using the complex everyday. One of the complexes is being maintained by the International Institute of Sulabh System by engaging six social workers. The second community complex having toilets is being used and maintained by the police force only and has no facility for women.

Collection and disposal of solid waste is an obligatory function of the municipality. This is being done manually and disposed of through tractor/trailor. The system is reported to be far from satisfactory. Lack of finance, labour problems and absence of compatible management system are some of the causes for this state of affairs. The drainage system for disposal of waste is also not satisfactory. During rainy season the low lying areas get flooded and creates environmental hazards, particularly in slum areas. The participation of local people to resolve these problems is negligible.

12. BARWANI (MADHYA PRADESH)

The town is situated on the bank of river Narmada. It has an area of 16 sq. km. The soil is black cotton type. It is elevated from the mean sea level by about 177.5 metres. The average

rainfall is about 507 mm. Soft and good quality ground water is available at a depth of about 15

to 20 metres. As per 1991 census, the town had a population of 33678 with 4862 households. About 8698 people live in slums, spread over about 7.5 sq. k.m (47%) of the town area.

Prior to LCS programme in 1991-92, out of 4862 households, 267 had water flush toilets connected to septic tanks. One thousand eight hundred and ten households had dry/bucket latrines and the remaining 2785 households did not have toilet facilities.

In 1991-92, eighty scavengers (37 male, 43 female) were identified who were servicing dry latrines. Out of them 56 (24 male, 32 female) have been trained in different trades and rehabilitated.

Initially, Sulabh started implementation of LCS programme and converted/constructed 654 pour flush latrines in 1991-92. Later, the implementation of LCS programme was entrusted to another NGO (Akhil Bhartiya Rachnatmak Karya Sansthan) and it has converted/constructed 755 pour flush latrines during 1992-94. Thus nearly 3200 households are yet to be covered.

There are only two community complexes - one is pay and use type and the other non-pay and use type. Both of them are maintained by the municipality. The former is three seated (2 for male, one for female) and the later is 4 seated (2 each for male and female). No bath rooms have been provided in either of them. However, urinal facility (2 units for male and female each) exists in the latter. About 100 persons use each of the complexes daily. Both are connected to septic tanks. Water is available to the users only during municipal water supply hours as there is no water storage facility.

Solid waste is collected by the municipality and disposed of as sanitary land fill. For disposal of town waste water, there are surface drains discharging in the river Narmada.

13. AMBATTUR (TAMIL NADU)

Ambattur is situated in the Chengalpattu MGR district on the suburbs of Madras city spread over an area of 40.36 sq km. It is an important industrial centre. Its elevation from mean sea level is five to six metres only. Soil is clay/sandy clay. Average annual rainfall is about 1200 mm. Ground water is available at a depth of two to six metres depending on the locality and season, but its quality is not good, generally saline as it is near the sea. As per 1991 census, it had a population of 215424 of which 138992 (64.52%) were living in slum areas. It is a town of slums only as 84.12% of the total town area covering about 34 sq. km. is occupied by slums.

The LCS programme was introduced in 1991. It is not known as to how many dry latrines existed prior to initiation of LCS programme. But out of 48322 households, 3785 had no toilet

facilities. The conversion/construction of pour flush latrine was entrusted to an NGO (Kalai Selvi Karunalaya) and they converted/constructed 1450 pour flush latrines during 1991-94.

Earlier 51 scavengers (14 males, 37 females) were employed in scavenging by the municipality, who have been absorbed as sanitary sweepers after initiation of scavengers liberation scheme. Training had not been imparted to these scavengers. Information is not available about the number of private scavengers, who are still engaged in scavenging work

There were 29 community complexes (out of which one has been demolished) These complexes were constructed by contractors engaged by the municipality. It is reported that five community complexes are being used and the rest 23 are not in use. But of these five complexes, two are of pay and use type and the rest three are non-pay and use type. Each of these five has one person for maintenance engaged by the municipality and the remaining 23, which are not in use have no person engaged to maintain

Generally bullock carts and lorries are used for the clearance of solid waste and surface drains spill over and sillage stagnates here and there, causing insanitary conditions, health hazard and environmental pollution and degradation in a slum town having large number of industrial units.

14. GONDA (UTTAR PRADESH)

The town is located to the north east of Lucknow, near the border of Nepal. Its soil is sandy/clay and elevated by 95 metres from mean sea level. It has an area of 12.67 sq. km. The average annual rainfall here is 1080 mm. Potable ground water is available at a depth of three to six metres. As per 1991 census, the town had a population of 106000 and 26.9% of them were residing in slums. The slums occupy about 35.52% (4.56 sq. km) of the total area of the town.

Low cost sanitation programme was introduced in 1991-92. At that time, there were 12223 households. About 8882 households had dry latrines, 611 households had septic tank latrines and 2730 had no latrines at all.

The NGOs (Sulabh International and Manav Uthan Samiti) were involved in implementing the LCS programme. A total number of 2390 pour flush latrine have been converted/constructed. There are 10 community complexes in the town and all are pay and use type. These complexes were constructed by Sulabh, Manav Uthan Maha Samiti and private contractors in co-ordination with the municipality. Five complexes are being maintained by Sulabh, three by the municipality and the remaining two by private contractors. One to three social workers are engaged for maintaining these complexes. Toilet and bathing facilities are available in nine complexes for both males and females, but in one complex toilet facility is available, not the bathing facility. There are urinals for males in six complexes and three complexes have urinal facilities for females. Number

of visitors in a complex varies from eight to 418 on an average per day.

Prior to introduction of LCS programme, the municipality had 213 municipal scavengers (128 males, 85 females) and 142 private scavengers (85 males and 57 females). All of them were identified for scavengers liberation and rehabilitation programme. None of them was given training, but all the liberated scavengers have been provided some financial assistance (between Rs. 15000 and Rs. 25000) through bank and SC & ST Finance Corporation to find self employment. Out of 355 identified scavengers, 90 (54 males and 36 females) are engaged in self employment as rickshaw pullers, and band and loud speaker workers during marriage and other functions.

Solid waste is disposed off by the sweepers of the municipality. Water waste of household is discharged in open drains causing acute environmental problems due to extensive water logging.

APPROACHES TO LOW COST SANITATION TECHNOLOGY

Under the present economic conditions, sanitation facilities can not be provided in urban areas in the foreseeable future, if sewerage and septic tank are continued to be advocated because their capital, operation and maintenance costs are too high besides other operational problems. Therefore, an appropriate technological option which provides the most socio-culturally and environmentally acceptable level of service at least economic cost, has to be found.

In India from 1930 onwards, a dynamic search for a safe and economical alternative to the sewerage and septic tank systems for the disposal of night-soil suited to our socio-cultural and economic conditions started. Various low-cost sanitation methods like Khurpi, Trench, Dug-well,

Bore-hole latrines, Over-hung latrine, Drop-privy, Aqua-privy, Off-set Compost latrine, etc. were tried, but failed. They could not satisfy Indian conditions and situations.

The first pour-flush waterseal system with spot disposal of human waste was developed by the All India Institute of Hygiene and Public Health (AIIPH), Calcutta in the mid-forties and it was then known as the "dug well latrine". The Research-cum-Action (RCA) Project was later taken up by Govt of India through the Health Centres of Poonamallee (Tamil Nadu), Singur (West Bengal) and Najafgarh (Delhi) in the mid-fifties. Another project was taken up at Planning, Research-cum-Action Institute (PRAI), Lucknow (U.P.) in 1958 and the off-set double pit system was evolved. These efforts were however restricted to rural areas.

In 1970 it was Sulabh International which first developed and introduced low cost sanitation in urban areas in a big way including towns above 100,000 population. Even the city of Patna with a population of nearly 5 lakh was provided with this innovative system of excreta disposal in congested localities.

Sustainability, replicability and affordability are the three important qualities which should be considered while choosing a technology. Sulabh Shauchalaya (twin pit pourflush toilet) developed by Sulabh International in 1970 fulfils these criteria fully as it is socio-culturally acceptable, affordable, easily available and users are able to operate and maintain it conveniently. It provides all the health benefits by safe disposal of human excreta on-site. Sulabh Shauchalaya is most appropriate to serve as an alternative to bucket privies and prevent open air defecation. It can be constructed even in the most congested areas of cities and towns.

Sulabh Shauchalaya is suitable to communities who use water or soft paper for anal cleansing. In India water is used for ablution except by a very small section of population in the far eastern region and very high altitude areas. Hence Sulabh toilet is highly acceptable, affordable and suits socio-cultural habits and attitudes of the people. Ventilated improved pit latrine can be an alternative for the people who do not use water or thin paper for anal cleansing. The squatting pan and trap of a Sulabh Shauchalaya are of special design requiring two litres of water for flushing. Of the two pits, one pit is used at a time. The liquid infiltrates and gases disperse into the soil through the holes in the pit lining. When one pit is full, the excreta is diverted to the second pit. In about two years, the contents of the pit already filled get digested and become safe for handling. The pit can then be conveniently emptied and is ready to be put back into use, after the second pit is full. Thus the two pits can be used alternatively and continuously. People who do not prefer pour flush, oppose this low cost system. Now two litres flushing cistern has been developed, which can be fixed and the pour flush toilet can be changed to cistern flush whenever desired. Thus it has been possible to overcome one of the factors that led to the non-acceptance of low cost system by the MIG and HIG population.

In a Sulabh Shauchalaya, vent pipe is not necessary as gases get dispersed into the soil. The special feature of this type of toilet is that it has two pits instead of one. The reason being that single leach pit units are appropriate only if they can be de-sludged mechanically by a vacuum tanker, since their contents are not pathogen-free. In the two-pit system, the filled pit can be cleaned manually even by the householder himself because of the long period of digestion which makes it free of foul smell and safe for handling. In a single pit system, de-sludging has to be done immediately after the pit has been filled up to enable its re-use and this involves handling of fresh and undigested excreta which is a health risk. If a deeper and larger single pit is provided, de-sludging operation will be difficult and there would be greater chances of pollution, especially where ground water level is high.

The advantages and specialities of the Sulabh Shauchalaya System are as follows

- i) It is a permanent installation which is economical and durable. It can be afforded even by the weaker sections of society,

- ii) It is odourless and there is no air pollution, as the waterseal prevents gases from leaking out of the pit through the pan;
- iii) Only a small quantity of water (about two litres) is enough to flush the excreta from the pan into the pit, while conventional flush latrine needs 14 litres of water for flushing. Thus, it conserves water which is a scarce commodity;
- iv) It requires less space than septic-tank latrine. It can be constructed even in the courtyard, corridor, verandah or in the living room of a house, as it is free from foul smell and there is no mosquito, fly or insect nuisance;
- v) It can be constructed in cross socio-cultural and economic set-ups where water is used for ablution, and in varied physical, geological and hydrogeological conditions with proper precautions,
- vi) The technique of construction of the Sulabh Shauchalaya is simple enough; an ordinarily trained mason can easily build it. It can be constructed by using local labour and materials,
- vii) It can be constructed on the upper floors of buildings also;
- viii) As the pits are covered with air-tight and water tight R.C.C. slabs, the place can be utilised for other purposes too,
- ix) It is free from all health hazards and does not pollute surface or ground water or drinking water sources like hand pumps, wells etc. if proper precautions are taken at the time of construction;
- x) Maintenance is easy, simple and costs little;
- xi) Services of a scavenger are not needed to clean the pit. The house owner himself or any labourer can clean it because the sludge of the pit is safe for handling after two years of rest period;
- xii) Organic manure and soil conditioner of good quality become available to the householder for use in the field or garden;
- xiii) It has a high potential of upgradation. The Sulabh Shauchalaya can be connected easily to sewers when sewerage is introduced in the area, and
- xiv) A low volume flushing cistern can be attached to avoid pour-flushing.

COST EFFECTIVE

Sulabh Shauchalaya is cost effective. It can be designed with different specifications and use of different types of material without compromising the basic design principles with variable costs ranging from Rs 500 (US \$ 15) to Rs. 5000 (US \$ 150). It can therefore be afforded even by the economically weaker sections.

The Bihar programme conceived and implemented by Sulabh International drew the attention of WHO, South Asia Region, Delhi. Greatly impressed with the Sulabh's modified design of two pit pour flush waterseal latrine with on-site sanitation popularly known as "Sulabh Shauchalaya" and its organisational activities, in 1997 WHO decided to study in depth the actual situation at site. An expert mission of WHO visited Patna. By that time Sulabh International had already converted 10,000 bucket privies into twin pit pour flush waterseal latrines (Sulabh Shauchalayas) in the most congested areas of the city of Patna and 40,000 in other towns of Bihar. The mission observed that to make the programme successful, a dedicated effort towards promotion, motivation, publicity and health education is needed to create awareness among the beneficiaries. The mission learnt from the Director of Health Services, Bihar that Shauchalayas constructed by Sulabh International had not caused any health hazard to the community wherever they had been adopted.

The WHO and the Ministry of Works and Housing (now Urban Affairs and Employment), Government of India in collaboration with Sulabh International and UNICEF convened the first National Seminar on Conversion of Bucket Privies into Sanitary Waterseal Latrines in May, 1978 at Patna. It was attended by public health engineers, public health specialists, scientists, administrators, planners and decision makers from all the States and Central Governments because of the multi-disciplinary nature of work. Based on the deliberations, and observing the work done by Sulabh in Bihar, the seminar concluded that two pit pour flush latrines with on-site sanitation popularly known as Sulabh Shauchalaya is the most appropriate low cost technology to be introduced on a large scale in the urban areas of the country.

In 1979, when the UNDP/World Bank took up the proposal for demonstrating the installation of low cost sanitation on a world wide basis, based on the experience of Sulabh International, the Govt of India decided that UNDP/World Bank should take up a Feasibility Study on low cost sanitation in India in 211 towns spread over in 21 States and Union Territories. Various studies were carried out by the UNDP/World Bank of the Bihar programme, investigation of various technical features and the study of pollution from the existing leach pits. The convincing data based on actual work done in varied physical, hydrogeological, socio-cultural and economic situations in Bihar provided useful material to draft the Feasibility Reports on low cost sanitation. Thus it is Sulabh International's successful achievement that showed the path for adoption of low cost sanitation system on a large scale, which was finally accepted all over India.

The Government of India, State Governments, various national, international and bilateral agencies like UNDP, UNICEF, World Bank, WHO, UNCHS, HABITAT etc. have acknowledged that Sulabh Shauchalaya is the most appropriate low cost technological option to improve the environment and quality of life of the people. They have suggested its adoption in India as well as in other developing countries.

POLLUTION ASPECT

Although Sulabh Shauchalayas are being advocated, yet the dangers of water pollution from the leach pits are often raised by several authorities desirous of adopting this system. The apprehension of ground water pollution is considered to be a deterrent factor in adoption of this system. The pollution problem has been studied in great detail both in India and abroad, although further studies are underway to evolve a more economical design to prevent pollution under different hydrogeological conditions. However, it has been conclusively proved that with due precautions, Sulabh Shauchalaya system can be safely implemented in almost all hydrogeological conditions.

To ensure that the risk of polluting ground water and drinking water sources is minimal, the following safeguards should be taken while locating the pits :

- i) Drinking water should be obtained from another source or from the same aquifer but at a point beyond the reach of any faecal pollution from the leach pits.
- ii) If the soil is fine (effective size 0.2 mm or less), the pits can be located at a minimum distance of three metres from the drinking water sources, provided the maximum ground water level throughout the year is two metres or more below the pit bottom (low water table). If the water table is higher, i.e. less than two metres below the pit bottom, the safe distance should be increased to 10m.
- iii) If the soil is coarse (effective size more than 0.2 mm), the same safe distance as specified above can be maintained by providing a 500 mm thick sand envelope, of fine sand of 0.2 mm effective size, all around the pit, and sealing the bottom of the pit with impervious material such as puddle clay, a plastic sheet, lean cement concrete, or cement stabilised soil.
- iv) If the pits are located under a footpath or a road, or if a water supply main is within a distance of three metres from the pits, the invert level of the pipes or drains connecting the leach pits should be kept below the level of the water main, or one metre below the ground level. If this is not possible due to site considerations, the joints of the water main should be encased in concrete.

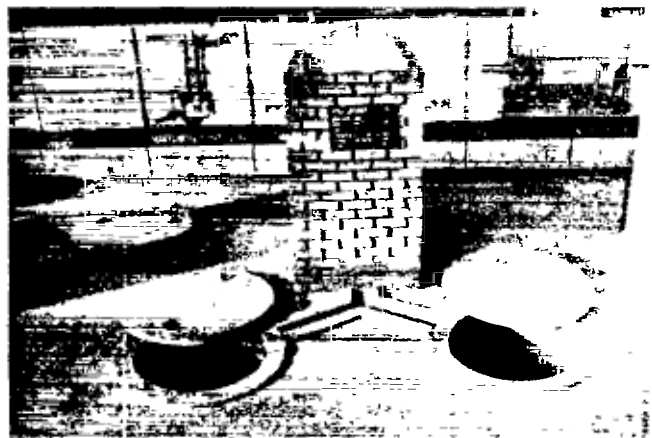
THE RATIONALE : LOW COST SANITATION-VIS-A-VIS SULABH SHAUCHALAYA

The Eighth Plan (1992-97) document envisages the concept of "total sanitation", covering primary health care, water availability, women's welfare, immunisation and provision of sanitation facilities all linked to cleanliness as a basic human need. It emphasises that every effort will be made to adopt a low-cost approach employing technical and scientific know-how and experience already gained by several non-governmental organisation in this regard.

It is against this background that the role of Sulabh and other NGOs in terms of sustainability, affordability and replicability for environmental upgradation in urban areas needs to be assessed. In a way, the country document admits the inevitable acceptability of low-cost approach. Also, it acknowledges the role played by NGOs like Sulabh unreservedly.

In 1985, Dr Raja J. Chelliah, the then Member of Planning-Commission, had observed that "with limited resources and an unabated rush to larger cities, search for low cost solutions, therefore, is a matter of priority. It has generally been accepted that India has two major areas for replication in this regard, namely, the urban community development programme and the low-cost sanitation project programme through the pour flush twin-pit latrine as in operation in a large number of States in India". Sulabh's pioneering efforts in popularising low-cost sanitation latrines have been commended widely.

Indian planners and NGOs working with people to accelerate the pace of progress of human development have unequivocally recognised that although more than nineteen types of human excreta disposal system have been identified the world over, only three systems are found to be suitable for adoption in India. These, in descending order of quality performance and acceptability are (i) the high cost local government managed sewerage system (ii) the medium cost household managed septic tank system and (iii) the low cost individual household and water friendly and multi-beneficiary pour flush water seal sanitary compost latrine or household toilets, popularly known as Sulabh Shauchalaya. Conventional sewerage, an ideal solution for disposal of human excreta and waste water satisfies most of the public health criteria and is also convenient. But, it requires large quantities of water for proper functioning. The capital cost of sewerage construction, including waste treatment is very high. Besides, operation and maintenance cost is also quite high. Although sewerage had been introduced in India about 120 year ago and most of the plan allocations for urban sanitation have been spent on sewerages yet only 232 towns and cities out of 4689 are served by sewerage. In most of them, the sewerage system does not cover the entire municipal area, leave alone the adjoining suburbs included within municipal limits. The first two categories are socially more accepted systems and all major cities and towns exceeding one lakh population have perspective plans already for full sewerage system including upgrading of septic tanks, notwithstand-



The 2-pit pour flush sanitation system is a cost-effective solution for individual toilet.

ing excessive construction and maintenance cost. Also, this option is exercised despite huge unrealisable targets, made difficult by a continued rush to urban areas. It has been acknowledged in various studies, corroborated by the observations in the present study, that untreated or partially treated sewerage and badly maintained systems could precipitate health hazards and septic tank are seldom free of mosquitoes.

Consequently, a wider applications of household toilets or Sulabh Shauchalayas, available in different models and designs suited to every range of user costing from Rs. 500 for five users with two year capacity pits to Rs. 5000 for ten users with twenty years capacity (excluding superstructure), etc. are available. These models have already been implemented by Sulabh in Bihar, Madhya Pradesh, Uttar Pradesh and Rajasthan among the economically weaker section (EWS) low income group (LIG) and middle income group (MIG) people. All these models and designs of Sulabh have been technically tested and implemented in different geophysical conditions. As these models are affordable to different income groups of people, particularly to economically weaker sections, the effective demand for household toilets or Sulabh Shauchalaya increased over the years and it had its spread effects in many towns/cities of 18 states and two union territories of India as the 'best practice' acceptable to the people and local bodies.

The other method of excreta disposal is the septic tank which is beyond the reach of the common man, it costs two to three times more than the household toilets or Sulabh Shauchalaya.

SPECIFIC ADVANTAGES OF SULABH SHAUCHALAYA OVER SEPTIC TANK ARE :

- i) Septic tanks have to be cleaned after every one-or two-years interval and wet sludge has to be taken out, which has fresh human excreta floating at the top and emitting obnoxious smell. It needs the services of scavengers for desludging, since the ordinary labour-

er will not be willing to handle it as it is mixed with fresh excreta. If desludging operation and disposal is not handled properly, it is a health hazard. Since the Government of India has already brought into force the Employment of Manual Scavenger and Construction of Dry Latrines (Prohibition) Act 1993 banning scavenging as such, desludging of a septic tank will pose a serious problem.

- ii) Services of scavengers are not needed in the case of Sulabh Shauchalayas. The pits can be cleaned by the householder himself or any labourer because the excreta is completely digested and safe for handling after one and a half years of disuse of filled up pit.
- iii) The maintenance of Sulabh Shauchalaya is easy and simple and costs little, whereas emptying of septic tank cost much. In case of Sulabh Shauchalaya, part cost of emptying can be met from the sale of sludge as direct fertilizer taken out from the pit.
- iv) Septic tanks have to be cleaned immediately on filling so as to allow uninterrupted use of toilet. In the case of Sulabh Shauchalaya, since one pit is used at a time, the filled up pit can be desludged at the convenience of the householder after one and a half years rest period, when the digested sludge is safe for handling and does not cause any health hazard.
- v) Although ISI code states that under no circumstances should effluent from a septic tank be allowed into an open channel, drain or body of water without adequate treatment, this is seldom done resulting in foul odour, fly and mosquito nuisance, health hazards and environmental pollution. The municipal bye-laws prohibit discharge of septic tank effluent direct to open drains or body of water but this provision is not strictly enforced due to various reasons. In Sulabh Shauchalaya, there is no such problem because liquid infiltrates into surrounding soil through the holes in pit lining.
- vi) Every septic tank is required to be provided with ventilating pipe so as not to cause smell nuisance. The emission of foul smell through the vent pipes pollutes the atmosphere. In Sulabh Shauchalaya no vent pipe is required as gases are dispersed into the soil.
- vii) There is shortage of drinking water in almost all the urban and rural areas of the country; hence water has to be conserved. Septic tank latrine usually needs 14 litres of water for flushing, whereas Sulabh Shauchalaya needs only one and a half to two litres of water.
- viii) Septic tank latrine requires more space than the pour

flush toilet. The design of Sulabh Shauchalaya has the flexibility, it can be designed to suit site and household requirements.

- ix) Sulabh Shauchalaya with twin pits has potential for upgradation. It can be connected to sewerage system easily; only leaching pits will become infructuous, whereas in septic tank latrine, the septic tank and effluent disposal system will become infructuous, which is costs two to three times more than the leach pits of a Sulabh Shauchalaya.
- x) The sludge and effluent from a septic tank cannot be used as manure directly without causing health hazards, whereas the sludge of the leaching pit is almost dry, odourless and safe for handling after about one and a half years of rest period; hence it can be used immediately after it is taken out. It is also a very good manure and soil conditioner.
- xi) The construction of Sulabh Shauchalaya is very simple and can be constructed by any mason with a little training, whereas skilled masons are needed for construction of a septic tank of proper design.

Sulabh Shauchalaya innovative models developed and implemented by Sulabh International with low cost technology are affordable and acceptable to the people because of their proper monitoring and effective delivery system.

The present study also supports the statement of Shri Mulk Raj Anand (Foreword, Restoration of Human Dignity 1994), that "the Sulabh International invention of dry latrines, which is flushible with one Lota of water, is revolution which now becomes imperative to adopt throughout the country". It has also been revealed through the findings of this study that the Sulabh flush has helped the scavengers in many parts of the country to free themselves from demeaning work. It is estimated that about 35,000 scavengers have been relieved of scavenging and enabled to seek alternate employment either in the local body establishment itself or elsewhere. Of the relieved scavengers, about 3,406 were trained by Sulabh itself to acquire job oriented skills. The integrated approach which the low cost sanitation programme emphasises is brought about by Sulabh through innovative initiatives. This research study based on 'Indian Experiences' went into this holistic approach in some detail.

The contribution of Sulabh International and some localised NGOs in attaining satisfactory levels of urban environment has been confirmed by the study. In the task of capacity building to tackle problems of urban environment, a co-ordinated approach is needed. The avowed objective of the Government of India to eliminate scavenging by the end of the Eighth Plan (1992-97) itself is the most evident sign of the feasibility of conversion of dry latrines and the efficiency of low cost ones on Sulabh Shauchalaya models. The ambitious Eighth Plan

national scheme of Rs. 464 crore for rehabilitation of scavengers again points out to the lead provided by Sulabh International to train and rehabilitate scavengers and their dependents.

To sum up, the present study has established that :

- i) Sulabh system qualifies on all counts as the 'best practice' in India to provide alternate integrated low cost sanitation facilities thus contributing towards capacity building to tackle urban environmental problems;
- ii) urban slums need much more attention;
- iii) community toilet complexes, though acceptable to the people need extensive promotion for installation at strategic urban centres to control pollution;
- iv) gender-specific facilities need to be augmented, and
- v) bio-gas plants based on night soil are still to be promoted in a big way as a source of non-conventional energy resource and utilization of waste material in urban areas for environmental upgradation.

GENDER ISSUES

Gender equality in matters of economic, social and political significance is a fundamental right guaranteed by India's Constitution to the 450 million Indian women, who form roughly one - sixth of the world's female population. India is one of the few countries which has a highly creditable record in regard to enactment of laws to protect and promote the interests of women. Using a Gender-related Development Index (GDI), the 1995 Human Development Report of UNDP places India in the 99th position among 130 countries in relation to the status of women. In dealing with sanitation and environment matters, attention has necessarily to be given to removal of hurdles that impede full participation of women. The present survey has revealed certain shortcomings in implementation of low-cost sanitation programmes that adversely affect women beneficiaries.

No doubt women were consulted in deciding the location of P.F. latrines. They were also informed about their usefulness before constructing them. They were made fully aware and even appreciated the harmful effects of open defecation or for that matter about the use of dry latrines on health and environmental grounds.

Though they know about the use and maintenance of PF latrines, many of them were not using them in the absence of superstructures. They were thus compelled to go for defecation in the open. Until and unless privacy for women is ensured by constructing the superstructure on PF latrines, women would have to go for open defecation.

As for community latrines, the women were consulted before construction of community latrine in their locality. They were informed about the usefulness of community complex and it was explained as to how it would improve environment and sanitation of the locality. But when they were asked whether the implementing agency had organised any training camp on health and hygiene and use of community complex, the respondents of majority of the towns stated that such training camps were not organised. Only in Madras, Bangalore and Puri such training camps were organised which were attended by 70 percent, 35 percent and 50 percent respondents, respectively.

When they were asked whether privacy and security of women was maintained in the community complex, they reported that there was no problem about security because there were women attendants in the complex. However there existed a problem of privacy. The survey reveals that there is lack of awareness and motivation amongst the women, particularly in slum areas as to how the effective use of household toilets and community toilet complexes could keep them and their family healthy to improve the quality of their life. Women's active participation in LCS programme is vital because the hygiene and sanitation of the entire family depends upon their awareness and motivation.

The survey has revealed that for maximising the use of LCS facilities in general and women and children in particular, the following observations need to be looked into

- i. Accessibility location of the community facilities should be near to residences
- ii. User charges : The system of per person per use charge should be replaced by affordable monthly payment for the entire family
- iii. Availability of water and electricity : There should be water supply for 24 hours. The complexes should be electrified to allow use in the night
- iv. Separate latrine seats for children . Each complex should have adequate number of seats for children.
- v. Bathing facility : Adequate bathing facilities should be provided for women.
- vi. Adequate number of toilet units . The number of toilet units should be provided keeping in view the number of expected women users of the locality. More seats in the complex could be arranged for women so that the waiting period could be reduced. This would facilitate women to attend more efficiently to their household duties related to child care, cooking, etc. As to the timing, most, of them preferred early morning and evening as it suited them most.

Although community toilet complexes have separate enclosures for women but the main entry point is common for male and

female Women preferred to have a separate entry point. It was gathered that if such arrangements could be made, more women of the locality might use the complexes.

ANALYSIS OF THE RESULTS OF THE SURVEY

The information gathered through the survey on various facets of household toilets (surveyed in twelve towns/cities) and community toilet complexes (surveyed in fourteen towns/cities) provide a vivid picture of the facilities under low-cost sanitation programme

The analysis clearly show that NGOs efforts in awareness campaigns have had the desired effect. An important aspect relevant to the situation in urban India is the composition of the so called weaker sections in the beneficiary group. Sulabh attends to more or less the same proportion of their population as their share in the country's population, the other NGOs in fact cater to more than their share. Another inference is that the slum population in the surveyed towns has substantial component of these weaker groups. This observation is further corroborated in terms of economic status through Table 4.8. While the 'poor' constitute one fifth of the total beneficiaries, it is the group in Rs 1251 to Rs. 2500 income bracket which dominates the scene. In fact both Sulabh and other NGOs attend to the same proportion of 'poor', the former caters to a larger proportion of the next category of 'less poor' (1250-2500) than the latter. These two groups account for eighty percent of the low cost sanitation beneficiaries in the surveyed towns. The inference is that the package under 'low cost sanitation', serves the target group in an undisputed manner. These three characteristics, (i) caste composition (ii) income levels and (iii) nature of habitations proclaim loudly the relevance of low-cost sanitation to the Indian situation. The other Tables presented in this study are self-explanatory which establish the living style and satisfaction levels of minimum needs of the household toilet beneficiaries in the surveyed towns thereby providing an overall profile of the users of the low-cost sanitation measures. In particular, through Tables 4.8 and 4.9, it has been established that the practice of open defecation continues unabated and that the inference is that more concerted efforts, through acceptable low cost sanitation package, would be needed to improve urban environment.

In regard to community complexes, it has been again established that these facilities largely meet the needs of poorer sections in the society in that 70 percent of the users are in the monthly income category not exceeding Rs. 2500/- The conclusion is that such facilities provide much needed benefits to a substantial population and contribute in maintaining clean environment

A study of the information contained in Table 4.10 establishes the fact that less the access to individual household latrines, the more the use of community complexes by women. This leads us to suggest that till such time individual household latrines can be provided in an adequate manner, the network of community complexes with sufficient arrangements for use by fe-



Community complexes meet the needs of poor and floating population.

males must receive priority attention. The survey also shows that in the towns served by community complexes managed by Sulabh, the users have faced less difficulties

In brief, the study establishes the fact that both household latrines and community complexes under the low-cost sanitation banner have contributed in improving urban environment and that in this endeavour both Sulabh and other NGOs have had an important role though the involvement of Sulabh has been more than other NGOs in the overall national context.

SURVEY FINDINGS OF TOWNS : HOUSEHOLD TOILETS

Out of 1649 respondents in twelve towns, 81 percent male respondents and 19 percent female respondents were interviewed. The survey findings revealed that 36 percent respondents obtained education below primary level, 26 percent upto high school and 12 percent above high school levels. The remaining 26 percent were illiterate. The percentage of illiteracy among the respondents was as high as 63 percent in those areas of Hyderabad where the NGOs other than Sulabh had constructed PF latrines. Among these respondents it was also found that 52 percent belonged to SCs, the overall percentage of respondents belonging to SCs, STs and others worked out to 20, 74 and 6 respectively.

With regard to income, it was found that 61 percent of the respondents of 1649 households had household monthly income between Rs. 1250 and Rs 2500, 14 percent between Rs 2501 and Rs. 4000 and only five percent above Rs. 4000. The percentage of low income group below Rs 1250 was 20 percent. The percentage of households having income below Rs 1250 was as high as 52 percent in Madras and as low as 4 percent in Ambattur.

With regard to occupation, it was found that the percentage of workers in twelve towns was 83 percent and the percentage of non-workers 17 percent. Among the workers, 32 percent were engaged in service, 47 percent in business and four percent in farming. There were 51 percent joint families as against 49 percent nuclear families.

With regard to characteristics of the respondents habitations, it was found that 21 percent were living in slums, 39 percent in slumlike situation and two percent in unauthorised colonies. The remaining 38 percent were living either in newly developed area or developed colonies. The percentage of respondents living in slums was nearly fifty or above in Bhopal, Madras, Ambattur and Gonda. With regard to types of housing, out of the total households in the twelve towns, 80 percent had either pucca or semi pucca houses and 20 percent were living in kutcha houses. The percentage of kutcha houses was as high as fifty in Bhopal and forty-four in Madras.

Piped water and handpumps are the major source for drinking and other purposes. The overall percentage of piped water and hand pumps in the twelve towns/cities was 80 percent. However, in Madras 48 percent depend on other sources. The people faced acute shortage of water.

With regard to location of PF latrines, it was found that 59 percent of the households had got their PF latrines constructed outside the covered area but within the premises and about 30 percent had got their PF latrines constructed in covered area in Verandah. Eleven percent had their PF latrines either outside the premises or attached to their rooms.

It was found that the women and children of 79 percent of the households were using PF latrines and 21 percent were not using. However the percentage of these households varied a great deal in respect of individual towns. In some towns like Ajmer, Ambattur and Gopalganj, the women and children of a large number of households were not using PF latrines. It was as high as 42 percent in Ajmer, 40 percent in Ambattur and 34 percent in Gopalganj. The main reasons for not using them were inhibition on the part of women, reluctance of children due to old habit of defecation outside, the absence of superstructure and apprehension of the pits getting filled up due to their small size.

Among women and children not using PF latrines, 67 percent of the respondents of sample households stated that women went to open field for defecation, 14 percent stated that the children used roadside for defecation and 11 percent stated that their children used open drain for defecation.

Only about eight percent sample beneficiaries observed technical defects in their latrines. However, the percentage of defects observed was substantially high in respect of two towns, namely Ambattur and Barwani. In Ambattur 45 percent had observed technical defects and in Barwani 31 percent had observed the same. In Madras and Gopalganj no beneficiary had observed any defect.

About 86 percent of the respondents felt satisfied with the PF latrines and 14 percent expressed dissatisfaction. However, the percentage of sample respondents expressed dissatisfaction was substantially high in Ambattur and Barwani. In Ambattur 51 percent expressed dissatisfaction with PF latrines and in Barwani 41 expressed similar dissatisfaction. Those who expressed satisfaction stated that scavengers were not needed for cleaning the PF latrines, privacy and security was maintained, foul smell was not emitted and less water was required. The reasons for dissatisfaction were absence of superstructure and installation or construction of small pits.

In the absence of meaningful comparable data in respect of eight towns where Sulabh had constructed PF latrines, our analysis covers the five towns where other agencies had constructed PF latrines. With regard to construction of superstructure on PF latrines located outside the covered area, 62 percent had got the superstructure constructed and the remaining 38 percent had no superstructure. However, the percentage varied between the towns. It was as high as 88 percent in Gopalganj and as low as 19 percent in Ambattur. Among those who had superstructures, 87 percent got the superstructure constructed by themselves. With the exception of Ambattur and Gonda almost all had got their superstructure constructed by themselves.

With regard to types of superstructure constructed by themselves, 60 percent had pucca superstructure and the remaining 40 percent had katcha superstructure.

Although the exact number of superstructures built on PF latrines constructed by the Sulabh was not gathered, it can be stated that the majority of women were not using the PF latrine owing to non-existence of superstructure.

With regard to construction of PF latrines by different agencies it was found that out of the total sample households in five towns, 66 percent had got their PF latrines constructed by NGOs, 23 percent by municipality, about eight percent by private contractors, three percent by self and others. However the percentage varied between the towns. In Ambattur, Gopalganj and Hyderabad it was mainly the NGOs who had constructed the PF latrines. In Barwani, it was primarily the municipality which did the construction, while in Gonda, various agencies had constructed the PF latrines though about 50 percent households had PF latrines constructed by private agencies.

When asked whether the household members were consulted in planning and implementation of the latrines, 46 percent households stated that they were consulted, and the remaining 54 percent stated that they had not been consulted. However, the percentage of households in five towns varied a great deal. In Hyderabad only about three percent were consulted while in Gopalganj 98 percent had been consulted.

When the respondents were asked to state the reasons for conversion of dry latrines, 48 percent stated that it was more

convenient to use PF latrines, 21 percent stated that it would not adversely affect the health, 18 percent stated that they were dissatisfied with the scavengers service and their service was expensive. Another four percent stated that the privacy of women could be maintained.

SURVEY FINDINGS OF TOWNS : COMMUNITY COMPLEXES

Educational level of the beneficiaries of the community complexes in different towns varied a great deal. The overall percentage of 593 beneficiaries as per levels of education were (1) primary level 26%, (2) upto high school 41% and (3) above high school 11%. The overall percentage of illiterate beneficiaries worked out to about 12. However, the percentage of

illiteracy was as high as 83 in Ambattur, followed by Gopalganj and Barwani where the percentage was more than 50.

The majority of beneficiaries were engaged either in service or business in all the towns except in Gonda. The overall percentage of beneficiaries engaged in service was 36 and in business 58 percent. The percentage of housewives was only seven percent. The students and children constituted three percent. The percentage of unemployed was insignificant. However the percentage of housewives was as high as 55 in Gonda, followed by Hyderabad (other NGO) and Barwani.

With regard to income, 30 percent of the beneficiaries belonged to monthly household income category below Rs. 1250, 19 percent belonged to income category between Rs. 2501 and Rs. 4000, and 11 percent belonged to income category above Rs. 4000. However this percentage varied a great deal in respect of individual towns. The monthly household income level of the beneficiaries in three towns, namely, Ambattur, Barwani and Gopalganj showed that largely the beneficiaries belonged to income category below Rs. 1250.

In the fourteen towns, 389 beneficiaries (66 percent) were local and 227 (34 percent) were commuters. Our household survey analysis was limited to local beneficiaries only because it was they who used these complexes more regularly.

With regard to housing, 50 percent of the beneficiaries had pucca houses, 13 percent semi-pucca houses and 36 percent katcha houses. In some towns like Ambattur, Barwani, the percentage of beneficiaries having katcha houses was quite high. In some towns like Madras, Jammu, Bangalore, Ajmer and Hyderabad the percentage of beneficiaries having pucca houses was quite high.

Out of 389 respondents using the community complex, 42 percent beneficiaries had individual household latrines and 58 percent did not have such latrines. The percentage of beneficiaries having individual latrines was as high as 96 percent in Bangalore and as low as 3.3 percent in Bhopal. When the respondents were asked whether the women of their households



Pay-and-Use Community Complex contributes significantly towards Environmental Improvement.

were using the community complex, 64.3 percent stated that they were not using the community complex. The percentage of households whose members were using the complex was as high as 87 percent in Bhopal, followed by Gonda, Bombay and Puri. It was below 20 percent in Ajmer, Jammu, Bangalore, Mirzapur and Patna. It was found that the lower the percentage of individual household latrines in a town, the higher was the percentage of women users of the community complex, and vice-versa. For instance, the percentage of households in Bhopal having individual latrines was only 3.3 but the women of 87 percent households were using the complexes. Similarly in Bangalore women of only 13 percent households were using community complex because 96 percent of the beneficiaries had individual latrines.

The survey findings revealed that 41 percent of the beneficiaries of the sample households were using the complex for only toilet, 24 percent for urinal and toilet, 13 percent for toilet and bathing, 19 percent for all the three types of facilities. The percentage of beneficiaries using them for bathing or urinal only was insignificant.

When the respondents were asked whether they had ever encountered any difficulty in the use of the complex, it was revealed that 21 percent of the respondents of the total sample households faced difficulties. It has to be noted that 95 percent in Ambattur, 65 percent in Jammu, 67 percent in Gonda and 56 percent in Barwani faced difficulties while in Patna, Bangalore, Hyderabad and Gopalganj none had faced any difficulty.

GENERAL OBSERVATIONS

The status of scavengers' liberation programme in case studies of fourteen selected towns/cities reveals that public scavengers, who were servicing dry latrines, have been absorbed in the local bodies as sweepers, gardeners, etc; their dependents are getting financial assistance for education and vocational train-

ing in different trades, who are mostly reported to be self-employed. But most of the private scavengers, who were servicing dry-latrines are even now engaged in the same job though secretly, where dry latrines exist. None of the municipalities and corporations of the surveyed cities and towns could provide information with regard to status of number of private scavengers and the number and nature of different types of latrines presently existing.

The general observations of the case studies of fourteen selected towns/cities reveal the problems encountered in implementation of the programme which relate to lack of co-ordination at the central, state and particularly at local levels of administration and management; delay in furnishing state Government guarantee for loan approval for LCS causing delay in sanction of loan by HUDCO as well as problem of release of subsidy amount by Ministry of Welfare for training and rehabilitation; non-availability of exact details of category-wise beneficiaries and number of scavengers to be liberated, trained and rehabilitated, non-availability of exact details of different types of latrines presently existing in the cities and towns for programming conversion/construction of low cost sanitation measures, lack of technical personnel for preparation of project reports and to monitor implementation of the programme; improper selection of implementing agencies for carrying out both programmes in small and medium towns, and last but not the least lack of effective arrangement to provide services for household toilets and suitable land for community toilet complexes. It is reported that due to various problems in implementation, physical achievement is not up to expectation.

The survey of selected towns/cities further indicates general acceptability and effective use of both the household toilets and community toilet complexes as 'best practice', followed by Sulabh International which have potential for not only replicability but also for creating long term impact in improving urban sanitation situation and health care of the people living in urban environment. This is because Sulabh takes entire responsibility of implementing the LCS from inception to the provision of facilities including maintenance and follow up with the guarantee of five years to the beneficiaries of household toilets. Moreover, it ensures community toilet complexes it owns responsibility for thirty years for operation, maintenance and upkeep without any liability on local bodies. On the other hand, the survey findings indicate that such methodology has not been adopted by NGOs, other than Sulabh, causing delay in implementation and dissatisfaction among the beneficiaries.

FORMULATION OF NATIONAL STRATEGY

CAPACITY BUILDING FOR URBAN ENVIRONMENT

The urban population of 21.7 crore,⁴ about 25% of India's total population of 84.6 crores in 1991 census (with growth rate of 2.14% per annum between 1981-91) is a vital concern to plan-

ners and policy makers. If the urban growth trend continues unabated, it is extrapolated that by the turn of the century, urban population may be one-third (about 33%) including more than 50% of slum and pavement dwellers and squatters of India's total population. The urban population is spread over 4696 urban settlements. The number of cities with a population of one lakh plus increased from 216 in 1981 to 300 in 1991 census. These cities account for 65 percent urban population. The growth of population in medium and small towns follows, more or less, the same trend. About 1292 medium towns (above 20,000 to one lakh size) share 24 percent, and the remaining 3104 small towns (less than 20,000 population size) constitute 11 percent of the urban population. The problem of excessive urbanisation and industrialisation leading to growth of slums (particularly in megapolis and metropolis and also in medium and small towns) has been causing insanitation and diseases with contaminated water supply, insanitation and mounting piles of filth due to lack of inadequate system of garbage disposal. Consequently, urban environmental degradation is visible to a greater or lesser extent in practically all cities and towns.

SEVENTY FOURTH CONSTITUTION AMENDMENT ACT (1992)

In the present scenario, the capacity building for urban environment management by local bodies (corporations and municipalities) calls for different urgent options. Presently, more or less, all local bodies are entrenched with the problems of lack of finances, motivation and coordination among different agencies concerned with governance and management of even the basic sanitation and health needs of the people in cities and towns. Their task is monumental. And, the prerogative of authority of decisions, governance and management of civic affairs are limited and/or insignificant, because these are delegated to or retained by state governments as custodian of local finances and power of governance.

The Seventy Fourth Constitution Amendment Act (1992) pertains to decentralised planning in local bodies (metropolitan and municipal areas) in India. The smallest urban settlements from 100 to 200 families and more, or service centres in metropolises above one million population constitute a hierarchy linked in many ways (such as socio-economic and socio-cultural heterogeneous population). Hence, planning for people living in urban settlements would mean a change in habit, attitude and behavioural pattern (of heterogeneous migrants). Besides, the planning process will need participation of the people, particularly women and the poorest sections (the scheduled castes, scheduled tribes and backward classes) in the governance of their civic affairs in urban areas where they live.

The participation of the NGOs along with residents welfare associations has been shown to be one of the most fruitful avenues to bring about the amelioration of urban environmental conditions (in urban pockets and slums) by implementing integrated low cost sanitation cum scavengers' liberation programme. The NGOs have also implemented low-cost technology, for example, bio-degradable solid waste have been sepa-

⁴ 1 crore = 10 million

rated for the production of bio-gas for cooking and mini-thermal power, deep tubewells are being excavated to supplement the declining water supply, street sanitation, drainage, and sewerage is being established and maintained by neighbourhoods; and last but not the least, the flood of people to urban areas (particularly in slums) cannot only be stemmed but also be reversed using the same family chains that brought the rural poor to metropolitan and other urban areas. Indeed, this needs unflinching and dedicated efforts of the NGOs/voluntary organisations

The Seventy Fourth Constitution Amendment Act (1992) therefore, raises more critical issues and doubts, for institutions of self-government to function effectively in the absence of complete autonomy to sensitize essential and desirable components, ensuring 'capacity building for urban environment management.' Thus, the components for institutions for local government/bodies should be (a) clearly demarcated areas of jurisdiction vis-a-vis central and state governments (b) adequate empowerment of power and authority in consonance with the responsibilities of development needs (c) ensured power and authority to raise and/or increase financial and human resources to manage civic affairs in terms of priorities (particularly sanitation and health affairs) and (d) complete functional autonomy to coordinate and monitor the civic affairs in active collaboration with NGOs/voluntary organisations and residents welfare associations

NATIONAL STRATEGY

The Seventy Fourth Constitution Amendment Act (1992) has therefore to be reviewed for evolving a National Strategy with a fresh look at legislative measures for operationalisation of urban environmental programmes.

Among the possible approaches, for early solution, one could include

1. Supplementing governmental efforts through privatisation and massive involvement of committed NGOs/voluntary organisations having track record in planning, development and management of :
 - (a) conversion/construction of household toilets and community toilet complexes
 - (b) garbage and sewage collection and disposal;
 - (c) propagation and dissemination of information, education and communication (IEC) for changing the habits, attitude and behaviour of people migrating from different linguistic, socio-economic and socio-cultural backgrounds;
 - (d) slum-improvement programmes;
 - (e) low-cost sanitation technology, especially for accelerating the process of items from (a) to (d)

- ii. Ensuring community participation particularly women involvement
- iii. Effective coordination of different actors at the local, state and central levels along with NGOs.
- iv. Imaginative changes in the municipal/local bodies bye-laws for the use of infrastructure support, including financial support to the NGOs.
- v. Meaningful land-use planning, and
- vi. Gender specific approaches to fully meet the needs of women, especially in relation to security and privacy, more specifically in urban slums

CAPACITY BUILDING AND INSTITUTIONAL STRENGTHENING

It is the primary responsibility of the local authorities to look after sanitation in their areas. Their resources being meagre, they are unable to meet the increasing demand. The local authority can therefore, get the sanitation programme implemented either through the State Government Engineering Department or Board incharge of water supply and sanitation or by awarding the work to a contractor or an NGO. The Government engineering department and many local bodies are strong in hardware but have no infrastructure for software which is an important input needed for the success of LCS programme. Many of the local bodies do not have technical persons and even where they are available, they remain busy in their day-to-day work with the result they are unable to pay due attention to the LCS programme.

The beneficiaries prefer an agency which is prepared to undertake the entire responsibility for the construction of toilet and the follow-up. Responsible and well established contractors are not interested in a project of this type, because the margin of profit is too small and the work is very time consuming being dependent on the convenience of the householders scattered throughout the town. The main motive of the contractor is profit making. Moreover, once the toilet is constructed, he does not bother about it. There is no follow-up. Hence people are not satisfied with the work carried out by the contractors.

For the implementation of social programmes like sanitation, NGOs with experience in the field of low cost sanitation are best suited. They work as a link and provide a transmission line between the people, the local authority and the Government. They motivate, persuade and popularise programmes and projects by bringing about attitudinal and behavioural changes and involving people in community projects. The active participation of the people ensures greater chances of success and cost-effectiveness than total dependence on the Government when people tend to become passive. The non-involvement of the people has also let them to always look to official agencies for help and thus lose private initiative. NGOs

organise communities and mobilise people's active participation. Women's involvement is also ensured at every stage of implementation.

Even when the LCS programme is implemented by the NGOs, the local authorities have to carry out certain functions. They will be responsible for :

- i) Preparation of budget
- ii) Training of personnel involved in the implementation of LCS
- iii) Preparing detailed programme of work
- iv) Processing of applications for construction of household latrines and execution of agreement with the householders for repayment of loans
- v) Receipt and disbursement of loans and subsidies
- vi) Supervising all construction operations to ensure that the works executed conform to prescribed designs and specifications
- vii) Monitoring for regular surveillance of project activities and to find out operational problems to solve them
- viii) Recovery of loans from the beneficiaries and repayment of loan taken by the local body for LCS
- ix) Providing pit emptying service to households on request and
- x) Attending to complaints of latrine adopters after implementing agency's warranty period is over.

For carrying out the above duties, the infrastructure in local bodies will have to be strengthened. The personnel engaged on LCS should not be assigned any other work but should look after LCS exclusively. The duties and responsibility of each should be clearly defined and coordinated.

WOMEN'S PARTICIPATION

Much of the demand for latrines comes from women as they are the worst sufferers due to non-availability of these facilities. Women have by far the most important influence in determining household hygiene practices and in forming habits of their children. So the facilities should be planned with full awareness of their preceptions and needs. Women can persuade male members to have a toilet in the house and pay for it. Women hold the key to the continued operation and effective use of these facilities for the benefit of family's health and better environment. The children can be educated by them to use the toilets. Involving women in water supply and sanita-

tion programmes, however, requires certain changes in approaches and techniques. Education materials should be geared and designed to suit their socio-cultural habits, beliefs and educational level.

PROMOTION AND HEALTH EDUCATION

The LCS programme offers a new facility to the people, but offering a facility is not an end in itself. It has to be accepted by the people for whom it is meant. People are often not fully conscious of the health hazards of insanitary latrines or open air defecation. Socio-cultural habits, customs and traditions are deep rooted in the society; to persuade the people to change their habits and accept the new technology, promotion, motivation and health education are important and essential inputs to make the programme a success. For this purpose a separate cell manned by suitable and adequate number of persons under social scientists should be created in the local authority or the NGO which is entrusted with the implementation of the LCS should have this infrastructure.

Women motivators and health educators are more useful. The motivators should approach the household individually and educate them about the social and health benefits of the programme. These efforts should be intensified during the initial phase of the programme or when the acceptance rate goes down. The motivation and education campaign should be monitored carefully (noting for example approach to audience, attractiveness and effectiveness) for streamlining and improving the approach.

At present latrine is not a felt need, hence when the community is made aware of the importance of sanitation, the people themselves come forward to demand the facility of latrines and encourage them to actively participate in the programme.

TRAINING MODULE

Although the low-cost technology is easy to implement, yet it requires all the ingenuity and expertise to provide for precision in construction and competence in supervision to guard against faulty construction, faulty practices and pollution, in the construction, use and maintenance of this relatively low cost sanitary device. It, therefore, calls for mounting a well-planned training programme for the personnel involved in the implementation of LCS programme.

The professionals incharge of implementing the sanitation project are mostly trained in conventional approaches. They need to be motivated and trained in the application of low cost technologies and exposed to different choices available in order to ensure rapid progress in expanding sanitation services. This calls for developing trained manpower.

The main task of training should be to sensitize decision makers, educate and train engineers and other personnel in the low cost technologies, to promote multidisciplinary approach em-

phasising socio-cultural and health considerations; and community participation specially involvement of women in planning, implementation and maintenance of sanitation systems

The training should bring about significant improvements in the effectiveness of sanitation investments and the extension of service coverage particularly to the low income population groups with a perspective of directing the investments towards, the use of low cost technologies which are cost effective, affordable, easily available and maintainable, and socio-culturally acceptable.

SULABH'S STRATEGY

Sulabh has been following the above practice in the implementation of low cost sanitation. It approaches people at their doorstep, discusses their problems in their own language and through their cultural medium and finds solutions. Sulabh volunteers go to beneficiaries to know their problem and find out solutions specially to sanitation problems. Once their income level, cultural preferences and indigenous resources position are known, the users are recommended the type of sanitation facilities they should opt for. The organisation takes full responsibility from beginning to end in providing the sanitation facility and also gives guarantee of five years for satisfactory performance. It encourages people to build such facilities on their own and help is given by Sulabh experts. There is a system to ensure quality control and participation of the community specially the women.

Sulabh's innovativeness is best demonstrated in another aspect of sanitation, namely, community pay-and-use toilet system which is a self-sustaining system adopted for the first time in the country. In 1878, the then Bengal Government of British India, had enacted a law to set up the pay-and-use toilet facilities in the city which was then the capital of India. But during the following 100 years nothing was done until Sulabh moved in to revive this concept which has become a roaring success today. Earlier, public toilets used to be the dirtiest places in city centres, but not now. More than 3,000 Sulabh pay-and-use toilet complexes are operating all over the country without any financial burden on public exchequer. Sulabh community toilets have improved the quality of life of poor people specially of the slum and pavement dwellers and have helped local authorities in keeping cities clean.

CONCLUSIONS

At the beginning of Sixth Five Year Plan in 1980-81, implementation of the programme for scavengers' liberation, through low cost sanitation scheme mainly by conversion of bucket/dry privies and construction of pour flush waterseal toilets and training and rehabilitation of scavengers and their dependents was taken up by the Ministry of Welfare, Government of India. This programme was initiated in pursuance of the legislation on Protection of Civil Rights Act, 1955. The expenditure on the programme was shared equally by the central and the state

governments; the local bodies implemented them as per prescribed guidelines. Besides, the Ministry of Welfare, other actors of the Government of India, namely, Ministries of Urban Development and Environment and Forests, local authorities and some NGOs/voluntary organisations were also implementing low cost sanitation programmes with different strategies. In the process, there was lack of coordination in implementation strategy.

For resolving the above issues, a co-ordination committee was constituted at the central level in 1989-90, with HUDCO as convener and composed of the representatives of all concerned Ministries of Government of India. A representative of NGOs, namely, Sulabh International was also invited for consultation. Thus, the Integrated Low Cost Sanitation for Liberation of Scavengers was brought together in a unified manner for implementation since 1990-91. The Ministry of Urban Development became the nodal agency for implementation of low cost sanitation programme, whereas liberation, training and rehabilitation remained with the Ministry of Welfare. The financial pattern for the programmes was modified.

An official report of HUDCO as of May, 1995 provides information on sanction in respect of pour flush household toilets and community toilet complexes under integrated low cost sanitation programmes of the Government of India, covering 996 towns. It has been indicated that from inception in 1980-81 as of May, 1995 a total of 23.93 lakh pour flush household toilets have been sanctioned for conversion of 13.58 lakh dry latrines and construction of 10.35 lakh new PF latrines. Further, 3843 community complexes have been sanctioned. Out of about 7.20 lakh identified scavengers and their dependents in 912 towns, 84,932 scavengers have to be liberated and rehabilitated as of May, 1995. In this, the contribution of NGO-Sulabh International Social Service Organisation is laudable.

The base-line situation of integrated low cost sanitation reveals the monumental task ahead as per 1991 census about 1.4 crore households (36.15 percent) do not have toilet facility in urban India. Consequently, majority of these people are compelled to defecate in the open causing unhygienic environment, contributing to many water borne diseases. Added to this is the abysmal state of sanitation and filth due to garbage and sewage generated every day, more or less, in all urban settlements causing immense damage to social fabric, environmental desirables and health standards. The local bodies administration is not equipped to handle the insanitation situation for lack of financial and manpower resources and poor coordination of different concerned departments from central to state levels. The NGOs also contribute their bit in tackling the situation. What is lacking as a baseline sine-qua-non is responsible co-ordination and monitoring attuned to achieve results.

An all India survey was conducted by the Ministry of Welfare, Government of India for identification of scavengers and their dependents under the National Scheme for liberation, training and rehabilitation. This was done with a view to providing

ultimate employment opportunities to both public and private scavengers. The status of scavengers' liberation programme in case studies of fourteen selected cities and towns reveals that public scavengers, who were servicing dry latrines, have been absorbed in the local bodies as sweepers, gardeners, etc; their dependents are getting financial assistance for education and vocational training in different trades, and are mostly reported to be self-employed. But most of the private scavengers, who were servicing dry-latrines are even now engaged in the same job though secretly, where dry latrines exists. None of the municipalities and corporations of the surveyed cities and towns could provide information with regard to status of number of private scavengers and the number and nature of different types of latrines presently existing.

In brief, the study establishes the fact that both household latrines and community complexes under the low-cost sanitation banner have contributed in improving urban environment and that in this endeavour both Sulabh and other NGOs have had an important role though the involvement of Sulabh has been greater than that of other NGOs in the overall national context

Indian planners and NGOs working with people have recognised that although more than nineteen types of human excreta disposal system have been identified the world over, only three systems are found to be suitable for adoption in India. These, in descending order of quality of performance and acceptability are (i) the high cost local government managed sewerage system (ii) the medium cost household managed septic tank system and (iii) the low cost individual household and water friendly and multi beneficiary pour flush water seal sanitary compost latrine or household toilets, popularly known as Sulabh Shauchalaya. The first two categories are socially more accepted systems and all major cities and towns exceeding one lakh population have perspective plans already for full sewerage system including upgrading of septic tanks, notwithstanding excessive construction and maintenance cost. It has been acknowledged in various studies, corroborated by the observations in the present study, that untreated or partially treated sewerage and badly maintained systems could precipitate health hazards and septic tank are seldom free of mosquitoes and disposal of sludge is health hazardous as untreated sewage has to be handled

Sustainability, replicability and affordability are the three important qualities which should be considered while choosing a technology. Sulabh Shauchalaya (twin pit pourflush toilet) developed by Sulabh International in 1970 fulfils these criteria fully. Although Sulabh Shauchalayas are being advocated, yet the dangers of water pollution from the leach pits are often being raised by several authorities desirous of adopting this system. However, it has been conclusively proved that with due precautions, Sulabh Shauchalaya system can be safely implemented in almost all the hydrogeological conditions.

It is against this background that the role of Sulabh and other

NGOs in terms of sustainability, affordability and replicability for environmental upgradation in urban areas needs to be assessed. In a way, the country document admits the inevitable acceptability of low-cost approach. Also, it unreservedly acknowledges the role played by NGOs such as Sulabh

The contribution of Sulabh International and some localised NGOs in attaining satisfactory levels of urban environment has been confirmed by the study. In the task of capacity building to tackle problems of urban environment, a co-ordinated approach is needed. The avowed objective of the Government of India to eliminate scavenging by the end of the Eighth Plan (1992-97) itself is the most evident sign of the feasibility of conversion of dry latrines and the efficiency of low cost sanitation models which have already been implemented in India. The ambitious Eighth Plan national scheme of Rs. 464 crores for rehabilitation of scavengers again points out to the lead provided through the arduous task taken up by Sulabh International to train and rehabilitate scavengers and their dependents.

To sum up, the present study has established that :

- i) The Indian Experience of involving NGOs in LCS has yielded results;
- ii) Sulabh system and methodology qualifies on all counts as the 'best practice' in India to provide integrated low cost sanitation facilities thus contributing towards capacity building to tackle urban environmental problems;
- iii) urban slums need much more attention,
- iv) community toilet complexes, though acceptable to the people need extensive promotion for installation at strategic urban centres to control pollution and improve environment;
- v) gender specific facilities need to be augmented; and
- vi) bio-gas plants based on night soil are still to be promoted in a big way as a source of non-conventional energy resource and utilization of waste material in urban areas for environmental upgradation.

The low cost sanitation programmes being implemented by the local bodies and the NGOs/voluntary organisations confirm affordability, sustainability and replicability of the ongoing programmes, especially the one developed by Sulabh. It is also established that the Integrated Low Cost Sanitation cum Scavengers' Liberation Programmes have had the desired impact in changing the habit, attitude and behaviour of the people towards sanitation. It also firmly establishes the fact that to achieve sustainable development of communities, enterprises and citizens' participation in civic affairs, particularly sanitation and health services, the massive involvement of committed NGOs and voluntary organisations under the guidance of local

bodies administration is absolutely essential. It has been observed that low-cost sanitation programmes mainly benefit the weaker sections of our population and hence the commitment of government to sustain the programme is crucial for the success of the programme.

The study suggests certain approaches for formulation of a National Strategy to effectively enhance the Capacity Building for Urban Environment Management capabilities of institutions of self-government. This, inter alia, calls for a review of legislative measures and for amendments to the Seventy Fourth Constitution Amendment Act, 1992. Institutions of self-government need complete autonomy and improvement in consonance with the responsibilities of development to raise their financial

and human resources, which have not been adequately considered in the Act of 1992.

The study points out the special areas, such as gender issues and slum populations, requiring deliberate interventions. The heterogeneous nature of the urban settlements calls for meaningful local initiatives to address adequately the varying demands for the low cost sanitation package with low cost technology strategy and large scale involvement of NGOs, voluntary organisations and residents welfare associations. The one summary conclusion that the study enables us to draw is that the country is on the correct path, though obstacles would need to be constantly cleared, in our search for clean urban living.

TABLE - 4.1

**SELECTION OF SAMPLE BENEFICIARIES OF HOUSEHOLD TOILETS AND COMMUNITY COMPLEXES
INSELECTED TEN TOWNS WHERE SULABH IMPLEMENTED THE SCHEME**

| State | Town/ City | Household Total | Toilets Sample size | Schedules adminis- tered | Community Total | Complexes Sample size | Schedules Admin- istered |
|--------------------|---------------------------------------------------------------------------------------------------|--------------------|---------------------------|--------------------------------|--------------------|-----------------------------|--------------------------------|
| SULABH | | | | | | | |
| Andhra Pradesh | Hyderabad | 7402 | 111 | 125 | 26 | 1 | 34 |
| Bihar | Patna | 18235 | 274 | 272 | 39 | 2 | 46 |
| Jammu & Kashmir | Jammu | 9259 | 139 | 140 | 8 | 1 | 26 |
| Karnataka | Bangalore | - | - | - | 38 | 1 | 29 |
| Madhya Pradesh | Bhopal | 605 | 100 | 103 | 4 | 1 | 30 |
| Maharashtra | Bombay | - | - | - | 201 | 6 | 152 |
| Orissa | Puri | 2064 | 100 | 109 | 5 | 1 | 30 |
| Rajasthan | Ajmer | 23050 | 346 | 334 | 7 | 2 | 46 |
| Tamil Nadu | Madras | 26 | 26 | 25 | 61 | 2 | 50 |
| Uttar Pradesh | Mirzapur | 2878 | 100 | 100 | 19 | 1 | 25 |
| OTHER NGOS* | | | | | | | |
| Tamil Nadu | Ambattur Kalai Selve Karunalaya | 1450 | 100 | 100 | 28 | 1 | 29 |
| Bihar | Gopalganj International Institute of Sulabh Systems | 537 | 100 | 101 | 2 | 1 | 25 |
| Madhya Pradesh | Barwani Akhil Bhartiya Rachnatmak Karya Sansthan | 755 | 100 | 100 | 2 | 1 | 26 |
| Uttar Pradesh | Gonda Manav Uthan Maha Samity | 37 | 37 | 35 | 5 | 1 | 20 |
| Andhra Pradesh | Hyderabad Lion Club, Urban Poor Society, Weaker Section Society, Urban Poor Syndicate | 7300 | 109 | 105 | 1 | 1 | 25 |
| | Grand Total | 73598 | 1642 | 1649 | 446 | 23 | 593 |
| | Sulabh Total | 63519 | 1196 | 1208 | 408 | 18 | 468 |
| | Other NGOs Total | 10079 | 446 | 441 | 38 | 5 | 125 |

* Other NGOs Town/City, Name of the Organisation

TABLE 4.2
GEO-PHYSICAL RESOURCE BASE

| State | Cities/ Towns | Area Sq Km. | Elevation above mean sea level (Metres) | Soil (Series) | Hydrology | | | Water quality |
|--------------------|------------------|----------------|-----------------------------------------------------|------------------------------------------------------|-------------------------------------------------|--------------------|--------------------|------------------------------|
| | | | | | Average rainfall (past 10 years) mm | Ground Water level | | |
| | | | | | | Summer (Metres) | Winter (Metres) | |
| Andhra Pradesh | Hyderabad | 259 | 536 | Sand | 880 | 15/40 | 15 | Sweet (Hard/ Brackish) |
| Bihar | Patna | 09.22 | 53 0 | Alluvial | 1154 | 6/12 | 5/7 | Good/sweet |
| Jammu & Kashmir | Jammu | 400 | 450 0 | Alluvial/ Boulder | 1348 | - | - | - |
| Madhya Pradesh | Bhopal | 284.0 | 460 | Red stone/ Morrum/ Lime Stone/ Black cotton | 1260 | 7 97 | 3.30 | Potable/ Soft |
| Karnataka | Bangalore | 225 | 900 | Black cot / Rocky Gravel | 741 | 7/8 | 5/6 | Sweet/Hard |
| Maharashtra | Bombay | 437.75 | 360/540 | Black Cotton | 1902 | 7.62 | 6 00 | Sour/Pure |
| Orissa | Puri | 16.84 | 12.19 | Alluvial | - | 6.1/12 2 | 3.1/7 6 | Saline |
| Rajasthan | Ajmer | 241 66 | 870 | Sandy/ Rocky | 494 | 90 | 60 | - |
| Tamil Nadu | Madras | 571 9 | 31 7 | Alluvial/ Gravel/ Sandy | 1286 | 5 | 1 | Saline |
| Uttar Pradesh | Mirzapur | 38 55 | 84.84 | Alluvial/ Silt/sandy Loan/Kankar | 1060 | 16.00 | 13.00 | Potable |
| Bihar | Gopalganj | 11 11 | - | Clay | 1292 | 7 | 4/5 | good |
| Madhya Pradesh | Barwani | 16.0 | 177.5 | Black Cotton | 507 | 20 | 18 | Soft/potable |
| Tamil Nadu | Ambattur | 40 3 | 65/6 | Clay/sandy | 1200 | 5 | 2 | Brackish |
| Uttar Pradesh | Gonda | 12 6 | 795 | Sandy/clay | 1080 | 5.76 | 3.54 | Potable |

Source District Census Hand Books and Municipal Offices

TABLE - 4.3
DEMOGRAPHIC CHARACTERISTICS

(in Lakh)

| Town/City | Population (1991) | | | | | Population (1981) | | |
|-----------|-------------------|-------|--------|--------|--------|-------------------|-------|--------|
| | Total | Male | Female | SC (%) | ST (%) | Total | Male | Female |
| Hyderabad | 29.81 | 18.58 | 11.25 | 8.36 | 0.98 | 23.04 | 11.14 | 10.36 |
| Patna | 9.17 | 5.03 | 4.14 | 8.23 | 0.27 | 7.76 | 4.29 | 3.47 |
| Jammu | N.A. | N.A. | N.A. | N.A. | N.A. | 2.06 | 1.09 | 0.97 |
| Bhopal | 10.63 | 5.61 | 5.02 | 11.82 | 2.77 | 6.7 | 3.59 | 3.12 |
| Bangalore | 26.61 | 3.91 | 2.71 | 2.02 | 0.79 | 24.76 | 13.05 | 11.71 |
| Bombay | 99.15 | 4.49 | 44.60 | 6.52 | 1.05 | 82.44 | 6.53 | 5.9 |
| Puri | 1.01 | 0.54 | 0.47 | 10.10 | 0.04 | 0.77 | 0.41 | 0.36 |
| Ajmer | 4.03 | 2.11 | 1.92 | 22.25 | 1.42 | 3.76 | 1.98 | 1.78 |
| Madras | 38.41 | 19.86 | 18.55 | 13.79 | 0.21 | 32.77 | 16.94 | 15.83 |
| Mirzapur | 1.69 | 0.97 | 0.73 | 12.31 | — | 1.28 | 0.69 | 0.59 |
| Gopalganj | 0.36 | 0.19 | 0.16 | — | — | 0.27 | 0.15 | 0.12 |
| Barwan | 0.34 | 0.18 | 0.16 | — | 0.2 | 80.1 | 50.13 | — |
| Ambattur | 2.15 | 1.12 | 1.03 | — | 1.16 | 0.61 | 0.35 | — |
| Gonda | 1.06 | 0.56 | 0.50 | — | 0.71 | 0.39 | 0.32 | — |

TABLE - 4.4
SLUM POPULATION AND AREA

| Town/City | Slum population | Percentage of slum population | Slum area Sq km | Percentage of slum area |
|-----------|-----------------|-------------------------------|-----------------|-------------------------|
| Hyderabad | 341095 | 11.51 | 3.63 | 1.40 |
| Patna | 323230 | 35.21 | 8.80 | 8.00 |
| Jammu | 6000 | 2.90 | 1.50 | 3.75 |
| Bhopal | 244473 | 23.00 | 3.33 | 1.17 |
| Bangalore | 342189 | 12.86 | 10.15 | 6.71 |
| Bombay | 4459296 | 45.00 | 197.00 | 45.00 |
| Puri | 23017 | 30.97 | 0.75 | 4.45 |
| Ajmer | 6000 | 1.48 | 1.70 | 0.70 |
| Madras | 1605692 | 41.80 | 58.00 | 10.14 |
| Mirzapur | 69560 | 41.00 | 9.25 | 23.80 |
| Gopalganj | 6500 | 18.00 | 1.26 | 11.30 |
| Barwani | 8698 | 25.80 | 7.51 | 46.90 |
| Ambattur | 138992 | 64.52 | 34.00 | 84.24 |
| Gonda | 28540 | 26.92 | 4.56 | 35.52 |

TABLE - 4.5
HOUSEHOLDS WITHOUT TOILETS (1991)

| Town/City | Total No. of Households | Households Without toilets (estimated No.) | Percent |
|-----------|-------------------------|--------------------------------------------|---------|
| Hyderabad | 461070 | 49150 | 12.29 |
| Patna | 164490 | 37531 | 16.36 |
| Jammu | N A. | N.A | - |
| Bhopal | 194755 | 558752 | 8.69 |
| Bangalore | 794065 | 125383 | 15.79 |
| Bombay | 2087785 | 455555 | 21.82 |
| Puri | 22765 | 7706 | 33.85 |
| Ajmer | 67455 | 14179 | 21.02 |
| Madras | 760600 | 134398 | 17.67 |
| Mirzapur | 24235 | 9578 | 39.52 |
| Gopalganj | 5714 | 3599 | 63.38 |
| Barwan | 4862 | 2109 | 43.38 |
| Ambattur | 48322 | 10616 | 21.97 |
| Gonda | 12223 | 3444 | 28.18 |

Source Housing and Amenities, Occasional Paper, Census of India 1991

TABLE - 4.6

HOUSEHOLDS TOILETS CONVERTED/CONSTRUCTED BY SULABH AND OTHER NGOS

| Town/City | Sulabh | | Other NGOs | |
|-----------|---------|---------|------------|--------|
| | Period | Number | Period | Number |
| Hyderabad | 1986/90 | 7402 | 1992/95 | 7300 |
| Patna | 1974/88 | 18235 | - | - |
| Jammu | 1984/91 | 9258 | - | - |
| Bhopal | 1988/95 | 21558 | - | - |
| Bangalore | — | - | - | - |
| Bombay | — | - | - | - |
| Puri | 1987/95 | 2064 | - | - |
| Ajmer | 1989/95 | 23050 | - | - |
| Madras | 1990/28 | - | - | - |
| Mirzapur | 1988/94 | 2878 | - | - |
| Gopalganj | 1984/86 | 935 | 1994/95 | 537 |
| Barwan | 1991/92 | 654 | 1992/94 | 755 |
| Ambattur | — | 1991/94 | 1450 | |
| Gonda* | 1991/95 | - | 1991/95 | N.A. |

*Note . Household toilets converted/constructed in Gonda town is 2390, but the breakup of Sulabh and other NGOs not available

TABLE - 4.7
TOILETS FACILITIES IN URBAN HOUSEHOLDS IN INDIA - 1991*

| | No. of urban households (Total) | Percent of households having toilet facilities | No. of Households without toilets (Estimated No.) | No of Sulabh Shauchalayas (as on March 1995)** |
|----------------------------------------------|---------------------------------|------------------------------------------------|---------------------------------------------------|------------------------------------------------|
| India (Excluding Jammu & Kashmir) | 39493450 | 63.85 | 14276882 | 730430 |
| States | | | | |
| Andhra Pradesh | 3367905 | 54.6 | 1529029 | 14886 |
| Arunachal Pradesh | 25738 | 75.05 | 6422 | - |
| Assam | 471660 | 86.06 | 65749 | 920 |
| Bihar | 1857145 | 56.54 | 807115 | 203622 |
| Goa | 92781 | 55.82 | 40991 | 9218 |
| Gujarat | 2673960 | 65.71 | 916901 | 5 |
| Haryana | 729015 | 64.25 | 260623 | 132 |
| Himachal Pradesh, | 109774 | 59.98 | 43932 | - |
| Jammu & Kashmir | N.A. | N.A. | N.A | 25983 |
| Karnataka | 2488710 | 62.52 | 932769 | 1262 |
| Kerala | 1357365 | 72.66 | 371104 | - |
| Madhya Pradesh | 2726030 | 53 | 1281234 | 211468 |
| Maharashtra | 5907495 | 64.45 | 2100114 | 8794 |
| Manipur | 83018 | 70.16 | 24773 | 3403 |
| Meghalaya | 62825 | 85.69 | 8990 | - |
| Mizoram | 56388 | 84.44 | 8774 | - |
| Nagaland | 48714 | 75.1 | 12130 | - |
| Orissa | 814980 | 49.27 | 413439 | 30755 |
| Punjab | 1023470 | 73.23 | 273983 | 3656 |
| Rajasthan | 1712450 | 62.27 | 646107 | 112866 |
| Sikkim | 7813 | 77.69 | 1743 | - |

| | No of urban households (Total) | Percent of households having toilet facilities | No. of Households without toilets (Estimated No.) | No of Sulabh Shauchalayas (as on March 1995)** |
|------------------------|--------------------------------|------------------------------------------------|---------------------------------------------------|------------------------------------------------|
| Tamil Nadu | 3915695 | 57.47 | 1665345 | 12136 |
| Tripura | 85054 | 96.32 | 3130 | 5515 |
| Uttar Pradesh | 4316660 | 66.54 | 1444354 | 72061 |
| West Bengal | 3609230 | 78.75 | 366961 | 10220 |
| Union Territory | | | | |
| Andaman & Nicobar | 15291 | 65.72 | 5242 | - |
| Chandigarh | 128555 | 79.77 | 26007 | - |
| Dadra & Nagar Haveli | 2292 | 65.14 | 799 | - |
| Daman & Diu | 9048 | 45.75 | 4909 | - |
| Delhi | 1696828 | 66.64 | 566062 | 3475 |
| Lakshadweep | 4510 | 64.65 | 15694 | - |
| Pondicherry | 93051 | 50.02 | 46507 | 33 |

Source *Census of India, 1991 Housing and Amenities, Occasional Paper, New Delhi
N.A. Jammu and Kashmir Census, 1991 was not conducted

**Sulabh International Social Service Organisation, New Delhi.

TABLE - 4.8
DISTRIBUTION OF SAMPLE HOUSEHOLDS ACCORDING TO MONTHLY INCOME

| Town/city | upto Rs. 1250 | Rs. 1251 to Rs. 2500 | Rs. 2501 to Rs. 4000 | Above Rs. 4000 | Total |
|--------------------|----------------------|-------------------------|-------------------------|--------------------|------------------------|
| SULABH | | | | | |
| Ajmer | 85 (25.5) | 200 (59.9) | 33 (9.9) | 16 (4.8) | 334 (100.0) |
| Bhopal | 25 (24.3) | 77 (74.8) | 1 (1.0) | - | 103 (100.0) |
| Madras | 13 (52.0) | 11 (44.0) | 1 (4.0) | - | 25 (100.0) |
| Patna | 52 (19.1) | 178 (65.4) | 28 (10.3) | 14 (5.1) | 272 (100.0) |
| Puri | 1 (0.9) | 79 (72.5) | 22 (20.2) | 7 (6.4) | 109 (9.0) |
| Jammu | 43 (30.7) | 90 (64.3) | 5 (3.6) | 2 (1.4) | 140 (100.0) |
| Mirzapur | 10 (10.0) | 62 (62.0) | 19 (19.0) | 9 (9.0) | 100 (100.0) |
| Hyderabad | 15 (12.0) | 96 (76.8) | 14 (11.2) | - | 125 (100.0) |
| OTHER NGOs | | | | | |
| Ambathur | 4 (4.0) | 50 (50.0) | 46 (46.0) | - | 100 (100.0) |
| Gopalganj | 26 (25.7) | 49 (48.5) | 22 (21.8) | 4 (4.0) | 101 (100.0) |
| Barwani | 31 (30.4) | 35 (34.3) | 20 (19.6) | 16 (15.7) | 102 (100.0) |
| Gonda | 12 (34.3) | 20 (57.1) | 3 (8.6) | - | 35 (100.0) |
| Hyderabad | 17 (16.5) | 53 (51.5) | 20 (19.4) | 13 (12.6) | 103 (100.0) |
| Grand Total | 334 (20.3) | 1000 (60.6) | 234 (14.2) | 81 (4.9) | 1649 (100.0) |
| Sulabh Total | 244 (20.2) | 793 (65.6) | 123 (10.2) | 48 (4.0) | 1208 (100.0) |
| Other NGOs Total | 90 (20.4) | 207 (46.9) | 111 (25.2) | 33 (7.5) | 441 (100.0) |

TABLE - 4.9

WOMEN AND CHILDREN BELONGING TO SAMPLE HOUSEHOLDS USING/NOT USING PF LATRINES

| Town/city | Household using the latrines | Household not using the latrines | Total |
|--------------------|---------------------------------|-------------------------------------|------------------------|
| SULABH | | | |
| Ajmer | 194 (58.1) | 140 (41.9) | 334 (100.0) |
| Bhopal | 82 (19.6) | 21 (20.4) | 103 (100.0) |
| Madras | 24 (96.0) | 1 (4.0) | 25 (100.0) |
| Patna | 262 (96.3) | 10 (3.7) | 272 (100.0) |
| Puri | 89 (81.6) | 20 (18.4) | 109 (100.0) |
| Jammu | 135 (96.4) | 5 (3.6) | 140 (100.0) |
| Mirzapur | 78 (78.0) | 22 (22.0) | 100 (100.0) |
| Hyderabad | 103 (82.4) | 22 (17.6) | 125 (100.0) |
| OTHER NGOs | | | |
| Ambattur | 60 (60.0) | 40 (40.0) | 100 (100.0) |
| Gopalganj | 67 (66.3) | 34 (33.7) | 101 (100.0) |
| Barwani | 72 (70.6) | 30 (29.4) | 102 (100.0) |
| Gonda | 33 (94.3) | 2 (5.7) | 35 (100.0) |
| Hyderabad | 101 (98.1) | 2 (1.9) | 103 (100.0) |
| Grand Total | 1300 (78.8) | 349 (21.2) | 1649 (100.0) |
| Sulabh Total | 967 (80.0) | 241 (20.0) | 1208 (100.0) |
| Other NGOs Total | 333 (75.5) | 108 (24.5) | 441 (100.0) |

TABLE - 4.10

NUMBER OF HOUSEHOLDS STATING THE PLACE OF DEFECATION BY WOMEN AND CHILDREN

| Town/City | Open field | On the road side | Open drain | Any other | Total |
|--------------------|---------------|------------------|--------------|--------------|----------------|
| SULABH | | | | | |
| Ajmer | 107 (76.4) | 21 (15.0) | 4 (2.9) | 8 (5.7) | 140 (100.0) |
| Bhopal | 5 (23.8) | - | 16 (76.2) | - | 21 (100.0) |
| Madras | 1 (100.0) | - | - | - | 1 (100.0) |
| Patna | 9 (90.0) | 1 (10.0) | - | - | 10 (100.0) |
| Puri | 11 (55.0) | 1 (5.0) | 8 (40.0) | - | 20 (100.0) |
| Jammu | 5 (100.0) | - | - | - | 5 (100.0) |
| Mirzapur | 13 (59.1) | 6 (27.3) | 1 (4.5) | 2 (9.0) | 22 (100.0) |
| Hyderabad | 10 (45.5) | 3 (13.6) | 7 (31.8) | 2 (9.0) | 22 (100.0) |
| OTHER NGOS | | | | | |
| Ambathur | 22 (55.0) | 6 (15.0) | - | 12 (30.0) | 40 (100.0) |
| Gopalganj | 31 (91.2) | 2 (5.9) | - | 1 (2.9) | 34 (100.0) |
| Barwani | 20 (66.1) | 6 (20.0) | 2 (6.7) | 2 (6.7) | 30 (100.0) |
| Gonda | - | 2 (100.0) | - | - | 2 (100.0) |
| Hyderabad | - | 2 (100.0) | - | - | 2 (100.0) |
| Grand Total | 234 (67.0) | 50 (14.3) | 38 (10.9) | 27 (7.7) | 349 (100.0) |
| Sulabh Total | 161 (66.8) | 32 (13.3) | 36 (14.9) | 12 (5.0) | 241 (100.0) |
| Other NGOs Total | 73 (67.6) | 18 (16.7) | 2 (1.8) | 15 (13.9) | 108 (100.0) |

TABLE - 4.11

THE BENEFICIARIES CONSULTED IN THE PLANNING AND IMPLEMENTATION OF PF LATRINES

| Town/city | Consulted | Not consulted | Total |
|-----------|---------------|---------------|----------------|
| Ambattur | 25 (25.0) | 75 (75.0) | 100 (100.0) |
| Gopalganj | 99 (98.0) | 2 (2.0) | 101 (100.0) |
| Barwani | 63 (61.8) | 39 (38.2) | 102 (100.0) |
| Gonda | 14 (40.0) | 21 (60.0) | 35 (100.0) |
| Hyderabad | 3 (2.9) | 100 (97.1) | 103 (100.0) |
| Total | 204 (46.3) | 237 (53.7) | 441 (100.0) |

TABLE 4.12

REASONS FOR CONVERSION OF BUCKET LATRINES OR CONSTRUCTION OF PF LATRINES

| Town/City | Dissatisfied with scave- nger service | Scavenger service too expensive | Convenience reasons | Health/ Hygiene | Lack of privacy for women | Any other | Total |
|-----------|---------------------------------------------|---------------------------------------|------------------------|--------------------|---------------------------------|--------------|----------------|
| Ambattur | 1 (1.0) | - | 46 (46.0) | 5 (7.9) | 15 (15.0) | 33 (33.0) | 100 (100.0) |
| Gopalganj | 1 (1.0) | - | 86 (85.1) | 8 (7.9) | - | 6 (5.9) | 101 (100.0) |
| Barwani | 35 (34.3) | 2 (2.0) | 20 (19.6) | 40 (39.2) | 1 (1.0) | 4 (3.9) | 102 (100.0) |
| Gonda | 16 (45.7) | 15 (42.9) | - | 3 (8.6) | - | 1 (2.9) | 35 (100.0) |
| Hyderabad | 8 (7.8) | - | 59 (57.3) | 36 (35.0) | - | - | 103 (100.0) |
| Total | 61 (13.8) | 17 (3.9) | 211 (47.8) | 92 (20.8) | 16 (3.8) | 44 (10.0) | 441 (100.0) |

TABLE - 4.13
CATEGORIES OF SAMPLE BENEFICIARIES

| Town/city | Local | Commuters | Total |
|--------------------|---------------|---------------|----------------|
| SULABH | | | |
| Ajmer | 34 (73.9) | 12 (26.1) | 46 (100.0) |
| Bombay | 89 (58.5) | 63 (41.5) | 152 (100.0) |
| Bhopal | 30 (100.0) | - | 30 (100.0) |
| Madras | 14 (28.0) | 36 (72.0) | 50 (100.0) |
| Patna | 36 (78.3) | 10 (21.7) | 46 (6.5) |
| Puri | 21 (70.0) | 9 (30.0) | 30 (100.0) |
| Jammu | 20 (76.9) | 9 (23.1) | 26 (100.0) |
| Mirzapur | 21 (84.0) | 4 (16.0) | 25 (100.0) |
| Bangalore | 23 (79.3) | 6 (20.7) | 29 (100.0) |
| Hyderabad | 28 (82.4) | 6 (17.6) | 34 (100.0) |
| OTHER NGOs | | | |
| Ambattur | 28 (96.6) | 1 (3.4) | 29 (100.0) |
| Gopalganj | 15 (60.0) | 10 (40.0) | 25 (100.0) |
| Barwani | 16 (61.5) | 10 (38.5) | 26 (100.0) |
| Gonda | 12 (60.0) | 8 (40.0) | 20 (100.0) |
| Hyderabad | 2 (8.0) | 23 (92.0) | 25 (100.0) |
| Grand Total | 389 (65.6) | 240 (34.4) | 593 (100.0) |
| Sulabhi Total | 316 (67.5) | 152 (32.5) | 468 (100.0) |
| Other NGOs Total | 73 (58.4) | 52 (41.6) | 125 (100.0) |

TABLE - 4.14

NUMBER OF SAMPLE BENEFICIARIES HAVING/NOT HAVING LATRINES OF THEIR OWN

| Town/city | Having latrines | Having no latrines | Total |
|-------------------|-----------------|--------------------|---------------|
| SULABH | | | |
| Ajmer | 20 (58.8) | 14 (41.2) | 34 (100.0) |
| Bombay | 32 (36.0) | 57 (64.0) | 89 (100.0) |
| Bhopal | 1 (3.3) | 29 (96.7) | 30 (100.0) |
| Madras | 12 (85.7) | 2 (14.3) | 14 (100.0) |
| Patna | 16 (44.4) | 20 (55.6) | 36 (100.0) |
| Puri | 10 (47.6) | 11 (52.4) | 21 (100.0) |
| Jammu | 8 (40.0) | 12 (60.0) | 20 (100.0) |
| Mirzapur | 13 (61.9) | 8 (38.1) | 21 (100.0) |
| Bangalore | 22 (95.7) | 1 (4.3) | 23 (100.0) |
| Hyderabad | 16 (57.1) | 12 (42.9) | 28 (100.0) |
| OTHER NOGs | | | |
| Ambattur | 2 (7.1) | 26 (92.9) | 28 (100.0) |
| Gopalganj | 5 (33.3) | 10 (66.7) | 15 (100.0) |
| Barwani | 1 (6.3) | 15 (93.7) | 16 (100.0) |
| Gonda | 3 (25.0) | 9 (75.0) | 12 (100.0) |
| Hyderabad | 2 (100.0) | - | 2 (100.0) |

| Town/city | Having latrines | Having no latrines | Total |
|--------------------|-----------------------------|-----------------------------|------------------------------|
| Grand Total | 163 (41.9) | 226 (59.1) | 389 (100.0) |
| Sulabh Total | 150 (47.5) | 166 (52.5) | 316 (100.0) |
| Other NGOs Total | 13 (17.8) | 60 (82.2) | 73 (100.0) |

TABLE - 4.15

NUMBER OF SAMPLE BENEFICIARIES STATING WHETHER WOMEN ARE USING/NOT USING

| Town/city | Using community complex | Not using community complex | Total |
|-------------------|----------------------------|--------------------------------|---------------|
| SULABH | | | |
| Ajmer | 3 (8.8) | 31 (91.2) | 34 (100.0) |
| Bombay | 48 (53.9) | 41 (46.1) | 89 (100.0) |
| Bhopal | 26 (86.7) | 4 (13.3) | 30 (100.0) |
| Madras | 5 (35.7) | 9 (64.3) | 14 (100.0) |
| Patna | 7 (19.4) | 29 (80.6) | 36 (100.0) |
| Puri | 10 (47.6) | 11 (52.4) | 21 (100.0) |
| Jammu | 2 (10.0) | 18 (90.0) | 20 (100.0) |
| Mirzapur | 3 (14.3) | 18 (85.7) | 21 (100.0) |
| Bangalore | 3 (13.0) | 20 (87.0) | 23 (100.0) |
| Hyderabad | 12 (42.8) | 16 (57.2) | 28 (100.0) |
| OTHER NGOs | | | |
| Ambattur | 9 (32.1) | 19 (67.9) | 28 (100.0) |
| Gopalganj | - | 15 (100.0) | 15 (100.0) |
| Barwani | 4 (25.0) | 12 (75.0) | 16 (100.0) |
| Gonda | 7 (58.3) | 5 (41.7) | 12 (100.0) |
| Hyderabad | - | 2 (100.0) | 2 (100.0) |

| Town/city | Using community complex | Not using community complex | Total |
|--------------------|-----------------------------|--------------------------------|------------------------------|
| Grand Total | 139 (35.7) | 250 (64.3) | 389 (100.0) |
| Sulabh Total | 119 (37.7) | 197 (62.3) | 316 (100.0) |
| Other NGOs Total | 20 (27.4) | 53 (72.6) | 73 (100.0) |

TABLE - 4.16

DISTRIBUTION OF SAMPLE HOUSEHOLDS ACCORDING TO TYPES OF FACILITIES

| Town/City | Toilet | Bathing | Urinal | Toilet and bathing | Urinal and toilet | Urinal toilet and bathing | Total |
|-------------------|---------------|------------|-------------|--------------------|-------------------|---------------------------|---------------|
| SULABH | | | | | | | |
| Ajmer | 16 (47.1) | 1 (2.9) | 1 (2.9) | 7 (20.6) | 1 (2.9) | 8 (23.5) | 34 (100.0) |
| Bombay | 38 (37.1) | - | 1 (1.1) | 3 (3.4) | 42 (47.2) | 10 (11.2) | 89 (100.0) |
| Bhopal | 7 (23.3) | - | - | 12 (40.0) | - | 11 (36.7) | 30 (100.0) |
| Madras | 9 (64.3) | - | 3 (21.4) | 1 (7.1) | - | 1 (7.1) | 14 (100.0) |
| Patna | 2 (5.5) | - | - | 2 (5.5) | 5 (13.9) | 27 (75.0) | 36 (100.0) |
| Puri | 15 (71.4) | - | - | 6 (28.6) | - | - | 21 (100.0) |
| Jammu | 4 (20.0) | - | - | 1 (5.0) | 4 (20.0) | 11 (55.0) | 20 (100.0) |
| Mirzapur | 12 (57.1) | 1 (4.8) | - | 2 (9.5) | 2 (9.5) | 4 (19.1) | 21 (100.0) |
| Bangalore | 3 (13.0) | - | 4 (17.4) | 1 (4.3) | 14 (60.9) | 1 (100.0) | 23 |
| Hyderabad | 14 (50.0) | - | - | 6 (21.4) | 8 (28.6) | - | 28 (100.0) |
| OTHER NGOS | | | | | | | |
| Ambattur | 28 (100.0) | - | - | - | - | - | 28 (100.0) |
| Gopalganj | 1 (6.7) | 1 (6.7) | - | - | 12 (80.0) | 1 (6.7) | 15 (100.0) |
| Barwani | 10 (62.5) | - | - | - | 6 (37.5) | - | 16 (100.0) |
| Gonda | 4 (33.3) | - | - | 8 (66.7) | - | - | 12 (100.0) |

| Town/City | Toilet | Bathing | Urinal | Toilet and bathing | Urinal and toilet | Urinal toilet and bathing | Total |
|--------------|---------------|------------|------------|--------------------|-------------------|---------------------------|----------------|
| Hyderabad | 1 (50.0) | - | - | - | - | 1 (50.0) | 2 (100.0) |
| Grand Total | 159 (40.9) | 3 (0.8) | 9 (2.3) | 49 (12.6) | 95 (24.4) | 74 (19.0) | 389 (100.0) |
| Sulabh Total | 115 (36.4) | 2 (0.6) | 9 (2.8) | 41 (13.0) | 76 (24.1) | 73 (23.1) | 316 (100.0) |
| Other NGOs | | | | | | | |
| Total | 44 (60.3) | 1 (1.4) | - | 8 (10.9) | 19 (26.0) | 1 (1.4) | 73 (100.0) |

TABLE - 4.17

NO. OF SAMPLE BENEFICIARIES WHO ENCOUNTERED DIFFICULTIES IN USE OF COMMUNITY COMPLEXES

| Town/City | Encountered difficulty | Encountered no difficulties | Total |
|-------------------|------------------------|-----------------------------|---------------|
| SULABH | | | |
| Ajmer | 9 (26.5) | 25 (73.5) | 34 (100.0) |
| Bombay | 9 (10.1) | 80 (89.9) | 89 (100.0) |
| Bhopal | 2 (6.7) | 28 (93.3) | 30 (100.0) |
| Madras | 1 (7.4) | 13 (92.9) | 14 (100.0) |
| Patna | - | 36 (100.0) | 36 (100.0) |
| Puri | 2 (9.5) | 19 (90.5) | 21 (100.0) |
| Jammu | 13 (65.0) | 7 (35.0) | 20 (100.0) |
| Mirzapur | 2 (9.5) | 19 (90.0) | 21 (100.0) |
| Bangalore | - | 23 (100.0) | 23 (100.0) |
| Hyderabad | - | 28 (100.0) | 28 (100.0) |
| OTHER NGOs | | | |
| Ambattur | 27 (94.5) | 1 (3.6) | 28 (100.0) |
| Gopalganj | - | 15 (100.0) | 15 (100.0) |
| Barwan | 9 (56.3) | 7 (43.8) | 16 (100.0) |
| Gonda | 8 (66.7) | 4 (33.3) | 12 (100.0) |
| Hyderabad | - | 2 (100.0) | 2 (100.0) |

| Town/City | Encountered difficulty | Encountered no difficulties | Total |
|------------------|------------------------|-----------------------------|----------------|
| Grand Total | 82 (21.0) | 307 (78.9) | 389 (100.0) |
| Sulabh Total | 38 (9.8) | 278 (90.2) | 316 (100.0) |
| Other NGOs Total | 44 (60.3) | 29 (39.7) | 73 (100.0) |

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City Wide Best Practices in Solid Waste Management in Collection, Transportation and Disposal

HSMI/MMC of UIFW, New Delhi

INTRODUCTION

'Garbage' is the waste generally thrown out of our homes, offices, shops, restaurants and small commercial establishments. In our country almost half of it consists of rotting vegetable and food matter. Besides, it also contains paper, plastic, glass, rubber, leather, coal, porcelain, metal, rags, toxic material (such as batteries, pesticides, paints, broken tubelights, and chemicals), building material and soil.

Materials are considered 'waste' when they exhaust their utility and they cause nuisance due to aesthetic and environmental reasons. Improper disposal of trash material may cause and spread disease by harbouring pathogenic microbes and disease vectors such as fly, mosquito, rodents and animals and even by attracting destitutes and rag pickers. They can also contaminate land or water and emit foul odour.

On the other hand, solid waste can be a potential resource. Some components of garbage can be processed into compost or bio-fertilizer or biogas can be produced. Some items of trash can be salvaged, recycled and reused.

In our country, most cities and towns have retailers and wholesalers and relatively large number of petty traders called 'rahdiwalas' who trade in different kinds of recyclable waste material. The ragpickers are often the primary agents of salvaging the recyclable waste. These materials are then sorted and sent to various small and large industries which use them in varying proportions to substitute for virgin material in the manufacture of articles.

Solid Waste Management involves managing activities associated with generation, storage, collection, transfer and transport, processing and disposal of solid wastes in an environmentally compatible manner with due considerations of the principles of economy, aesthetics, energy and conservation.

Over the last couple of years, there has been a growing concern about the problems associated with garbage management and the country woke up with a jolt to realize and face the dire consequences when the plague broke out in Surat in 1994. The

publicity and wide coverage of the event has been able to attract considerable attention to the issue of solid waste management. In spite of this, the problem seems to be insurmountable due to resource constraints, lack of awareness and a number of other factors.

The primary responsibility of solid waste management rests with the local bodies. But due to the reasons mentioned above and rapid urban growth, the municipal services have become either partly or wholly inadequate. No thought seems to have been given to integrated environmental planning for the whole town or city. Some of the conventional systems and arrangements seem to have lost their relevance under changed circumstances.

This calls for a review of the situation at present, proper planning and introduction of suitable innovative ideas.

ISSUES AND CONSTRAINTS

The prominent *issues* in waste management are

- 1) Various types of wastes, each requiring a different type of handling and treatment are mixed and disposed together;
- 2) Both the formal and the informal sectors consisting of the municipal services on the one hand and the ragpickers and others in recycling trade on the other are operating without any coordination,
- 3) The quality and efficiency of waste management has direct impact on the environment and the health of the citizens; and
- 4) Both, the organic as well as inorganic wastes are a valuable resource

The system also has a number of *constraints* such as

1) INABILITY OF EXISTING INSTITUTIONS TO PROVIDE EFFECTIVE SOLID WASTE MANAGEMENT

Municipal solid waste management service is usually limited to

SOME FACTS

According to WHO, every year 50 lakh people die due to diseases related to improper disposal of waste.

India produces about 75 million tonnes of waste every year out of which in urban areas, only 50-70% is collected.

The plague outbreak in Surat was aggravated further by the uncollected garbage just lying around on the streets.

There are many potential infernos like Jwalapur Market, Delhi, which was gutted due to unsafe and improper waste plastic management.

Since, 1987 Bangalore has no official dumping sites for its 2000 tons a day of garbage.

only a part of the population and, moreover, has considerable operational deficiencies. The root cause of these problems is inefficient institutional arrangements. Most agencies responsible for solid waste management do not have the organizational structure with qualified staff for proper planning and operational management of solid waste. There is also poor coordination within municipal or local authority departments which are involved in various aspects of planning and implementation of solid waste activities.

2) LACK OF SUFFICIENT FINANCIAL RESOURCES AND THEIR MANAGEMENT

Although solid waste management activities take a large share of the municipal budget, financing is insufficient and charges, if any, do not cover the cost of even the inadequate services provided. The low priority accorded to solid waste management is shown by the inadequate budgetary provisions for operations and the lack of mechanisms for financing capital investments and for effectively recovering costs of services from the beneficiaries.

3) INAPPROPRIATE TECHNOLOGIES

Often there have been lapses in proper planning and judicious selection of appropriate technologies. The concept of proper treatment and sanitary disposal of solid waste has been more or less absent. As a result there has been lack of efficiency in collection and transportation with wastage of manpower, equipment and funds. The insanitary landfills, rather garbage dumps have become point sources of pollution.

4) LACK OF HEALTH PROTECTION AND COMMUNITY PARTICIPATION

The health risks to solid waste workers and waste pickers as well as the general public have largely been overlooked by the agencies. Consequently adequate measures to prevent adverse health impacts of handling hazardous and infectious hospital wastes have not been established.

Community participation has usually been confined to short awareness and local clean-up campaigns. Public education for participatory activities by the community has generally been inadequate.

5) PROBLEMS FACED BY WASTE PICKERS AND THOSE CREATED BY THEM

The wastepickers have a very low social as well as financial status in the society. Those involved in this job, most of whom are women and children are looked upon with doubt and dissent, though they work in most hazardous conditions.

On the other hand, the waste pickers are responsible for spread of waste around the bins causing more nuisance and spread of disease.

THE STUDY CONTEXT

The focus of the study is on capacity building at the local level. The study attempts to consolidate examples of innovative practices "best practice" having potential for scaling up and wider replication at the city level.

There is no town or city in our country where proper solid waste management is actually being practiced on a town/city wide scale. The situation in general is far from satisfactory. Even component wise total coverage of solid waste management, for example, collection or transportation is not to be found in any urban area. At the same time, it is also being realised that most of the conventional systems, which were designed long back, have become much less effective because the situations (ground conditions) have changed significantly.

On the other hand, there have been many instances of positive interventions, either in terms of technology or community action which seem to have greater relevance to the current situations. None of these, however, have been taken up at a city wide scale so far. But some of them appear to have great potential for wider replication, especially in a decentralised manner.

For this study, six cities have been chosen across the length and breadth of the country where such instances have come to light

The study provides insight into waste management practices. Identification of the key practices that can be implemented in other cities would be useful in designing a capacity building programme

The present study identifies the most important city level issues of urban environment management and of the "best practices". Based on local experiences and best practices, national capacity building strategies have been formulated and developed under project.

IDENTIFICATION OF BEST PRACTICES

'Best Practices' are actions, initiatives or projects which have resulted in tangible improvements in the quality of life and in the living environments of people, in a sustainable way. A 'Best Practice' may be the improvement in the efficiency of the waste management systems for the delivery of basic services; it could also be the forging of new partnerships between public and private sectors for more effective investments; or it could be the harnessing of new technology to improve productivity, efficiency and income.

They represent up-to-date solutions to common problems faced by many cities and communities and demonstrate how some of the pressing problems can be solved.

The scaling up and wider replication of "best practices" have been considered with due regard to the critical conditions for their success in terms of the required institutional framework, financial management capability, municipal autonomy and decentralization, public participation and community linkages and other related aspects through a research agenda.

OBJECTIVES

The main objectives of the study are as follows.

- i) To document the innovative practices in collection, transportation, disposal and recycling aspects of solid waste management in selected cities, namely, Ahmedabad, Bangalore, Bombay, Madras, Pune and Raipur;
- ii) To analyze operational features of each "successful practice" vis-a-vis its scale of operation and acceptance by the community; and
- iii) To understand the partnership developed between NGOs/CBOs community groups and local agencies in operationalising the system under consideration.

THE FRAMEWORK OF STUDY

Various significant aspects of the 'best practices' in the cities have been duly covered with proper emphasis on each of the following aspects .

TECHNICAL ASPECTS

The technical details of storage, collection, transportation and disposal of waste for domestic, institutional, commercial, construction, hospital and industrial wastes have been covered

INSTITUTIONAL SET UP

This includes and evaluates various current institutional arrangements in terms of delegation of powers, decision-making process, intra-organizational relationship, strategic and operational planning and monitoring at different levels

FINANCIAL ARRANGEMENTS

The financial set up constitutes the estimation of financial requirements of the system options, the scale of tariff for cost recovery and the role of beneficiaries.

SOCIAL ASPECTS

Social aspects in terms of profile of the area, people's perception about the present practices of handling the waste and their understanding of the health and hygiene aspects of waste disposal have been taken into consideration.

HUMAN RESOURCE DEVELOPMENT ASPECT

The human resource development aspect includes the changes and recommendations for training for better planning and functioning of the "best practices".

LEGAL ASPECTS

These include the laws and regulations on SWM, their adequacy and effectiveness and an analysis of the amendments required to sustain the improved practices in solid waste management.

METHODOLOGY

In order to identify the practices, which have a wider acceptability and sustainability, an inventory of the organisations and individuals involved in solid waste management was prepared. The inventory contained a general outline of the agency/individual, their activities, objectives, scale of operation, etc.

This information was further analysed in terms of sustainability, replicability and effective utilisation. Few prominent practices

were selected for detailed documentation. These were studied in terms of the institutional, technical, financial and managerial linkages with formal agencies and community. Their linkage with formal solid waste management system was looked into and the role of various stake holders involved in the practice was studied. View points of the agency and other actors involved in the practice, were taken to consolidate the opinion about the success of the practice. The report helped in assimilating the issues and shortcomings, which were further elaborated to formulate strategies which would overcome these shortcomings.

THE COMPONENTS OF SOLID WASTE MANAGEMENT

TYPES OF SOLID WASTE

The quantities and characteristics of solid waste vary from region to region, from city to city and from country to country. The factors that influence the quantities and composition are, the average level of income, the sources, the population, social behaviour, climate, industrial production and the market for waste materials. As economic prosperity increases, the amount of solid waste produced increases in weight and volume and a proportionally larger part will consist of luxury waste, such as paper, cardboard, and plastic and heavier organic materials. There are also differences in solid waste composition due to season and location, for example, coconut hulls are more prevalent in spring and paper after festivals.

Solid waste is usually categorized according to the sources from which it emanates. A common classification is as follows

1. Municipal Solid Waste (MSW)

It includes domestic waste, street/kerb side waste, commercial/institutional waste, market waste, and hospital wastes.

2. Industrial Solid Waste

Includes scrap metals, alloys, ores, glass, paper, plastic, chemicals and other industry specific items.

3. Agricultural and animal waste

Includes biodegradables (also known as compostables), combustibles, inerts and hazardous material.

THE CHARACTERISTICS OF WASTE IN INDIA

Being a developing country, the characteristics of solid waste in India are drastically different from those in the developed countries. Indian waste has very high density compared to its western counterpart.

The main reasons for it are, *firstly*, the content of paper, newspapers, plastics, bottles, aluminum foils and other packaging materials in the garbage is much less than in the western countries. As these recyclable materials fetch a price in the market, most of them are segregated at source by the households and sold separately. Besides, the culture of packaging, tinned foods and disposables has yet not fully invaded the country. *Secondly*, the organic content such as kitchen waste, vegetable market waste, etc. and street sweepings is very high.

A few aspects of solid waste in India at a glance have been shown in Table 5.1 and Table 5.2.

TABLE 5.1 SOLID WASTE GENERATED AND BUDGET ALLOTTED TO IT IN MAJOR CITIES OF INDIA

| Solid Waste Details | Ahmedabad | Bangalore | Bombay | Madras | Pune |
|-------------------------------|------------------|------------------|------------------|----------------|---------------------|
| S W Generated (TPD) | 1,683 | 2,130 | 5,800 | 2,675 | 1,000 |
| SW cleared (TPD) | 1,200 (71.3%) | 1,800 (84.5%) | 5,000 (86.2%) | 2,140 (80%) | 700 (70%) |
| Municipal Budget (Rs million) | 2,700 | 2,370 | 24,360 | 1,450 | 2 (for disposal) |

Source Annual reports of the cities.

TABLE 5.2 COMPOSITION OF CITY REFUSE

(percentage by weight)

| Contents of Solid Waste | Ahmedabad | Bangalore | Bombay | Madras | Typical European City |
|-------------------------------|-----------|-----------|--------|--------|-----------------------|
| Paper | 3.0 | 1.5 | 3.2 | 7.85 | 27 |
| Putrescible matter | 49.0 | 75.2 | 59.4 | 48.0 | 30 |
| Dust, Ash | 34.0 | 12.0 | 59.4 | 28.0 | 16 |
| Metals | 0.4 | 0.1 | 15.9 | 0.95 | 7 |
| Glass | 0.2 | 0.2 | 0.5 | 0.96 | 11 |
| Textiles | -3.1 | 3.3 | -3 | | |
| Plastics, Leather, Rubber | 0.8 | 0.9 | - | 0.9 | 3 |
| Other (stones, wooden matter) | - | 18.9 | 16.4 | - | 3 |
| Density (kg/m ³) | 535 | 578 | - | 329 | 132 |
| HCV (K Cal/kg) | 990 | - | - | 1070 | - |
| Per Capita per day | 0.33 | - | - | 0.37 | - |

Source: Bhude A D and Sundaresam B.B., *Managing Solid Wastes in Developing Countries*, Ed Holmes, John R. Wiley & Sons, Norwich, 1984

It can be seen from the Table 5.2, that the average paper content in the refuse of Indian cities is about 2 to 3 percent as compared to about 27 percent in a typical European city. On the other hand, the putrescible matter content is as high as 60 to 70 percent in India, as against about 30 percent in Europe. This is an indicator of the difference in densities in the two wastes. The amount of refuse collected from urban areas in India is of the order of 0.3 kg to 0.5 kg per person per day excluding night soil.

PHASES OF WASTE MANAGEMENT

The basic problems in solid waste management in India, which take up maximum resources and manpower from the local bodies, are administrative, financial as well as technical. They are discussed below, categorized under four fundamental aspects of solid waste such as collection, transportation, disposal, and recycling and resource recovery.

STORAGE AND COLLECTION

1) There is an adhoc system for storage of waste at

source. Proper storage facilities for segregating waste at source for households, commercial establishments, and institutions needs to be worked out.

- 2) The community waste storage facilities are not conveniently accessible due to long distances, are open and are unhygienic as well as inadequate. They are an open invitation to ragpickers, animals, birds and parasites.
- 3) Due to lack of proper collection system, the garbage is unnecessarily handled several times and even put on ground before being finally put on the transport vehicle.
- 4) Streets and public places are often treated as receptacles of waste by general public, as places of defecation by the slum dwellers and as dumps for infectious wastes by nursing homes. Almost two thirds of the waste from hospitals in all the cities goes to community bins, some to sewerage system whereas very little gets properly incinerated (Annex I)

- 5) The general public attitude is to blame the city government for its inefficient and unsatisfactory functioning. Neither the public wants to assume any responsibility in its operation, nor are institutions coming forward to rope them in.
- 6) The people are not aware of their contribution in the huge quantities of solid waste generated, the immense mechanism, money and manpower involved in its clearance and disposal and the hardships faced by the local bodies to execute these functions.

bage reduced from the streets by them, and so treat them shabbily and look upon them with doubt.

- 2) They do not fully realize the value of waste, its recycling prospects, the importance of segregation, and innumerable environmental hazards created if it is handled wrongly.
- 3) Due to mixing of garbage, valuable recyclable material gets wasted as it gets soiled besides the fact that lot of time and money are sacrificed in its segregation.

TRANSPORTATION

- 1) The waste is generally loaded manually into the trucks and lorries for transporting to the dump sites or transfer stations. This poses a great degree of health risks to the workers handling it.
- 2) It is transported to dumping sites mostly in open flat-bed trucks, which spread foul smell and drop garbage on the way.
- 3) Due to lack of a systematic study on the quantity and quality of garbage generated at the neighbourhood level, monitoring is ineffective, thereby leading to malpractices and un-satisfactory lifting of garbage from dumps and roads
- 4) Lack of route optimisation leads to wasted mileage and manpower.

THE EXPERIENCES OF "BEST PRACTICES" IN SWM

THE SIX CITIES IN RETROSPECT¹

The six cities are spread over four Indian states and vary widely as far as population characteristics, political situation, geo-physical condition and socio-economic status is concerned. These cities also show a variety of solutions to the solid waste management problem. The solutions in these cities are different in approach, technology and community involvement.

All six cities selected have different characteristics with respect to innovative practices. In a couple of cases, the municipal corporation itself has shown awareness and managed and coordinated such activities in the city. The demographic data and the comparative SWM details of the six cities has been described in Annex II and Annex III respectively.

DISPOSAL

- 1) Disposal of waste is invariably done by land filling or dumping it at the dump sites, without observing scientific norms and assessment of environmental parameters
- 2) Resource recovery from organic waste, which is an important and major component of Indian waste is seldom done in an organised manner. The recyclable dry waste is wasted too by mixing it with wet waste.
- 3) Toxic and hazardous wastes are dumped, quite often, alongwith other city wastes in landfill sites. No special provisions are made to segregate them from biodegradable and recyclable waste.

AHMEDABAD

The city of Ahmedabad founded in the year 1411 A.D. has grown into a metropolis with nearly three million people in 1991. The city today is humming with several industrial, commercial and economic activities. Apart from being the capital, it is undoubtedly the premier city of Gujarat.

The Department of Health in the Corporation is responsible for carrying out this obligatory function of sanitation and conservancy including solid waste management. The entire city has been subdivided into five zones for better performance of the institution in management of the solid waste in the city. The service in each zone is under the supervision of a Zonal Dy. Commissioner/Health Officer/Additional Health Officer (one in each zone)

RESOURCE UTILISATION, RECOVERY AND RECYCLING

- 1) People do not understand the importance of ragpickers, their role in recycling trade and the amount of gar-

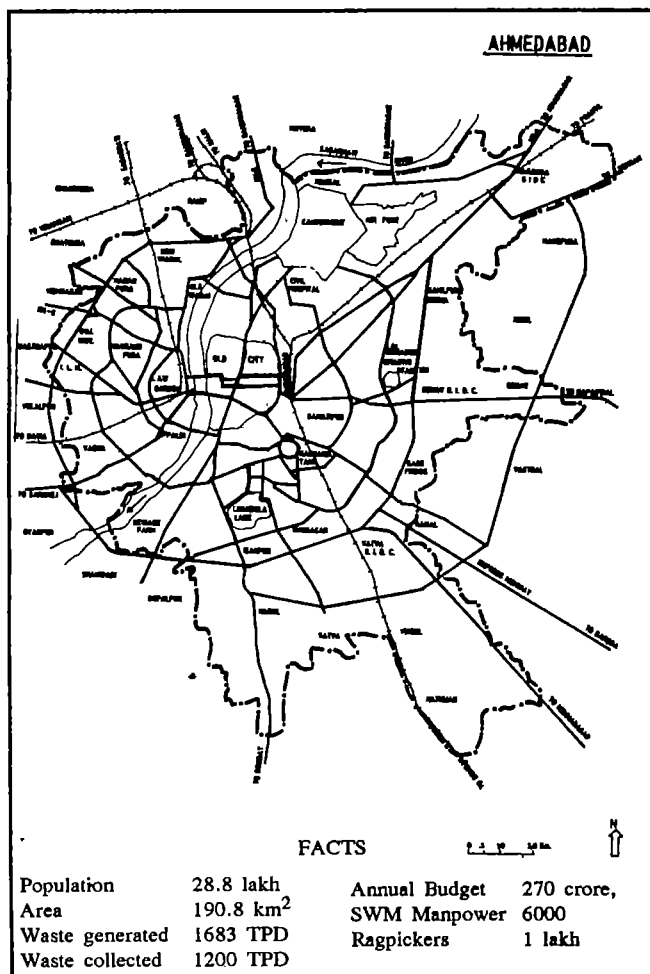
The city has an elected body comprising 127 councillors who have constituted a special committee for Solid Waste Management for improving solid waste management practices in the city.

¹ The statistics used in this section are based on the articles published in India Today, 1994; The Hindu Survey of the Environment, 1995 and Census of India, 1991

Until recently the city of Ahmedabad like any other city in the country was following age old practices for collection, transportation and disposal of waste and the beauty of this historic city was getting marred because of uncollected garbage accumulation.

Disposal of waste was done through landfilling, the sites being at R.T.O., Sabarmati, Sardar bridge, Sewage farm, Odhav Canal, Vatva and Jalpa Society. Four more are proposed at Vasna, D Cabin, Wadi and Narayan Ghat.

The Municipal Corporation finally decided to modernise its solid waste management practices and make a complete change in its age old systems. A very ambitious modernisation programme was worked out with the financial assistance of World Bank and Govt. of Gujarat and the Corporation became determined to make it a success story. Many of the practices undertaken by the corporation are worth appreciating. These practices have qualified the test of time. These practices may be adopted/adapted for other cities also.



Ahmedabad

BANGALORE

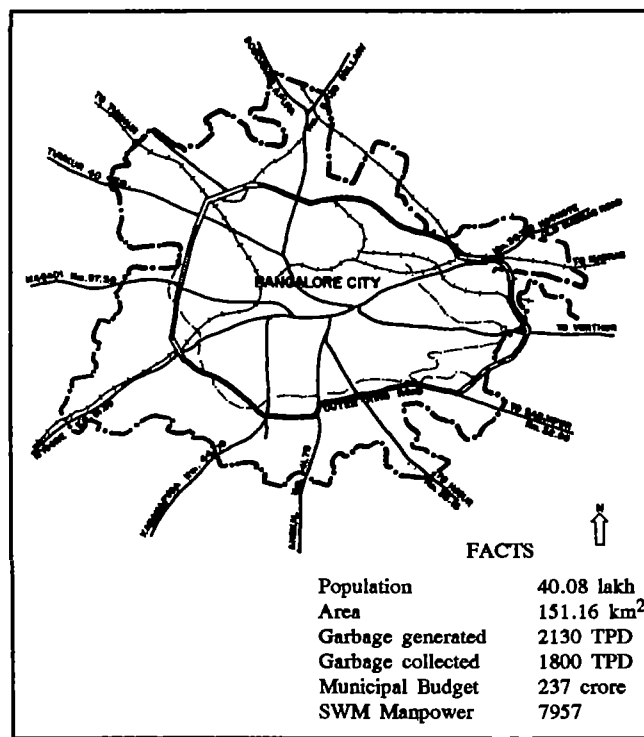
Bangalore, the capital city of the state of Karnataka is one of the most modern cities of India. Acclaimed as most vibrant and progressive, it has attracted many tourists as well and has been the favourite city for both national and international business and industrial establishments. Bangalore has a history of 487 years and it has witnessed a steady growth in population. If this rate of growth continues, the population of Bangalore is estimated to reach 70 lakh by 2000.

Solid waste is a major problem for this rapidly growing city too.

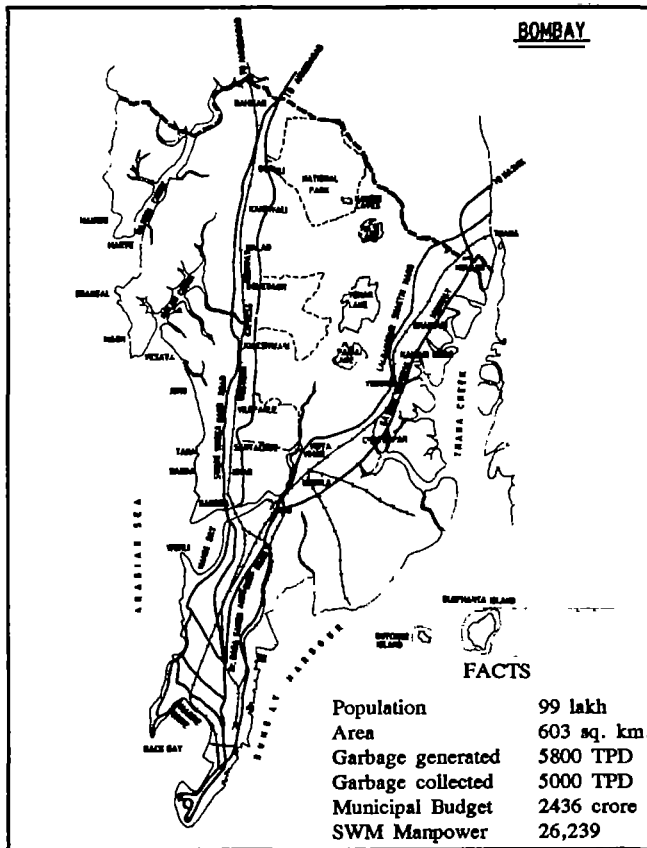
The budgetary expenditure on solid waste management for the year 1994-95 was Rs.350 million, that is Rs.480/ton for collection and transportation. Whereas, only 50 lakh is kept aside for disposal by sanitary land fill in 1995-96 budget. This is very small compared to the usual 50% of budget spared by developed countries for disposal.

About 100 corporation lorries and 120 contractor lorries work to remove garbage daily where city cleaning is an important public health priority next only to safe drinking water and sewage disposal.

The speciality of Bangalore is that there are various non governmental organisations which are working at small scale for complete cleaning and disposal of waste in small manageable areas.



Bangalore

BOMBAY

Bombay

The city of Bombay is the financial capital of our country where tremendous population growth and urbanisation has led to over-stretched services which are totally inadequate to look after good health and hygiene of the citizens.

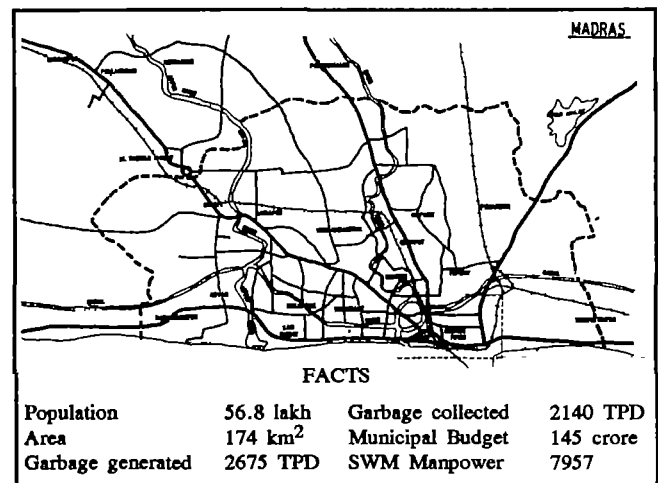
Solid waste management in Bombay is one of the services which is grossly overburdened and if continued in the same vein, will lead to disastrous results. This service is looked after by a separate Solid Waste Management Department of MCGB. It is under dual control of Chief Engineer who provides technical supervision and the Ward Officer who exercises administrative control. About one third of the total municipal staff is employed in SWM Department. The municipal budget in 1992-93 for SWM was Rs. 1,230 million. Continuously for a decade now, the percentage of SWM budget to total MCGB budget has been around 5.7% to 6.0%. In 1995-96, it proposes to spend Rs. 1,785 million on the service, that is 31.1% increase in three years.

Transportation of 60% of garbage is done through hired vehicles. The MCGB does it with the help of compactors, trucks, lorries, etc For the year 1994 :

| | |
|--------------------------------------------------------------|-------|
| Average daily trips for transportation by municipal vehicles | = 161 |
| by hired vehicles | = 389 |
| by hired debris vehicles | = 418 |
| Total trips | = 968 |

The city has four disposal sites, at Deonar (111 ha), Malad (19.2 ha), Gorai (14.5 ha) and Mulund (25.2 ha).

With increase in environmental awareness and realisation of money involved in waste, many NGOs and industries have ventured into the field of solid waste disposal. Bombay presents one such example where recycling of waste through anaerobic composting, aerobic composting and pelletisation is done on partnership basis.



Madras

MADRAS

The city of Madras in 1668 comprised of Chennapatna and the Fort St. George. Today the urban agglomeration of Madras Municipal Corporation (MMC) has grown into a huge city with ten zones. During the years 1971-81, the growth of the population in the

MMA is said to have been more than that of the city.

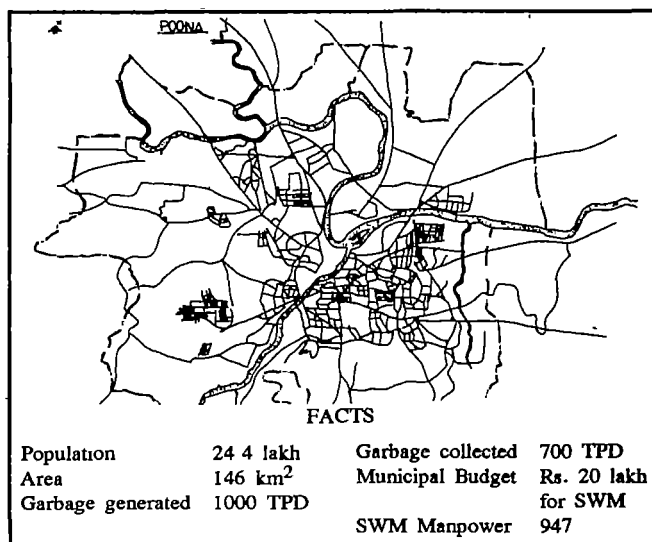
The Solid Waste Management (SWM) department was set up in the year 1993. It acts like an umbrella organisation uniting the three main aspects of SWM, namely, conservancy, transport of garbage, and disposal of garbage. The annual budget for SWM is Rs.400 million and major portion of it is spent on wages.

There are two dumping grounds in the northern and southern

parts of the city with the weigh bridge facility. One is at Kodungayur (18 ha) and other is at Perungudi (384 ha). Besides, there is 40 ha of surplus unauthorised area where dumping is done. The dump pickers are a problem that cannot be wished away by the Corporation. Though dump picking is illegal the Corporation is not able to stop it. The most dangerous activity they indulge in is burning the garbage.

Keeping in mind the welfare of the society, the Corporation introduced the 'Clean and Green Project' in June 1993. The conservancy work of different divisions has been handed over to four NGOs. This programme is sponsored by the Corporation of Madras. The important feature of this city has been the work done by NGOs in improving the social status of street children, ragpickers and abandoned youth by educating them and involving them in city cleaning, greening and waste management.

PUNE



Pune

Pune is one of the most important cities of Maharashtra, and it has developed at an alarmingly fast rate. It is a city with lateral spread, increasing the cost of infrastructure. The population outgrows the installation of services. In solid waste management, there being a centralised system, all refuse of the city is collected and dumped at the two dumpyards.

In Pune, the solid waste management (SWM) department is under the Medical Officer of Health (MOH). In addition, he also has the responsibility of the National Health Programmes, medical units, hospitals and dispensaries and so, practically, the working of the solid waste management department is looked after by the Deputy Medical Officer of Health (DMOH).

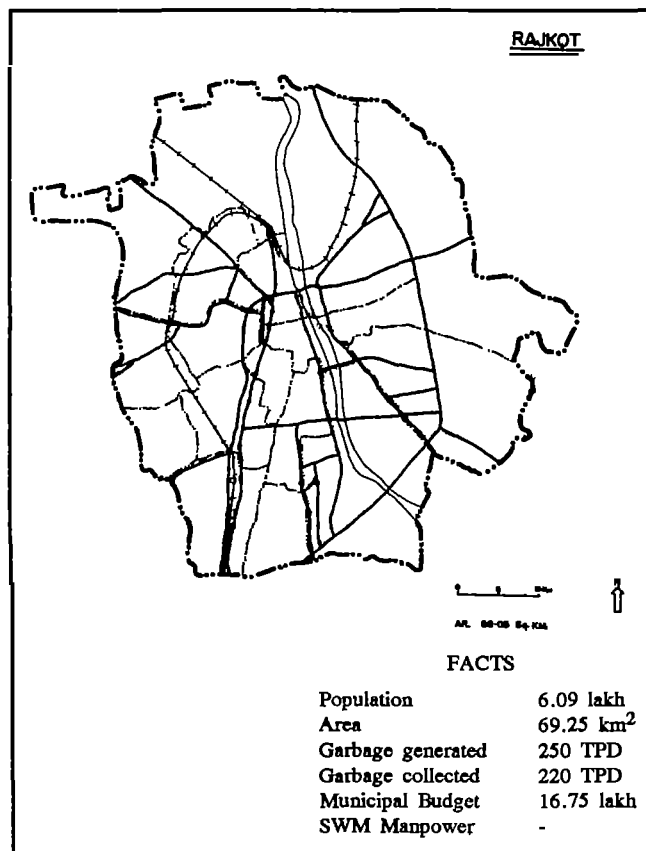
PMC gets much of the transportation work done through hired vehicles, but there is no privatisation of the service anywhere.

It has 29, ten to twelve ton tippers, 15 dumpers, five three ton tippers and 20 premier road masters, that is, a total fleet of 69 vehicles.

Disposal of the garbage is done by the ordinary landfill and dumping methods, there being two landfill sites at Rantekdi and Yeravda and two dumping sites at Paud (12 ha) and Devachi Urali (18 ha).

The overall awareness towards waste and hygiene is quite high in Pune compared to other cities of Maharashtra. But the efforts towards cleanliness are at a very small and local or society level. The earthworm technology for decomposition of organic waste has been successfully demonstrated in Pune. Many individuals and societies have started adopting it successfully.

RAJKOT



Rajkot

The city of Rajkot is the largest and the main city of Saurashtra region in Gujarat. The primary civic needs of the city are being attended to efficiently and effectively by the civic administration, namely, the Rajkot Municipal Corporation.

In recent years the horizontal and vertical growth in and around

the city has led to speedier urban agglomeration. This has also caused severe pressure on the existing civic services and financial management. The RMC spends Rs 1.7 million (approx) on collection of waste alone.

To take care of this scenario, which got worse every year, the city administration started thinking of newer ways to provide the services in a much more efficient and effective fashion. The assessment of the potential of private sector to take a more active role in provision of public services and physical infrastructure drew considerable attention. Rajkot Municipal Corporation, now successfully demonstrates the successful models of public-private participation in solid waste management.

CATEGORIZATION OF BEST PRACTICES

As stated before, Best Practices are the actions, initiatives or projects which have resulted in tangible improvements in the quality of life and in the living environments of people in a sustainable way. They are actions which could be adapted by the others to their own situation.

The best practice is either an improvement in the efficiency of management systems for the delivery of the service, or it is a forging of new partnership between public and private sectors for more effective investments or it is the harnessing of new technology to improve productivity, employment and income.

The categorization of the best practices identified from the six cities based on above specifications has been done into the four main aspects of solid waste management, namely, collection, transportation, disposal and resource utilisation, recovery and recycling. It has been observed that out of these four main activities of solid waste management, most interest is shown in collection and disposal by non-governmental organizations. Hardly, any innovation has been made in transportation of solid waste in the selected cities, except for propagating partnerships. Private involvement is mainly restricted to giving out vehicles to the local authority on hire basis.

The major heads under which the best practices have been studied, are as follows :

1) DOOR TO DOOR COLLECTION AND PUBLIC AWARENESS

These practices have proved to be very successful and they operate on a small scale, restricting the operation to collection of waste and its local transportation to the municipal collection points. They have good scope of expanding further, as they are single in operation and also cost-effective.

2) COLLECTION AND NEIGHBOURHOOD DISPOSAL

There are various practices in which waste collection and its disposal is done in the same neighbourhood. In most of the cases, these practices have been launched by voluntary organizations, NGOs or CBOs, with the help of or in partnership with the local body, the informal sector and the private sector.

These practices have made an impact in the form of clean environment for the neighbourhood, efficient use of manpower such as ragpickers, decrease in solid waste to be transported due to the local disposal system, training of the workers in disposal techniques and change in habits of the people.

The only problem sometimes faced by such organizations is of funding. Otherwise, they are sustainable practices, with a simple operational frame work.

3) TRANSPORTATION

Very few private organizations are concerned with long distance transportation of solid waste. It is predominantly the local body's domain and so the practices mentioned are resorted to by the corporation only. These practices are cases of partnership between the local body and private sector.

4) DISPOSAL

The private sector, the NGOs and the academic and scientific community have come up with new technologies and mechanized plants for large scale disposal of waste which requires large capital. The entry of private sector into this sector is a clear indicator that this venture could also yield profits. This practice has made a direct impact on the rate of accumulation of waste in the city dumpyards and/or at landfill sites.

5) RESOURCE UTILISATION, RECOVERY AND RECYCLING

The principle objective of some of the voluntary organisations is public awareness, motivation of youth and welfare of the exploited women and street children or ragpickers. Their involvement in SWM practice is with the objective of giving job and a social status to the downtrodden people by associating them formally in waste management at neighbourhood level. They have made a discernible difference for these exploited workers, have helped in changing the attitude of the public and in increasing the general awareness about solid waste thereby ensuring better resource utilisation and recovery.

A brief introduction of various 'best practices' in the six cities based on the above categorization has been given in the succeeding sections. A brief sum-up of these practices taken up for study is as follows:

TABLE 5.3 LISTING OF BEST PRACTICES /ORGANIZATIONS IN SWM

| Ahmedabad | Bangalore | Bombay | Madras | Pune | Rajkot |
|-----------------------------------------------------|------------------------------------------------------|-----------------------------------|-------------------------------------|------------------------------------------|---------------------------------------------|
| Collection | | | | | |
| World Bank Aided Project | Sadashivnagar welfare forum | Mr. George Bhopali | Civic Exnoras | Mr. PA Deshpande | Primary removal of solid waste, RMC |
| Zero Garbage on Roads Project | Ragpickers Education & Development Scheme | Clean Bombay Foundation Committee | | Save Pune Citizens | Primary cleaning of housing societies, RMC. |
| Clean Ahmedabad Abhiyan | Civic Amenities and Cultural Association, Acts Trust | Vasundhra | | | |
| Collection and Neighbourhood Disposal | | | | | |
| | Centre for Environmental Education | | IIT | | |
| | Mythri Sarva Sewa Samithi | | | | |
| | Suchi | | | | |
| Transportation | | | | | |
| World Bank Aided Project | | | | | Secondary Solid waste removal |
| Disposal | | | | | |
| Excel Industries India Ltd | Karnataka Compost Development Corporation Ltd. | Excel Industries India Ltd | | Western Paques India Ltd. | |
| | Terraforma Biotechnologies | DST/CMC | | Bhavalkar Earthworm Research Institute | |
| | | MCGB/IIT | | Institute of Natural Organic Agriculture | |
| | | Green Cross Society | | | |
| Resource Utilisation, Recovery and Recycling | | | | | |
| Self Employed Women's Association (SEWA) | Bangalore Onyavara Seva Coota (BOSCO) | | Don Bosco | National Society for Clean city | Pujit Roopani Memorial Trust |
| | | | Madras Clean and Green City Project | SNDT Women's University | |

Source Six City Based Studies

OPERATIONAL AND INSTITUTIONAL FRAMEWORK OF THE 'BEST PRACTICES' IN COLLECTION

In the preceding section various solid waste collection, transportation and disposal options in the preidentified cities were

discussed. Each practice has its unique characteristic of operation based on the legal and institutional support, and citizens' initiative. The approach towards better garbage collection has been mainly because of the initiatives of citizens or non-governmental organizations. Initiative of municipal functionaries and privatisation of some services have also shown impressive results at some places. Inspite of all these ventures in different

regions or cities, there are considerable overlaps and similarities in the work styles, technologies and methodologies of their operations. With a view to understand and study their operations, the common denominators of institutional, legal and financial framework have been examined

This section will look into the operational models of solid waste management in terms of

- door to door collection as well as public awareness and
- door to door collection and local disposal

in the six selected six cities of Ahmedabad, Bangalore, Bombay, Madras, Pune and Rajkot

PRACTICES / ORGANIZATIONS INVOLVED IN DOOR-TO-DOOR COLLECTION AND PUBLIC AWARENESS

CONCEPT

The solution, to residents' haphazard discarding of waste on streets, a bad/irregular municipal collection system and the nuisance of the ragpickers is, door-to-door collection of waste, sweeping and dumping it at a common municipal collection point by the ragpickers. And a step further than this is, collection of segregated garbage. This way, all three purposes are solved; the waste gets cleared from the locality as well as the houses, the residents don't have to go out to dispose the waste, and the ragpickers get employment as well as self respect. On the other hand, such schemes have been started by a few local authorities too whereby they give a grant to housing societies for cleaning their area or they contract out selected wards/localities to private contractors.

This system has government's full support and works well. Those involved are generally new voluntary organizations or



Door to door collection of solid waste in Bombay

those which have been formed by a group of local sensitive and environmentally aware people for cleaning their own area. Such organizations involve themselves in waste disposal only after establishment of their roots. In such an arrangement, the clearance of debris, garden waste and street sweeping or disposal of night soil remains the responsibility of the local body.

OPERATIONAL FEATURES AND ECONOMICS

This system operates at a small neighbourhood level. To initiate such a system, an awareness has to be created amongst the residents so that they agree to join it. After that a residents association or a CBO is formed. Every member contributes Rs. 10 to 20 towards purchase of equipments, materials, vehicles and payment of workers' salaries. A soft loan is also often taken for this purpose. One or two ragpickers are contacted to collect the waste from door-to-door. In cases where the residents themselves segregate the waste, the collectors are given two baskets, one for dry and the other for wet waste.

The ragpickers are given a bicycle or a tricycle to collect and transport all the waste to the municipal collection points. That point onwards, it is the local body's responsibility to clear the waste. These workers usually work in two shifts, in morning and evening and sweep the streets too. The remuneration given to them ranges from Rs. 1200 to 3500 per month, depending upon the area covered, number of households, etc.

In case of municipal bodies, or other larger associations, tempos are used for waste collection. They have a bell, on ringing of which the households or their servants come and deposit their day old stored waste in the mini truck. But for obvious reasons, the door-to-door collection system is more popular.

INSTITUTIONAL / LEGAL REQUIREMENTS

Such a venture generally needs one president, one treasurer and one joint secretary. They operate together, the bank account for all financial transactions, employment of workers monitoring, attend to residents complaints, etc. Examples of organisations practicing this system have been detailed below.

AMC'S WORLD BANK AIDED PROJECT, AHMEDABAD

Municipal Corporation has undertaken a World Bank aided Solid Waste Management Project of Rs. 38 million for modernising its SWM practices. On analysing the improved practices in collection, transportation and disposal of solid waste it has been observed that these can serve well as a replicable model for the other cities also, if adapted wisely depending on the scale of activity and on the composition of the waste.

The best practices in primary collection and storage of waste in the city of Ahmedabad include the following.

SHOWING THE WAY

At Exnora International's modest office in T. Nagar, Madras, the postman is delivering more letters than usual. After the Surat tragedy, concerned residents are writing to ask if they, too, can become members of this five-year-old voluntary organisation's garbage clearance system, Civic Exnora, which organizes garbage collection in 1,300 streets of Madras - that is 20 per cent of the City.

Civic Exnora is an example of what people can do if they want to help themselves. "When there's a power cut, you light a candle. That's what I did," said M.B. Nirmal, a retired banker who founded Exnora, because he was appalled by the fifth.

The system is simple. In its member streets, residents place the waste in bamboo baskets inside the compounds of their buildings and houses. Every morning, a 'street beautifier' pushing a cycle cart collects the baskets and takes them to the nearest corporation transfer station.

It costs the residents of member streets Rs. 10 a month for the services. The minimum number of households for one unit is 120. The subscription per head goes up if the number is lower. Exnora equips the 'beautifier' with the necessary implements and assists him in getting a bank loan for the cart. He is paid out of the monthly subscription. "Earlier, servants would just dump the garbage outside the compound to save on the trip to the corporation bin. Now, my street is a member of Exnora and looks really clean," says Meenakshi Shankar, a resident of T. Nagar.

Exnora has also transformed Navalur nagar, one of the dirtiest slums on the banks of the Buckingham Canal, into a showpiece. The low-lying part, on level with the canal, has been raised with rubble and a park designed on it. Sixty volunteers now sweep the roads and maintain plants in the colony. Says S.S. Kannan, one of the volunteers: "We want to tell people that the broom is not a lowly object, that it helps to keep us free from filth and disease."

But despite the good work, Nirmal believes the only permanent solution is to privatize garbage collection and disposal. "The corporation has too much on its hands. It cannot give top priority to all its duties." he says.

Source: India Today, October 31, 1994

1) Introduction of house-to-house collection system

House-to-house collection system has been introduced in posh residential areas for collection of domestic waste. At present this is being tried out on an experimental basis in nearly 2000 households in a few colonies only but it is intended to cover up larger percentage of population. A primary survey of a small 'sample' of this user group indicates that the results are positive with a high level of satisfaction from the users. Together with the Corporation there are volunteers and NGOs too who are actively involved in making this practice a success.

2) Special scheme for cleansing the hutments, private chawls and housing societies

For ensuring hygienic conditions and preventing the recurrence of epidemics in the hutments/ chawls etc the Corporation has decided to give grants to those who shall arrange for the primary cleaning of their area with the help of part time or full time paid

workers. It gives about Rs.150 per month per 3000 sq.m. of open area.

Litter bins have been placed in the hospitals, public parks, theatres, important bus-stands and on important roads. The waste from these bins is collected on day-to-day basis by the sweepers in their hand carts during the street sweeping. Collection of trade waste is done by the refuse collectors on day-to-day basis in the newly introduced one cu m. bins.

3) Introduction of litter bins and metallic containers for storage

All the open communal waste storage sites have been abolished and instead roll-off roll-on containers of three to six tonne capacity with four to six lids have been introduced. For transferring the waste from the handcart to the container and keeping the area around the container clean. Sweepers at the rate of one person per container were posted. The bins will be placed on asphalted land to facilitate cleaning. As the waste

brought from the handcart will be directly transferred to the containers the practice of double handling of the waste is eliminated.

4) Introduction of community bins for the hutments and chawls

Community bins of 80-litre capacity have been introduced in the slum and chawl areas for group of 25 families for the storage of domestic waste. These bins are lifted on day-to-day basis by a specially designed vehicle known as community bin carrier. Chawl and slum dwellers are being encouraged to take advantage of these facilities instead of throwing their waste on the streets.

5) Mobile waste collection system in the congested areas

Waste collection vehicles of one cubic metre capacity are introduced in areas where large size containers

can not be placed. These vehicles are parked at identified sites where sweepers bring their waste in handcarts and transfer it into the mobile vans. The mobile 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.

Financial Arrangements

The Ahmedabad Municipal Corporation was the first in the sub-continent to introduce the closed container system for primary collection and transportation of city garbage. The project took momentum with the financial assistance of Rs 38 million by the World Bank. Today the Corporation spends about Rs.180 million annually in handling and disposing the city's solid waste.

The financial benefits from the new practices adopted in solid waste management in Ahmedabad have been summarized in Table 5.4.

TABLE 5.4 ADVANTAGES OF MODERNISATION OF LIFTING AND TRANSPORTATION VEHICLES IN AHMEDABAD MUNICIPAL CORPORATION

| | Before Modernization | After Modernization |
|--------------------------|--------------------------|-----------------------------|
| Waste lifted /Shift | 7.5 tons | 25 to 30 tons |
| Manpower required | 6 labourers, 1 driver | 4 labourers, 1 driver |
| Trips /Shift capacity | 3 trips | 5 to 6 containers of 5 tons |

Source: Ahmedabad Study Report.

The Low User Charges and Tax Rates

The Corporation spends around Rs.180 million on SWM alone. In lieu of this, it charges a conservancy tax of 15% of Annual Ratable Value (ARV). As of this date the total collection accounts to a bare minimum of Rs.27 million to 30 million.

CIVIC AMENITIES AND CULTURAL ASSOCIATION, INDIRA NAGAR, BANGALORE

About 20 to 30 houses are covered under this scheme. Each house has been requested to separate wet and dry wastes. All

houses are doing self composting in the house gardens or any other space available. The dry waste is collected by the corporation sweepers.

RAGPICKERS EDUCATION AND DEVELOPMENT SCHEME (REDS), BANGALORE

It works exactly on the same concept as that of Sadashivnagar Welfare Forum, the only difference being that of the scale, which is 175 houses and 300 kg waste daily as depicted in Table 5.5. The entire activity is funded by Marianist, Society of Mary.

TABLE 5.5 SADASHIVNAGAR WELFARE FORUM AND THE RAGPICKERS EDUCATION AND DEVELOPMENT SCHEME (REDS), BANGALORE

| Name of Area | Sadashivnagar Welfare Forum | Ragpickers Education and Development Scheme |
|------------------------------|-----------------------------------------------------------------------|----------------------------------------------------------------------|
| HH in area | 1000 | - |
| HHs Participating | 400 | 175 and some offices |
| Waste Collected | - | 300 kg/day |
| Wet Recyclable Segregated by | residents | residents |
| Method of Collection | door-to-door | door-to-door |
| Method of Transportation | 3 wheel barrows, 1 tricycle | 3 tricycles |
| Method of Disposal | dumped in municipal bins | emptied in municipal lorries |
| Land Area for Disposal | 0.25 acre sanctioned | - |
| Manpower Involved | - | 6 boys |
| Service Charge | Rs.10/m | Rs. 10/m |
| Payment to Ragpickers | - | - |
| Technical Assistance | Waste wise | - |
| Other Help to Workers | | |
| Grants | Rs.10,000 from Rotary club and Rs.40,000 promised for composting pits | Funded by Marianist (Society of Mary), a religious Christian society |

Source: Centre for Environment Education, Bangalore.

For door to door collection of unsegregated waste they follow the same principle Their other programmes are:

- 1) PEAS Programme for Environment Education in schools which is designed for motivating the children into concrete action.
- 2) Full cycle Garbage Disposal and Recycling Project, in which two blocks in Koranangala having 500 houses are covered. Two tons of waste is collected here every day

SADASHIVNAGAR WELFARE FORUM, BANGALORE

This forum began its activities by introducing the rag-pickers scheme for door-to-door collection of waste This activity is operational in 400 out of the 1000 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 in municipal bins.

The organization takes Rs.10 per month as contribution from households It has received a donation of Rs.10,000 from the Rotary club and Rs.40,000 more have been promised for

composting pits in the future. This information is depicted in Table 5.5.

While introducing the scheme, a systematic and planned approach was developed, and NGOs like waste-wise were asked for help. Presently, the money collected is remitted to bank account under Sadashivnagar Welfare Forum. This account is operated by the Chairman, the Secretary and the Treasurer jointly. The ragpickers involved are verified by the police and are provided with uniforms.

CLEAN BOMBAY FOUNDATION (CBF)

The Clean Bombay Foundation, which was established in 1989 by Mrs. Kunti Oza from Colaba, is a non-profit making organization, committed to the improvement of environment in the city of Bombay. The bad situation due to accumulated garbage in the surrounding areas, prompted Mrs. Oza to create awareness in the MCGB workers as well as the residents. She started working voluntarily towards these goals in her area, at her own expense, and then established the CBF and widened her scope of work. CBF conducts educational awareness programmes in schools, colleges, slums and even for MCGB workers.

The main objectives of CBF are:

- 1) To conduct educational awareness programmes in schools, colleges and even for MCGB workers and slums through workshops, audio visual show, posters, banners, etc.
- 2) To organise the collection of garbage in different areas by maintaining communication and co ordination with the MCGB staff as well as the residents of the area
- 3) To try to introduce environment friendly disposal techniques.
- 4) To improve the working conditions of the labourers; and
- 5) To beautify the South Bombay area and the Western Express Highway.

The CBF is active in the A and D wards of Greater Bombay which have shown considerable progress in collection of garbage. It has helped the corporation in settling petty technical issues. It is a part of the M.E I.P and it has propagated its message through newspapers and talks at various clubs. Twenty Rotary Clubs have joined it in its efforts

MR. GEORGE BHOPALI**The Operation and Finance**

Mr George Bhopali is a resident of Dadar, Bombay who has ventured into the task of cleaning Juhu beach. He initially started with roping in about 15 hoteliers on the beach front with BMC's approval. These hoteliers sponsored him for cleaning the beach, collecting waste from the hotels and dumping it at

the MCGB's collection points. He had employed 40 people who worked in morning and evening shifts for sweeping the beach and paid them between Rs.1200 to 1800 per month. But after four months the sponsorship was stopped due to which he had to seek BMC's help.

Now there is an agreement between him and the MCGB that he would clean the beach and MCGB in return would give him three hoarding sites, two at Juhu and one at Worli. He nets about Rs.70,000 /month from them which cover his expenses for running the project. The waste collected is about five tons/day.

In addition, Mr.Bhopali has also taken up few slums for clean-up, creating awareness among residents and improving sanitation in that area. The details of his venture are given in Table 5.6.

Problems Faced

He had been promised four lorries by the MCGB for collecting the waste and depositing it at its primary collection point or in the MCGB truck for transportation to the disposal sites. But now he is facing difficulties from BMC staff. They provide him with two lorries only and sometimes not even those, stating that there are no free or spare lorries. In which case he has to manage with a single tractor, which he has arranged himself which is utterly inadequate and expensive for such a huge mass of waste from the beach. He wants some contract to be signed with MCGB which would circumvent this problem.

TABLE 5.6 MR. BHOPALI'S PROJECT AND SAVE PUNE CITIZENS COMMITTEE AT A GLANCE

| Name of Area | Mr. George Bhopali, Bombay | Save Pune Citizens Committee, Pune |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| Area of Operation | Juhu beach | Kanchangalli, Yerandwane |
| No of HHs | 15 hoteliers | 70 hhs |
| Waste Collected | 5 TPD | 35 to 40 kg /day |
| | Wet/Mixed Dry | 10 to 12 kg /day |
| Method of Collection | door-to-door in hotels and sweeping on beach | door-to-door by the waste women |
| Segregation by | - | residents |
| Method of Transportation | two lorries provided by MCGB | manually in baskets |
| Manpower Involved | 40 people who work for 2 shifts | 1 waste picker woman |
| Service Charge to HHs | - | Rs. 10 /month |
| Payment to Workers | Rs. 1200 to 1800 / month | Service charge from residents + sale of recyclables. |
| Grants / Funds | Was sponsored by the hoteliers for first 4 months Now BMC gives him 3 hoarding sites from which he nets Rs.70,000 | - |

VASUNDHARA

What started off as an independent efforts by two students, deputed by the Nirmala Niketan College of Social Studies, to survey the damage caused by Bhopal gas tragedy in response to a call by the government has today blossomed into an environment protection cell. It is a city-based institution and concentrates on environmental hazards like pollution afflicting the city. Mr. Elvis Thomas is its director.

The Work Area

Their work encompasses five vital areas .

1) Awareness

To develop awareness round environmental issues through multimedia exhibitions, theoretical inputs, discussions and practical activity among youth groups, communities, Mahila Mandals, B Ed trainees, teachers and other interested groups.

2) Work in Communities

To assist in building up of action groups for intervention in problem situations and to work in communities affected by environmental problems. Also to work in industries and trade unions in the area of industrial pollution.

3) Documentation

To maintain a good record of concerned periodicals, books, reports, documents, newspaper cuttings and other audio-visual media on environmental issues.

4) Networking

To maintain links with related organizations, groups and individuals for mutual support and joint action.

5) Research

To carry out research work in the field of waste recovery methods and psychological aspects of waste pickers. Vasundhara also works as a resource institution for various other organisations and programmes.

THE CIVIC EXNORA, MADRAS

The Civic Exnoras are affiliates of Exnora International which is a non governmental, non-political organization started by a few committed individuals in the year 1989, with the objective of bringing about civic consciousness and environmental awareness among the masses. They are grassroot level organizations which try to bring about cleanliness with the help of community participation.

There are approximately 1500 civic Exnoras functioning in the city of Madras and many more outside Madras including Bangalore, Pune, Vijayawada, etc

The first experiment of Exnora was at Kamaraj Avenue, Adayar. The Municipal Corporation decided to experiment with hydrocontainers in this area in 1990. This would eliminate the necessity of handling the garbage manually. The Civic Exnora at the street level took over the responsibility of ensuring that the garbage was dumped only in the hydro-containers.

The Civic Exnora took a two-pronged approach. First, it sought the cooperation of the local residents. Whereby they would hand over the garbage directly to a "street beautifier" (a sweeper) who would also sweep the streets. Second, Exnora decided to involve the local rag picker. So that he /she would not look for recyclables in the bin, the garbage would not be strewn by him /her and he /she would not be deprived of his income. The beautifier was provided with a specially designed garbage removal tricycle for which the local residents took a soft loan from a bank. They paid a salary of Rs. 650 every month to the beautifier. The residents of Kamaraj Avenue, contributed a sum of Rs 10 per month towards the salary of the beautifier and repayment of the loan and other incidental expenses.

The experiment saw the birth of the Civic Exnora Movement. After successfully working hand in hand with the Corporation, Exnora International has used this model to promote the idea of community involvement in the collection and transportation of garbage.

SAVE PUNE CITIZENS COMMITTEE

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 choked sewerage system due to litter on street and garbage from overflowing bins finding access to sewers.

The Operation

A scheme of separating the household waste into four baskets was formulated: one for kitchen waste; a second for paper, packaging material, broken glass, wire, rags, plastics of all kinds etc. to be handed over to the *kachrawali* at the doorstep, a third basket for absolute filth like soiled rags, cotton wool, sanitary towels and hair, which could be burnt, and the fourth basket was for the garden waste which was to be separately dumped, next to the bin for cattle and goats to feed from. All households 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. They have thus managed to clean their own area without being totally dependent on the municipal vans. Many of them have adopted

vermiculture to take care of their organic waste. Details are given in Table 5.6.

The sweeper woman who is also the ragpicker there, collects the recyclable material, for 15 days on an unoccupied empty plot. She has to guard it constantly, to prevent any theft. After 15 days, she rents a bullock cart, and sells her collection to the co-operative store for recyclable materials.

PRIMARY REMOVAL OF THE SOLID WASTE, RAJKOT

The Operation

The Rajkot Municipal Corporation is responsible for primary solid waste removal in each of the 20 administrative wards in Rajkot. Out of these twenty wards the corporation has contracted out two wards, namely, Ward No.7 and Ward No. 10 for primary solid waste removal.

The wards consist of 330 household units, each with an area of 30,000 sq. ft. The total number of garbage collection centres in these wards are 120.

The sweeper cum waste picker woman's 15 days collection is :

| | | |
|-------|-------------------|-----------|
| 20 kg | Plastic bags | Rs. 2/Kg |
| 30 Kg | Paper, waste | Rs. 1/kg |
| 25 kg | Notebooks, covers | Rs. 3/kg |
| 20 kg | Tin Sheets | Rs. 4/kg |
| | buckets | Rs. 10/kg |
| 6 kg | Milk bags | |
| | • uncleaned | Rs. 5/kg |
| | • cleaned | Rs. 20/kg |

Her earnings are Rs. 515.00 per fortnight approx.

The Financial Advantage

The viability of contracting out the service to a private entrepreneur can be clearly understood from the assessment of the economic benefits to the corporation. A brief analysis of the same is given in Table 5.7 below:

TABLE 5.7 COMPARATIVE FINANCIAL STATEMENT FOR PRIMARY COLLECTION OF WASTE, RAJKOT (RMC OPERATES 105 SOLID WASTE COLLECTION UNITS OUT OF A TOTAL OF 330 IN RAJKOT)

| When Privatized | | When not Privatized | |
|--------------------------------------------|----------------|-------------------------|----------------|
| Expenditure & Overheads on these 105 units | | Annual | |
| Unit x Unit Rate / month | | Establishment | |
| 105 x 1140 x 120 | | Expenditure : | |
| | | | Rs.16.47 lakh |
| | | 1 sanitary inspector | |
| | | 1 sanitary subinspector | |
| | | 1 naik /peon | |
| | | 105 sweepers | |
| | | Annual Cost of | |
| | | Items | |
| | | | Rs. 0.50 lakh |
| | | * Instruments | |
| | | * materials | |
| Total | Rs. 14.36 lakh | Total | Rs. 16.97 lakh |
| | | Net Financial Advantage | Rs. 2.61 lakh |

Source : Rajkot Study Report.

PRIMARY CLEANING OF HOUSING SOCIETIES, RAJKOT

The Operation

The scheme was introduced in 1978 under which one housing society with 87,750 sq.ft. of open area was given a grant of Rs.500 per month for its internal cleaning. The most important aspect of this scheme is that the whole operation is managed by the society members themselves.

The scheme has gained momentum since 1990, and many housing societies have come up with a request for a grant for the same. Today 14 housing societies and four trusts avail these facilities of grant for internal cleanliness.

Finance

The policy for the approval of the grant for a society under this

scheme is fixed. The rate is fixed on the basis of per sq.ft. of open area. The schedule is as under:

| Area (Sq.ft) | Grant (Rs /month) |
|------------------|-------------------|
| 10,000 to 20,000 | 300 |
| 25,000 to 30,000 | 600 |
| more than 30,000 | pro rata basis |

The viability of grant-in-aid for internal cleanliness of society, by self-management who in turn contracts out the service to the private entrepreneur can be gauged from the assessment of the economic benefits to the corporation. A brief analysis is stated in Table 5.8 as under :

TABLE 5.8 COMPARATIVE FINANCIAL STATEMENT OF SWC IN HOUSING SOCIETIES, RAJKOT.

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

Source . Rajkot Study Report

* Solid waste collection

PRACTICES / ORGANIZATIONS INVOLVED IN COLLECTION AND NEIGHBOURHOOD DISPOSAL OF WASTE

These are the organizations which work on a scale larger than the ones described earlier as they carry out all aspects of the solid waste as a complete package in the given area. In such cases, there is generally very little involvement of the local body in the total process.

Most of these voluntary organizations (VOs) take the help of ragpickers for collection, transportation and composting or vermicomposting for disposal of solid waste. The ragpickers /workers are taught disposal techniques such as pit composting, vermiculture, etc. Liasoning with municipal corporation is done to get a small piece of land near the locality for waste disposal. Some of them bear their expenses through the sale of recyclable materials and service charges from the households, others get grants /funds from environmental organisations, institutions or government bodies.

CENTRE FOR ENVIRONMENTAL EDUCATION(CEE), BANGALORE

The Centre for Environmental Education (CEE), Bangalore is an organization which concerns itself with each and every aspect of solid waste management. It has done various projects in Bangalore whereby some projects involve mere cleaning of an area and collection of solid waste; some involve total SWM aspects whereas still other projects deal with creating awareness amongst the masses and increasing public participation.

The Objective

The primary aim of CEE is to develop itself into a resource centre, creating educational materials, resource persons and methodologies for spreading environmental awareness

Garbage disposal has been recognized by them as an issue which calls for immediate attention. The CEE South has made an action plan which is being field tested for its validity at three different places in Bangalore such as Frazer Town, Jayanagar 1-E Block and Rest House Crescent.

A Case Study: The Project Area

Coles Park, a prominent part of Frazer Town in Bangalore city is a well known area of churches and schools. Out of the 180 households residing in this area, only 110 showed willingness to participate in the CEE launched programme.

Mode of Operation

This programmes involves door-to-door collection of segregated waste and its disposal at neighbourhood level. This is done by the local boys employed for this purpose. Two tricycles are used for the purpose of collecting all waste and depositing it at the common place where its proper disposal is done. Two plastic bins for the dry waste and a plastic bag for the organic waste is kept on each cycle. In addition, there are buckets, etc. for fetching the waste from the houses

Disposal

The method adopted for disposal is aerobic composting. The collected organic waste is taken to the composting site where it is further segregated into dry, organic, soiled and toxic wastes. On an average, the wet waste generated per day is 65 to 70 kg while the dry waste is about eight kg. About 2000 sq. ft. of land has been given by the Bangalore Municipal Corporation for composting within Coles Park, where eight pits have been made with a capacity of 500 kgs of wet waste in summer.

These pits are filled upto three-fourths capacity to facilitate turning of material for barbed aerobic composting. Fencing with granite pillars and wire has been provided to prevent vandalism. The heat generated in the pit reaches upto 60\$ C but is brought down to less than 30\$ C by sprinkling water and



Disposal of Organic Waste through Composting in the Neighbourhood, Bangalore

turning regularly every two to five days. The soiled and toxic waste is disposed into municipality bins

Finance

The dry recycle waste is sold by the ragpickers to the recycling agents. The ragpickers get Rs 100 to Rs 125 by selling the dry waste. Each household contributes Rs.10 /month as service charge.

The salary of the ragpickers is Rs.550 /month which is funded by NORAD (Norwegian Agency for Development Corporation). Funding from outside for such projects and works is essential as the financial gains in terms of service charges are low, only $110 \times 10 = \text{Rs.}1,100$ per month, which barely pays for two workers' salary. Besides the residents are not regular in paying even such small amounts. Hence, all other administrative charges have to come from grants /funds.

Efforts at Public Awareness

Besides managing the solid waste in the given area, CEE makes simultaneous effort at public awareness to increase the efficiency of the programme

- 1) A motivator goes from door to door stressing the importance of the venture, explaining its system of operation and informing about the end product being rich manure
- 2) Public meetings are held where experts are invited for talks
- 3) Cable T V is used to reinforce the solid waste message

- 4) Constant interaction through visits or telephone calls is maintained.
- 5) Media is resorted to in the form of pamphlets, posters, films etc. They are inspired to resort to segregation.

| The results are : | Segregation |
|---------------------------------|-------------|
| 1 After 1st round of motivation | 4.50% |
| 2 After 2nd round of motivation | 11.49% |
| 3 After distribution of bins | 43.59% |

Special Feature

CEE South provides breakfast to the ragpickers and also gloves and gumboots, etc for their safety.

Secondly, ragpickers are made to undergo a literacy programme which specially stresses health and hygiene aspects.

Suchi, Bangalore.

It is an organization performing the activity of collection of household waste from 100 BDA flats out of the total 560 ones. Its operation is based on the methodology exactly similar to the previous one.

Special Feature

An important feature of this organization, is employment of women for the process of collection and transportation. The three women employed, receive Rs.300 /month whereas the households have to pay Rs.5 /month as service charge. These women are domestic servants working in the flats and so are morally more responsible towards the work. The entire process begins at 8 am. and takes three hours every day. The programme has become successful owing to help from the residents.

Waste-wise, Mythri Sarva Sewa Samithi, Bangalore.

This is another organization which has done a lot of work in solid waste. They have started a project called 'Waste-Wise' under which work is done in five different areas for clearing of solid waste. Besides, they also act as resource persons and give technical advice to other organizations venturing into the field.

The areas in which work is being carried out are Jayanagar B.T.M. layout, Jaymahal, Malleswaram and Sadashivnagar. Here too the system is exactly similar to the preceding organization with a little change in scale and persons involved as shown in Table 5.9.

TABLE 5.9 PROJECTS BY MYTHRI SARVA SEWA SAMITHI, BANGALORE

| Name of Area | | Jayanagar | B.T.M. Layout | Jayamahala | Malleswaram | Sadashivnagar |
|--------------------------|------------|------------------------------------------------------------------------------------------------------|---------------|----------------------------|-------------|----------------------------|
| Waste collected Kg/Day | Wet | 150 | 60 | 100 | 100 | 600 |
| | Recyclable | Segregated and sold by the rag pickers | | | | |
| Method of Collection | | Door to door collection by the waste pickers | | | | |
| Method of Transportation | | Trolleys for local transport | | Coordinated by corporation | | Trolleys are used |
| Method of Disposal | | Organic waste is composted | | Taken away by corporation | | Organic waste is composted |
| Manpower Involved | | Each area has 2 collectors and 1 supervisor | | | | 4 collectors, 4 organizers |
| | | 1 waste-picker organizer, 1 community organizer, 1 composting specialist, 1 project manager | | | | |
| Service Charge | | Rs. 5 to 10 /month from each household | | | | |
| Grants | | They receive Environmental NGO Funds | | | | |

Source . Six city based studies.

INDIAN INSTITUTE OF TECHNOLOGY, MADRAS

This Institute has come up with a novel method to dispose the garbage generated by them in an environmentally friendly way. The Indian Institute of Technology (IIT) situated in the heart of the City at Adyar, has 980 apartments, where the staff of the Institute live. There are 14 hostels for the students. Adding to it is the College, library and the administrative office.

A voluntary organization called SWARM (Solid Waste Recycle and Management) is involved in the collection and disposal of garbage generated in this campus on contract basis. Swarm was formed in the year 1993 by a few Professors of IIT. The programme is co-ordinated by Prof. Dr. Durga Prasad Rao. The management of IIT pays SWARM, but it does not interfere with its operating system.

Operation

SWARM has appointed 11 boys to do the conservancy work. They have been provided with six tricycles with two metallic bins. One bin is for dry waste and the other for wet waste.

There are two kinds of bins placed in the Campus. One is the cylindrical metallic bin the other a rectangular bin. Both the bins are mounted on iron legs and are two feet above ground level. The bins are painted in two colours. The blue coloured bins are meant for organic garbage and the green coloured bins for inorganic waste. They are provided with heavy lids attached to the body of the bin to prevent monkeys from ram-paging through the garbage.

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

The boys who are called "SWARM Volunteers" work in two shifts. Collection is done from residential area during the morning shift. Waste from the canteen and hostels are collected during the evening shift. The garbage is segregated at the source.

The garbage that is collected is carried to the ground earmarked for segregation at the western end of the campus. The paper, plastic, glass, metal scraps are separated. Coconut shells are kept in separate bags to be sold as fuel material. The organic waste is vermicomposted.



Separate Bins for Organic and Inorganic Wastes in IIT, Madras

Finance

The volunteers of SWARM are paid Rs.45 per day. Some of them work during the afternoon between 10.00 and 1.00 p.m. They segregate the garbage, help in removing the branches and thorny bushes along the roads. For this they are paid Rs.10/- per hour.

Problems faced by the Organization

- The residents inspite of repeated requests do not segregate their garbage
- Both the wet and dry waste are deposited in the same bin
- Many of the residents feel touchy to touch the dustbins and leave the garbage outside.

All these examples prove that community participation is the most successful solution to tackle the huge quantities of wastes generated. Secondly, women have a very major role to play in these practices. Managing and segregating the household waste is predominantly a woman's domain in our society. On the other hand, even the ragpickers population mainly consists of women. Thus women have to be made the targets of health education for successful operation of these community-based programmes

OPERATIONAL AND INSTITUTIONAL FRAMEWORK OF THE 'BEST PRACTICES' IN TRANSPORTATION

Transportation of solid waste is done at two stages. First stage, primary transportation includes transporting the waste to a local temporary storage site, that is, community bins whereas secondary transportation, consists of transporting it from these bins to the final disposal /dumping /landfill sites. The former is done manually with the help of hand carts while the latter is highly mechanised. On the way to disposal sites, the waste is sometimes taken to the transfer station where the waste is transferred to the compactors for speedy and enclosed transportation of larger amount of waste.

Innovations in this operation are mainly initiated by public agencies. The main innovations have been in the design of primary transportation vehicles such as hand carts, tricycles, etc., community bins and transfer stations. In case of secondary transportation, main efforts have been in the hiring of private vehicles on contract basis and also in contracting out garbage lifting of a particular area.

Out of the six cities studied, there are only two examples of private involvement in transportation as detailed below.

AMC'S TRANSPORT MODERNIZATION PROGRAM, AHMEDABAD

As mentioned before, AMC is carrying out modernization of its

solid waste infrastructure with aid from the World Bank. It is in the process of making changes in its equipments and in work methodology. The steps taken are as follows:

1) Changing the design of handcarts

Instead of traditional handcart, a newly designed handcart with six small containers of 40 litre capacity each with three wheels and sealed ball bearings has been introduced. This handcart facilitates direct transfer of waste into the community bins. This way, deposition of waste on the ground causing nuisance and health hazard, is stopped. Such examples of changes in equipment design are found in Madras and Bangalore too, where the handcart has four small bins which can be lifted and emptied into the collection bin easily by one person.

2) Transportation of waste in closed metallic containers

Closed metallic containers are in use for the secondary transportation of waste instead of earlier practice of using open trucks which cause great nuisance. Thus the waste is transported from the city in a hygienic manner. Other additions to the fleet are compactors which carry more waste (7 tons) than the traditional trucks (3 to 5 tons); the front end loaders, and the flat bed trucks with net cloth covering to prevent dropping of garbage.

SECONDARY SOLID WASTE REMOVAL, RAJKOT

THE OPERATION

The salient feature of secondary removal of solid waste is the involvement of private men and machines in this operation in an efficient and effective manner. The Health Department of RMC has deployed its trucks and labourers only in four wards falling in the old city areas. In the remaining sixteen wards, this service has been contracted out to private entrepreneurs. The contractors have to load the waste from the open site / dust-bins into trucks and these are then taken to the dumping site for final disposal. These dumping sites are 4-5 kms. away from the city.

The payments are made on the basis of the auction. The auction amount is for lifting all the waste completely from a particular ward and transporting it to the place of final disposal.

FINANCIAL ADVANTAGE

The advantage of contracting out the service to the private entrepreneur can be clearly understood from the assessment of the economic benefits accrued to the Corporation as a result of introducing this practice. A brief financial analysis of this operation is given in Table 5.10.

TABLE 5.10 SECONDARY REMOVAL OF WASTE, RAJKOT: COMPARATIVE FINANCIAL STATEMENT

| | | | |
|-------------------------------------------------------------------|----|-------------------------------------------------------|----------------------------|
| Total wards where RMC works | 4 | | |
| Total wards where privatisation of waste collection has been done | 16 | | |
| WHEN PRIVATIZED | | WHEN NOT PRIVATISED | |
| Approx Avg. rate/ton = Rs. 50 | | Daily Establishment Expenditure for 4 tons of waste : | |
| Max. allowed in a truck = 4 tons | | | |
| The cost = 4 x 50 | | 1 driver | Rs. 60 |
| | | 1 cleaner | Rs. 50 |
| | | 3 labourers | Rs.150 |
| | | Fuel, etc. | Rs 50 |
| Total Rs. 200 /4 tons of waste | | Total | Rs. 260 /4 tonnes of waste |
| Net Financial Advantage | | | Rs. 60/4 tons of waste |

Of the total 250 tons of waste lifted in the city 200 tons is done by the private sector

Hence total financial advantage is Rs. 3000 per day on operational cost only. If we add the capital savings on buying of trucks, etc. then the advantage is still more.

Source Rajkot Study Report.

OPERATIONAL AND INSTITUTIONAL FRAMEWORK OF THE 'BEST PRACTICES' IN DISPOSAL

For years people have been using organic waste from kitchens, gardens and farms for making compost. But it was not always done scientifically. Now, various scientific and result oriented processes have been developed to dispose and recycle the organic waste in a hygienic manner. A few of them are such as can be operated at a very small or household level also. Very recently, the disposal of solid waste has been thought of a profitable venture too by many industries who are coming to the fore with varied processes. Different methods of waste disposal that are being practiced by different industries or organizations are as follows:

1. Mechanical Aerobic Biocomposting
2. Pelletisation
3. Vermiculture and
4. Biogas Production and Power Generation

Some of these ventures are very large with more than 100 TPD input capacity, whereas others are as small as to cover selected housing societies, neighbourhoods, and a campus

For comparative analysis purpose, the disposal options have been grouped into large scale and small scale as follows:

Large Scale

- 1) Excel Industries India Ltd., Bombay (aerobic composting)
- 2) DST /CMC, Bombay (pelletization)
- 3) MCGB /IIT, Bombay (vermiculture)
- 4) Western Paques India Ltd Pune (biogas power generation)

Small Scale

- 5) Green Cross Society, Bombay (Vermiculture)
- 6) Bhawalkar Earthworm Research Institute (BERI), Pune : (Vermiculture)

- 7) Institute of Natural Organic Agriculture(INORA), Pune
(Vermiculture)

The detailed description of the above along with their processes, manpower and material requirements, the financial arrangements, problems faced and their merits and demerits are given below

EXCEL INDUSTRIES : MECHANICAL BIOCOMPOSTING

THE BACKGROUND

The project for city solid waste conversion into bio-organic manure /enricher was undertaken by Excel Industries Ltd. Bombay, about six years back. The plant details are as follows.

- | | |
|---------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| 1) Project developers & managers | Excel Industries Ltd. |
| 2) Project Capacity | 500 TPD of mixed garbage |
| 3) Project Execution Time | 6 to 9 months |
| 4) Conversion Rate | 30 to 35% of input in 6 to 8 weeks cycle. The clearance is done 6 to 8 times a year. |
| 5) Working Time | 2 Shifts, 20 hrs /day |
| 6) Type of garbage preferred | Garden,Fruit,Vegetable Waste |
| 7) Ash content in manure. | about 6% |
| 8) Collection pre-decided with BMC, having predominantly vegetable waste. | Points:17 in no , |

Note

- # The first phase defouling plant is at Chincholi.
- # The second phase bio-conversion and packing plant is at Amboli Hill, Andheri
- # The Head office is at Jogeshwari

THE PROCESS

This process is carried out in two phases depicted in Figure 5.1 at two different places as follows :

Phase I : Defouling

The technology is primarily based on application of suitable indigenously selected cultures for speedy fermentation of mixed garbage. The composition of these bio-cultures is done as per the predominance of materials like carbohydrates, lignins, proteins and fatty substances

Objectives of Defouling :

The main objectives of the defouling phase are :

- 1) To carry out speedy fermentation of waste and thereby remove the foul smell and pathogens, making it safe for handling by conservancy workers and wastepickers and also reducing its bad effects on the neighbouring residential colonies.
- 2) To prevent the nuisance of birds /vultures, etc. which spread disease and also are a menace near aviation routes

The waste is stocked in long rows or heaps of 500 tons called windrows. The garbage is treated with microbial slurry mixed with herbal concentrate for defouling and accelerated bio-conversion (slurry rate has to be 10 kl/ton). Fermentation being an exothermic reaction, causes the temperature to rise to about 70 degrees centigrade, killing the pathogens and ensuring proper composting.

Required moisture is maintained and aeration is done after about every 15 days (by turning around the garbage). After 45 to 60 days, the full cycle is complete. With the progress of decomposition, the organic biomass changes its colour to dark brown.

Phase - II : Bio-Conversion

At the end of fermentation, it is easier to segregate biodegraded organic portions from plastic, glass, wood, coconut shells, etc. This is done through a series of sieves for the sizes of 1 1/2" and 1/2" separation; including de-stoning operations through cyclone aspirator, etc. The non-organic, non-biodegradable left-over materials are dumped back into the dumpyard. At Amboli, it is further passed through screens of 1/4" (6mm) and 4 mm to get a humus like biomass as end product. It is then packed in 25 kg packages for export and 50 kg. packages for local use. Oversize residual matter is used for lawns.

Marketing of the product is done at Jogeshwari. Figure 5.1 shows all these stages of the process

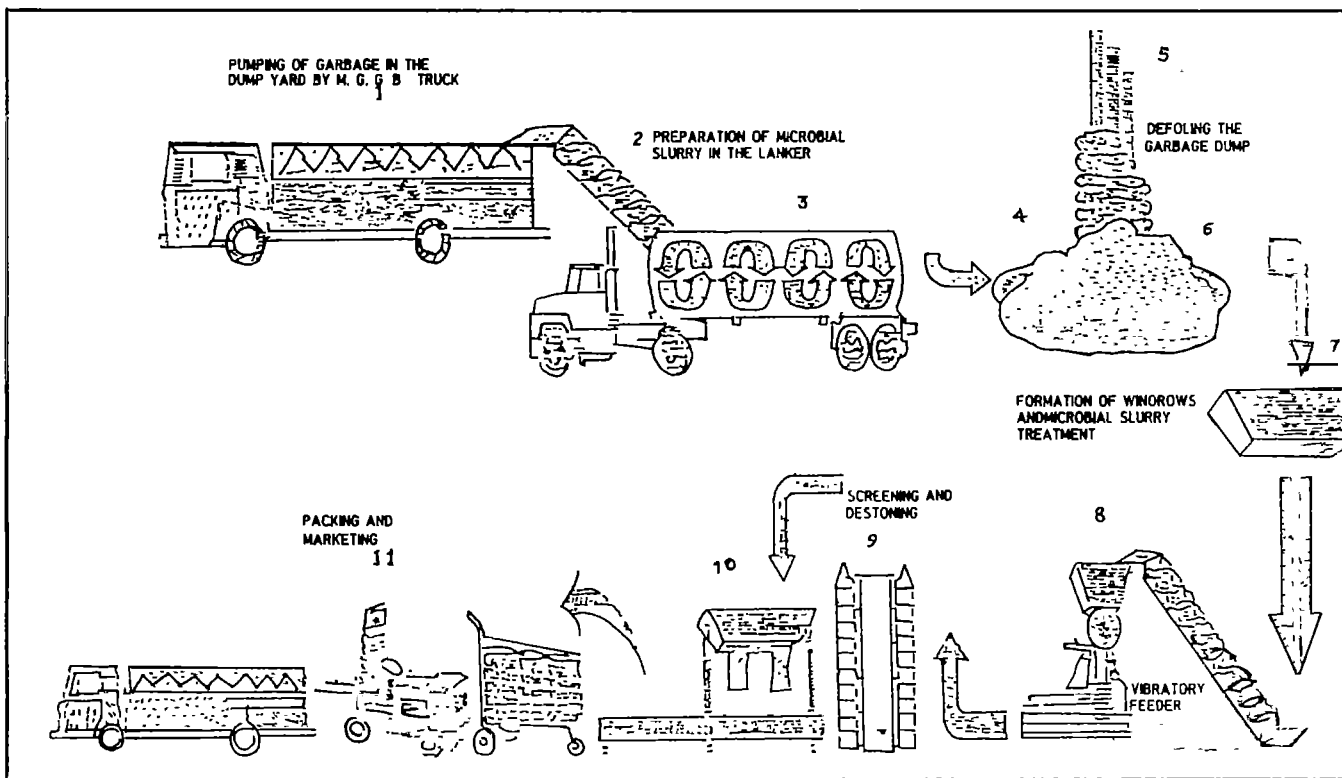


Figure 5.1 - Various Stages of Aerobic Bio-conversion Process as Practised by Excel Industries Ltd.

LABOUR AND VEHICLES REQUIREMENTS

Manpower required : One person /one ton of finished organic manure.

Semi Automatic : 1/2 person /one ton of finished product

For a 500 TPD plant, the company requires one tanker for slurry spraying, two loaders for feeding garbage into the equipment, three JCB's turning and transportation of garbage, and one bull-dozer for making heaps.

The plants work in two shifts, that is, 20 hrs /day

Labour Charges : Rs 40 to 70/day

Land area : 24 acres.

THE ECONOMICS

A 500 tons /day plant is considered to be of ideal capacity. The cost estimates for various plant sizes are given in Table 5.11.

For a 500 TPD Plant, the recovery time for capital investment works out to be three to four years with profit margin being 20 per cent. The capital investment includes transportation costs for up to 100 kms.

TABLE 5.11 : COST ESTIMATES FOR VARIOUS PLANT SIZES OF AN AEROBIC BIOCONVERSION PROJECT

(Rs lakh)

| Plant Size | 500 TPD | 300 TPD | 100 TPD |
|-----------------------------------------|------------|------------|------------|
| (A) Project Feasibility Survey | 20 | 15 | 7 |
| (B) Site and Infrastructure Development | 120 | 65 | 38 |
| (C) Plant Machinery | 250 | 170 | 90 |
| (D) Electrical O.C. and other operation | 40 | 30 | 15 |
| GRAND TOTAL | 430 | 280 | 150 |

Source: Excel Industries Ltd., Bombay.

THE PRODUCTS

1) Celrich /Organic Manure

The organic manure produced from this process has been given the brand name of CELRICH by Excel Industries Ltd.

This product can be used for special area development projects like saline land improvement, waste land improvement, social rehabilitation projects, afforestation projects, greening of mined areas, etc. The product is priced at Rs.1200-Rs.1600/ton.

2) Celrich substrate DF BC 01

It is used to make slurry for waste treatment. This product is available in powder as well as liquid concentrate form. Celrich substrate DF BC 01 in powder form is available at Rs 30 /kg and in liquid concentrate form at Rs 160 /litre (local taxes extra)

3) Sprayer

Excel Industries markets a sprayer with the solution for inoculation for domestic use also. The sprayer can be used as a deodorant too

SIMILAR PROJECTS ELSEWHERE AND FUTURE PLANS

The agency has done successful work, especially of inoculation treatment at critical situation in various cities like Bombay and Delhi and Ahmedabad when called upon.

The complete process of bioconversion has already been applied at Deonar and Mulund in Bombay whereas the one in Thane has been sanctioned. According to the company such proposals are also underway in various other cities such as Ahmedabad, Bhopal, Gwalior, Kanpur, Chandigarh, Jaipur, etc.

Thus presently the company is concentrating mainly on the disposal of garbage with future plans in all the major cities of India. At a later date they might diversify into the transportation of solid waste too. This way, they could get selective garbage, as required.

THE MERITS AND PROJECT VIABILITY

- 1) It is a considerably fast process which completes itself within six weeks and also does not require skilled manpower. Its first phase starts showing results within days and the second does so within months.
- 2) It comes as an affordable cost option with the investment recovery period being three to four years.
- 3) Composting acts as a good resource as the organic wastes recovered have a high market potential.

THE DEMERITS

The drawbacks of this process are:

- 1) The organic content of the final product, the manure (Celrich bio enricher) is low i.e. 30 to 40%.
- 2) Ash content in the organic manure is as much as 6% and hence the price obtained for the manure is only about Rs 1600 /ton.
- 3) It requires a good marketing and transportation network for selling the final product which Excel Industries can manage because of their presence in the business for almost half a century.
- 4) During the rainy season the moisture content increases largely resulting in a slowing down of the fermentation process. Therefore, large covered storage space is required for stocking the fermented waste during monsoon time. As this facility is not being provided owing to high cost, there is diminished production during monsoon.
- 5) At distant locations, the cost of production increases, making it a major constraint for the average farmer.
- 6) The product cannot compete with synthetic fertilizers because of the higher maintenance cost.

DST/CMC: PELLETISATION PLANT

BACKGROUND

In-depth research was carried out by the Department of Science and Technology (Govt. of India), New Delhi in collaboration with CMC Ltd., in the field of scientific disposal of urban solid waste. Several technological options were scanned, the marketability of various products was assessed and then the technology of pelletization was chosen as a suitable option over other processes like incineration, biogas and compost production for dealing with the issue of garbage disposal in a scientific way.

THE PROJECT

The DST and the CMC have initiated a pilot project on integrated waste management (IWM) in Bombay. This project is not run on a commercial basis yet.



The DST/CMC Plant, Bombay

- 1) The technology developed and funded by : DST
- 2) Established and managed by : CMC
- 3) Project Capacity : 400 - 500 TPD garbage or 100 TPD finished product i.e. fuel pellets.
- 4) Working hours /day : 20 hours
- 5) Working days /year : 250 days
- 6) Conversion Rate : 20 to 25% of input
- 7) Type of Garbage Preferred : coconut shells, textile paper, rags etc.
- 8) Connected Load : 600 HP
- 9) Land Required : 0.8 to 1.6 ha

The product has acceptability in industries. The plant is at Deonar dumping yard.

The above figures are for the plant's full capacity but actually the present plant production is only at the rate of 1.5 TPH working 8 hours, that is, one shift per day in one acre of land. It has to close down for the monsoon.

THE PROCESS

This process is semi-automatic and requires little manual operation. The raw material, that is, the mixed garbage, is obtained free of cost, from BMC. The process of conversion of garbage into fuel pellets involves primarily :

- 1) drying
- 2) separation of incombustibles
- 3) size reduction and
- 4) pelletization

The plant design has to be tailored in accordance with quality and quantity of garbage from city to city. The BMC trucks unload their city garbage in the Deonar dumping yard. It is taken by the agency in the required quantities as and when needed.

The garbage is spread out in the open for about two days for natural drying and then it is mechanically dried at 400°C. If the moist waste such as vegetables, hospital waste, etc is more in proportion, then extra energy gets wasted in drying. After this, the mass gets reduced by almost 50 percent.

The incombustibles such as sand grit, stones, glass, etc are separated out, through various sieves. The remaining stuff, that is, the combustible material is subjected to size reduction and is powdered. A binding material, which is an agricultural produce is added and pellets are made out of it. These pellets are then matured and they become hard enough to be transported loose and stored like coal.

LABOUR AND VEHICLES REQUIREMENT

A fully automatic plant being an extremely expensive proposition, the plant at Deonar is semi automatic with the manpower requirement being 15 labourers/ shift (8 hrs.)

The present capacity of the plant is 1.5 TPH or 12 TPD, i.e., 1.25 persons per ton of finished product.

For the existing working capacity, they require three vehicles for handling and spreading the garbage. Labourers are paid between Rs. 40 to 70 /day.

THE ECONOMICS

For a capacity of 100 TPD of processed goods (pellets) or 400-500 TPD of mixed garbage input capacity, the capital investment required is Rs 4 crore. The production rate of the project has to be about 4 to 5 TPH, working 20 hrs/day, for it to be profitable and economically viable. Thus the capital cost is very high and its running cost is also high owing to the large amounts of energy required for mechanically drying the garbage. For a 100 TPD project one can get a 5-year tax holiday. Recovery time for capital investment is seven to eight years.

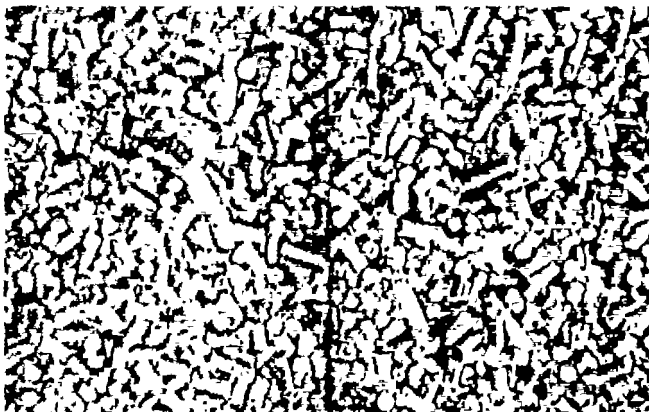
THE PRODUCT: FUEL PELLETS

The fuel pellets produced out of the waste combustibles are of cylindrical shape of different diameters upto 30 mm as required by the end users. The pellets are hard enough to be transported loose and stored like coal.

Their calorific value is 4000 k cal/kg as against that of coal being 3500 k cal/kg.

The characteristics of fuel pellets are :

| | | |
|-----------------|---|-----------------------------|
| Size | : | dia 8/20/30mm, length 40 mm |
| Bulk Density | : | 0.7 MT /cu m |
| Density | : | 1.3 gms /cc (minimum) |
| Ash content | : | < 15% |
| Moisture | : | 10% (approx) |
| Product sold at | : | Rs. 1000 /ton |



Fuel Pellets

The Market for the Product :

The fuel pellets have market potential in the non-coal producing zones. They can be efficiently used in fixed grate, travelling grate, fluidized bed, and multi-fuel packaged boilers. The advantages that the fuel pellets have over coal are:

- # Clean fuel, free from stones, etc
- # Lower ash content
- # Uniform size (No size reduction required at the user end)
- # Regular trouble free supply.

VIEWPOINTS OF CONCERNED PERSONS

The Agency

The plant at Bombay is a pilot project producing pellets at 1.5 TPH rate. The agency thinks that when rate of production is increased to four to five or more tons/ hour, this process would be very profitable. It is of the viewpoint that any city's garbage problem cannot be solved by a single process, for example, this process needs only combustible and dry garbage where as composting requires only organic garbage which can be wet garbage. So there should be coordination and understanding between various technology adopters for dealing with the problem of waste management together. Besides, the agency wishes that the civic body would :

- # give them land at a nominal lease
- # deliver the garbage free of cost
- # pay them (the company) the waste conversion charges
- # subsidize electricity
- # give incentives in terms of grant in aids, etc

privatise collection and transportation

Also they are of the opinion that private people are already involved in disposal and therefore collection and transportation should also be privatised.

THE MERITS

It is a new and good energy source processed from dry waste and or good option to coal, the natural resource.

It involves less labour at semi-automatic level which saves persons from working in such type of conditions or environment.

THE DEMERITS

- 1) The capital investment required is very high and therefore the recovery period is longer.
- 2) The drying of waste is done mechanically at a very high temperature of 400 degrees centigrade which demands a lot of energy in the form of electricity.
- 3) If the moisture content of waste is more, which generally is the case for Indian garbage, then the energy spent and the cost of production increases tremendously. So, it is suitable for high fuel value garbage only.
- 4) It has to have a good market network and /or be nearer to the industries or the end users to reduce the transportation cost, otherwise the industries always have the other alternative of using coal, open to them.

MCGB/IIT:VERMICULTURE PLANT

BACKGROUND

The project which is being implemented by BMC for part of its solid waste disposal programme at Deonar dumping ground has been developed by Dr. H S Shankar who is a professor at I.I.T. Powai. He has studied the ecology of waste environment in depth.

According to Dr H.S.Shankar, waste has two major components as follows :

1. Cellulose, which is responsible for acidity, and
2. Protein, which is responsible for alkalinity.

Increase in any one of these causes proliferation of pathogens which in turn are responsible for the foul smell. Management of acidity and anaerobicity which are major problems in large

scale organic matter, is the crux of vermiculture technology. This acidity reacts with rock in presence of aerobic bacteria to form soil (one can say that rock arrests acidity).

The vermiculture earthworm, which is a deep burrowing one (*Polyferitima elongata*), plays two main roles in the process as follows

- 1) The earthworm is at the apex of the soil food chain as shown in Figure 5.2. It is a predator and feeds on selective bacteria giving first preference to the bad and unwanted ones. It regulates the microbial population, keeping it young and productive. These micro organisms produce value added by-products such as antibiotics, vitamins and plant growth hormones, etc, thus enriching the soil. Earthworms are not found in large numbers in good healthy soil.
- 2) On the other hand the earthworm does the weathering of rock due to aberration. The earthworm eats rock and decomposes it, making available more area for reacting with acidity. Besides, it aerates the soil by its burrowing motion.

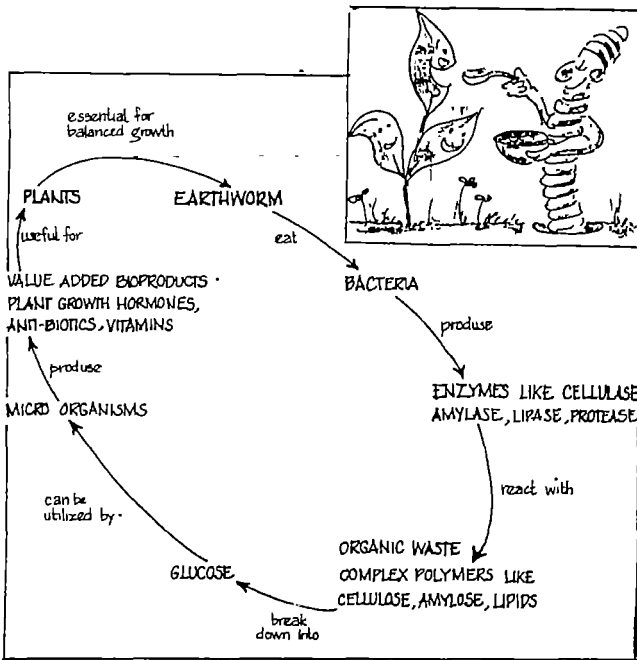


Fig 5.2 The Soil Food Chain

The earthworm maintains the soil pH at seven. Decrease in pH value to less than seven represents acidity and one sees the presence of fungi, termites, cockroaches, rats, ants, etc. If the case is vice versa, it is indicative of alkalinity, which breeds mosquitoes and flies. Either of these extremes are bad for health and hygiene

The pests and insects mentioned above are the biological indicators and natural alarms for warning us of dangerous unhy-

gienic environment as shown in the Figure 5.3. These indicators inform us of the type of additives required.

One more important role player in this drama is the green plant itself which completes the cycle. Thus the five characters involved are rock, organic matter, earthworm, bacteria and green plant.

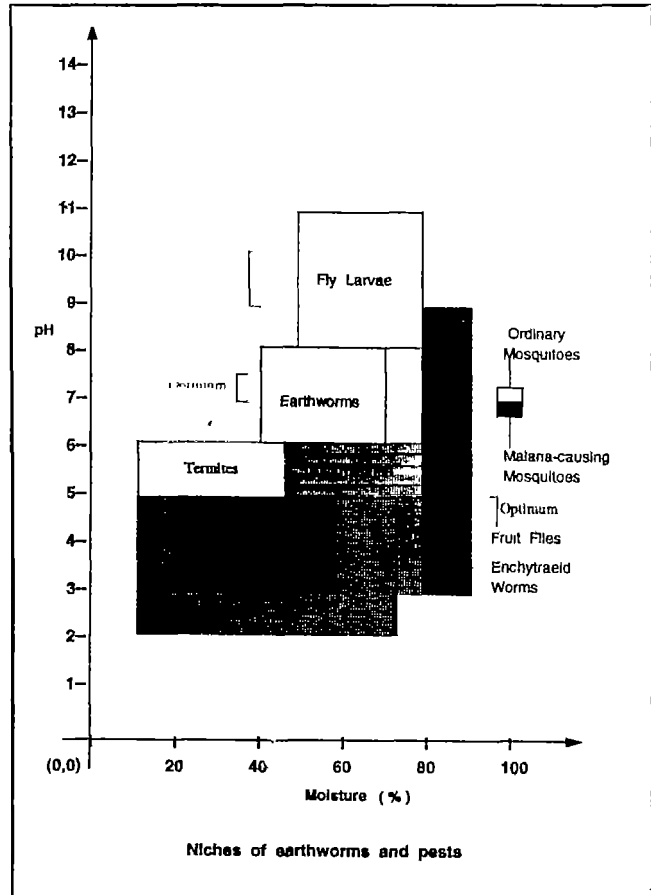


Fig. 5.3 : The Biological Indicators

They together are responsible for enhancing soil nutrient value. This technology can be adopted at the smallest household level and even at the city level.

THE PROJECT

The waste processing project based on vermiculture has been set up by the SWM Department of MCGB at Deonar dumpyard. The details are as follows :

- 1) Project developed by : Prof Dr. H. S. Shankar.
- 2) Project managed by : MCGB.
- 3) Project capacity : 400 TPD (Present project: 100 TPD)

- 4) Soil preparation time for waste loading : 6 months
- 5) Conversion rate : about 30%
- 6) Conversion time : 18 months
- 7) Land occupied : 20 ha. i.e.49.4 acres (Presently utilized:5 ha)
- 8) Clearance/year : twice
- 9) Type of garbage : Any type of organic waste such as that from vegetable market, slaughter houses, hospitals etc. (free from toxic material)
- 10) Process : Fully manual, Large labour requirement
- 11) Vermicomposting beds : 56
- 12) Culture tanks : 7

The project was set up in 1993 on trial basis treating around 35 to 40 TPD. But floods during 1994 monsoon killed the entire earthworm population. Nevertheless design of the unit was changed after that, the capacity hiked and top few inches of soil removed to overcome the flooding problems before restarting the unit.

THE PROCESS

In this process, the major investment goes into making bacterial culture. This culture is made according to the composition of the garbage to be treated. Seven tanks for making the culture have been prepared on site. This culture in turn is used for preparation of the vermicomposting pits. The soil gets acclimatized to receive the waste after 6 to 8 months of application of the culture to it.

The culture is to be applied at the rate of : 15 kg/sq.m.

Rock or murum is added : 100 gms /1 kg too, at the rate of organic matter

56 vermicomposting pits have been prepared to receive the waste.

The waste is loaded at the rate of : 5 kg/sq.m /day

The total land has been scheduled in four parts. Each part is loaded for six months only, in rotation. Its next turn to get

reloaded comes after 18 months. Thus any one area gets cleared after every six months resulting in two clearances per year. Plantation is done in rows in this area and the waste is spread between two rows of plantation. Unwanted materials such as tin, shoes, glass, etc. have to be segregated manually through the ragpickers.

LABOUR, VEHICLES AND MATERIAL REQUIREMENTS

It is a heavily labour intensive process. It is not easy to mechanize, where energy is provided by soil biology. Only harvesting, sieving and bagging are the later peripheral operations which can be mechanized. The various requirements/ton of waste to be treated are as follows.

| | |
|-------------------------|--------------------------------------------------------|
| Labour | : 1 Man day /ton (50 in number at Rs 1000/- per month) |
| The additive (culture) | : 0.1 to 0.5 ton /ton of garbage |
| Solids handling machine | : 0.5 machine hours /ton |
| Potable water | : 1 cu.m/ton (non monsoon) |

THE ECONOMICS

For the 400 TPD Vermicomposting plant at Deonar

| | |
|--------------------------|------------------------|
| Estimated project cost | : Rs 51.50 lakh. |
| Running cost | : Rs 6 lakh/annum |
| Cost of production | : Rs.800 /ton |
| Expected price of manure | : Rs.1800 to 3000 /ton |
| Payback period | : 4 years |

The designed capacity is of 20,000 ton of vermicompost per annum at the end of five years.

THE PRODUCT

The bacterial culture required to start the process is very costly at Rs 8,000 to 14,000/ton.

The end product or the manure is called vermicasting or vermicompost. It harbours earthworm cocoons and a wide spectrum of beneficial bacteria. It is a humus-like material of dark brown colour, with very high nutritional value. Due to the nutrient value addition, one kg of organic matter gives 20 kg of nutrients and 10 kg of organic matter fixes one kg of N₂ in soil.

Thus in presence of rock, the magnification of nutrient value takes place by a factor of ten. It is sold at Rs. 20-50 per kg.

The Merits

The advantages and the plus points of vermiculture technology are listed below.

- 1) The value added product has a very high nutrient value and so it fetches better price.
- 2) This process can take care of virtually any type of organic matter and it requires much lesser investment than any other method.
- 3) It utilizes the natural biological energy for bioconversion
- 4) It is labour intensive and requires unskilled labour.
- 5) It gives excellent results at the decentralized local community, society or household level where the waste gets attended to much more efficiently, reducing the transportation and collection cost. Besides, every household is made responsible for its own garbage.

The Demerits

Some of the problems faced in vermicomposting, especially if not managed properly are as follows :

- 1) There is a possibility of the earthworms migrating during monsoon. Besides, their hibernation period is from November to February when the earthworms remain in cocoon stage.
- 2) In case of high temperature, gas, acid or leachate frequently prevailing in the dumping ground which has been contaminated for years with inorganic wastes; earthworm mortality increases. Besides, several years of burning and dumping have made the area impermeable to water.
- 3) Land and labour requirement is very high.
- 4) Market for the product has to be developed
- 5) Since garbage segregation is done manually only, some unwanted glass, tin pieces are sometimes left back which show up in the vermicompost.

Vermiculture biotechnology has gained recognition and is in the market for about a decade now, and Mr. Uday Bhavalkar of Pune is one of the persons responsible for the phenomenon. Taking cue from him, various organizations and individuals have made efforts to popularize the technology at the micro level, that is, at household as well as community level, on commercial and voluntary basis

WESTERN PAQUES (INDIA) LTD. : BIOGAS PRODUCTION AND POWER GENERATION

BACKGROUND

Western Paques India Ltd is an environmental engineering company which undertakes turnkey contracts in power generation from non-conventional energy sources. The company has also worked in other waste management areas like sewage treatment and recycling of non-biodegradable waste.

They had put up the proposal of setting up a power generation plant in Pune with Pune Municipal Corporation (PMC). In response, PMC asked them to set up a demonstration plant of five TPD upto the methane production stage which was successfully carried out by them (the company). Now they are being asked to demonstrate electricity generation too. The PMC has about four different proposals to choose from, including the one from Western Paques, and it is dragging its feet to make the final decision.

The Company plans to establish a plant of about 400 TPD garbage input capacity at Pune. The details given below are for the pilot plant located at the Paud dumping yard.

- | | |
|--------------------------------|---------------------------|
| 1) Project developed & managed | Western Paques India Ltd. |
| 2) Pilot plant capacity | : 5 TPD |
| 3) Proposed capacity | : 400 TPD |
| 4) Conversion Rate | : 30 to 35% of the input |
| 5) Conversion Time | 18 months |
| 6) Type of garbage preferred | : Any biodegradable waste |
| 7) Rejects | : 10 to 15% |
| 8) Output from the | : 5 cubic meters of gas |
| | : 5 TPD plant |
| | : 1.5 tons of fertilizer |
| | : 150 cu m of effluent |
| | : 6% wastage |
| 9) Output from a | : 500 cubic meters of |
| 400 TPD plant | methane |
| | : 3 MW electricity |
| | (72000 units) |
| | : 100 tons of manure |
| | : 150 cu m of effluent |

THE PROCESS

The process of power generation from city waste can be explained in five major steps

Manual Segregation

The plant is situated in the dumpyard itself and so garbage can directly be brought into the premise. From this mixed waste all non-biodegradable material such as plastic, glass stones, etc is separated out manually on a platform.

Drum Sieving

The segregated waste is loaded on a conveyer belt and taken to the drum sieve which is a wet sieve. In this drum, the wet waste (water is added) falls and rolls many times and thus disintegrates and reduces in volume.

The Reactor Stage

Next, the disintegrated matter is passed through the floating type reactor where sand and other heavy material separates out. Besides, methenogenic bacterial culture is loaded into the reactor to speed up the decomposition of organic matter anaerobically. The process inside the reactor is much faster compared to natural decomposition. The bacteria acts on organic matter to produce the biogas. The residual mass that accumulates at the bottom of the reactor is used as organic manure and the sludge or liquid waste is disposed off.

Biogas Collection

The biogas which is produced from the reactor is collected into the gas holder for further use. In case of the pilot plant at Pune, it is blown away in a gas flame.

Biogas Power Generation

In the biogas power generation plant, the biogas from the gas holder is used as a fuel for prime mover to produce power. The power produced is pollution free. The process cycle is given in Figure 5.4

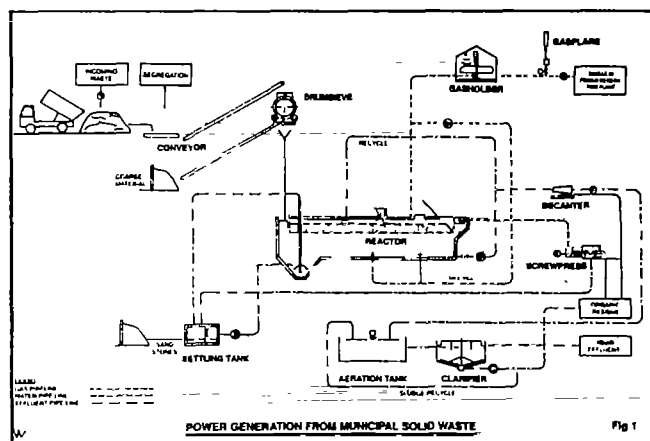


Figure 5.4 Process cycle for Biogas Power Generation from Municipal Solid Waste

LABOUR REQUIREMENT

For a semi-mechanised fertilizer plant of capacity of 100 TPD, 60 to 70 labourers/day are required for segregating, loading, unloading and bagging, etc. which works out to be 0.6 or 0.7 persons /ton finished product.

THE ECONOMICS

Western Paques not only finances the projects, but also installs, operates and maintains the plant with its own resources. The investment required is Rs 10 to 12 crore /MW against Rs 3 to 4 crore /MW by conventional sources. For installing a 3MW plant at Pune, investment needed would be over 25 crore. Cost recovery period is 10 to 12 years.

THE PRODUCTS

Organic Fertilizer

The residue of the reactor process is used as the organic manure. Its organic content is 50 percent. It is sold at a price of Rs. 1800 /ton and is used in agriculture and gardening

Electricity (Power)

The power generation rate for the proposed plant capacity is three MW (72000 units) The cost of power generated is Rs. 2.25 /unit. Almost 10 percent of it goes as input into industries. It is costlier than that produced through conventional energy resources.

SIMILAR PROJECTS ELSEWHERE AND FUTURE PLANS

Presently, the company is involved in the waste processing field only but it plans to expand its horizon into collection and transportation of solid waste in near future. The future plans of the company are as follows:

For Biodegradable Waste

Western Paques have executed projects at Warna, Sangamner, Bazpur, Harihar, Kodinar, Diu, Ahmedabad and Bidar. Latest installations have been done at Calcutta for 1000 TPD and at Madras for 400 TPD.

Many proposals are under considerations for other towns, namely, Bombay, Pune, Delhi and Bangalore, etc. Orders have been received and MOUs have been signed by them with various city corporations such as Calcutta, Madurai, Cochin, Calicut, Belgaum, Vijaywada, Vishakhapatnam, Aurangabad, Kolhapur and Trivandrum.

For Non-biodegradable Waste

The company has also developed technology for recycling of non-biodegradable waste too and is ready to cater to this portion of city waste in future. It is ready to use even debris, sand

and other light aggregate material in building construction works. But city waste pickers and other organisations doing social work opposed this on the ground that it would snatch the means of earning from the ragpickers. It is suggested that they should buy the recyclable waste from the ragpickers at market price.

THE MERITS

- 1) The foremost advantage in this process is that the production or work is not hampered by monsoon. Rather in its first stage of drum sieving, moisture is added to the garbage.
- 2) The whole process is proven in the laboratory and its every stage and components on site are predecided, controlled and monitored. Hence, none of the results are unexpected and the composition of the end product is fully known.
- 3) Being an established company they have a fully developed market network and experienced management.

THE DEMERITS

The drawbacks of the process is as follows:

- 1) The fact remains that it is a very costly proposition even though the company is ready to invest the huge amount required
- 2) It is an anaerobic process and hence the work site is heavily infested with flies and odour which result in unhygienic and uncomfortable condition for the workers.
- 3) The power generated by the process as its end product is costlier than that produced by conventional methods or that supplied by MSEB which would make it unaffordable.

VERMICULTURE BY BHAVALKAR EARTHWORM RESEARCH INSTITUTE

THE BACKGROUND

This Institute has been established and run by Mr Uday Bhavalkar, a chemical engineer. He is in the field of bio-waste processing through vermiculture for about twenty years. He has made vermiculture his life's profession. At the same time he has strong footing in Pune as well as Bombay.

He has proved that throwing away solid waste is like throwing away a valuable resource which can greatly enrich the environment and soil with the help of vermiculture

Any organic matter starts decomposing due to the presence of bacteria, fungi, etc. If the composting takes the right course of biological process with the right kind of bacteria, then its product is one which is required for healthy plant growth. On

the other hand, if it is done in an improper manner then toxins are produced which are ecologically harmful. The role of biological indicators has been depicted in Figure 5.3.

THE PROCESS

At Household Level

A family produces 400 to 500 gms of waste per day which is equivalent to 100 gms of dry waste and needs one sq.m. of area for treating it, though Mr. Bhavalkar can do it within 0.1 sq.m due to his experience and expertise. This process can be done directly below a tree, or in wooden bins of one sq m area and 60 cms height, or even in garden pots

In case of bins :

- # The bottom is lined with 4 to 5 sheets of newspaper.
- # 5 kg of vermicasting is spread over it and covered with 5 kg of cowdung and one kg of oil cake
- # The next layer is of garden or vegetable waste.
- # Water is sprinkled till it drains out from the bottom.
- # After 15 days the bin is ready for adding fruit and good waste.

In case of pots :

- # 7.5 cms of top soil is removed and 100 gms of vermicastings are added to the soil.
- # It is covered with 100 gms of cowdung.
- # Seven such pots are made, to take care of all household waste. One pot is fed with one day's waste in rotation.



Vermi-composting at Household Level, Pune

Under the trees :

- # The proportions are same as above, only the amount has to be, four to five kg of earthworm culture for trees with girth is of about 30 to 45 cms and about one to two kg for smaller trees like chickoo, guava, etc.

Note For one kg of organic matter, 100 gms of rock dust is to be added for better results

THE PROJECTS

Mr Bhavalkar has managed to reach vermiculture to around 2000 families in Pune within five years. Besides, he also has executed projects at community, industry or company level. The projects which have been installed by him, their capacity and place are listed below

- | | |
|-------------------------------------------------------------------------------|-------------------------------------------------------|
| 1) Indian Aluminum Company Ltd, Belgaon. Colony garbage and sewage processing | N.A. |
| 2) Canteen Waste Water, Belgaon | N.A. |
| 3) Onion Residue, Nashik | 10 tons /day |
| 4) Distillery Waste Water, Nashik | 110 tons/day |
| 5) Citric Acid, Waste Water, Nashik | 100 tons /day |
| 6) Soya Processing Residue, Roha | 3 tons /day |
| 7) Soya Processing Project, Devas, MP | 5 tons /day |
| 8) Mixed Yard (Garden) Residue, Maryland, USA | 10 tons /day |
| 9) House waste, Salisbury Park, Pune | N.A. |
| 10) Venkatesharia Hatcheries | N.A. |
| 11) Project KISS (Keep It Separate Sir) | separation of garbage technique for public awareness. |

All these plants are running successfully and he has proven that any type of waste, ranging from slaughter house waste to sewage to distillery waste can be treated with vermiculture.

LABOUR REQUIREMENT

About five to six labourers are required for handling a ton organic waste at the cost of Rs.300/ton

One ton of wet mixed garbage is converted to about 200 to 250 kg of vermicastings as end product. Thus the labour required would be 20 to 25 labourers/ton of finished product.

THE ECONOMICS

As per Mr. Bhavalkar, one can recover one's investment within a year. He charges one year's profits or an amount equivalent to the investment as his consultancy fees. A family has to invest Rs. 100/sq ft for its household and garden waste. The family can recover this money within one year by selling the end product, the vermicastings.

The recovery of money from a large vermiculture project is shown in the following chart.

INPUT

For a typical, large project of 300 tons of dry waste/day or 800 tons of mixed waste /day.

OUTPUT

300 TPD of vermicastings X Rs.20,000 /ton selling price.

PROFIT

Recovery of Rs 60 lakh /day X 300 days of the year Rs 18,000 lakh /year

THE PRODUCT

The bacterial culture made as per the specifications of the waste to start a project costs Rs 8,000 to 14,000/ton.

The end product or the manure is called vermicastings, is sold in the market at Rs.20,000/ton or Rs.20 to 50/kg

THE MERITS

The advantages of vermiculture technology are discussed below.

- 1) The value added product has a very high nutrient content and it therefore fetches excellent price besides requiring much lesser investment than any other method.
- 2) This process can take care of virtually any type of organic matter utilizing the natural biological energy for bioconversion
- 3) It gives excellent results at the decentralized local community, society or household level, where the waste gets attended to, much more efficiently, reducing the transportation and collection cost. In addition, every household becomes responsible for its own garbage.

THE DEMERITS

Generally problems are faced in very large scale projects only and especially if they are not managed properly

- 1) There are chances of the earthworm population migrating during monsoon.
- 2) Their hibernation period is from November to February when earthworms are in cocoon stage.
- 3) Land and labour requirement is very high.
- 4) Overloading creates problems and one has to therefore be very alert for indicators /alarms, besides high temperature, gas, acid or leachet are harmful to the earthworms and so are cats and dogs to the waste.
- 5) Since garbage segregation is done manually sometimes unwanted glass or tin pieces show up in the manure

THE GREEN CROSS SOCIETY

THE BACKGROUND

The Green Cross Society has been established by Mr. Shantanu Shenoy who incidentally is an electrical engineer. Though the society's self demarcated work area includes Greater Bombay and Thane district, most of its work has been done in Western Bombay only Mr Shenoy who has made vermiculture his profession started off by spending from his own pocket for the cause Due to the age old deep set unhealthy attitude of the masses towards garbage, the response to the process was not heartening enough, he feels It is only recently, after much propaganda through many organizations, that people have started acknowledging and accepting the system. The society has helped construct about 21 vermipits in different parts of Bombay, getting good response and co-operation from the people.

THE METHOD

The vermiculture process can be started off in makeshift wooden bins, or in properly built brick pits in the garden. Bins can be made by using a wooden packing case about one sq.m. in Bins can be made by using area and 60 cms in height. The same method as explained earlier could be applied to this bin as well.

PROGRAMMES

Various activities and programmes of Green Cross Society are as follows

- 1) Distribution of vermikit consisting of made plants in pots, trays, etc for house garden alongwith pamphlets
- 2) Talk Shows in schools and colleges

- 3) Seminars in various clubs, etc.
- 4) Coordination with other organizations like YMCA, YWCA, etc.
- 5) Sale of culture
- 6) Biofertiliser Sale
- 7) The Organic Club
- 8) Farming
- 9) Consultancy
- 10) Micro Projects
- 11) Vermi Toilets
- 12) Books
- 13) Vermi tours
- 14) Exports

THE PROJECTS

The Green Cross Society has 21 demonstration projects of various types in various situations.

INSTITUTE OF NATURAL ORGANIC AGRICULTURE (INORA)

THE BACKGROUND

This Institute was established by Mr. M.R Bhide

The objective of the institute is development and promotion of organic agriculture using vermiculture as the most environmentally sound way of producing healthy food.



Back to Nature

The Activities

It is essentially a voluntary organization which carries out research and development work on organic systems, use of earthworm technology in organic systems and advises individuals and organizations about the potential of earthworm technology in organic farming. For this they have:

- 1) A fully developed organic farm-cum-demonstration land on the Bombay - Pune road, two kms before Kamshet
- 2) A research programme with a fully equipped research laboratory at Shivapur.
- 3) An advisory and extension service. It has 25 centres throughout India for vermicomposting. They have developed three approaches to research and development work
 - a) Recycling of organic waste by vermiculture
 - b) Monitoring of the farms after application of vermicompost in the process of conversion
 - c) Conducting farm trials, demonstration and training programmes.

THE PROCESS AND THE PRODUCT

The earthworms used by INORA are surface dwellers, namely, *Eisenia foetida*, *Perionyx excavatus* and *Eudrilus euginae* to convert any organic waste into humus rich fertilizer called vermicompost. The conversion rate is 40 percent of biodegradable segregated garbage. The process of vermiculture and its application is similar to that of Bhavalkar Institute with slight variation.



The Earthworms

THE PROJECT

The organization sells the technology on turnkey basis. It does projects at all scales, for example:

Small Scale: Flats, bungalow : 1/2 kg /day

Medium Scale: Hostels, dormitories factories, etc. 2-3 tons/day

Large Scale: Military dairy farm:11 tons /day

One of the projects executed was Military Dairy farm. The requirement was to treat the cowdung from the military dairy farm. The capacity was 11 tons cowdung/day. The organization operated 11 centres such as Khadki, Pimpri, Deolali, etc. in the southern command for two years. Their responsibility was 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 :

- 1) Set-up Visit
- 2) Harvest Visit and
- 3) Follow up visit.

THE ECONOMICS

Being a voluntary organization, it gives services on a non-profit basis.

Vermicompost is sold at Rs 2100 ton

Vermiculture with adult worms is sold at Rs 1500 / kg.

FUTURE PLANS AND PROPOSALS

They also plan to go into collection field in future. They have submitted a proposal to the PMC for collecting and treating waste in four areas in Pune. They are:

- 1) Gokhalenagar (Patrakarnagar) . 500 kg /day
- 2) Kamala Nehru park : 100 kg /day
- 3) Mitramandal area 100 kg /day
(to be increased based on availability of land)
- 4) Kalyaninagar 100 kg /day

THE MERITS

- 1) It can treat any type of organic matter.
- 2) It is completely ecofriendly, it improves soil pH, enhances water drainage and water retention capacity

of soil. The soil productivity improves and agricultural produce obtained is of very high quality.

- 3) It is cost effective.

THE DEMERITS

The demerits of this process are.

- 1) The earthworms can not tolerate excess or very low sun and water
- 2) The process is labour intensive.
- 3) Great care has to be taken in large-scale projects.

RESOURCE UTILIZATION, RECOVERY AND RECYCLING: ORGANISATIONS AND THEIR PRACTICE

It has already been established that waste is a major resource available in ample quantities, if utilized properly. It requires timely and appropriate treatment for recycling and further use. On the other hand, there is no dearth of human resource too. If these two resources are combined and handled optimally, one can create wealth from them. But the catch word in this type of resource recovery is Segregation, which can only be achieved through public participation

For any new practice or method of solid waste management to succeed, cooperation and participation from the public is very essential. And it can be acquired only if they are aware of the quantity of garbage produced, the scale of its contribution to deterioration of environment and its hazardous effect on public life. *Segregating the waste and not littering public places is in itself the first major step towards resource recovery.* This way, the recyclable waste is saved by not mixing or soiling it and human resource is optimally utilized by saving time on segregation

Precisely this kind of work of increasing awareness amongst people and properly channelling resources is being carried out by various voluntary organizations in different cities. They pick up small areas for their operation and then branch out as the idea takes roots. Most of them get funds, grants or occasional help from other environmental organizations.

THE COMMON OBJECTIVES

Most of these organizations which are working in the field of solid waste and environment have more or less common objectives. Only their scale may differ owing to their financial status

- 1) Some of them stress on helping the poor, destitute and exploited street children, youth, women and

ragpickers; obtaining for them proper footing in the recycling trade.

- 2) A few organizations are working at the city level, organizing the ragpickers of the city and acting as their representatives to set up a dialogue with and ask for help from the authorities and other organizations.
- 3) Few organizations involve themselves in the work of awareness and education of the residents.
- 4) Many of them are presently concentrating fully on ways and means of getting the waste segregated.

Examples of some of these practices are as follows:

SEWA /PRARTHANA CONSTRUCTION PVT. LTD'S 'ZERO GARBAGE ON ROADS' PROJECT, AHMEDABAD.

The New Beginning

In addition to Ahmedabad Municipal Corporation which plays a major role in managing solid waste disposal in the city, there are a few other agencies also which play a small but significant role in this area. They are largely helpful in appropriate utilization of material as well as the human resources and thus also help in resource recovery.

The Ahmedabad civic administration along with the voluntary organizations and NGOs have come up with an innovative concept of 'Zero Garbage On Roads.' The salient features of this programme, the efforts made through it, its success rate and replicability has been discussed as a city-wide best practice in solid waste management in Ahmedabad.

The success of this practice is a result of the efforts of :

1. the women organized and engaged in the job through SEWA or Self Employed Women Association.
2. the chairperson of Prarthana Construction Pvt. Ltd., Mr. Mayur Shah; also the President, Clean Ahmedabad Abhiyan Committee, who through his untiring efforts has floated this new concept with the help of the Dy. Municipal Commissioner (Health) Mr. P. U. Asnani.

To make this experiment a success, various new committees have been set up to monitor the steady progress in this regard

The Apex Committee

To develop the city of Ahmedabad as a model and to execute and follow up a time-bound programme, an Apex Committee has been formed. The committee is responsible for developing the vision and concept of city cleanliness and disposal of garbage.

The committee is headed by the Deputy Municipal Commissioner of health and also includes representatives from various voluntary organizations of the city.

The main objectives are:

1. Zero garbage on roads
2. Minimum land fill by recycling most of the waste and minimising the handling and transportation cost of AMC
3. To bring in economic opportunities for poor and unemployed by encouraging self employment and creating massive awareness amongst the public for participating enthusiastically in civic affairs.

The Ward Committees

This committee consists of persons who are active and leaders in the ward, the health officer in charge in that ward, volunteers from various organizations and representatives from the NGOs

The tasks before these committees are.

1. To execute and monitor vision programme given by the Apex Committee
2. To develop new approaches if required for the unique situation of the ward
3. To coordinate various agencies involved in the management of solid waste in the ward.

The Coordinating Committee

This committee has members from the Apex Committee as well as from the ward committees. This committee is a window for exchange of information between:

1. Apex Committee,
2. Individual Ward Committees and
3. Various Ward Committees

In Ahmedabad, SEWA operates an excellent system for separation of dry and wet waste. Households are given large HDPE bags to hang outside their gates to be filled with dry recyclable waste. SEWA arranges with local rag-pickers to collect the contents of the bags weekly. The HDPE bags are sponsored by different industries who print their name and logo on the bags. This serves a dual purpose as it gives the corporate sector enormous publicity at negligible cost apart from the environmental benefits

BANGALORE ONIYAVARA SEVA COOTA (BOSCO)

OBJECTIVES

BOSCO is an organization working with the children on streets of Bangalore. Their solid waste management activity scheme was started in 1992 and aims at motivating the street children to find alternative jobs. It involves collection of waste papers by street children from schools, offices, etc. Three boys collect waste papers from selected schools and private offices on tricycle (shared by 2 boys) and one bicycle. The boys receive a stipend amount of Rs.50 per month funding and an extra amount by selling the recyclable/waste papers. The fund for this scheme is provided by the University for Global Concern, Singapore. The boys are provided with uniforms and identity cards, which give them respectability and save them from residents' suspicion.



Wastepickers engaged in waste collection and street cleaning, Madras

THE CLEAN AND GREEN MADRAS CITY PROJECT

The Municipal Corporation of Madras has started an innovative project called 'The Clean and Green Madras City Project' since 1993, 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 corporation finances the project, supervises it and also provides any other aid required by the organization

The work entrusted includes :

- 1) House to house collection of waste
- 2) Sweeping the streets, open public places and cleaning the open gutters.
- 3) Transport the waste to the nearest dumping point allotted by the local body from where the municipal lorries carry it to the dumping ground.

Financial Management

The Corporation of Madras provides the boys boots and gloves and two sets of uniforms. The materials used for cleaning brooms, baskets tricycles are also provided by them. The boys receive a consolidated salary of Rs. 1000 to Rs. 1925 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 accounts in the banks and they have to save upto Rs.150/- per month compulsorily. They are allowed to draw festival loans from their account.

PROBLEMS FACED

The project faced many basic problems in its initial phase. But by the efforts of the organisations, the process has become easier and more acceptable. The problem-prone areas are where many shops are located. Packing materials are discarded on the road side at any time of the day. This dirties up the roads after they are cleaned. The Director of AYC says stray cattle are a challenge to the boys.

The Project Officer Mr. Susai Raj of Neesakaram, said that initially they had encountered a lot of problems with the boys. The boys hated working under a particular time frame. Many of them tried to absent themselves from work. But, in the course of time they realized that the job provided them an identity of their own and they got more respect from society. This program has successfully completed its second year.

According to Father David of DBAI, this approach has brought positive results. The residents have now been requested to hand over the garbage directly to the boys. The boys try to remove the recyclables and sell them to itinerant buyers. There is no problem of accumulated garbage in the bins since cleaning is done twice daily. The boys are not paid salary if they are absent on any day. This makes them work everyday and efficiency of work is maintained.

Involvement of various organizations in different areas has brought efficiency and good results. These organizations were already into social work and so had experience in dealing with the public and the poor. They are doing other projects too, along with the corporation's clean and green city project.

NATIONAL SOCIETY FOR CLEAN CITY (NSCC), PUNE

BACKGROUND

This organisation was established by Begam Ali Yawar Jung. It deals with civic issues, has branches in all major cities of India and looking after solid waste is only a part of their overall campaign. The Pune chapter had patrons like Mr Kirloskar.

They have introduced Mohalla committee system where the region is divided into different zones termed as Mohallas with a committee appointed voluntarily to look after its problems, people's complaints, etc. At the year end, they organize a meeting of all Mohallas from the city and discuss each others work, achievements, setbacks, etc.

ACTIVITIES AND WORKPLACES

- 1) The organization has started a resident's forum. They ask people from various fields such as cantonment board, police, corporation, etc. to address them. They are asked questions by the residents and are made aware of the local problems. Most of these guests have power in their hands to help out the residents in some way or other.
- 2) The NSCC has fully adopted vermiculture and the committee members help people to set up the process. They try to create public awareness for garbage segregation. Ms. Sheila Christian and Ms. Geeta Vir are very strong supporters of this system. They have installed such plants at various places like Boat Club Area, Koregaon Park Area, Maxmuller Bhavan, St Phelex School, Vimannagar, Sopan Baug, Kondwa, Kalyaninagar and Aundh.
- 3) They have made an association with the ragpickers. A meeting is arranged with them every month and they are asked about their problems, opinions, etc. These ragpickers collect segregated waste from buildings and are paid by the residents on a monthly basis.

PROBLEMS FACED

In spite of being paid and being lectured every month, the ragpickers do not maintain timings, do not give a substitute if for any reason someone is not able to come some day and so on. Sometimes the ragpickers come and stay at the site along with their families. The committee has to remain alert and prevent any such developments in their area.

Even the residents do not always cooperate always. The committee, therefore, has to strive all the time to keep in touch with them and to make them aware of the advantages.

Two ladies, Ms. Sheila Christian and Ms. Geeta Vir have started 'Greenvich Education Consultants College'

SNDDT, PUNE

BACKGROUND

In SNDDT Women's University, the department of adult and continuing education, Pune, have involved themselves completely in the welfare of ragpickers. It has organized the

ragpickers of Pune and works for their welfare, education and rights Ms Chickermame and Ms. Laxmi Narayan are two very dedicated workers for this cause from the department. They have started an organization called 'Kagad Kanch Patra Kashtakari Panchayat' (KKPKP) whose members are the ragpickers and the cooperative stores which buy the recyclable material from them. They are around 4000 member waste pickers who pay Rs.15 /year towards membership fees. The ragpickers are given photo identity cards, the union cards or the SNTD-GRASP cards as identity cards.

THE EDUCATIONAL AND OTHER DEVELOPMENTAL ACTIVITIES FOR THE RAGPICKERS

1) Garbage Recycling And Segregation Programme (GRASP)

This programme promotes the collection of segregated waste from households and commercial establishments by waste pickers bearing photo identity cards. Presently about 60 waste picker women collect waste from 7000 households in Aundh, Koregaon Park, Boat Club Road, Model Colony and Kothrud. Each woman has a reach of minimum 100 households/day. This doorstep segregated waste collection earns the ragpickers about Rs 10 /household/month

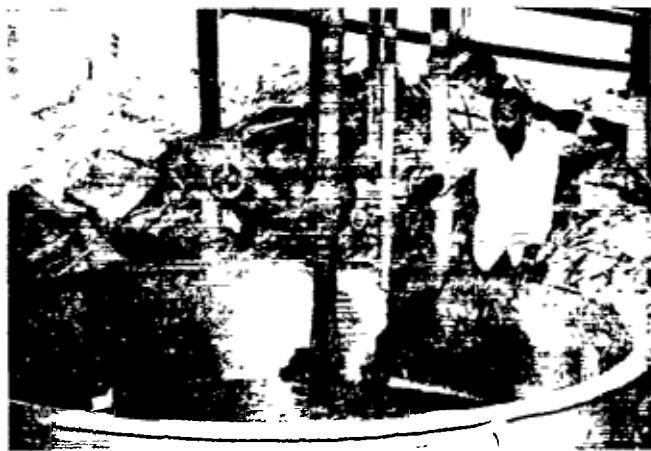
Various other programmes are as follows.

2) Health

Health facilities are provided to 40-50 waste pickers per week through the Spicer College Mobile Clinic.

Over 370 waste pickers from various places were examined and treated in special camps organized by a team of three doctors from Sasoon General Hospital

3) School Enrolment



Paper Waste Recycling Factory, Bangalore

Waste in Money

If one assumes that a waste picker earns on an average Rs. 30 per day from this business then his earnings per annum are $30 \times 30 \times 12 = \text{Rs. } 10,800$.

There are around 8000 such waste pickers in Pune. So their collective gains are $10,800 \times 8000 = \text{Rs. } 864 \text{ lakh}$.

This large scale money is involved in just the first stage of the primary collection phase.

One can imagine the total turnover brought about by the complete process of waste management.

In 1994-95, 237 child waste pickers attended non-formal education centers conducted by this department. As many as 2000 exercise books provided by 'Inner Wheel Club' were distributed as an educational incentive.

Nearly 630 children of waste pickers were enrolled in school in July 1995 and 82 children gave up waste picking to join school.

4) Domestic Violence

Counselling/arbitration/legal assistance is provided to female waste pickers who are victims of rape and domestic violence. This department is part of Mahila Dakshata Samiti at Pune Municipal Commissionerate.

5) Research

A study titled 'Child Waste Pickers in Pune City : A Situational Analysis' was undertaken by this department in 1994-95. The study was supported by UNICEF.

6) Self Help Groups - Savings

Waste pickers do not have access to lending institutions, consequently they borrow from money lenders and shop keepers at very high rates of interest

In the savings scheme started, each group of 10-20 women collects savings of Rs 10-20 per week per member. This amount is deposited in a joint account in a Nationalized Bank. After a period of six months, it is used as a revolving loan fund by the group. A circular issued by NABARD directs banks to permit opening of such accounts

On July 31, 1995, 37 groups of women waste pickers with a membership of 400 were a part of this scheme.

7) Cooperative Stores

They have started cooperative stores with about 200 members where all members (waste pickers) sell the collected waste to the trader. They get higher prices and the profit is shared.

SNDT PROPOSALS

Various proposals put up by SNDT and the KKP KP are as follows:

- 1) They need PMC's authorization letter for the ragpickers and PMC's stamp on their identity cards. PCMC (Pune Chinchwad Municipal Corporation) has already agreed for the proposal and have funded the pamphlets.
- 2) PMC could give licences to the waste pickers for specific areas or the association could be authorized and given licences.
- 3) The ragpicker women could be given vermiculture training and it could be carried out by them (licence holders) at the collection bin itself.
- 4) The waste pickers should be made a part of the solid waste management system Just like conservancy tax, a separate tax could be levied on the public for the ragpickers operation.
- 5) Space for recyclable material cooperative stores and for the vermipits could be given. Nearly 90 percent of the waste pickers are from backward classes and 90% of those are women So, help for them is very essential.

WASTE PICKERS

Waste pickers contribute to the solid waste management system by selling sorted waste materials to the buyers and wholesalers and thereby providing raw material for the recycling. And although waste pickers are seen to be self employed producers, in reality, they are part of the whole recycling sector.

ADVANTAGES OF WASTE PICKING

- 1) waste pickers can work every day and have daily though fluctuating earnings
- 2) waste pickers have no formal boss or overseer and do not depend on others for work
- 3) a certain degree of freedom and control over working hours makes it easier to combine this work with household duties including child care
- 4) the amount of work is to a certain extent determined by the individuals themselves
- 5) there is the possibility to combine waste picking with fuel collection
- 6) waste pickers do not have to invest money, they do not have to be trained nor do they have to have contacts to start waste picking

THE DISADVANTAGES OF WASTE PICKING

- 1) the supply of raw materials fluctuates and this fluctuation is uncontrollable. The monsoon rains destroy the waste paper and make it almost impossible to collect paper for several months each year. The monsoon income of a waste picker frequently falls to 25 percent of his/her income during the rest of the year
- 2) the prices paid for materials also fluctuate and thus, regardless of how efficiently waste is collected, they do not have a guaranteed income. Besides, the total number of waste pickers is increasing due to lack of other employment possibilities, this forces the prices downwards
- 3) the activity has many occupational health problems
- 4) picking waste carries no status and waste pickers are looked down upon by others in society. The conditions of this work combined with the victimizing effects of caste belief make a lot of these women/children feel ashamed and have low self-esteem.

ROLES PLAYED BY THE ACTORS INVOLVED IN BEST PRACTICES

Solid waste management is a subject which is a part of day-to-day life of every citizen. And, so, the success of a practice or operation in this field is a function of various actors, their behaviour, attitude and policy. The four major actors who play a lead role in causing the success or failure of any solid waste management project or in improving the solid waste situation in a city are:

- 1) The agency/organisation concerned
- 2) The local body
- 3) The ragpickers/waste workers and
- 4) The residents

Each of these four actors need a genuine and strong support from the other three for smooth functioning of the system and for maximum efficiency coordination is essential. Their role is described below.

THE AGENCY

The word 'Agency' with context to this study implies, the governmental or non- governmental organization or private enterprise which practices an innovative method in solid waste management. All 'best practices' mentioned in this report have been successful in smaller or larger extent and have potential

of being replicated under specific conditions. For the given agency to be successful, the main factors responsible are:

- 1) appropriateness of the technology
- 2) the funds and
- 3) the management

THE TECHNOLOGY

It is extremely important for the technology adopted to be well established and to be applicable to Indian condition in general and site conditions in particular. If this is not the case, output and efficiency reduces. This can be illustrated with the help of following examples:

- 1) *Excel Industries India Ltd.* is a good example of a technology suitable to Indian conditions which can be proved from the number of plants it is helping to establish in different cities and its popularity. Being a big company involved in other areas of biochemical engineering too, it has a widespread market network for its organic manure product. It has also put in remarkable efforts in Research and Development.
- 2) *DST/CMC* on the other hand have a good technology but it is suitable only for a small fraction of Indian garbage, namely, paper, plastic, rags, etc. The process requires dry and combustible material whereas Indian garbage has a high content of wet organic waste, which demands excessive use of energy, rendering the whole process costlier. The *DST/CMC* plant is yet to achieve its installed capacity.
- 3) *Vermiculture* technology is extremely good for small scale projects. Various institutions are experimenting with this, but still, it has not reached the stage where it becomes cost effective at a large city scale. Still more needs to be done in terms of practical application and marketing. The vermiculture plant in Deonar, Bombay is facing various problems due to this.
- 4) *Biogas production and power generation* technology works well as it is an anaerobic process where wet garbage does not hamper production. But solid waste based biogas plants have problems of size reduction, feeding and scum formation which require substantial power input.

THE FUNDS

Adequate funding is important for running the system. This holds good for agencies from all the sectors - Government, municipal, NGO and private. It is always desirable to have a stable financial system which is achieved either by self-sustain-

ing revenue generation or external budgetary support. Solid waste management has been regarded so far as an essential service dependent upon budgetary support. But considering the increased dimension of the services and treatment/disposal facilities required due to rapid urban growth, external budgetary support has become wholly inadequate in a majority of the places. Therefore, every possible attempt should be made to generate revenue from (i) recycling and resource recovery activity and (ii) service charges as the case may be.

Lately, some private enterprises are also trying to make waste management activity paying. However, support in the form of a grant would still be necessary in the pilot demonstration phase of a technology/system/service before it is thoroughly established, especially, if it is being handled by an NGO/CBO.

THE MANAGEMENT

Management plays a vital role in enhancing project efficiency. The concerned agency must have a proper management service backed by rational planning and institutional framework.

It is still more important for small organisations, NGOs and CBOs. They may need manpower training and input of information to a greater extent. Indian experience has shown that many projects had poor output or even failure due to inadequate management support.

THE ROLE

The arrival of all these agencies with best practices in the solid waste management area has made a remarkable difference. There have been innumerable experiments out of which some have been successful. They provide good competition to the local body, and on the other hand also reduce its work load.

As mentioned before, Bombay produces approximately 2742 TPD of refuse and 2260 TPD of debris. Out of this, 500 TPD is taken up by Excel, about 75 to 100 TPD goes into vermiculture plant and about 300 TPD* is expected to be consumed by the *DST/CMC* pelletization plant. Besides there are various other smaller organizations who do not dump their garbage into municipal bins. Thus presently about 900 to 1000 TPD of city garbage is off loaded from the Corporation's shoulders by these agencies in Bombay.

If these agencies take up further load, then the Corporation's responsibilities can be reduced proportionately and it can concentrate on planning, management or other activities.

Whatever is the field of work of all these agencies, it is their moral responsibility to make an effort towards public awareness, which is the basic necessity at the present stage of development. This would directly help the agencies' functioning and increase their efficiency as well as profit.

* The plant capacity of *DST/CMC* is 80 TPD but it needs 4-5 times more garbage.

THE LOCAL BODY

The local body plays the central role in these ventures. According to the BPMC Act, the solid waste is Municipal Corporation's property and so, no private body can do anything with it without their prior official permission

In many of the best practices discussed in the previous chapters, they have played a very positive role but at the same time the local body has also been found to be inadequate or constrained in many cases.

- 1) One such case is that of Mr. George Bhopali who cleans Juhu beach. In spite of there being an agreement that he would be given four lorries to collect the beach waste many a times these vehicles are not provided.
- 2) The response to Western Paques in Pune by PMC, on the other hand is a case of delay in decision. Even though the pilot plant producing methane gas has been successful, the company has still not been given permission to establish a full scale plant.
- 3) Exactly opposite is the example of the Madras Municipal Corporation. It has started the Madras Clean and Green City Project under which it has allotted different areas to different non-governmental organizations for cleaning. As the Corporation is acting as a funding body and provides an umbrella over the agencies, this project has become a success story.
- 4) Even Ahmedabad Municipal Corporation has taken the reins in its hands and is carrying out solid waste management modernization project with the help of a grant from the World Bank. But the Corporation shows reluctance towards privatization.

A local body, with its infrastructure, experience and its standing in the society can change the solid waste management scene of any city.

THE RAGPICKERS / WASTE WORKERS

The ragpickers form the lowest but one of the most important links in the chain of solid waste management system. Almost all the organizations, especially SNTD Pune and those in Bangalore have made efforts at organizing the ragpickers. But the ragpickers have shown considerable reluctance in some cases.

There have been instances where ragpickers do not come on time, do not turn up without prior intimation and so on and so forth. Through their own sincerity, they can earn respect in the society as well as money. They are the most important link between primary collection and recycling of waste. Their role is being increasingly realised.

THE RESIDENTS

Even though the executing body is some agency or a Corporation, not much can be achieved without the help of the public - the residents, their awareness and participation.

The work done by National Society for clean city in Pune, the Civic Enxoras and other voluntary organizations in Madras has been a success only because of residents' cooperation and participation.

The projects like 'Clean and Green Madras City' faced problems in initial stages as the residents used to throw waste even after the sweepers swept the street and in spite of the provision of dustbins.

Therefore it has been observed that small scale projects have higher success rate due to people's participation as well as cooperation.

INTERPRETATION AND LOOKING AHEAD

Various practices related to collection, transportation, disposal and public awareness have been discussed in the preceding sections. Each of them have made contribution for betterment in their own way, have had an impact on the respective city's scenario and have the possibilities of application at a wider scale. They have their own advantages or disadvantages in different circumstances.

IMPACT OF THESE PRACTICES ON THE SWM SCENARIO

These practices have contributed towards better SWM as a whole through their own areas of operation such as collection, transportation and disposal and wider plans for the future. This point is illustrated with the following cases:

COLLECTION

- 1) Beaches are the most popular tourist spots in all sea-side cities and are thereby places of maximum litter and garbage. Persons such as Mr. George Bhopali carries the responsibility of cleaning the Juhu beach in Bombay and has plans to do so at Marine lines, Gateway of India, Malabar hill, Colaba, Dadar, etc. This would be a major contribution to the city's cleanliness, as well as it would drastically improve the city's image in the public eye. It would thus have a direct impact on people as well as the corporation.
- 2) Contribution of organizations like SPCC, Pune is that they take care of the waste in their own area without relying on municipal lorries. A clean and decent locality is the result. They have spot impact on the city but many such spots can converge into a region.
- 3) Practices by Sadashivnagar Welfare Forum and REDS

in Bangalore have given a professional attitude to the task of collection, a system of working and at the same time, employment to the ragpickers by involving them in the collection exercise. Their impact on residents is that they get good service and clean area and the impact on ragpickers is that they get employment and recognition. The local body is the beneficiary too in terms of reduction of its work.

- 4) Primary removal of solid waste and primary cleaning of housing societies projects in Rajkot has posed an excellent example of positive points of partial privatization by the Municipal Corporation. The RMC has plans to extend it further, the impact is seen in more efficient work in area and increase in people's involvement.
- 5) All the organizations which are doing collection as well as disposal have made two-fold contribution to the SWM. Firstly, the waste gets efficiently collected and secondly, it gets disposed locally within the area, thereby decreasing the amount of waste to be transported to the disposal site and all nuisances attached to it. This holds true for CEE, Mythri Sarva Sewa Samithi and 'Suchi' in Bangalore. The result is, the given area becomes self sufficient in solid waste management.
- 6) The AMC's modernization project has much larger scale effect and impact naturally because of AMC's larger reach, expertise and financial backing. It has made a difference in every aspect of solid waste management in every area of the city.

TRANSPORTATION

Very few private organizations have taken up transportation of solid waste. The Municipal Corporations have complete control on this aspect.

- 1) Under the modernization programme funded by the World Bank, AMC has made changes in the design of its equipments and method of working. This has increased the overall efficiency of the system.
- 2) Contracting out solid waste transportation in Rajkot in 16 wards by RMC has given them financial advantage, improved efficiency and relieved the RMC personnel from related problems to a great extent.

DISPOSAL

Solid waste is an important resource, if treated properly. Till now, only non-organic waste got its due consideration by getting recycled, but organic waste has remained neglected. But the past decade has seen it receive increasing attention with industries like Excel Industries India Ltd (Mechanical bio-composting), DST /CMC (Pelletization), MCGB /IIT

(Vermiculture) and Western Paques India Ltd (Biogas power generation) coming up with different processes to recycle it on a large scale. They have major impact as they take care of large amount of city waste. If the complete disposal of total city waste is given to them, the city Corporation can be free from a major problem.

Other institutions which resort to vermiculture in smaller areas can also become very effective in disposing the waste locally.

RESOURCE UTILISATION, RECOVERY AND RECYCLING

The organizations working for the above purpose have brought about changes at the grassroot level. They have made an impact on the residents who are the generators of waste and the ragpickers who in a way are the foundation of the solid waste management tower and a link between collection and disposal or recycling.

- 1) National Society for clean city, Pune through its mohalla committee has served as a common platform for public bodies, public (users) and ragpickers to interact.
- 2) SNDDT, Pune has made drastic impact on the population of ragpickers in Pune. They made possible the historical decision of Pimpri-Chinchwad Municipal Corporation to give municipal identity cards to all ragpickers. Thus a way has been shown to absorb the informal ragpickers into a formal system.
- 3) The Madras Municipal Corporation has shown the way by acting as the coordinator, financier and consultant to various voluntary organizations working in the city. Allotting different areas to different agencies and maintaining the reins in their hand, the MMC has made a city wide impact in a cost-effective manner.

SCOPE OF APPLICATION AT LARGER SCALE

As this whole exercise is to find out best practices and their potential of replication and form national strategies, it now remains to be seen as to which practices could be replicated and at which scale.

COLLECTION

- 1) The system of Mr. George Bhopali can be applied in any coastal city. The only stipulation is, the local body has to provide the vehicles for transportation of waste to dumping place and fund the project. Commercial establishments such as hotels can either wholly or partially sponsor such schemes which will also improve their clientele.
- 2) All other systems of collection described earlier can also be applied if a voluntary organization (NGO/

CBO/Resident societies, etc.) is ready to take up the work

It can be extended to city scale too. But many such systems of localised collection and disposal have to be established in different areas because a single organization of this nature cannot manage the total city. Besides, it then also loses public faith and participation. In such case there has to be good coordination possibly under the leadership of the local body.

And of course funding has to come from government or trusts or other environmental organizations

Instead of just collection, if training, land and funds are given to the organizations, they can also do local disposal by composting and vermicomposting. This would automatically relieve the coporation of the burden of transportation.

TRANSPORTATION

Privatization of transportation is one of the good solutions to the problem. Almost all corporations are already hiring private vehicles for the purpose. The basic requirements in the planning of any of these arrangements is a study on how much waste is produced at what point and monitoring of the work. There have to be enough weigh bridges at the dump sites to keep a check on the waste brought in by lorries and trucks. Optimisation of routes and streamlining of the collection system can greatly reduce time and dead mileage.

DISPOSAL

Proper and sanitary disposal of garbage is essential for public health. At the same time, the system has to be technically viable and as economical as possible. The systems of waste recycling and resource recovery are becoming more important in this context.

The treatment/disposal options are related to the nature of the concerned waste. Only a landfill can accept all kinds of waste. Of course precaution has to be taken in the case of toxic/hazardous waste.

Biodegradable organic waste can be treated by any one or more of the following technologies:

- (i) Composting (aerobic, aerobic with defouling, anaerobic, vermicomposting, etc.)
- (ii) Biomethanation (biogas production with heating, power generation facility).

Composting in the urban sector had started in the 30's in our country but only in the 50's composting of nightsoil was practised by some municipalities. In the 70's mechanical composting plants were set up in several towns/cities but the experience was not encouraging due to poor product quality and consequent feeble market response as well as poor O&M. Against

this backdrop, the performance of the aerobic composting with defouling arrangement developed by M/s Excel Industries India Ltd., Bombay brings a ray of hope. So far they have established the technology at a scale of 500 tons of garbage per day. This means, an approximate population of 1.25 million may be covered. For larger population, a suitable number of facilities may be set up in a decentralised manner.

As pointed out already, vermicomposting can play a significant role in a small scale operation and can be replicated in an environment-friendly manner. Anaerobic composting, being a very slow process, is not recommended on a large scale. It can and is, however, used in small private lawns and gardens.

Biomethanation is an established technology but its application to garbage in this country has been limited to laboratory work and a very small number of small demonstration plants. As pointed out already, it has to overcome a number of engineering problems and power input.

Its scale-up and replication, however, is highly desirable in view of our energy shortage. Its success would depend on pricing of the products, that is, biogas, electric power generated, sludge manure, etc.

Combustible dry waste such as paper, plastic, rags, etc. can be subjected to

- (i) direct incineration or
- (ii) pelletisation (refuse derived fuel).

Incineration has a discouraging example at Delhi (Timarpur). But infectious hospital waste, on the other hand, must be incinerated on health grounds. Pelletisation is gradually picking up since one decade but so far there is no plant which is operating regularly at its rated capacity. As pointed earlier, the small fraction of this category of material available in Indian garbage is a big limitation to this technology.

RESOURCE UTILISATION, RECOVERY AND RECYCLING

It is a voluntary activity and cannot be forced on anyone. Though almost all environmental institutions and organizations are making their own contribution, but a city level campaign can be launched only by the local body as no organization will be interested in doing so unless there are some direct gains.

INTEGRATED SWM

The key to the success of any town or city-wide SWM system is overall planning in a meticulous way, taking into account the ground conditions and sufficient future projections. The total system from generation to final disposal has to be intertwined into a meaningful process.

One has also to consider if centralised or decentralised mode has to be adopted. As per the situation obtaining in most of

the Indian urban agglomerates, a judicious mix of both should have the best chances of long term success.

Landfill (sanitary) is still the most used method of garbage disposal. But a judicious combination of appropriate technologies for bio-degradable organic waste, combustible dry waste, etc. may be useful in practice. The 'best practice' studied in this report can thus be utilised meaningfully. For example, a city may have composting/bio-methanation facility, supplemented by pelletisation. There can be a harmonious combination instead of unhealthy competition.

GENDER ASPECTS

The issue of women in solid waste management could be said to be two-fold. Women have an important role in the generation, segregation and primary transportation of the waste. The second is their involvement in waste recycling as waste pickers. In the Indian scenario kitchen is still the domain of women and therefore they can be an asset for better management of waste by practicing the following:

- * reduction in waste generation
- * segregating the waste at source and making productive use of non-organic components
- * appropriately disposing the organic waste through composting/vermiculture
- * inculcating waste management habits in the other members of the family

Waste pickers are mainly from socially backward groups which occupy the weakest economic positions in Indian society. Due to poverty, a large number of women are also forced to work in this sector as an alternate means of living. This sector also attracts women due to their caste position and also because they can only perform unappreciated and badly paid labour. This sector does not attract men due to uncertainty of earning.

WOMEN WASTEPICKERS

A study was carried out in Bangalore on gender aspects of waste picking in 1989-90 and it was found that women far outnumber men in this profession. A closer look at statistics reveals that of the men, most are boys. Women of all age groups engage on waste picking and no age group is dominant in particular.

These women have a very low level of education or are illiterate. According to the study, before starting waste picking in Bangalore, 64 per cent women had tried other jobs but they switched over to waste picking because of following reasons :

- the work was too heavy (due to health situation or to dependent children) 41%
- to low or no daily wages (the time and mode of payment for work) 25%
- No work available 13%

- husband passed away, left the family or became unemployed 9%
- accident or forced removal 16%
- forced to stay home because of illness 6%

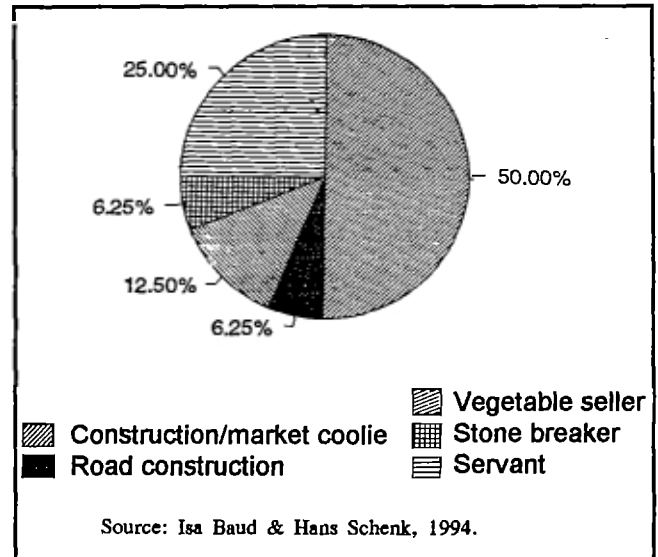


Fig. 5.5 : Jobs before waste picking

GENDER SPECIFIC CASES RELATED TO PRIMARY COLLECTION OF WASTE

EFFORTS IN AHMEDABAD

In Ahmedabad the work of door-to-door collection of waste on a daily basis has been undertaken on an experimental basis. At present nearly 10,000 people of Ambawadi area, a high income group locality of Ahmedabad, are being benefitted under the scheme.

The Practice

Under the present concept of Zero Garbage On Roads, women engaged in the job of waste collection /ragpicking are formally grouped together. They are deployed in various colonies and are paid by the beneficiaries on monthly basis. Their job includes the daily collection of household waste from each house and depositing it into the community bins. These bins are subsequently taken to the disposal site by the Corporation employees.

The Advantages of this Practice

The benefit of this practice is that one no longer finds any waste being dumped in the rear lanes or by the sides of the streets. As regards the economic benefits the status of the working women is upheld by a regular income. Moreover from a sociologist view point their social status has improved from

a nomadic waste picker to an organized household worker who collects waste from the houses. She is now a formally employed person as well. Being associated with the elite of the city it can be expected that their perception about living habits and clean environment shall also improve. They can also segregate the reusable/ saleable part of the waste thereby putting some check on wastage of resource.

SEWA and the Paper Pickers of Ahmedabad

The paper/ rag pickers have an important place in the segregation of the reusable matter from the city waste. In this regard SEWA, an NGO in Ahmedabad has contributed in organizing the women engaged in this activity and safeguarding their interests from the clutches of the paper contractors and the middle men. SEWA has plans directed to free them from the dependence on these agents and allow them to take greater control of their work and their lives. A godown of their own has been made from where the collected waste paper is sold to the mills directly SEWA's efforts have safeguarded them from the drudgery and dangers of work

The Economic Benefits

In terms of the economic benefits of the system, by eliminating middlemen, the returns have increased tremendously as compared to what they used to get from the contractors or agents of the paper mills.

Social Benefits

From the view of social upliftment their status has improved from a rag /paper picker to an organized worker who collects waste paper /rags and sells it directly to the mills through its own cooperative. Being well organized they can no longer be exploited by the middlemen.

Their contribution is also praiseworthy because they are self employed and most of them are the sole bread earners for their family. Also they segregate the reusable/ saleable part of the waste there by preventing the wastage of resource to a large extent

Efforts in Pune

The adult education department of SNDT College Pune has put in maximum efforts at upliftment of the waste pickers by starting various schemes for them and by putting up their problems before the local body. Efforts that have been made especially for women waste pickers involve starting a creche for the children of these women so that they can work for the day, free of worry for their children or the hassle of carrying them along. They have also initiated some savings schemes and helped them open accounts in various banks.

CONCLUSIONS AND FORMULATION OF APPROPRIATE STRATEGIES

This study has led to the following conclusions:

- (i) Proper solid waste management practices on a city wide scale is not to be seen anywhere in our country. No local body, whether small or large, has been able to tackle this issue in its entirety.
- (ii) The endeavours studied have the potential of being adopted/adapted as 'best practices' under suitable conditions.
- (iii) They may be integrated into suitable sizes of systems with integrated waste management planning
- (iv) Long term monitoring and a proper mechanism of feedback would help to generate valuable experience and confidence in these systems.
- (v) Appropriate strategies have to be formulated to obtain optimal results.

APPROPRIATE STRATEGIES

Technology:

- (i) Selection of appropriate technology/combination of suitable technologies is the most important step. It must be viable from the point of view of local conditions, investment capabilities, infrastructure available, etc. Simple rugged technologies have a higher chance of sustainability under developing country conditions.
- (ii) Finance. It is difficult to make solid waste management a revenue earning venture. It is mandatory to protect public health. Therefore, careful planning is necessary to make the most of available finances. Appropriate service charges and taxes may be levied. Lately, some financial institutions, notably HUDCO, have started financing this vital sector. Loans are available on concessional terms for providing an essential support system.
- (iii) Land and other infrastructure: It is imperative that land and other infrastructure be provided at suitable terms for operating solid waste management systems.
- (iv) Institutional and Management Aspects: Proper distribution and delegation of work and responsibilities backed by detailed planning are important for SWM system. Integration of different endeavours would necessitate a coordinator, possibly the local body under whose umbrella different agencies (NGO, CBO, private entrepreneur etc.) may carry out their work. Public participation is crucial for the success of these programmes. As such, public participation should be made an integral part of the institutional mechanism. Efficient management and effective management information services are essential for successful imple-

mentation Therefore training and HRD components have necessarily to be included.

- (v) Policy and Regulatory Measures: In the absence of a consistent and detailed policy statement/document on solid waste management, decision making becomes difficult and cumbersome and may even lead to inappropriate decisions. This need becomes more accentuated when a number of 'best practices' are considered for application Their relative merits, scope and benefits of integration must be brought out clearly in a policy document

Existing regulatory measures, such as the municipal acts are not adequate to handle the complex and constrained present day urban scenario Suitable amendments and supplements may have to be incorporated in these acts in consonance with the Environment Protection Act, 1986 and considering the obligatory functions of the local bodies as well as the mandatory regulations for the public.

- (vi) All out effort must be made to generate public awareness because this is the best guarantee for the involvement and active participation of the public which is the key to the success of the system.

Under the 'BPMC ACT 1949 Chapter XVIII Sanitary Provisions': Scavenging and Cleansing is an obligatory function for the local body The Delhi Municipal Corporation Act of 1957 has similar obligatory functions (Chapter XVII). For nearly four decades now, this service is being looked after by the Municipal Corporations Therefore, only they can play a major rôle in the upliftment of the Solid Waste Management situation in the city, by acting as promoters, coordinators and resource persons All alterations, amendments or gearing up that need to be done for system betterment, can be categorized under five distinct headings as follows :

- 1) Strengthening the institutional framework
- 2) Develop appropriate technical and managerial guidance material for SWM through research and documentation
- 3) Promote public-private partnership
- 4) Give health education to residents, ragpickers as well as government staff
- 5) Promote community based practices and public participation

(B) Strengthening the institutional framework

- 1) First and foremost, as the BPMC Act states, refuse should not be considered as the sole responsibility

and property of the local body. Those who create the garbage should also be made equally responsible for it and accordingly amendments to the law should be carried out.

- 2) There is no dearth of innovative ideas for any system. New equipments, processes and technologies are constantly being marketed and SWM is no exception. Municipal personnel need training so that they can accept new ideas, can operate new equipments and are kept abreast of latest happenings.
- 3) The local body staff lacks conviction and interest at the lower level So even if the work is approved by higher authorities, it still does not get done by the next rung of staff. If there is close monitoring, compulsory feedback, incentives or competition, work efficiency would increase.
- 4) The responsibilities should be clearly demarcated without overlapping of work zones or authorities. For instance in most of the SWM departments, the conservancy staff is under dual control of Chief Engineer who provides technical supervision and the Ward Officer who exercises the administrative control, with the ward officer reporting directly to Dy. Municipal Commissioner. This creates administrative problems, delaying decisions including those affecting the outsiders.
- 5) The ragpickers can be given recognition and licences for working in specific areas so that even the residents can identify with them.

DEVELOP APPROPRIATE TECHNICAL AND MANAGERIAL GUIDANCE FOR SWM THROUGH RESEARCH AND DOCUMENTATION

- 1) A detailed survey of the city to find out the type and quantity of garbage produced at different collection points needs to be done. Depending on this, the work norms for the staff, vehicles and private contractors should be rationalized Strict monitoring of collection time, transportation vehicles and their optimum utilization should be done.
- 2) National, State and Local level information centres should be initiated for reference and coordination

PROMOTE PUBLIC-PRIVATE PARTNERSHIP

Many new agencies, environmental engineering companies and other private entrepreneurs are coming forward to put up solid waste processing projects or collection and transportation networks in the cities. The Municipal Corporations need to analyse them through experts and then choose the most feasible one. But this decision should not take very long In

addition, there are some organizations which work for public awareness or in backward areas.

All these agencies require help and cooperation from the local body which could be provided in the following way :

- 1) In order that work on private projects starts on time, quick clearance of papers from the municipality is required
- 2) In order to prevent encroachment it should be mandatory on the Corporation to produce fencing and boundary for the dumpyard.
- 3) Land for the SWM project plant should be given at minimal rent lease.
- 4) Road to the project site could be made by the local body as it is a very costly proposition for private entrepreneurs
- 5) Garbage should be given free or at minimal cost by the local body to the private waste processing projects. In some countries, the local body actually pays those private bodies who help process the waste.
- 6) Some grant-in-aid or capital subsidy shall be useful to smaller private entrepreneurs
- 7) Water and power should be made available. Subsidized electricity could be given.
- 8) Municipal Corporation could pay the conversion charges (because of value addition of the solid waste).
- 9) Incentives from Municipal Corporation are essential.

GIVE HEALTH EDUCATION TO RESIDENTS, RAGPICKERS AS WELL AS GOVERNMENT STAFF

Training of residents and ragpickers in health education can be done by non-governmental organisations with the help of the local body. Government staff can be educated by formal training institutions through workshops and skill upgradation programmes. Other awareness creation activities should be suitably devised through media, door-to-door canvassing, pamphlets, street plays, and so on.

PROMOTE COMMUNITY BASED PRACTICES AND PUBLIC PARTICIPATION

- 1) Any citizen who litters or spits on the streets or any public place should be fined heavily on the spot. But this shall require equally adequate waste collection facility to match the efforts.
- 2) Though house-to-house collection system is not prev-

alent in all cities, the local body should make it compulsory for every household to deposit segregated garbage at the collection points

- 3) A dustbin place and a composting corner can be made compulsory in the building bye-laws.
- 4) It is every environmental body's moral responsibility to promote and work for public awareness even if their field of work is waste transportation or processing.
- 5) Various bodies are operating towards the same cause or are using similar technologies, but some are working voluntarily while others are working commercially. Hence, there is not much coordination between them. It is imperative that all these bodies coordinate their activities and keep each other informed about their operations. Only then can very large number of households be reached within shorter time.

CAPACITY BUILDING FOR INSTITUTIONAL STRENGTHENING

It is evident that a variety of institutions are engaged in SWM. What is required is their stock taking and defining a coordinated mechanism for implementation to achieve the desired result. All the actors involved need training and strengthening of the system of solid waste management.

The following points are important for capacity building and institutional strengthening.

- (a) Necessary technical assistance and guidance from central/state Governments;
- (b) political will and commitment;
- (c) city/town level short (say 5 years) and long (say 20 years) term master plans to be developed and implemented,
- (d) for larger towns/cities, separate SWM Department may be established for better coordination of all these 'best practices';
- (e) HRD and training - involving the local bodies as well as the other agencies involved; and
- (f) MIS (Management Information System) based on proper database for planning, execution as well as operation and maintenance.

At the outset, it may appear that the multi-agency involvement may lead to confusion and inefficiency. But with proper coordination, it should be possible to consolidate these endeavours.

1) THE AGENCY

All voluntary organisations working at the small local level can be given information and training in various disposal methods which they can utilise and even teach the ragpickers so that programmes can be implemented with maximum reliability of results

2) THE RAGPICKERS

Ragpickers need to be taught discipline, punctuality and regularity, and have to be given health education and monetary help. In some of the cities, they are a part of some union and these unions can be taken into confidence to reach the ragpickers. They should also be taught the importance of saving, education, health and hygiene.

If these ragpickers are trained in disposal techniques, garbage can be taken care of locally

3) RESIDENTS

Public in general needs civic discipline and lessons on not to litter the streets and public places and on the importance of segregating their garbage at source

Segregation at source can increase the disposal or processing efficiency of garbage by almost 20 percent.

4) LOCAL BODY

Many new equipments are bought and latest or new technologies are adopted by the local bodies, but they lie unused as the local body staff does not know how to operate them.

There are always invariably small things that need to be changed, a little change of habits and a little sincerity. However, the small contribution is required from everyone

Annex-I

HAZARDOUS HOSPITAL WASTE GENERATION IN BOMBAY

| HOSPITAL | VOLUME/DAY | INCINERATOR | NO OF BEDS |
|---------------------|------------|-------------|------------|
| 1) Cama | 10 kg | No | 400 |
| 2) Bhatia | 40 kg | No | 250 |
| 3) Masina | 1 ton | No | 244 |
| 4) Bombay Hospital | 1 truck | No | 800 |
| 5) Wadia | - | No | - |
| 6) J.J.Hospital | 40 kg | Yes | 1000 |
| 7) Breach Candy | 10 kg | No | 174 |
| 8) K.E M | 1500 Kg | No | 1850 |
| 9) INHS Ashvini | 600 kg | Yes | 825 |
| 10) Nair Hospital | 600 kg | No | 1350 |
| 11) S T Georges | 15 kg | No | 467 |
| 12) Bhabha Hospital | 125 kg | No | 400 |
| 13) Jaslok | 25 kg | Yes | - |

Source Bombay Study Report.

Annex-II

DEMOGRAPHIC DATA FOR THE SIX CITIES

| Cities | Ahmedabad | Bangalore (incl. BDA area) | Bombay | Madras | Pune | Rajkot |
|-------------------------------------------|-----------|----------------------------------|-------------|------------|-----------------------|---------|
| State | Gujarat | Karnataka | Maharashtra | Tamil Nadu | Maharashtra | Gujarat |
| Estimated Population 1991 (in lakh) | 28.77 | 40.08 | 99.0 | 56.8 | 24.4 | 6.09 |
| Area Sq Km. | 190.84 | 151.16 | 413.3 | 174 | 146 | 69.25 |
| Estimated Slum Population (%) | 60% | - | 60% | 66% | 40% | 15% |
| No of adm/election wards | 5 zones | - | 23 | 10 zones | 111 election wards | - |

Source Six city-based studies

Annex-III

DETAILS OF SOLID WASTE MANAGEMENT IN SIX CITIES

| Description | Ahmedabad | Bangalore | Bombay | Madras | Pune | Rajkot |
|--------------------------------------------------------------------------|-------------------|----------------------|---------------------------|----------------------------------------------------------------------------------|-------------------------------------------|--------|
| Total Waste Generated (TPD) | 1683 | 2130 | 5800 | 2675 | 1000 | 250 |
| Total Waste Collected (TPD) | 1500 | 1800 | 500 | 2140 | 700 | 220 |
| Total Budgetary Exp. for C ¹ /T ² (in Rs. million) | - | 350 | 1500 | 400 | 2.0 (for Disposal) | - |
| Per ton Exp. for Collection, Transportation | - | Rs.480/ton | Rs.62/ton (for C only) | - | - | - |
| No of Workers for Collection i.e n /1000 Population | - | 6671 + 1740 hired | 22,128 | 7,500 | 947 | - |
| No of Total SWM Staff | - | - | 26,239 | 7,957 | - | - |
| Municipal Vehicles | - | 100 | 161 trips | | 29 tippers 15 dumpers 5(3T) tippers | - |
| Contractors Lorries | - | 120 | 389 trips | 500 (5T) tippers 100 (3,2,1T) mini lorries 250 (1T) bullock carts | 20 road masters | - |
| Debris Vehicles | - | - | 418 trips | - | - | - |
| Total Lorries/ Trips /Transp. Capacity | - | 220 | 968 | (500+100) = 600/850, (8 X 850) | 69 | - |
| No of Dumping sites | 6 land fill sites | No official site | 4 | 2 | 2 | - |
| Total area of dumping sites | - | Done along roads | - | 169.9 ha | 443 ha | 30 ha |

¹ Collection² Transportation

Source The six city based studies.

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6

Environmental And Health Improvement In Jajmau Area, Kanpur - Lessons And Experiences For Wider Replication

Ministry of Environment & Forests, New Delhi

THE THEME

The Indo-Dutch Environmental and Sanitary Engineering Project (IDP) at Jajmau Kanpur has been taken up as part of the Ganga Action Plan (GAP), the main objective of which has been cleaning of the river water to certain acceptable levels. In the implementation of the Indo-Dutch project, emphasis has been on the integrated development of three interdependent elements namely, the river, the industries polluting the river and the low income community sending workers to the industrial units. In the process of implementation of the IDP integrated project, a number of beneficial practices, individually as well as in an integrated manner have been evolved.

The main idea of the study is to develop a theme for best practices for a typical situation that involves water body pollution arising from industries as well as hygienic and health problems of low income communities. There are situations similar to this at a number of places in the developing countries, where such programmes could be beneficially replicated. With this in view, the present report has been prepared in the following sections:

- Ganga Action Plan
- Indo-Dutch Sanitary Engineering Project - the integrated approach.
- Interventions under the project
- Community participation with special emphasis on gender aspect.
- Strategy formulation for river cleaning projects.
- Sustainability and institutional development for scaling up
- Best practices replicability.

GANGA ACTION PLAN

The River Ganga is the lifeline of millions in India. It traverses a length of 2,525 kilometres from its origin in the Himalayas



In Jajmau area (Kanpur) there is heavy discharge of Industrial waste in the river.

to the Bay of Bengal and passes through the three basin states, Uttar Pradesh, Bihar and West Bengal. All along, for centuries past, the river had the cleanest of water. In the recent past, in the process of development and with the emergence of more and more urban settlements and sprawling cities along its banks leading to discharge of liquid and solid waste directly into the river with no prior treatment, has made the river water polluted below even the standards set for bathing, a major *in situ* use most of the major Indian rivers are put to.

A study was carried out in 1985 to determine pollution levels in the Ganga. It was found that the main source of pollution was due to the discharge of urban sewage from 29 cities with population over 0.1 million, 23 cities with population between 50,000 and 100,000 and 48 towns having a population of less than 50,000. These towns and cities depend on the river for potable water, *in situ* uses, fisheries and in turn discharge their waste into the river. Even the towns with sewage treatment facilities, discharge polluted waste water into the river because these treatment systems do not treat all the waste water. The bigger towns and cities were major contributors of the pollution as is evident from the fact that twenty five out of 100 towns located along the river accounted for 88 per cent of the sewage load in the Ganga. Industry in the large towns adds further, often hazardous industrial pollutants to the river. The river stretch along Jajmau-Kanpur, the area of the case study, was

found to contain the highest level of pollution with BOD ranging from 10 to 55 mg/l and DO 4 to 6 mg/l. Upstream of Jajmau-Kanpur, the dry weather flow of the river is diverted into canals for irrigation. As such there is very low dry weather river flow at this place while there is heavy discharge of industrial and municipal waste, resulting in the failure of the self-purification capacity of the river to recuperate its water quality for a long stretch downstream.

To combat this pollution, and improve the water quality all along the river, at least to bathing quality, the Ganga Action Plan was launched in 1985. The Plan is fully funded by the

Government of India and implemented by the three Basin State governments, with the Ganga Project Directorate, Ministry of Environment and Forests (MOEF), as the nodal agency. Its primary focus is on the interception, conveyance, treatment with resource recovery and safe disposal of polluting liquid wastes, including reuse, on land from the cities and towns on the banks of the Ganga. (Refer Box for the identified components of the Ganga Action Plan). Phase-I of the plan implemented between 1985 and 1995 has been successful in reducing the pollution levels of the Ganga to render it fit for bathing (BOD 3 mg/l and DO 5 mg/l).

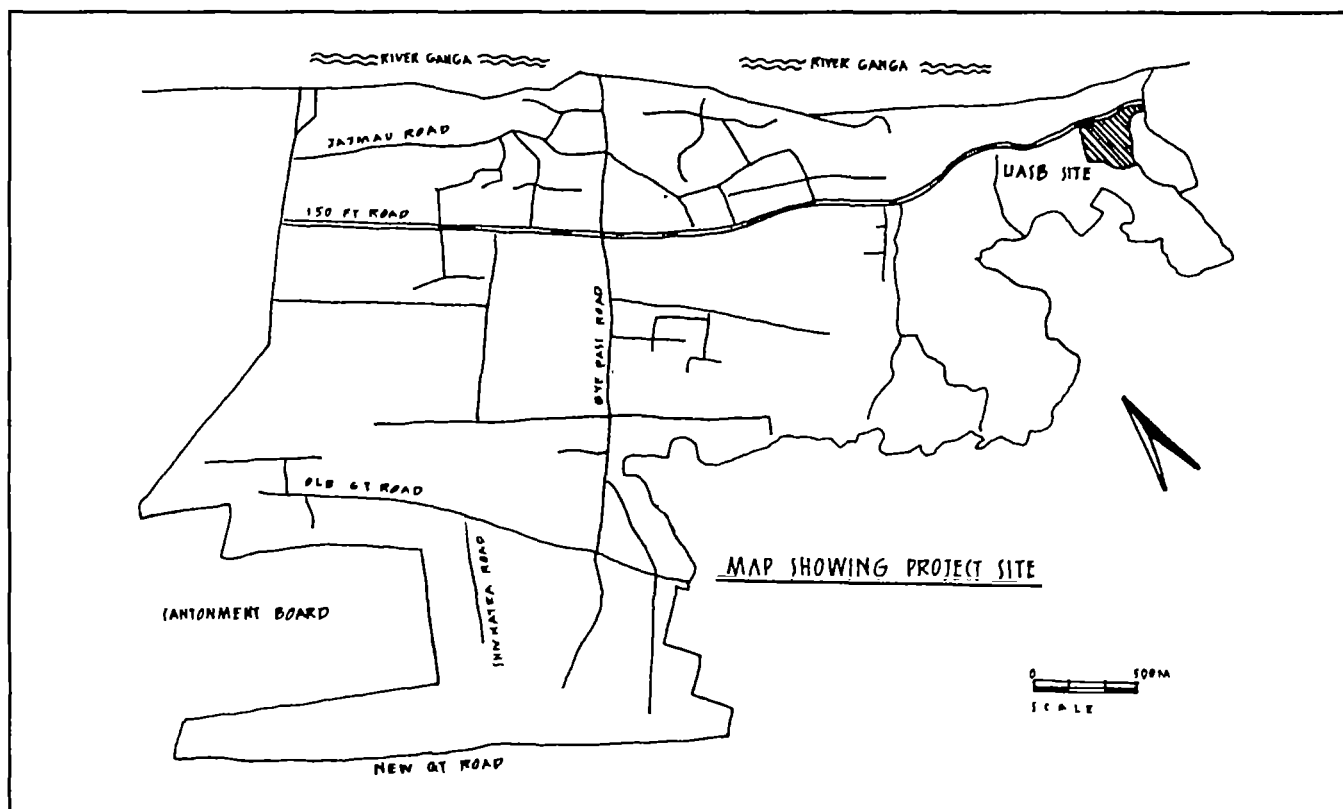
Components of Ganga Action Plan

- *Renovation (cleaning/desilting/repairing) of existing sewers and outfalls.*
- *Laying of trunk sewers to tap and divert flow of sewage and other liquid wastes away from the Ganga.*
- *Providing sullage or sewage pumping stations at the outfall points of open drains, to divert the discharge from the river into the nearest sewers and treatment plants.*
- *Setting up of sewage treatment plants to treat the waste water at the outfall end of sewer line, recovering the resource in the shape of biogas, sludge, treated effluent as irrigant etc.*
- *Low cost sanitation schemes in areas adjoining the river to contain open defecation and prevent the wash off of human wastes into the river.*
- *Pilot projects to establish feasibility of innovative technologies application in the treatment of wastes and recovery and recycling of resources/energy recovery, aquaculture etc.*
- *Monitoring of gross polluting industries located on the Ganga and taking necessary steps to reduce water pollution by such units through enforcement of laws.*
- *Construction of electric crematoria along the river bank for cremation of dead bodies to prevent throwing of partially burnt or unburnt bodies into the river. The use of electric crematoria will also save considerable amount of firewood and reduce pressure on the forests.*
- *Construction and development of bathing ghats along the river at selected locations so that the river front is maintained clean and aesthetic.*
- *Biological conservation measures based on proven techniques for purification of streams and restoring the river ecology.*
- *Regular monitoring of water quality by setting up base line, trend and impact stations all along the river in 25 Class-I cities.*
- *Undertaking research for biological restoration of the river.*

INDO-DUTCH ENVIRONMENTAL AND SANITARY ENGINEERING PROJECT (IDP), JAJMAU - KANPUR

Kanpur is one of the major industrial metropolises located on the banks of the river Ganga about 800 km downstream Gangotri, the origin of the Ganga. It is one of the 25 Class-I towns

covered for pollution abatement under Phase-I of the Ganga Action Plan. The city has 175 tanneries located as a cluster along the river in the Jajmau area. The waste water from these tanneries along with chemicals used in the tanning process pollute the Ganga water. Most of the workers in the tanneries live in sordid conditions in a nearby slum area, the liquid and solid wastes from which also pollute the river water.



JAJMAU - THE PROJECT AREA

The Jajmau area forms part of the municipality of Kanpur. The area has the following characteristics:

- located on the banks of river Ganga;
- a total area of about 900 ha,
- a major centre of the clustered tannery industry;
- distance to Central Kanpur, about 10 km;
- in general a low income area;
- poorly developed tax recovery structures;
- high population density and high built-up density, especially in the northern belt and in the southern part;
- poor accessibility for motorised vehicles in highly built-up areas and the north eastern part of Jajmau,
- reasonably well developed urban road network;
- in general poor road conditions except for the arterial roads,
- high traffic density at arterial roads, low traffic density outside arterial roads.

Table 6.1: Population census data of Jajmau and Kanpur city

| Year | Jajmau | Kanpur City |
|------|---------|-------------|
| 1981 | 79,700 | 1,639,064 |
| 1991 | 113,806 | 2,029,889 |

Source Govt of Uttar Pradesh District Census handbook.

THE IDP PROJECT

Although the main objective of the Ganga Action Plan was the cleaning of the river Ganga, in Jajmau, an integrated development approach has been followed under the Indo-Dutch project of GAP with the dual objective of cleaning the Ganga and the integrated development of Jajmau covering both, the work place areas (tanneries) and the living areas with community participation. The project has been taken up under the Indo-Dutch collaborative programme and named as Indo-Dutch Environmental and Sanitary Engineering project (IDP). The philosophy behind IDP is that river cleaning efforts cannot be sustained in isolation of the people and their needs.

The main objectives of the IDP integrated development project have been as follows:

- To design and implement a sanitary engineering project with a view to reducing the pollution load of the River Ganga, by improving sanitary conditions in Mirzapur town as a whole and the Jajmau area in Kanpur, adopting an integrated approach.
- To demonstrate that by using Dutch developed UASB anaerobic waste water treatment processes, a substantial part of the energy requirements for waste water treatment can be met from the production of electricity from biogas, apart from the much lesser requirement of land, equipment and operating reliability under adverse conditions of electric supply.

- To lay special emphasis on the tanneries of Jajmau area with regard to their waste water treatment, chromium recovery at source and solid waste management and occupational, health and safety resources.
- To establish best practices and solutions using a need-based approach, with respect to the basic criteria for the technical designs in sanitary engineering projects in India, as well as the introduction of well established technical solutions in this field.
- To develop effective mechanisms for active community participation with special attention to the role and position of women. Special emphasis to be given to improvement of living conditions of the poorest communities in the area.

The IDP as an integrated approach and GAP are complementary for tackling the urban sanitation issues related to the project area by way of schemes for water supply, storm water drainage, sewerage, solid waste disposal, community participation and occupational health promotion.

INTERVENTION UNDER THE IDP

Deviating from the conventional engineering approach of solving the river pollution problem, the IDP extended its scope to areas such as urban sanitation, community and occupational health, institutional and community participation. Integration of all these was considered essential to achieve the overall IDP objectives of demonstrability and replicability. To this effect there have been technical interventions, interventions of human resource and institutional development, and interventions in community participation, each linked to the other.

Under the GAP in Kanpur, 20 schemes have been taken up in the central drainage district of Kanpur at a total cost of Rs.40.11 crores. Of these, 11 schemes in the project area of Jajmau in Kanpur are part of the Indo-Dutch Cooperation and relate to an integrated approach comprising various infrastructural and other components for Jajmau area. The cost of the Indo-Dutch Project component at Kanpur is expected to be about Rs.28.65 crores.

An important outcome of the implementation of the technical components, namely, water supply and sewerage systems, storm water drainage systems, waste water treatment, low cost sanitation and solid waste management has been to recognise that there is a strong need for close coordination, commitment and cooperation amongst all the participating institutions and the beneficiaries. In this context, the institutional and human resource development activities as well as community participation and health promotion campaigns are of vital importance. While on the subject of institutional cooperation, the role of consultants has been substantial, in terms of participatory, catalytic and financial aspects.

Though the scope of technical interventions has indeed improved the environmental and sanitary conditions in the project areas, the feedback from community participation activities

reveals that there is a definite need to further densify and improve the institutional development and sanitary provisions with an area development approach. The development priorities in such an approach should emanate from within the community itself and could contain all interrelated aspects, such as cost recovery and sustainable operationality.

The IDP interventions which have brought out significant replicable practices could be classified as follows:

I. INTERVENTIONS IN WASTE TREATMENT FROM TANNERIES

- i) Introduction of a new technology (UASB) for waste water treatment.
- ii) Chromium recovery from tannery waste and its recycling.
- iii) Common industrial waste water conveyance system for the tanneries' waste water.
- iv) Handling of tannery solid wastes and recovery of byproducts therefrom has been deferred, though recognised as viable.

II. INTERVENTION IN OCCUPATIONAL SAFETY AND HEALTH PROTECTION MEASURES FOR WORKERS IN TANNERY UNITS.

III. SLUM AREA DEVELOPMENT

- i) Water supply.
- ii) Sanitation.
- iii) Solid waste management.
- iv) Storm water drainage.

IV. INTERVENTIONS IN INSTITUTIONAL DEVELOPMENT

V. COMMUNITY PARTICIPATION

- i) Inter-relationships with technical components
- ii) Support to area level organisations (ALOs)
- iii) Health related aspects.
- iv) Hierarchical linkages at tactical and operational level community, through change agents and NGOs to local bodies.

VI. DEVELOPMENT OF WOMEN

Training of community womeefolk as plumbers, handpump mechanics, masons and fabricators of FRP toilets, and importantly mothers in poorer communities to contain child morbidity and immunisation

Each programme/scheme has been analysed to be demonstrative of replicability practice under the following heads

- i) Background/pre-project condition
- ii) Programme/scheme implementation experience.
- iii) Evaluation.

INTERVENTIONS IN WASTE WATER FROM TANNERIES: INTRODUCTION OF A NEW TECHNOLOGY

BACKGROUND

Jajmau in Kanpur is one of the most important centres for tanneries to provide leather as raw material and finished leather goods to the Kanpur metropolis as well as for export of footwear and leather goods. The leather industry which is one of the major foreign exchange earners, is often seen from a critical viewpoint for its environmental pollution. During a survey carried out in 1988 in Jajmau by CLRI, there were 151 tanneries located in a cluster along the banks of river Ganga with an estimated present and future waste water discharge of 5.8 to 8.8 million litres per day. Including the domestic waste, present and future waste water generation beyond 2001 has been estimated to be 13.5 mld and 20.3 mld respectively.

Under the Ganga Action Plan various technologies for the treatment of domestic waste water and treatment of tannery waste water from the industrial area were tested. As part of the approach, a comparatively newer Dutch technology was introduced at Jajmau for treatment of domestic and tannery waste. The technology is known as Upflow Anaerobic Sludge Blanket (UASB). The UASB system is based on the upward flow of waste water through a sludge layer of active anaerobic microorganisms (Refer Box for UASB Technology)

ADVANTAGES OF UASB TECHNOLOGY

Some major advantages of UASB technology have been found to be as follows

- a) A UASB treatment plant has very few mechanical components, which makes it a system with very low degree of maintenance requirements and it is highly rugged and reliable
- b) The energy requirements of a UASB reactor are very low. Instead, it produces energy in the form of biogas which is rich in methane content and has a higher calorific value
- c) Even after long sewage feed shutdowns and power breakdowns, the anaerobic purification process starts immediately and no specific operations are required to be executed and can thus stand prolonged shutdowns and can buffer moderate hydraulic shock loads.
- d) UASB treatment plant has reduced space requirement which is 0.17 ha/mld that is, one fifth of the usual oxidation pond and half that of activated sludge process.
- e) Sludge from a UASB reactor dewateres quickly, is nonfoul and has good fertiliser value.

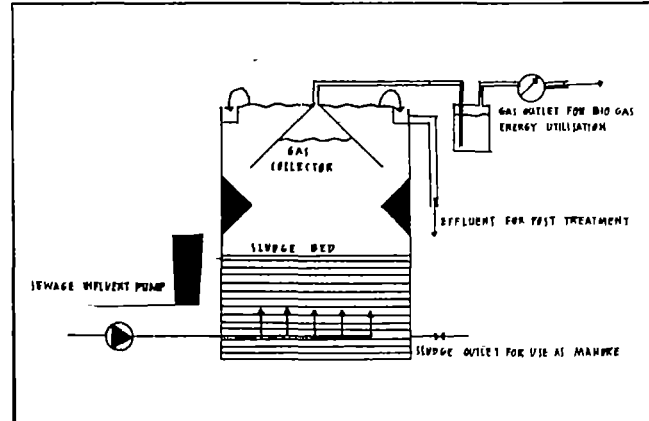


Fig-6.1

THE PRINCIPLES OF UASB SYSTEM

- * The UASB-system is based on the upward flow of waste water through a sludge layer of active anaerobic micro-organisms, thereby packing a large solids residence time in a much lesser reactor volume than the known anaerobic processes.
- * The waste water is equally distributed over the bottom of the reactor.
- * The contact between the micro-organisms and the organic material in the waste water is enhanced by the biogas production as this provides gentle mixing, while the bottom portion of blanket filters the suspended sewage solids.
- * After passing through the sludge bed, the mixture of biogas, sludge and water enters a three-phase separator.
- * The biogas is separated in a gas-collector, whilst the sludge-water mixture enters a settling compartment.
- * Digested sludge particles which are mineralised biomass can settle in the settling compartments and flow back into the digestion compartment, thus providing effective sludge retention in the reactor.
- * The effluent is discharged via an overflow weir to the polishing pond for further treatment.
- * The system produces biogas.
- * Easily dewatered excess sludge can be used as manure.

- f) The UASB treatment system is lower in investment and life cycle costs compared to conventional aerobic systems. Presently (1995) the cost is around Rs.16 lakh/mld of sewage without post treatment and 19 lakh/mld with post treatment for meeting the GAP standards for river discharge
- g) The cost per mld for tannery cum domestic waste treatment plant worked out to Rs.52 lakh per mld but this is also comparatively cheaper than the conventional aerobic treatment for such tannery waste water, on life cycle costs due to low O&M costs and resource recovery.
- h) The O&M costs of the UASB technology is much less than the aerobic treatment process since power consumption is negligible and power generated from biogas utilisation adds sustainability to the revenue of the waste water treatment plant.
- i) The replicability of this technology is demonstrated, by adoption of this technology in 18 STPs in the Yamuna Action Plan, after careful examination by Japanese Aid Agency OECF.

For the first time UASB technology was introduced in the country under GAP and the benefits of this were not available earlier

SCHEME IMPLEMENTATION EXPERIENCE: EXPERIENCE OF 5 MLD UASB TREATMENT PLANT AT JAJMAU

In the initial stages of the project a 5 mld UASB treatment plant for domestic waste water was constructed to demonstrate the viability of the UASB technology under Indian conditions. The performance of the plant was monitored over a period of one year. A joint evaluation mission comprising the experts of India and the Netherlands evaluated the performance of the plant and positively recommended the application of UASB technology for domestic waste water treatment with appropriate post treatment to meet GAP treated sewage standards that is, less than 30 mg/l BOD at 20°C and less than 50 mg/l of suspended solids in the treated sewage.

EXPERIENCE OF UASB PLANT FOR TANNERY WASTE WATER

Based on the results of UASB treatment plants for industrial waste waters elsewhere in the world, it was decided to construct and monitor a pilot plant for treatment of a mixture of tannery and domestic waste. Based on the monitoring results, it was concluded that 1:3 dilution of tannery waste water with domestic sewage was treatable with other control conditions. On the basis of the findings of this pilot reactor, a full scale 36 mld UASB plant has been constructed at Jajmau.

EVALUATION FOR COST EFFECTIVENESS: FINANCIAL ASPECT OF UASB WASTE WATER TREATMENT PLANT

A cost comparison study of sewage treatment plants which have been constructed under the GAP revealed that the investment



The chromium recovery system separates sludge from the liquor for reusing the chrome liquor.

costs for a UASB treatment plant are significantly lower than those of conventional activated sludge process aerobic treatment systems. Cost comparisons between UASB and normal ASTP had also revealed that per mld, gross capital cost (including land cost) for UASB plant was working out to about 70 percent to 80 percent of the gross capital cost in the case of ASTP plant, after considering the O&M costs.

The experience also revealed that the potential resource recovery including biogas and effluent for irrigation alone can cover fully the operating and maintenance costs. In the case of 5 mld UASB plant, this has been estimated at Rs.5 lakh per year (1994):

- a) The anticipated biogas production of the 5 mld UASB plant is estimated as 0.1 m³/kg COD removed (COD: Chemical oxygen demand mg/l)
- b) The sludge production of the 5 mld UASB plant is above 0.3 kg ss/kg COD removed
- e) Raw waste water has been applied to the sewage farm for irrigation of crops at an average load of 130 mld. Thus about 2000 acres of land has been brought under cultivation. With this, the Kanpur Nagar Municipality is now leasing the land to farmers for an increased price of Rs.1000/acre per year.

Designing of STPs under an OECF funded programme for cleaning the Yamuna river are now being based on UASB technology after a very thorough evaluation and plants inspection at Kanpur and Mirzapur by two Japanese expert missions in June and September 1995.

INTERVENTION IN WASTE WATER FROM TANNERIES: CHROMIUM RECOVERY AND ITS RECYCLING

BACKGROUND

Of the 175 tanneries in Jajmau, 87 tanneries are partly or completely adopting chrome tanning. The total quantity of

chrome tanning compound applied in Jajmau amounted to 10,000 kg. per day which is equivalent to 1700 kg of pure chromium. According to the survey only 70 percent of the chromium is taken up by hides which means that every day 1 tonne of chromium is wasted, mostly via the waste water. It is also expected that in future more and more chrome tanning will be applied. Although the trivalent form of chromium which is used in tanneries is less toxic and less dangerous than hexavalent chromium, it is desirable not to spread chromium in the soil or water resources.

SCHEME IMPLEMENTATION EXPERIENCE

The technology: The chromium recovery system applied, is based on the characteristics of chrome tanning salts to precipitate with MgO almost completely at pH 8-9. The formed sludge is separated from the liquor, dissolved in sulphuric acid and the obtained chrome liquor is reused.

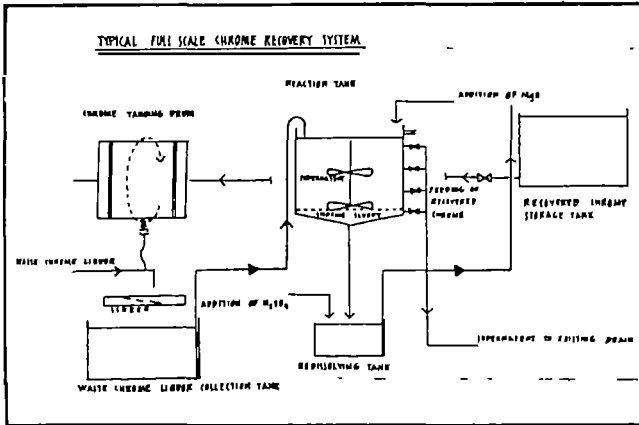


Fig 6.2

Experiments with hides tanned with 70 percent fresh chromium and 30 percent recycled chromium showed that the leather has the same quality as leather tanned with 100 percent fresh chromium. Because of the relatively simpler process and low investment costs, the chrome recovery system has been found to be appropriate for tanneries of any size.

TRAINING OF TECHNICIANS AND CHEMISTS

The technicians and chemists designated by the respective tannery owners for the operation of the plants were given adequate training during commissioning and trial runs of the plants. The technical personnel of the chrome tanning section were also trained in adopting the modified tanning system using regenerated chromium.

EVALUATION FOR COST EFFECTIVENESS/REPLICABILITY

After successful introduction of the pilot plant at one of the tanneries, five subsequent units were constructed at five other

tanneries in Jajmau. At various stages of development, the design was optimised and suitable construction materials selected. With innovations, costs of operation, maintenance and investment was reduced. A typical cost benefit analysis of chromium recovery plant is shown in the table 6.2.

Table 6.2: Cost benefit analysis of chromium recovery and reuse (based on January 1992 rates)

| | |
|--------------------------------------------------------------------------------------------------|---------------------------------------------|
| i) Tannery processing capacity | 5 tons of hides/day 1250 tons hides/year |
| ii) Use of chromium salt | Rs.3,50,000 |
| iii) Annualised operating and capital cost of the chromium recovery plant including depreciation | Rs.2,47,500 |
| iv) Value of chromium recovered @ Rs.18,000 per ton for 30 tons | Rs.5,40,000 |
| Net profit per year after break even period | Rs.2,93,000 |

Source: Environmental and Sanitary Engineering Project in Kanpur and Mirzapur - Draft Final Report

The payback period for the chrome recovery plant is estimated to be less than three years. Realising the cost effectiveness of such a recovery system, six tanneries have so far set up chrome recovery plants having witnessed the pilot plant functioning. But the remaining chrome tanners are not taking the cue and are waiting for Dutch aid for this profitable activity too. They appear to be disinclined to even contribute their share for a revolving fund with equal state loan to create chrome recovery plants on soft repayment terms. It is time now that UPSPCB and the UP Government and its department of environment coerce these tanners through legal actions, to contribute their share or set up chrome recovery plants before scheduled dates, failing which they may be prosecuted.

INTERVENTIONS IN WASTE WATER FROM TANNERIES: COMMON CONVEYANCE SYSTEM

BACKGROUND

In Jajmau, the waste water which originated from the tanneries was either discharged into the sewer system or via various factory outlets, via roads, drains and nalahs to the river Ganga. As per present regulations, waste water with BOD of more than 500 mg/litre is not allowed to be discharged into the public sewer system. Therefore, individual tanneries had to set up fullfledged biological treatment units with sludge dewatering

arrangements within their premises to meet those requirements. The land needs, capital investment and operations and maintenance costs for these individual ventures would have been high for all tanners and for most of the smaller units non feasible/prohibitive. At the same time it would have been rather difficult for the statutory pollution control boards to monitor the continuous and satisfactory operation of all treatment units and ensure compliance of tannery waste treated water effluent quality of all the tanneries on a continuous and representative basis. Sludge originating from these treatment plants had to be disposed of in an appropriate way. Such sludge would still have had a very high BOD requiring further treatment while it would also be contaminated with chromium. Hence for an individual tannery in Jajmau, total treatment for river/public sewer discharge is a non feasible proposition. Under the circumstances, it was decided that tanners would setup only pretreatment facilities in their premises as per the Supreme Court directions and the tanners were to share the cost of common conveyance and treatment for the entire complex in proportion to their pollution load, where state funds are also provided. In a nut shell, a common ETP was to be established on 'polluter pays' principle.

PROGRAMME/SCHEME IMPLEMENTATION EXPERIENCE

A separate waste water collection system was designed and constructed to convey all waste water generated from the industrial belt of Jajmau including 2.7 mld of domestic waste water and 8.8 mld of tannery waste water. For ease of maintenance, a surface gravity conveyance system was selected with removable top slabs. Four pumping stations and a common rising main were installed to pump the mixed tannery waste water to a common treatment plant located outside Jajmau town down stream of the river Ganga.

All tanneries were provided with screen/collection chambers located on the tannery premises and connected to the common conveyance system. The tanneries have to convey all their waste water into the respective screen chambers either by gravity or pumping and subsequently demolish or plug all the other remaining waste water outlet drains. They were also to pretreat these wastes as per the Supreme Court directions.

EVALUATION

After the common conveyance system was implemented, a survey to find out its effectiveness was conducted which revealed that 64 per cent of the tannery units were connected to the system with screen chambers, 30 per cent connected directly without screen chambers and 6 per cent did not connect. UPJN jointly with the UP Pollution Control Board are presently in the process of getting the remaining tanneries connected via project screen chambers. All operating units were meeting the Supreme Court directions for pretreatment facilities, as per the latest affidavit of the State Pollution Control Board.

HANDLING OF SOLID WASTE AND RECOVERY OF BY PRODUCTS

BACKGROUND/PRE-PROJECT CONDITION

Jajmau tanneries generate daily about 400 tonnes of solid wastes. Though most of these are utilised for various commercial purposes, the present unhygienic way of collection drying, transportation, spillage, wastage, ineffective utilisation and difficulty in disposing them during the monsoon etc. causes serious environmental pollution problems in Jajmau. The types of solid wastes generated from Jajmau tanneries and their quantity is given in table 6.3:

Table 6.3: Solid Waste generated from Jajmau tanneries.

| Type of waste | Quantity (tonnes/day) |
|----------------------------------------------|-----------------------|
| Raw hide trimmings and waste | 10-15 |
| Dusted/wasted salt | 6-10 |
| Hair | Very small quantities |
| Fleshings and pelt trimmings | 30-50 |
| Sludge from lime pit | 15-20 |
| Vegetable tanned barks/nuts | 200-300 |
| Vegetable tanned trimmings | 2.5-3.0 |
| Chrome shavings | 6-8 |
| Chrome trimmings and finished leather pieces | 2.5-3.0 |
| Buffing | 0.5-1.0 |
| Sludge from pre treatment units | 50-60 (Expected) |

From the above Table 6.3, it is clear that three categories of solid wastes form the major problem from the quantitative point of view, namely fleshings, bark and sludge.

FLESHINGS AND PELT TRIMMINGS

The fleshings cause foul smell and other problems in the area owing to slow drying rate. Furthermore a great part of the fleshings have to be transferred to far off places. Transport of wet fleshings over long distances, which takes place in open trucks, becomes very expensive, offensive and difficult to carry because of the high moisture content and putrefaction effect.

BARK

In Jajmau some 50 tanneries process about 100 tonnes of cow and buffalo hides per day, adopting vegetable tanning using bark and nuts for this process. About 100 to 150 tonnes of bark and 40-60 tonnes of nuts are used and exhaust bark and nuts are discharged as solid waste in wet conditions which

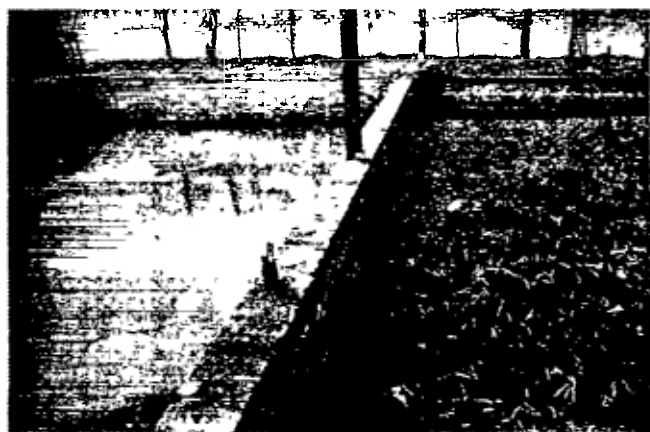
amounts to about 250 tonnes per day. The main environmental problems assessed in the whole process are as follows:

- * Dust generation during the crushing of barks and nuts
- * No provision to protect workers from dust.
- * For drying wet exhausted bark the whole tannery open areas and pathways outside the premises are used
- * All areas where the bark is stored produce a stench.

The bark is used as fuel in boilers, however the bark having a loose composition and high moisture content burns very inefficiently

SLUDGE FROM PRETREATMENT UNITS

Many tanneries have constructed pretreatment systems. In the event of proper operation and maintenance of primary treatment units by the tanneries a large amount of sludge will be generated. After partial drying in sludge drying beds 50-60 tonnes of sludge with 50 percent moisture are expected to be generated from the pre treatment units which will be loaded with chromium, which can be avoided only by chrome recovery plants



Pre-treatment plants generate large amount of sludge.

PROGRAMME/SCHEME

Extensive surveys and preparatory works were carried out and proposals have been prepared. However the scheme is to be taken up in Phase-II. This scheme has essentially to be an integral part of the project. The daily generation of three to four hundred tonnes of sludge, fleshings and bark continues to affect the environmental and living conditions of the population of Jajmau until improved handling and processing methods are introduced on a full scale. In addition some of the solid waste

is dumped directly into the Ganga or reaches the river via various drains and nalahs. It is demonstrated that vast improvements could be achieved by the introduction of economically and financially viable alternatives.

BARK BRIQUETTES

The technology of agro wastes is available in India. A volume reduction of bark seven to eight times can be achieved by the direct briquetting method without additions. Apart from being an energy source, the cost of briquettes is half that of coal.

GLUE

Processing of dried fleshings into a low quality glue is already done in Jajmau and elsewhere in India (e.g. Bhopal). However the drying of fleshings is causing environmental problems. Hence the method of wet processing into a high quality glue has been proposed for the solid waste management in Phase-II.

SLUDGE

Primary treatment at tanneries consists mainly of alum dosing, precipitation and sludge drying. Sludge originating from the primary treatment plants at the tanneries is highly organic. Thus it is recommended that before final disposal the sludge should be further treated.

INTERVENTIONS IN OCCUPATIONAL SAFETY AND HEALTH PROTECTION MEASURES FOR WORKERS IN TANNERY UNITS

BACKGROUND/PRE-PROJECT CONDITIONS

To assess the preproject conditions on the occupational health a survey involving 605 tannery workers was conducted by ID consultants which revealed certain salient facts.

PREVALENCE OF SYMPTOMS

At the time of examination 57.3 percent of workers reported one or more symptoms. The most common symptoms being backache (16.9%), cough with expectoration (19.5%), skin lesions (10.4%), difficulty in breathing (5.8%), common cold (9.8%) and watering/redness of eyes (5.0%). The majority of the common symptoms as mentioned were related to work exposures or work postures.

PREVALENCE OF MORBIDITY

The number of workers found to be suffering from some form of occupation related morbidity was 26.4 percent. The major forms of occupational morbidity were lumbar backache posture related (15.5%), respiratory irritation due to workplace dusts/gases (3.8%), conjunctival irritation (3.0%), contact dermatitis (2.5%), occupational asthma (2.2%), and skin/nasal chrome ulcers (2.0%).

ACCIDENTS

About 20.1 per cent of the workers gave a history of having suffered an accident at some time while working in the tanneries, and 11.3 per cent stated that they had suffered an accident within the last one year, 5.4 per cent during the period from five years back to one year back and 3.4 per cent prior to five years ago. The common types of accidents reported were falls (9.0%) machine cuts (3.0%), knife cuts (2.6%) and machine amputation (1.8%)*. The occurrence of accidents was high in the beam house (26.7%) and tanyard chrome (26.9%) sections, compared to tanyard vegetable (20.3%), finishing (19.0%) and other sections (9.3%).

MEDICAL AID

The common sources of medical aid in case of accident were private practitioners (9.3% of all workers having availed of their services subsequent to an accident), ESI dispensary hospital (6.6% of all workers) and tannery first aid services (3.8% of all workers).

THE PROGRAMME/SCHEME IMPLEMENTATION EXPERIENCE

Based on the findings of the situation analysis, an intervention programme was formulated by the project. The programme was executed under the responsibility of the Kanpur Nagar Mahapalika and aimed at diminishing the risk of occupational health hazards. Support was provided to Kanpur Nagar Mahapalika by Kanpur Medical College, project staff, the Regional Labour Institute and the Directorate of Factories. The programme interventions are as follows.

FIRST AID AND SAFETY TRAINING TO TANNERY WORKERS

Tannery workers are trained in first aid and safety measures to be followed in tanneries. Other actions carried out are

- i) workers interested in the environmental issues related to tanneries to be stimulated,
- ii) awareness programmes conducted about the environmental effects of the handling and disposal of hazardous substances,
- iii) unsatisfactory conditions at certain work stations like grinding, spray painting, buffing section etc. to be improved,
- iv) first aid kits frequently examined for their proper use and replenishment of contents.

WORKSHOP ON OCCUPATIONAL AND ENVIRONMENTAL HEALTH AT JAJMAU

A workshop on occupational and environmental health improvements at tanneries in Jajmau Kanpur was held from 5 to

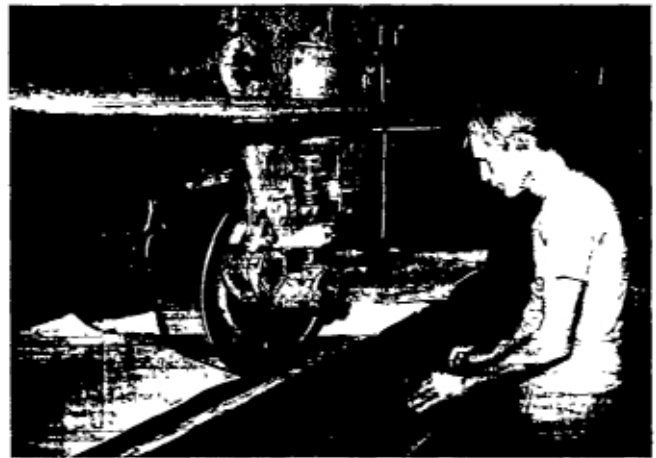
9 March 1990. The workshop made a number of suggestions on the subject, some of the important ones being

i) Formation of safety councils in tanneries

This is to include tannery workers who have been trained in first aid and also representatives from the management. The safety council to regularly meet to review health and safety measures.

ii) Machine protection/workshop improvements

In view of the fact that the primary hazard analysis has revealed certain hazardous work situations in tanneries, it was recommended that machine working stations (grinding, chrome tannery drains, buffing of hides, staking machines, spray painting section) should be rendered safe for working by installation of protective measure/devices. It was also recommended that a suitable engineering consultancy firm which normally renders such types of services to tannery owners should be contracted for designing machine protective devices.



Improved machines are designed for prevention of accidents

iii) Medical treatment for follow-up survey

The surveys should be carried out and attempts made to get all the eligible workers registered for Employees Scheme for Insurance (ESI). Also the services of ESI should be maximally utilised.

EVALUATION

Following the recommendations of the workshop, the programme has been successfully completed and some tannery owners have implemented improvements in their tanneries. Another positive effect of the occupational health programme was the inclusion of occupational health as one of the main elements for industrial counselling in the framework of the bilateral collaboration on environmental protection between the Government of

India and the Government of the Netherlands. The evaluation of the occupational health programme in the framework of the overall evaluation of the project yielded positive results. Yet a study is required to be carried out so far to measure the long term impact of the occupational health programme. This aspect is of crucial importance in view of the replicability of the programme and for design of future activities

SLUM AREA DEVELOPMENT: WATER SUPPLY

BACKGROUND/PRE-PROJECT CONDITIONS

The existing water supply system for Jajmau was primarily based upon a number of deep tubewells which deliver water to two overhead tanks from which water is distributed to consumers via pipe network systems. The pipe distribution system covers most of the area, with individual connections for 47 percent of the population and from public stand posts 10 percent of the population. The remaining population obtained water from other sources like handpumps, the shallow open wells. The handpumps lacked proper maintenance, the shallow dry wells supply water below quality and also tend to dry up in the hot season because of insufficient depth.

Though much of the distribution system was new, its operation was far from satisfactory. Water supply was intermittent with sometimes three hours of low pressure supply per day; the revenue received was only for 20 per cent of the water produced. In addition there were numerous illegal connections, which in general, have been constructed poorly, a situation which adds significantly to the losses due to leakage from the system. The survey indicated that unaccounted water amounted to approximately 40 percent of the water produced of which 25 percent was due to illegal connections.

Operation and maintenance is the responsibility of the Kanpur Jal Sansthan (KJS). The water works under KJS include pumping stations, treatment plants as well as distribution network. The procedure of getting a regular connection is time consuming and discouraging because of the long distances between the central office and Jajmau, leading to illegal tapping. In case of regular connections, meter reading, billing and collection carried out by KJS required a lot of improvement.

PROGRAMME/SCHEME IMPLEMENTATION EXPERIENCE

As an initial step, an extensive survey was carried out to assess the condition of the available water supply assets, as well as the amount of water lost through leakage and wastage. Based on the information obtained, a crash programme was formulated to augment the number of handpumps with 180 units with simultaneous construction of three new tubewells and regeneration of two existing tubewells. The new tubewells were connected to the respective overhead tanks by pressure lines.

For the design of the water supply system, the following criteria were adopted:

| | |
|---------------------------------------------------------------------|--------------------------|
| * Average water consumption for standposts | 27 lpcd |
| * Average water consumption for house connections | 150 lpcd |
| * Seasonal peak factor | 1.3 |
| * Daily peak factor for hourly consumption | 2.0 |
| * Waste water generation factor | 0.7 |
| * commercial and institutional demand as percentage of total demand | 3% |
| * Industrial demand at year 2021 | 7300 m ³ /day |

EVALUATION

With increased water supply infrastructure, the number of daily supply hours in Jajmau went up substantially. However the problems of illegal connections of households continued to remain, the cost of illegal connection is about seven times lower than an official regularised connection. In spite of this the Kanpur Jal Sansthan performance in Jajmau area compared with the rest of Kanpur before and after project intervention showed impressive performance.

Table 6.4: KJS Performance comparison of Jajmau and rest of Kanpur

| | Jajmau | | Rest of Kanpur | |
|----------------------------------------------|----------|----------------------|----------------|---------------|
| | 1987 | 1993 | 1987 | 1993 |
| - Number of houses assessed for ARV | 8900 | 12600 | - | - |
| - Number of registered house-connections | 3400 (a) | 7398 (a) 218% of (a) | 42509 (b) | 4762 (b) 112% |
| - Revenue collection (in Rs.lakhs per annum) | 8.5 | 19.3 | 362.0 | 581.5 |

Source: KJS

The number of registered house connections in Jajmau grew by about 118 percent while the figure for the rest of Kanpur city grew only by 12 percent. The annual revenue collection performance in Jajmau more than doubled (127% growth) over the project period while the rest of Kanpur grew by 60 percent.

SLUM AREA DEVELOPMENT: SANITATION

BACKGROUND/PRE-PROJECT CONDITIONS

Sulabh International carried out a survey on behalf of the project to assess the existing sanitation service levels in Jajmau, Kanpur. The survey covered 1724 households out of a total of 20,445 households. The results of the survey are shown in Table 6.5

Table 6.5: Status of Sanitation at Jajmau in Kanpur based on a survey in 16 sample areas

| Cate- gory | Actual HH | Latrine with conn. to pits/ tanks | Latrine with conn. to sewers | Dry/ bucket latrines | No latri- nes | Total HH sample areas |
|---------------|--------------|--------------------------------------------------|------------------------------------------|----------------------------|---------------------|-----------------------------|
| 1 | 4156 | 29 | 18 | 110 | 199 | 356 |
| 2. | 844 | 7 | 49 | 5 | 137 | 198 |
| 3. | 2858 | 17 | 63 | 10 | 341 | 431 |
| 4. | 8113 | 43 | 119 | 81 | 242 | 489 |
| 5. | 4474 | - | 249 | - | 1 | 250 |
| Total | 20445 | 100 | 498 | 206 | 920 | 1724 |

The survey indicated that more than half of the households had no latrines at all while 65 percent have substandard latrines.

PROGRAMME/SCHEME IMPLEMENTATION EXPERIENCE

To gain experience by evaluation related to implementation, public acceptance and performance, in the first instance a crash programme was formulated which included the following:

- Conversion of 88 bucket latrines
- Construction of 55 new latrines
- Construction of 4 community sanitation blocks with 10 seats each.

After the success of the crash programme, to provide access to sanitation to the total population the following programme was carried out:

| | Number | Population covered 1987 |
|----------------------------|---------------|----------------------------|
| - Private on-site latrines | 2430 | 12490 |
| - Private off-site latrine | 2366 | 12161 |
| - Public latrine complexes | 12(140 seats) | 7000 |
| - Sewer connections | 14287 | 73437 |
| Total | | 105088 |

Low cost pour flush latrines were included in the programme. Depending on the presence of the sewers, these latrines were either connected to leaching pits or to the sewers. For those people who can not afford private latrines or do not have sufficient space in their premises, and for the floating population public latrines were constructed.

Three types of private on-site latrines were designed for various numbers of users namely 10, 15 and 20 users. After a survey it was revealed that the actual number of users of private latrines hardly exceeded 10 in all cases. Subsequently about 95 percent of the private on-site latrines had soakage pits with a capacity of 10 users. The existing unhygienic bucket latrines were all converted into either on-or-off or off-site sanitary pour flush latrines with water seal and connection to either soak pits or sewer system.

The sewerage system of Jajmau was laid out to cater to the population for the year 2021 which is estimated to be 181192. It was experienced that by and large the houses with private water supply connections were taking sewer connections at their own cost. At some locations public pressure to connect to the newly laid sewers was so high that certain sewers had to be commissioned before hydraulic testing could be completed.

The community sanitation blocks are operated and maintained by Sulabh International on a pay-and-use basis, which charges male adults a nominal fee. The private off-site latrines are to be maintained by the house owner who only once in a few years has to empty one of the two soak pits on an alternate basis.

EVALUATION

The project provided sanitary facilities to the entire population. But the Jajmau population grew from 105088 in 1987 to 165,000 in 1993 an increase of 65 per cent in 6 years which was not anticipated. *Perhaps a lesson for pilot projects in big cities can be learnt that if integrated infrastructural improvements are implemented in only a small part (5%) of the city, an additional population growth has to be anticipated possibly due to improved services. Even tannery owners, that is, families with higher income are setting up their residences inside the Jajmau area.*

Monitoring and evaluation revealed that non provision of superstructure in low cost sanitation is a major bottleneck in their usage. Therefore it could be recommended that in low cost sanitation (LCS) programmes, construction of superstructure and water supply needs to be included in the total package.

A unique feature of the LCS programme has been the training and involvement of women masons in the construction of LCS facilities. This has enhanced the involvement of women in development work, community mobilisation, income generation for women and resulted in good quality work.

SLUM AREA DEVELOPMENT: SOLID WASTE MANAGEMENT

BACKGROUND/PRE-PROJECT SITUATION

In the pre-project situation solid waste collection and disposal was in a two stage system. In the first stage of primary collection, the wastes are collected in handcarts and brought to rubbish depots. The rubbish depots are either masonry structures or open piles of waste. In the second stage of waste collection, the waste is transported by tipper trucks to disposal sites. The loading of the trucks is done either manually or mechanically.

Within Kanpur Mahapalika two departments are involved in solid waste collection and disposal, for example, Health Department and City Cleansing. The Health Department is responsible for the cleaning of streets and open roadside drains and for night soil collection. City Cleansing is responsible for the transport of wastes from the rubbish depots and for the disposal of wastes.

In general, the pre-project solid waste management in the Jajmau residential area was very poor and numerous piles of refuse are scattered all over the area. Domestic solid waste is usually thrown on the streets from where it is supposed to be collected by road sweepers. About 194 sweepers are deployed and 40 handcarts are in working condition. As per the norms of KNM there is a shortage of 100 sweepers and 110 handcarts.

Loading of trucks by front end loaders is very slow and often causes traffic jams in crowded streets. The loading of most trailers and mini tractors is done manually which is also time consuming and unhygienic. No regular deployment of vehicles for solid waste collection is however available in Jajmau area.

The estimated total quantity of solid wastes generated in Jajmau excluding reused tannery waste is tonnes per day is as shown in Table 6.6.

Table 6.6: Estimated total quantity of solid waste generated at Jajmau

| | 1987 | 1991 | 1995 | 2001 |
|-----------------------------------------|-------------|-------------|------------|------------|
| | 105000 | 120000 | 140000 | 175000 |
| Domestic solid waste at 0.5 kg/cap. day | 55 | 60 | 70 | 90 |
| Roadside drain cleaning | 5 | 6 | 8 | 8 |
| Commercial waste | 10 | 12 | 14 | 18 |
| Subtotal | 70 | 78 | 92 | 116 |
| Hospital waste | 0.5 | 0.5 | 1 | 1 |
| Animal corpses | 5 | 5 | 5 | 5 |
| Industrial waste* | 10 | 12 | 15 | 15 |
| Total in tonnes/day | 85.5 | 95.5 | 113 | 137 |

* The reused quantities of the tanneries are excluded from this estimate.

The pre-project method of disposing solid waste creates many health risks for the population and gives disease vectors like flies and vermin a chance to breed.

PROGRAMME/SCHEME IMPLEMENTATION EXPERIENCE

The solid waste management proposed scheme consisted of five basic elements:

- storage at source
- primary collection
- transfer
- secondary collection
- disposal.

Accordingly the programme had the following highlights:

- i) The population is to bring the waste outside the houses into the roadside bins. Sweepers collect the domestic solid waste from these bins in their handcarts and dispose of it in containers. This handcart system is called primary collection.

- ii) As a secondary collection, a dumper placer system is used for collection of the containers and for the transfer of solid waste to the disposal sites.
- iii) At the disposal sites a sanitary landfill operation is carried out with equipment like tractors with dozer blades.
- iv) Roadside drains and gully pits are cleaned by the same sweepers. Each sweeper is given the responsibility for cleaning one area.
- v) Commercial waste is placed by the producers directly in the containers.
- vi) For hospital waste, handcarts, bins and an incinerator are proposed.
- vii) In order to keep operations as hygienic as possible, a truck and the use of canvas slings are suggested for the removal of animal carcasses.
- viii) Sewer cleaning is a separate operation carried out by KJS, for which, under this programme, the transport equipment for the sewer cleaning material is provided

Evaluation

The experiences gained during Phase-I in three pilot areas were very useful in planning for solid waste management in the whole of Jajmau. The experiences can be summarised as follows.

- i) The programme was successful and improved the solid waste management situation considerably
- ii) The assignment of area responsibility to sweepers instead of a task responsibility has greatly facilitated the accountability of sweepers' performance.
- iii) The condition of areas in terms of paved road and provision of proper drainage system greatly influenced the performance of solid waste management. Handcarts proved difficult to move on unpaved 'bumpy' roads, while undrained ponds and depressions were not cleaned by sweepers.
- iv) Some kind of institutionalised incentive system in the more deprived/poor areas proved very useful like 'Best sweepers of the year' award or just some direct payment by the public. In the more well to do areas, such an incentive system was already in practice.

- v) As Jajmau has a shortage of 100 sweepers as per KJM norms, some areas have to be cleaned on a contractual basis. Experience showed that contractors recruited from the benefitting community itself though mandals proved much more successful than contractors coming from outside the target areas

INSTITUTIONAL DEVELOPMENT

BACKGROUND

The strength, capacity and quality of local institutions dealing with the provision of services such as water, sewerage, solid waste is of paramount importance for the sustainability of the project interventions. While local level agencies directly deal with project implementation, national and state agencies provide policy guidance. The important institutions covered in the project are UP Jal Nigam (UPJN), Kanpur Jal Sansthan (KJS), Kanpur Nagar Nigam (KNN).

Institutional development aims at providing a mechanism within the project area so that the efforts can be sustained even after the capital investment on the project are gradually withdrawn. Thus the institutional development in the present context is the process to enhance the capacity and capabilities of the responsible agencies concerned with the eventual operation and maintenance of the environmental and sanitary facilities provided under the project. It consists of the following:

- i) Institutional strengthening - a process which aims at the establishment of the necessary infrastructure (staffing, budgets, equipment, materials, etc.) to carry out its task.
- ii) Training, which is a method for human resource development and improvement of the capabilities and skills of the different layers of staff responsible for operation and maintenance of the schemes

PROGRAMME/SCHEME IMPLEMENTATION EXPERIENCES

Under institutional development, programmes for the establishment of O&M systems for each scheme with financial and staffing implications were drawn up in consultation with the agency concerned.

The training was seen as a means of improving the inter-relationship within the various municipal agencies and the relationship between the implementing agencies and the beneficiaries. A series of courses were arranged for

- i) The latest information on a broad range of low cost, easy to use and appropriate technologies in the field of environmental and sanitary engineering

- ii) Good project management education in public health and hygiene and community participation - essential for the success of water supply and sanitation components of the project.
- iii) Importance of involving those who will actually use water supply and sanitation facilities taking into account relevant socio-economic and cultural factors. This was accomplished by using different techniques for communication with small and large groups of the community in the project.
- iv) Targeted selected information dissemination to engineers and other professionals, field staff, and government decision makers. Training activities were carried out to strengthen institutional development of these agencies, so that effective operation and maintenance of the new facilities to be installed under this project is ensured.

The training activities were directed - (i) at the policy level to involve key decision makers, (ii) at the management level to involve general managers, engineers involved in day to day management, (iii) at the technical level to involve the engineers, operators and skilled workers, and (iv) at the beneficiary level to involve the users of facilities and the community in general.

EVALUATION

It was observed that participants from various local agencies and other categories took a keen interest in the different training programmes. These programmes had a positive impact on the attitude of the participants towards various issues raised especially with regard to operation and maintenance.

The outcome of the training imparted is very positive and UPJN engineers are quite involved independently in various operational aspects of the 5 mld UASB treatment plant at Kanpur.

Experience indicates that it will be appropriate for municipal agencies to have training cells responsible for human resource development within the organisation as well as for coordination of training programmes.

FINANCIAL ANALYSIS

There were 11 schemes under the Indo-Dutch project for the Ganga Action Plan Phase-I at Jajmau in Kanpur. Total investment in these schemes was Rs 3349 lakh with a breakup as follows:

| | Cost (Rs. lakh) |
|---------------------------------------------------------------|-----------------|
| i) Sewer cleaning | 29.45 |
| ii) Expansion of sewerage system | 269.00 |
| iii) Storm water drainage improvement system | 257.18 |
| iv) UASB plant (36 + 5 mld) | 1863.07 |
| v) 10 M ³ UASB pilot plant for tannery waste water | 11.42 |
| vi) Chrome recovery pilot plant | 2.87 |
| vii) Low cost sanitation | 167.51 |
| viii) Water supply programme | 245.17 |
| ix) Solid waste management | 41.70 |
| x) Public health education and community development | 32.63 |
| xi) Common conveyance system for tannery waste water | 429.00 |
| | 3349.67 |

Source : MOEF

In the case of UASB STP a further break up is as follows:

| | |
|------------------------------------------------------------|---------|
| 5 MLD domestic waste sewerage treatment plant | 100.16 |
| 36 MLD tannery cum domestic waste sewerage treatment plant | 1762.91 |

The capital investments in all the above schemes has been made by the Central Government from the Dutch assistance amount except in the case of the 36 MLD tannery cum domestic waste sewerage treatment plant and common conveyance system for tannery cum domestic waste where the sharing has been as follows:

| | |
|--------------------------------------------------|--------|
| Central Government share (from Dutch assistance) | 65 % |
| State Government | 17.5 % |
| Tanners | 17.5 % |

O&M COST

Most of the schemes above for O&M and recovery are linked to the city as a whole to be borne by the municipality. In the case of 36 mld UASB plant and low cost sanitation O&M and recovery have been separately worked out and the same is as follows.

The O&M for 36 mld treatment plant at Jajmau, Kanpur

| | Annual O&M Cost (Rs. lakh) |
|-----------------------------------------------|-------------------------------|
| i) UASB plant | 124.12 |
| ii) Raw sewerage pumping | 12.73 |
| iii) Individual waste water conveyance system | 26.86 |
| iv) post treatment plant | 53.76 |
| Total (Rs. lakh per year) | 217.47 |
| Saving of electricity | 48.00 |
| Net O&M cost | 169.47 |

Source: Report Effluent Discharge Levies, Kanpur (UP) by IWACO B V.

The final O&M cost is 1.69 crore per year. Sixty per cent the O&M cost is to be borne by the tanners and forty per cent the Kanpur Nagar Nigam.

LOW COST SANITATION

There are two types of low cost sanitation (i) pour flush toilets (individual), and (ii) community complexes. In the individual toilets, construction upto plinth was done free of cost under the Indo-Dutch programme and the beneficiary was to construct the superstructure and maintain the complete toilets. In community complexes, these are maintained by Sulabh (NGO) on a 30-year maintenance contract. They have kept a caretaker for maintenance as well as for collection of use charge. The male members pay Rs 0.50 to Rs one for one time use while females and children are provided free service. In certain cases Rs. 50 per family per month is charged.

COMMUNITY PARTICIPATION WITH SPECIAL EMPHASIS ON GENDER ASPECT

BACKGROUND

In the pre-project situation, there was no direct or indirect involvement of the community in planning or implementation of any tasks which lead to the common good of the community

and also enhance the environmental conditions of the area. One of the project objectives laid out was to develop effective mechanisms for active community participation with special attention to the role and position of women. Special emphasis was to be given to the improvement of the living conditions of the poorest communities.

PROGRAMME/SCHEME IMPLEMENTATION EXPERIENCE

Related to the project objectives, the following activities were carried out as interventions in community participation:

- i) Prioritisation of the project activities for those areas which belong to the poorest of the poor according to the socio-economic criteria of the project and preparing an inventory of pre-project sanitary facilities.
- ii) Community participation for planning, implementation, operation and maintenance of the different project components, with special focus on women.
- iii) Interventions in the field of drinking water supply and sanitation.
- iv) To facilitate the implementation of the programmes in regard to identified needs, perception and attitude of different categories of population in terms of income levels, caste, class, community and gender
- v) To enhance the health awareness level of the residents in Jajmau in general, and of the tannery workers in particular, by way of preventive and curative occupational health interventions.
- vi) To facilitate the training programme for different target groups of the population to achieve and sustain the project objectives.

The community was treated as "directly approached unit" with intermediaries for participation in the schemes of water supply and low cost sanitation. Direct communication channels were established between the socio-economic unit of the project staff and the community. By the end of the project period a large group of trained community based intermediaries or change agents existed in the project to carry out the proper operation and maintenance of the infrastructure created under the project.

An "indirect-approach" was followed in public health programmes. Instead of using direct communication, the community was reached via a network of trained change agents such as traditional birth attendants (TBAs), private medical practitioners (PMPs), primary school teachers (PSTs), anganwadi workers (AWWs), adult education teachers (AETs).

INTER-RELATIONSHIP WITH TECHNICAL COMPONENTS

In the beginning it was found that there was a kind of insensitivity in the community towards the project, the reasons being:

- The prevailing poor levels of services before the project interventions.
- The poor financial position of the maintenance agency.
- The large distance between the centralised maintenance office and the project area.

Water supply and sanitation were in a very bad condition. The involvement of the target population was found crucial for introducing measures conducive to environmental improvements. The approach was therefore, to help the community to help themselves. The community was broadly involved in the following technical activities:

HANDPUMP

- Identification of
 - locations for handpumps,
 - community based handpump caretakers at the time of installation.
 - community based handpump mechanics.

LOW COST SANITATION

- Identification of
 - beneficiaries for the construction of pour flush-latrines,
 - sites for public latrine complexes,
 - community based male and female masons.

REHABILITATION OF WATER SUPPLY

- Identification of
 - community based standpost caretakers,
 - sites for public standposts,
 - community based standpost mechanics,
 - illegal water connections.

SOLID WASTE MANAGEMENT

- Identification of
 - location of roadside bins for the primary collection of solid waste,
 - community based volunteers for the community based monitoring of the solid waste management schemes.

HANDPUMPS

From the outset, the community was involved in the site selection of handpumps. Awareness campaigns were launched at the time of handpumps installation itself and two community based handpump caretakers were identified for each handpump. Care was taken that at least one of the two was female. Preference was given to persons who were more motivated and who were living close to the handpumps. These caretakers were given short training for making the community aware of the proper use of these handpump as well as of using handpumps water for drinking purposes and safe storage of drinking water within the home. The caretakers were also trained in the regular preventive maintenance of the handpumps.

Kanpur Jal Sansthan was the executing agency. The handpump locations were decided jointly by the project staff, KJS staff in consultation with the community. Location of 180 handpumps was identified and marked at site by the project. Subsequently a survey conducted by the project indicated that out of 180 handpumps installed, only one was found to be unacceptable by the community.

One problem that did arise over time, however, was that the KJS mechanics who had been trained by the project to carry out repairs of handpumps were frequently unavailable at the time of handpump breakdowns. This resulted in handpumps remaining unused for periods up to two weeks before another KJS mechanic could be arranged to carry out the repair. To solve the problem, in the second phase of the project, some of the community based caretakers were therefore trained to become handpump mechanics to implement a single tier maintenance system.

The local mandal is the nodal agency for the maintenance and repair of handpumps. A special tool kit essential for the repair of handpumps is provided to each of the fourteen mandals. One tool kit is available at the community centre. The mandal also maintains a community handpumps O&M fund. This fund is used for the purchase of spare parts. The perceptible change in maintenance of handpumps before and after the project intervention is shown in table 6.7:

TABLE 6.7: AVERAGE TIME BETWEEN BREAKDOWN AND REPAIR

| Activity | No of Days | |
|-------------------------------------------------------------------------------------------|----------------|---------------|
| | Before Project | After Project |
| Handpump breakdown reaction time | 1-2 | 1-1.5 |
| Complaint to be lodged by handpump caretaker | 3-4 | - |
| Community based handpump mechanics to repair and mandal support for procurement of spares | - | 1-1.5 |
| Community to collect funds for spare | 3-5 | - |
| Handpump repair time (Total) | 10-14 | 2-3 |

LOW COST SANITATION

In the beginning of the project, the construction of on-site pour flush latrines was started. For proper implementation, it was decided that under the crash programme 600 units should be constructed initially. The responsibility of construction was given to an outside agency. It was found that the work was of poor quality and it did not correspond to the original design submitted by the agency. The progress of the work was slow. There was also dissatisfaction among the community volunteers trained under the project.

There was need for a different approach as the project was confronted by an awakened and motivated community. For the effective implementation of this scheme, it was decided to involve the community in general and women in particular in scheme implementation. The project thus had twin objectives - firstly with the involvement of women, the scheme would be implemented more effectively because of better communication with the local community. Secondly women were to be trained in trades which were until then considered to be of the male domain only. With this in mind, three groups of female masons and subsequently one group of male masons were trained. They received very positive support from the community mandals and the community, which helped not only in identifying the beneficiaries but also helped them in the execution of the scheme.

During the two days of pour flush latrine construction, the community based masons were trained to communicate the messages related to health, hygiene and sanitation to the occupants of each house. This was a basis for effective communication, as the masons were also from the same community.

The quality of work was found to be satisfactory and the status survey carried out in December, 1992 indicated that about 85 percent of the beneficiaries were using the toilets. This was during the time that latrine construction was still in progress.

REHABILITATION OF PIPED WATER SUPPLY

Rehabilitation of piped water supply included the repair of leakages, replacement of old dilapidated pipelines and regularisation or disconnection of illegal house connections. It also included promotion of house connected supplies, awareness enhancement related to water wastage, finance, public health and careful planning of standpost supplies for the deprived sections of the community.

The project in close association with the Urban Community Development (UCD) Cell of KNN, the field staff of KJS, community volunteers and local mandals took the initiatives to raise the awareness of the community for preventing water wastage and illegal connections, and promoting legal house connections from the piped water supply.

The following community awareness measures were taken

- * Leaflets prepared by the project were distributed.
- * Audio cassettes were recorded and played on rickshaws.
- * Banners were displayed at important crossings.
- * Decentralised camps and area meetings were organised.

Efforts were made simultaneously along with the above, for pressurisation of water pipeline sections, so that improvement in water supply was felt by the community.

Trained female plumbers were able to repair leakages and disconnect illegal connections. They also explained and convinced the community about the role that the community members can play in the improvement of the water supply system. About 3500 illegal house connections were disconnected. Disconnection on such a scale without arousing any kind of

adverse reaction of the local community towards the project is demonstrative of the fact that through strong community organisation, management can gain beneficiary confidence in its efforts to establish an effective water supply system.

PUBLIC STANDPOSTS

From the financial point of view, it is important for the water supply agency to maximise the number of house connections and to minimise the number of public standposts. However the objective is the provision of water to all urban citizens including the poor and the floating population. Public standposts are a must in most cities. Under the project, 120 standposts were provided.

Through mandals and community volunteers, the standposts catering to the poorest of the poor and in some cases for the floating population, were completed. Community based standpost mechanics and caretakers were trained by the project. Thirty standpost mechanics were trained to maintain and repair when needed the 120 standposts. The funds for the repair of the public standposts came from the respective mandals.

SOLID WASTE MANAGEMENT

At the start of the project, the solid waste management was not properly organised. The number of staff involved in its management was insufficient. As it was not feasible to increase the number of government staff, an attempt was made to provide for a solid waste management system that is manageable by the existing staff and outside contracted labour. It was also decided to involve the community, on contract basis, for the operation and maintenance of the systems as well.

Through the organisation of community meetings, in close association with the Urban Community Development Cell of KNN and the mandals, the community was asked to dispose of the solid waste only at the roadside bins and preferably before the emptying of the bins that is, before 11.a.m. Through a format, community volunteers monitored the quality of work carried out by the sweepers within the respective area, although officially the work of sweepers was supervised by the sanitary supervisor of each respective area. However, this community based monitoring system was designed to involve the community in implementation of the scheme and to provide for interaction between the beneficiary and the implementing agency namely the Health Department of KNN. In the first phase, this scheme was executed in three demonstration areas.

The monitoring of these three demonstration area was done jointly by the Public Health officials and through community volunteers. The experience from the demonstration areas has shown that the community is prepared to cooperate to achieve good environmental and sanitary conditions. As soon as the roadside bins were in place the community gradually started putting the household solid waste into them. The success of the community participation in the implementation of this scheme can be attributed to the active role played by the change agents and the mandals.

SUPPORT TO AREA LEVEL ORGANISATIONS (ALOS)

The project pursued a definite policy of creating community based structures known as ALOs or mandals. This was made possible with the training of a significant number of change agents or intermediaries in different pockets of the project area, especially within the poorest sections of the society. An attempt was made to create grassroots level organisations and provide them with an interface between the community and the existing local governmental agencies. It is in this perspective that the area level mandals have been trained, and have become dynamic organisations at the grassroots level. These area level organisations have been trained to prepare the communities to operate and carry out certain activities by themselves on an autonomous basis.

The mandals played a very active role in the following:

- The identification of beneficiaries to be provided with pour flush latrines under the low cost sanitation scheme.
- The identification of change agents/intermediaries namely, private medical practitioners, primary school teachers, Anganwadi teachers, community volunteers and so forth.
- The identification of community based mechanics for handpumps and standposts.
- Identification of school for the school sanitation programme.
- In organising cultural programmes such as puppet shows, slogan competitions, art competitions, quiz competitions and a Race for the Environment. All these programmes were organised to improve the awareness of the community in the project area with respect to health, hygiene and sanitation.
- For the execution of the scheme of social forestry and in the establishment of useful interaction with the Department of Forestry.
- For organising the Adult Education Centre, the mandals helped in the selection of teachers as well as in the selection of premises which can be used for organising classes on a purely voluntary basis.

HEALTH RELATED ASPECTS

There is an established link between environmental protection and the improvement of the living conditions of the community specially the low income residential areas. Health promotion of the community is thus of paramount importance. Activities related to health can broadly be classified into four categories:

- i) Support to health intermediaries
- ii) Primary health care production unit

- iii) Diarrhoea incidence study and control
- iv) Development of communication material.

SUPPORT TO HEALTH INTERMEDIARIES

The community is reached by the involvement of trained health intermediaries:

Private Medical Practitioners (PMPs) were trained for diarrhoea management,

prevention and promotion of water usage and sanitation. Emphasis was laid on specific health education inputs which the PMP's are to provide to their patients.

Traditional Birth Attendants (TBAs) received training in safe delivery practices and delivery kits. They were also involved as change agents and promoters of the environmental sanitation aspect

Angan Wadi Workers (AWWs) were given orientation to play a catalytic role in promoting activities related to water and sanitation. Their services were also used for marketing Safe Delivery Packets to expectant mothers and also ORS packets to diarrhoea patients.

Primary School Teachers (PSTs) Five groups of PSTs totaling about 100 were trained to educate the families through the children. It was also seen as an essential component of the school sanitation programme

Community Volunteers (CVs) Nearly 200 CVs were selected from different areas and provided with training for improved environmental sanitation, better water use, diarrhoea management practices, use of ORS and establishment of community level organisation.

Adult Education Teachers (AETs) Twenty women were selected from the most backward of slums in Jajmau and trained in the effective method of running adult education centres.

Primary Health Care Production Unit

A production unit for the preparation of ORS and safe delivery packets was set up at the community centre. Four women were trained for the production of ORS packets. Because of its low cost and easy availability, the packets gained acceptance amongst the people and the women working on the scheme received small amounts as profit also.

Longitudinal study of diarrhoea incidence

In cooperation with the Kanpur Medical College, five rounds of diarrhoea incidence study have been completed. It was noted that the rate of diarrhoeal incidence in the under 5-years age children was reduced from 23 percent to 7.5 percent.

Development of communication material

Flip cards containing key messages on river pollution, solid waste, sanitation, safe water practices, personal hygiene, diarrhoeal management and preparation of home made ORS packets were distributed to facilitators at the community level. Leaflets were developed on sanitation, solid waste, handpumps and piped water supply. Video films have been prepared on skill training of female construction workers and traditional birth attendants. Materials from other sources were also used.

Evaluation

The IDP has initiated a programme with strong focus on communities and their involvement in the planning, implementation, operation and maintenance. The involvement of the communities through change agents was done to create a sustainable set up for community participation in effective utilisation of the installed facilities. They have formed the potential nucleus for community level organisations, which in turn are able to communicate directly with the available governmental infrastructure on the one hand and also mobilise community manpower.

During the inventory phase, a number of surveys and in-depth studies were conducted and contacts were established with informal leaders at the community level. The contacts resulted in the establishment of informal groups of men and women in selected slum areas. In the selection of handpump sites, caretakers, female masons, plumbers and FRP workers, direct communication lines were established between the field staff and the community via their representatives, mainly the community volunteers.

The community volunteers were selected from all over the project area and after undergoing proper training, have now been attached to the mandal (ALO) of their area or of the nearest neighbouring area.

An indirect approach is followed throughout the different training programmes. By means of trained intermediaries, the community is reached. Training of professional intermediaries has a twofold aim. The first is to improve their professional skills and the second is to prepare them for improving the knowledge, attitudes and practices (KAP) of the community at large.

The project has made a concerted effort to interrelate and combine technical and socio-economic activities. Its implementation networking of the intermediaries has proven to be very useful. In the initial phase, this helped in reaching out to the public at large and in the final phase it is hoped that this will ensure the sustainability of the facilities provided by the project and will help in retaining the improvement in KAP.

The project facilitated the formation of area level organisations or mandals. These mandals enhanced the activities in the

community, brought about marked cohesiveness and finally resulted in the formation of an apex body through voting. The experience of the project with the ALOs has raised several points which should be kept in mind for replication of this practice. These are:

- i) The orientation of mandal representatives proved so significant in enhancing their activities that, in future, their training should be done in the earlier stages of the project.
- ii) In areas where mandals do not already exist, efforts should be made to facilitate the formation of mandals as early as possible.
- iii) The involvement of the ALO representatives in formulating and implementing the activities of a project should be ensured.
- iv) Where such mandals are already in existence they can be consulted in the formulation stage when surveys are done, regarding vital problems faced by the people in those areas and their suggestions can be sought about possible remedies.
- v) Mere training and the organising of mandals should not be an end in itself. The goal should be to utilise them as a means to fulfil project objectives and goals. For this, it is essential to provide them with ample confidence and an awareness of their own organisational strength. This can be achieved by consulting them at each stage of the project.
- vi) The experience clearly demonstrates that with the involvement of the area level organisations in the formulation and implementation of project schemes not only can the project costs be reduced but also the quality of works can be improved considerably compared to those done through agencies by outside contractors. In addition it enhances community participation in the overall development process.

IMPROVEMENT IN KAP

Diarrhoeal incidence can be an important surrogate parameter for monitoring and evaluating the status of water supply, sanitation and community health for a specific project area. During the course of the project, six rounds of diarrhoeal incidence surveys were carried out by the Kanpur Medical College. The results of these studies have direct bearing on the community knowledge, attitude and practices, (KAP).

It has now become increasingly evident that the mere provision of safe drinking water and sanitation facilities is not going to produce a perceptible dent in the problems of diarrhoea and water borne diseases unless human and behavioural aspects concerning water and sanitation facilities are also taken into account.

Thus IDP project has projected very well the significance of community participation in environmental development. The results achieved merit in the total integrated project as one beneficial replicable practice elsewhere.

GENDER ASPECT: DEVELOPMENT OF WOMEN

BACKGROUND

Women in any community provide a crucial link for the integrated development scenario. The IDP project provided enhanced role for women. The need was realised for creating opportunities for specific development orientation in the given social context. The restricted entry of women into work fields such as that of plumbers, fitters or masons are not so much because they are back breaking or too tiring, but they are historically and culturally being done by men only. Female construction workers have in fact physically a far more difficult job. Hence it was resolved to train women so as to not only question the very basis of gender discrimination but also to prove a point for women that they can do similar jobs as well as and along with men.

Three different types of skill training programmes for women were carried out in the field of water and sanitation.

TRAINING OF WOMEN AS MASONS

In Jajmau initially a batch of 15 women was given training in the field of construction as masons. To ensure that the female masons could function independently without outside support, a cooperative of all the women was formed and they were registered under the Society's Registration Act as an Independent society.

After the training, the women were assigned the task of constructing sanitary latrines by the Kanpur Nagar Mahapalika with advance payment. Subsequently in order to keep abreast of the work load and time constraints of the implementation of low cost sanitation scheme, two more batches of women masons composed of 15 women each were trained and registered as women's societies. In addition, a group of twenty men were also given training as masons.

TRAINING OF WOMEN AS PLUMBERS

As part of the work of rehabilitation of water supply programme for Jajmau, both the executing agencies namely, UP Jal Nigam and Kanpur Jal Sansthan (KJS) felt the need for trained plumbers/fitters to initiate this programme. As no such staff was available with these agencies it was decided to recruit fifteen women from the project area and train them as plumbers/fitters. The socio-economic unit of the project having already gained the experiences of training women in masonry works, readily took up the challenge for training women plumbers.

TRAINING OF WOMEN IN FABRICATION OF FRP PRODUCTS

The FRP centre was initiated because of the large requirement of sanitary pans of uniformly ensured quality in the LCS programme. In the absence of local suppliers of quality products, the idea was put forth to establish an FRP production centre. The earlier skill generating programmes had generated enough interest in the area - women had already started enquiring about this new skills training programmes.

PRODUCTION OF FRP PANS FOR POUR FLUSH LATRINE

The FRP production unit has been constructed by the female masons. Women fabricators also formed into a society and did production as well as marketing

EVALUATION

The findings indicate that not only did the women masons construct good quality latrines, they also acted as motivators, promoting the community's adoption and proper usage of sanitary latrines. All four women's mason societies have successfully completed the construction of about 2500 sanitary latrines in Jajmau as part of low cost sanitation scheme. In addition to sanitary latrines these female groups have also completed the construction of one community centre, one FRP production centre, one nursery and labour quarter at the zonal garage.

All the fifteen women plumbers worked full time with Kanpur Jal Sansthan and UPJN in the rehabilitation work of legalising connections, installing water metres, repairing leakages and making new connections. They have registered as a society with the name 'Sahastradhara'. It is however, felt that the women working in the FRP unit should have skills in marketing of the product so as to compete with the local traders.

In general, the practices followed in IDP described in this section have proved to be highly beneficial which and capable of being replicated

STRATEGY FORMULATION FOR RIVER CLEANING PROJECTS

The river cleaning programmes undertaken so far have laid emphasis on capital works such as interception/diversion of waste water, its treatment, certain activities like low cost sanitation, crematoria and bathing ghat development. Industrial pollution was to be taken care of through enforcement of laws. The O&M of the facilities created is the responsibility of the state organisation. In the absence of pressure groups from the public it leaves much to be desired. Further the local people specially those from low income groups, do not perceive/see much to their benefit from such massive investment, although these are the first victims and of maximum damage arising

from any water/sanitation related epidemics for want of massive investments in these river clean up facilities.

In the present project, linkages have been taken further to the sources, considering the lowering of the pollution levels of the pollutants at the source. Further the involvement of workers in that industry, training them for occupational health and safety, involving the residential community in improving the physical infrastructure, better health for the members of the community, has successfully sought their participation in the project. This approach has possibilities for the sustainability of the assets created. Technical inputs for cleaning the water body would not arouse public investment nor sustain itself for long. In the present context IDP has been taken up within the GAP overall frame, but based on the experiences of the project it is concluded that the river cleaning strategy in general should include successful elements of IDP and thus river cleaning should not necessarily depend on the second level project like the IDP. The river cleaning strategy based on the experiences of IDP will have following components:

- i) Integrated approach.
- ii) Holistic technical inputs.
- iii) Institutional development.
- iv) Community participation.

INTEGRATED APPROACH

As the purely sectoral approach to solve environmental problems have not succeeded, the IDP project demonstrates that an integrated approach towards the project should be formed for sustainable impact. The vertical integration from project formulation to operation and maintenance and horizontal integration of various interrelated aspects should be included. Integration of beneficiaries' desires through community participation as well as interagency coordination of design, implementation and O&M are major aspects to be incorporated in an integrated approach. Because of its complexity and sheer volume of work, early priority setting is advocated.

HOLISTIC TECHNICAL INPUTS

The holistic approach to technical interventions is required which should be based on realistic projections and designs. These include house to house surveys, studies on willingness to pay and affordability to pay and so on.

INTRODUCTION OF NEW TECHNOLOGIES

The UASB waste water treatment technology was successfully introduced and a 5 mld domestic and waste water treatment plant has been operated and maintained.

An investment in the economics of the UASB system when used for the treatment of domestic waste water definitely

revealed its lower investment and operation cost per mld of water

Similarly, the results of the chrome recovery pilot plant were very promising technically as well as economically. Thus the introduction of new technologies provided financial benefits as well as reduced the pollution levels

OPERATION AND MAINTENANCE

As part of the strategy, the operation and maintenance aspects of technical facilities should be taken into account during the planning and design stage in order to guarantee long term sustainability of the facilities. This means that in a given context the choice of technology application should not necessarily be the most advanced and the latest or the cheapest but should be appropriate and cost-effective enough including its operation and maintenance costs.

COST RECOVERY AND FINANCING MANAGEMENT

The technical interventions to improve cost recovery should be based on needs and paying capacities of the beneficiaries. Tariff setting and the revenue collection structure should be reviewed taking the following principles into account.

- i) Beneficiaries should contribute to the cause of O & M and investment of the services provided to them to an extent, whereby an optimum mix of subsidy and direct beneficiary contribution is established
- ii) Sharing of the cost of services related to pollution abatement should be based on the principle of "polluter pays", whereby the polluter should pay for the cleaning of the pollution brought by him into the environment.

DEVELOPMENT OF MIS

For the efficient management of the scheme, the management information system (MIS) including physical and financial progress indicators, periodic critical action points as well as quality aspects have proven to be very effective as a tool by all parties involved. Amongst other things, it revealed critical elements in the project's time bound completion schedule and addressed at critical action points for the attention of all players. MIS reports were also instrumental in quality monitoring and control, apart from cost and time controls.

In order to achieve timely completion, to control costs and to attain required quality standard an effective monitoring set up is needed. In this regard regular meetings to review the progress at monthly intervals should be part of the strategy.

INSTITUTIONAL DEVELOPMENT

In the experience of the IDP, the institutional development activities created a significant momentum with regard to organizational improvement and financial management. A number of related conclusions are:

- i) Institutional development should start at an early stage of project implementation preferably concurrent with the project implementation stage.
- ii) For synchronisation of project execution, it is important to strengthen coordination through establishment of project management groups. Such units in the IDP had a telling demonstrative effect on the new schemes in GAP-I.
- iii) The implementing agencies should include the socio-economic unit, O&M department, and training facility
- iv) Performance standards should be streamlined and set up, where there are none. There should be lucid formats of designs and operating data and manuals for an improved reporting and communication system, apart from sound O&M practices including inventory management.

COMMUNITY PARTICIPATION

The involvement of the community in dealing with the user aspect of technical inputs has been proved to be strategically the most important. The area level organisation (ALOs) and trained agents of change fully participated in the decision making processes for - (i) Selection of priority areas, (ii) prioritisation of area specific needs, (iii) preparation of area development plans.

The experience with the ALOs that is, the mandals has been very constructive and effective. ALOs should be part of the strategy. With community participation there was increase in KAP.

GENERAL STRATEGY ASPECTS

CRASH PROGRAMMES

A special consideration under this project was given to crash programmes. They were meant to tackle quickly some obvious bottlenecks in the existing sanitary conditions. It was further found that it created a positive attitude within the people in the project areas, because they could see the work started almost immediately.

SOCIO ECONOMIC COMPONENTS

Besides community participation, the socio economic compo-

ment which has produced very impressive results in - i) support of technical activities, ii) public health promotion, iii) occupational health promotion, iv) skill training, and v) strengthening of community organisations

EVALUATION AND MONITORING MISSIONS

The mid term evaluation missions were instrumental in producing opportunities for all involved parties to review developments and redesign policies and approach to achieve the project objectives. The monitoring missions provided useful second opinion information which helped the government in its decision making.

IDP/GAP EXPERIENCE BASED STRATEGY FOR RIVER CLEANING PROJECTS

SUSTAINABILITY OF THE PROGRAMME

THE CONCERN

One important concern towards the completion of IDP is that the achievements of the project are sustained and action taken for its scaling up so that the reasonable gains achieved so far, be further strengthened and coverage is increased. The Ganga River Cleaning Programmes in India are thus far implemented by the state governments with 100 percent assistance from the central government but the expenditure on operation and maintenance of assets created under the programme, is shared between the centre and the states for the first three years and subsequently the complete maintenance is to be done by the state governments. However to obtain an effective involvement and motivation of the states concerned in further National River Conservation Programmes, the centre and states participate equally in capital costs while the O&M burden is squarely on state agencies, through cost recovery and efficient service delivery. The provision of resource recovery by way of production of power from methane, treated water for irrigation and sludge as manure, under the IDP programme, did contribute towards the operation and maintenance cost. However the major portion of O&M cost had to come from the general revenues of the states which implies a responsibility for local bodies as well. In general, state governments and the local bodies with whom the O&M of the facilities rest, have always been facing resource constraints; as a result some of the facilities in course of time ran the risk of becoming defunct.

REVENUE GENERATION MEASURES

Resources at the local level are raised through water and sewer taxes. Generally, water tax is levied at 14 percent of the annual rateable value of the property and the sewerage tax at 4 percent. If the house is actually connected with the water system, the owner has to pay an additional charge which is proportionate to the volume of water consumed. For the billing and collection of revenues, the local bodies depend fully upon the number of properties that have been officially regis-

tered. A study conducted in this regard revealed that out of an estimated 0.3 million properties in the city of Kanpur, only 0.1 million have actually been registered by the Kanpur Nagar Nigam. As a consequence, Kanpur Jal Sansthan collects only one-third of the potential revenue income of about Rs.0.8 million which is hardly sufficient to cover the salaries of its 2500 staff. Similarly, the Kanpur Nagar Nigam which looks after other civic amenities such as street lighting, storm water drainage, garbage disposal, public health, has poor revenue collection owing to non-registration of many properties and under-valuation of the registered ones. Yet another study revealed that half the water supply connections in Kanpur were unauthorised. This did not allow the authorities to collect the water charges, but made it impossible to carry out its leak detection programme to prevent the losses from physical leakage.

The following action has, therefore, been envisaged to augment the resources for O&M:

- i) Registering of all unregistered house properties.
- ii) Authorising/disconnecting unauthorised water connections.
- iii) Plugging the physical leakages in the water supply system and ensuring better water supply to citizens.
- iv) Efficient and computerised billing and collection of charges.

INTEGRATION OF URBAN SERVICES ORIENTED PROGRAMMES

In most states the urban development and health departments are already operating several projects as centrally sponsored schemes with emphasis on:

- i) Urban poverty alleviation through employment generation.
- ii) Community based activities for improvement of urban slum and sanitation.
- iii) Child and women welfare development particularly of low income strata.
- iv) Promoting NGOs in community awareness and health promotion campaigns.

These schemes are supported by the central government and soft loans from HUDCO. Since the river action plan supports similar activities such as low cost sanitation, solid waste disposal, river front development, wood efficient crematoriums and community participation and help minimise the stress of poverty on environment and quality of life of the city and the river, it is befitting that the on-going programmes of the state are

integrated and dovetailed with the river action plan so as to make both these programmes more meaningful. This will enable NRCP to cover basic human issues relating to poverty and living conditions which will reinforce

PLANNING URBAN EXTENSIONS

New extensions to the urban area without proper infrastructure are bound to add to the pollution load to the city. Urban development departments of the states have been advised to enact suitable laws to provide for decentralised sewage and garbage disposal facilities for the new areas independent of the core city infrastructure. The beneficiaries of such an infrastructure should share amongst themselves the capital and O&M costs to obtain sanitation services to their satisfaction without burdening the city's core infrastructure.

LONG TERM SUSTAINABILITY: ICDP

The need for a long term arrangement to ensure sustainable operation and maintenance of assets had been engaging the attention of the Indo Dutch project. In the course of implementation of the project, it was increasingly felt that the resources for O&M should primarily come from the users of the facilities. With this in view, a new project the Ganga Institutional and Community Development Project (ICDP) has been initiated since March, 1995. This project is a logical extension of IDP to strengthen the local bodies with appropriate action plans at local and state levels to render the schemes, benefits sustainable.

The ICDP have, in the first instance, reviewed the current state of affairs as an input for strategy formulation. In India, in the recent past, two important changes have taken place at the national policy level, one of liberalisation of the economy and the second the constitutional amendment for conferring powers to local bodies for planning and development. These changes have brought in a very special environment of positive change. Economic liberalisation was a move away from centralised planning to a more market oriented approach. Thus, the financing of metropolitan development, it is stated in the Eighth Plan, should, in principle be from local resources and self financing in nature. As per the 73rd and 74th constitutional amendments, the state governments will transfer powers to municipal bodies and recognise these as a more autonomous third tier of the government. These amendments provide the means for implementation of national strategies at the local level. Further, the devolution of fiscal responsibility proposed by the state finance commission will lead to a desirable transparency in fiscal matters and improve financial management. The creation of a third tier of government, at local level, implies a need to develop local policies and strategies. While the, municipal authorities are aware of the policy changes that have been introduced, action has not yet been taken to translate these into clear local policies and actions. The ICDP will support and help guide the process of change.

WEAKNESS OF THE EXISTING INSTITUTIONS

The ICDP has also in its initial review assessed that with the meagre allocation of resources to the urban planning and development sector, the state retaining a monopoly over financial resources for grants and subsidies, and urban centres like Kanpur growing rapidly because of the urbanisation taking place in the country, the capacity of the government for investment compared to the need has diminished. The present rural bias in planning, general budgetary constraints plus the inability of agencies to generate internal resources does not allow demand for services to be met. The diagnostic review carried out as part of this project and part of the draft inception report of ICDP revealed some weaknesses of the existing institutions:

- i) **Mismatch between institutional capacities and responsibilities:** Over a period of time the capacity of the institutions in each urban sub-sector has seriously lagged behind the growing urban needs, be they in terms of coverage or quality of service. At the same time, depending on contemporary needs or project compulsions, greater responsibilities have been assigned to local institutions without any corresponding effort to ensure that these institutions are strengthened to carry out their enhanced tasks by improving their MIS systems, retraining their staff, equipping offices with adequate automation, computerisation and communication, adopting reward/merit based personnel policies and improvements in rational pricing policy for services provided.
- ii) **Lack of adoption of commercial/semi-commercial policy and practices:** Urban services are frequently considered, by various parties involved, as meeting essential public welfare needs and hence gratis. It is traditionally believed that provision of urban infrastructure facilities fulfils a basic human need and that users cannot be denied free access to urban services. This attitude has prevented the emergence of a policy which ensures that revenues equal (or exceed) expenditure at least in the upper economic strata consuming 80 percent of goods and services. At present the larger the increase in production of urban services, the higher will be the mismatch between revenue and expenditure. This is mainly so, because most of the beneficiaries are not adequately charged nor are the costs collected effectively for the services provided.
- iii) **Rigid and inward looking institutions:** Local institutions are not, on the whole, driven by the needs or demands of consumers. They look towards the state government for survival or expansion, rather than to the people for whom they were constituted. This institutional culture does not result in actions to strengthen user organisations nor to provide resources to support their activities. There is an over-emphasis on construction activities, with systematic neglect of

other vital areas such as assets maintenance and resource mobilisation. As creatures of the state, they follow state personnel policies, rules and regulations and instead of being entrepreneurial in cultural orientation, they are inward looking institutions, unable to grasp opportunities.

- iv) **State monopoly in the urban services sector and scarcity of resources:** On the one hand the state agencies acquired a monopoly in production, retailing and O&M of urban sanitation facilities and on the other, owing to lack of resources and poor cost recovery, the supply of services fell woefully short of requirements.

IDENTIFIED ACTIVITIES

For scaling up and even maintaining the local services level of the achievements of the IDP project, the weakness of institutions at policy level and at working level are to be tackled. To achieve this objective, a set of activities have been identified by ICDP which are briefly as under:

- i) **Activities to promote commitment:** This will include basic issues such as privatisation, cost recovery, staff motivation and also inter-agency cooperation.
- ii) **Activities to optimise distribution and coordination of roles:** The idea is to establish clarity regarding the distribution of roles and responsibilities. The idea is also to explore alternative arrangements for service delivery in urban areas, possibility for internal delegation of powers compatible with responsibility or delegating roles to ALOs that is, mandals.
- iii) **Activities for improved O&M practices:** This will focus mainly on two areas -(A) Improving the efficiency and service delivery and effectiveness of O&M carried out by public utilities and municipal institutions. The activities will include - (a) decentralisation of O&M of water and sewerage systems to zonal level; (b) training of operators; preparation of guidelines for management information system; (d) computerisation of O&M planning budgeting and monitoring; (e) computerised registration and billing of water consumers and easy access and broad based payment centres. (B) Identification of tasks under O&M which can be more effectively carried out by ALOs that is, mandals. This will include research, analysis and presentation of appropriate models used in India and elsewhere for privatisation, commercialisation, corporatisation and participation in delivery of services and revenue collection centres management.
- iv) **Activities to enhance the financial viability:** This will deal with privatisation of recovery and computerisation of billing system, telescopic tariff to curb

wastage, incentives for timely payment and vice-versa and to simplify collection.

- v) **Activities to promote organisational development:** This will include analysis of organisations, objectives, key tasks and performance indicators and also developing training plans for staff of the agencies, exposure to successful case histories and training with efficiently functioning municipalities abroad, through twinning arrangements.
- vi) **Activities to strengthen user involvement:** Strategies and action plans to strengthen the community based organisation (CBOs) and develop their role and linkages with services delivery. Also to strengthen women's participation in CBOs.
- vii) **Activities to intensify private sector involvement:** This will include private sector involvement in -(a) meter reading, billing and collection, (b) in O&M of water supply system particularly pumps, overhead tanks and piping system valves and metres, (c) in solid waste management by contracts for primary collection and transportation to the designated areas.
- viii) **Activities to privatise certain sewage treatment plants and pumping stations on BOT or BOOM basis.**

THE PROPOSED STRATEGY

To conduct the activities and take of the weaknesses outlined above, the ICDP have identified a seven point strategy:

- i) Development of networks and relationships at three levels, namely, user level, local level and state level.
- ii) Adoption of step by step approach to organisational improvement.
- iii) Exposure of the key staff to suitable examples of innovative projects in India and abroad.
- iv) Discussion and articulation of policy issues.
- v) Training needs assessment for human resource development.
- vi) Regular formal evaluation during the period of the project.
- vii) To use technical assistance from ICDP only as a catalyst.

With activities identified and the strategy as given above, it is expected that the ICDP will achieve the desired results for the sustainability and scaling up of the IDP project

BEST PRACTICES REPLICABILITY

Based on the experiences gained in the present project, the replicability of practices could be in the following ways:

- I) Specific practices
- II) Typical situation.
- III) A framework for integrated approach for improved urban environment management.

REPLICABILITY OF SPECIFIC PRACTICES

For replicability, the beneficial practices could be pulled out from the Indo-Dutch Environmental and Sanitary Engineering project in relations to - i) Tannery industries, ii) UASB technology, iii) upgradation of the environment in the slum settlements, including the practices of community participation and institutional development. These specific practices could be replicated not necessarily in River Action Plans but also in different situations with similar environmental problems.

TYPICAL SITUATION

The typical situation i.e. water body, industry polluting the water body and low-income settlement providing workers to the polluting industries exists at large number of locations in India and outside. The present practice as an integrated approach could be taken as one single practice for such a typical situation and could be taken up for replication.

A FRAMEWORK FOR INTEGRATED APPROACH FOR IMPROVED URBAN ENVIRONMENT MANAGEMENT

Finally, the basic concept of the project i.e. an integrated approach which has been so well implemented as part of this project could be fully enhanced with a new framework of integration for improved urban environment management. This would require - i) development of an information base, ii) need based projects to relate to information base, iii) enhancement of public awareness and participation, and iv) an appropriate institutional arrangement.

i) Development of an Information base

Based on the experience of the project, it could be said that for a well integrated approach to a project, the first requirement is the development of an information base. The objective often would be to optimise decision making in order to make strategic choices based on local needs and perceptions, ideas and visions on what should happen in the city, what all activities should be taken care of for a quick and good response of the community towards environmental improvement, and how best the condition for both the citizens and the economic activities can be created. The whole process of data collection and analysis, evolving the formulation of a vision and strategy for

conservation, improvement and further development of the urban environment, is a vital step in the development cycle. In the context of present project, the information required relates to the economic and social activities that lead to environmental degradation, nature and type of pollution sources and the types and costs of possible interventions and their effectiveness and resource mobilisation strategies.

Based on the experience of the Jajmau project, it could be said that the information base provided a more realistic perspective about the socio-economic fabric of people in certain specific areas and the type of sanitary service level that were appropriate and affordable for a certain living standard and life style. For instance sewers were not planned in areas which could not afford a water supply house connection and a sewer house-connection. Instead they were provided with on site LCS facilities. But information base did not attempt the institutional capacities, resources vis-a-vis needs of the IDP for achieving long term sustainability through appropriate parallel measures in the IDP implementation phase.

ii) Need based project to relate to information base

Service standards must be in accordance with affordability and partial interventions must be avoided. Because of high cost of investments, service standards should be designed in accordance with affordability and willingness to pay in different areas of the city of course not sacrificing, the absolute minimum level of environmental hygiene and sanitation for the poorest of the poor.

The experience of the projects indicates, that the intervention required should be planned in such a manner that they focus on public health improvements, reducing the threats to the urban environment and contribute sustainable economic development. In order to accomplish these goals, problems such as inadequate domestic waste water treatment, industrial pollution and inadequate solid waste collection and disposal should be resolved through investment in pollution abatement measures. Partial intervention i.e. water supply without sanitation, storm water drainage without solid waste management should be avoided. The experience in Jajmau reveals that through community participation, technical investments like handpumps, water supply, LCS, solid waste disposal etc have better chances for long term sustainability. In this manner the concept of integrated approach becomes a reality.

iii) Enhancement of public awareness and participation

After the measures for the improvement of the urban environment are accepted and supported by the communities, an on-going interface between the communities and municipal agencies is required. To facilitate an effective communication, community level organisations like the mandals in Jajmau should be established and encouraged to interface continually. An awareness raising campaign about the clean environment and its relationship with better health can be meaningfully chan-

nelled through these mandals to reach grass root levels. These area level organisations could also provide interface in the operation of infrastructure assets created and also as local interest groups to monitor the functioning of the river cleaning mechanisms, say treatment plants for sustainability of the project. In addition to this a permanent community development cell within the local body staffed with trained community workers can play a catalytic role in establishing the dialogue between the communities and the various city level agencies. Such a cell existed within the Kanpur Nagar Nigam and with their involvement in the community participation effects were visible and quick

iv) An appropriate institutional arrangement

The technical and financial strength and appropriate organisational frame work of the implementing agencies is of crucial importance in the sustainability, and thus for replicability for additional projects under the River Action Plan elsewhere in India. For this certain degree of freedom has to be provided to the concerned institutions for O&M and for financial commitments. The institutions should have freedom for enhancing charges for services. They should be allowed to decide themselves for the integration of existing sanitation programmes in the overall project. Part of the services at construction distribution and maintenance level should be allowed to be privatised.

For privatisation of services, contracting out could be adopted which is the most common means of involving the private sector. It is flexible as it is possible to contract out either relatively minor items of works such as maintaining small parks or large scale activities such as solid waste management or operating a sewerage treatment plant. For small and simple contracts, it is easy to monitor performance. Contracting leads to efficiency in expenditure as private firms have flexibility in employment of workers as part-time, temporary etc. with rewards for work.

TRAINING MODULE FOR CAPACITY BUILDING

The beneficial practices and experiences of the IDP project could be taken up on training module to convey to the trainees its (i) integrated approach, (ii) holistic technical inputs, (iii) institutional development, and (iv) community participation. Some of the specific practices/experiences should form special units in the training module, these are:

- i) UASB technology for sewage treatment.
- ii) Community participation for the area development and maintenance of infrastructure assets.
- iii) Programme for women development.
- iv) Efficient accounting and finance management practices for cost efficient service delivery.

With some further work, the UASB technology could be made into a full training module by including technical and financial details and a site visit.

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An Approach to Pollution Prevention in the Electroplating Sector

Development Alternatives, New Delhi

INTRODUCTION

The process of rapid industrialisation often results in the release of hazardous wastes and emissions into the environment, thus affecting the quality of life of the surrounding people.

With the increasing demand for non-corrosive, aesthetic looking consumer items, there has been a tremendous growth in electroplating units. The growth of these units is mainly urban oriented owing to the inherent advantages associated with it.

The unplanned growth of these units and the thoughtless dumping of hazardous chemical residues on to the land and water courses has been a cause of major environmental concern especially in urban areas.

In Delhi, besides causing local land and environmental problems, a significant part of the pollution load to the River Yamuna is contributed by small scale electroplating units.

While the local governments are responsible for improving the local environmental conditions, they are inadequately equipped to confront the environmental problems in a professional way owing to constraints of resources, institutional constraints, legal impediments and insufficient human resource.

On the issue of urban environmental quality improvement, the Rio conference (1992) on environment and development has recommended 'capacity building for human settlements' as one of the prime solutions to achieve sustainable development by national governments.

Even in the forthcoming Second United Nations Conference on Human Settlements, the Habitat II, scheduled to be held in Istanbul, Turkey, the focus will be primarily on the issue of sustainable human settlements development in an urbanising world. Attempts will be made in this meeting to identify and compare the 'best practices' in the field of environmental quality improvement in human settlements regionally and globally.

OBJECTIVES OF THE RESEARCH STUDY

- * To consolidate examples of good practices in electroplating that have an impact on urban environmental quality.
- * To identify key strategies to be adopted for capacity building at the local level.

The area of focus for the study is Delhi and is limited to the more prevalent operations such as nickel-chrome and zinc-cyanide plating. However, to consolidate best practices, case studies from other areas such as Madras, Parwanoo (Himachal Pradesh) have also been taken up for this study.

AN OVERVIEW OF THE ELECTROPLATING SECTOR

SMALL SCALE INDUSTRIES : THE INDIAN SCENARIO

Ranked one among the top fifteen industrial economies of the world, industrial pollution in India is shared equally by large scale enterprises (LSEs) and small and medium enterprises (SMEs). While two thirds of the goods and services of the national economy are provided by SMEs, maximum resource wastage and pollution load to the environment is also contributed by this sector.

The Government of India's thrust has been towards the promotion of SMEs through fiscal incentives and policy measures. One such measure was to allot 836 product categories for production exclusively by SMEs and reserve 409 items for 100 per cent or partial purchase by government stores from SMEs.

In spite of all these measures, the growth trend of SMEs is not up to the expectation and is in fact facing gradual decline, as industrial sickness is on the rise. In the wake of global competition and the changing market scenario in recent years, it makes a good business proposition to improve the productivity and efficiency and competitive edge of small enterprises through cleaner production.

The Government of India offers subsidies for installing pollution control equipments through their various schemes.

DELHI

Delhi and its surroundings have often attracted varying types of small and medium sized units. The advantages of operating in and around Delhi are enormous. To quote some of these features: better access to markets, transportation facilities, assured business centres, tax relaxations and incentives among others. There are about 9000 small and medium industries operating in Delhi. The types of units vary from soft industries such as the electronic industry to highly polluting ones such as textile dyeing, electroplating, rolling and pickling units.

The urban environmental quality of Delhi is facing equal threat from the burgeoning population as well as industrial growth, especially the small scale industries.

ELECTROPLATING SCENARIO IN DELHI REGION

The growth of the electroplating sector has direct correlation with the rapid industrialisation process. The growth of this sector is largely urban oriented as it mostly operates as a service sector to big enterprises.

The electroplating sector can mainly be categorised into three types (i) Captive type where electroplating is an ancillary operation in large scale production units such as cycle part manufacturers, automobile part manufacturers and such others. (ii) Feeder type: where electroplating is usually a medium scale operation. These units provide services to fixed clients, usually the big companies (iii) Job type: These types of units are usually small scale operations and the day to day operations vary quite drastically.

It is estimated that there are about 3000 electroplating units both authorised and unauthorised units operating in the eight industrial pockets of Delhi. The industries are represented by industrial associations within an estate. Most of them are small scale job platers and are characterised by the following features:

- * Generally family owned enterprises, employing unskilled and untrained manpower;
- * Insufficient work place resulting in inadequate operational facilities and poor house-keeping;
- * Inadequate water supply and improper drainage system;
- * Frequent variations in the daily production schedule;
- * Unaware of the benefits of waste minimisation and pollution prevention measures
- * Unaware and ignorant of the consequences of pollution on the environment and people, including the work force.

SCENARIO OF THE STUDY AREA

Of the eight industrial pockets of Delhi, four pockets of West Delhi were chosen for the study (a) Naraina, (b) Anand Parbat, (c) Mayapuri, and (d) Wazirpur. The most common electroplating operations in these regions are nickel-chrome (Ni-Cr) and zinc-cyanide (Zn-CN) plating. Table 7.1 shows the total number of electroplating units in these four industrial pockets.

Table 7.1: Electroplating Units in the Study Area

| Industrial Area Units | No. of Zn-CN Units* | No. of Ni-Cr |
|-----------------------|---------------------|--------------|
| Naraina | 20 | 18 |
| Anand Parbat | 28 | 38 |
| Mayapuri | 18 | 27 |
| Wazirpur | 15 | 26 |

* This number does not represent a minimum of 100 very small household units in these areas. (Source : Industrial associations).

Of these four industrial areas, Anand Parbat Industrial Area is not located in a confirmed industrial zone. A large number of Ni-Cr and Zn-CN plating units are operating in this area and are located in the midst of a thickly populated residential area, thus posing greater environmental threat to the surrounding people. All the units are small scale job platers and they do not have adequate space nor do they have technical or financial capability to install and maintain individual waste treatment and disposal facilities.

In the absence of any organised sewerage system in this area, all these units discharge their waste water containing heavy metals into open storm water drains, which are finally connected to a domestic sewer.

The situation in the other industrial areas is more or less the same, except for the fact that they are situated in authorised industrial areas and not in the middle of the residential areas.

In a recent drive to contain pollution, the Supreme Court has ordered 3000 small scale units in Delhi in various industrial areas to close down owing to lack of pollution control measures. While some units are ready to shift to Haryana, most of them are still trying to adopt suitable pollution control measures. But the progress is very poor.

In Anand Parbat area, the land has been acquired by the Municipal Corporation of Delhi for developing the area and all these industrial units will be asked to shift out from there.

No firm action has been taken so far to close down the units, as the socio-economic and political links are very sensitive in this sector.

TECHNICAL DESCRIPTION OF ELECTROPLATING OPERATION

Electroplating process

Metal finishing is an activity which is introduced early in the



Inside view of an Electroplating unit

process of industrialization. *Electroplating is the process of coating a layer of one metal on another metal or conducting a metal by electrolysis*

It contributes significantly towards offering a good pleasing and decorative finish, rendering objects non-corrosive and rebuilding worn metal surfaces in engineering applications at affordable prices without placing too large a demand on skilled labour or sophisticated equipment.

However, for many processes the consumption of water and chemicals involved in them can be astoundingly high, and constitute, unless reasonably controlled, a major threat to the health of people and the environment.

The plating operation is mainly carried out in three process steps:

- a Pre-treatment
- b Electroplating
- c. After-treatment

A general process flow diagram is given in Annex-I

a. Pre-treatment

Pre-treatment of work pieces is done to remove dust, scales, oil and grease and to make the surface receptive to the final coating. The process steps are :

- * Polishing: buffing and belt sanding to prepare even surfaces.
- * Water rinsing: to remove dust

- * Degreasing :vapour degreasing in advanced scale of operations
- * Acid dip: to remove rust, oil and grease by strong acid or strong caustic solutions.

b. Electroplating

After pre-treatment the work pieces are dipped into an electrolytic cell, usually containing a salt solution of the metal to be plated. An electrolytic cell contains two electrodes, namely, an anode and a cathode. The two electrodes are connected to a low potential, direct current electric power source. The work piece to be plated acts as a cathode and the metal used for plating acts as the anode. During the plating process the anode will be dissolved and coated on the cathode. The plating process can be classified as :

- * Acidic process: Nickel, Chromium, Copper, Zinc, Cobalt etc.
- * Basic process: Copper, Brass, Silver, Zinc, Cadmium, Gold, Cyanide etc.

It is very important to maintain the required conditions of temperature, pH and concentrations of the bath chemicals for various plating operations.

c. After-treatment

After-treatment involves passivation, lacquering, polishing, final rinsing and drying

Passifying - A Surface Hardening Process

A zinc layer is passified by applying a thin layer of chromium as a visual enhancement and extra protection against corrosion. Blue - passifying is the application of a very thin passifying layer, yellow - passification is the application of a slightly thicker layer.

Rinsing

Rinsing takes place between various baths to avoid drag-in and contamination of the next bath. Rinsing also prevents surface staining caused by drying out as a result of crystallization.

Rinsing is usually done in two ways:

- a. **Still rinsing baths :** The still rinse baths (also referred to as economy tanks) are tanks filled with water in which the workpiece is immersed. Over a period of time, the contamination level of this rinse water increases. It is therefore essential to be renewed periodically.

- b. **Running water baths** : The running water baths are tanks in which the rinsing water circulates. This water is replenished on a continual basis and thus the level of contamination remains low. A filtration and water-softening unit (ion exchange) is incorporated in the circulation system

Drying

Drying is conducted in a centrifuge or by circulating hot air in the area.

SOURCE OF POLLUTION

Metals and chemicals are the basis of the metal finishing industry. The thoughtless use, release or dumping of chemical residues and effluents can affect a wide range of environmental species, as well as cause serious human health effects. Most processes which involve the use of chemicals should be examined for their propensity to cause pollution. Loss of chemicals can occur from rinsing operations, from spills, or the discarding of spent solutions. In a few instances the products from the industry may be of environmental concern as for example, objects plated with cadmium.

The main sources of wastes are :

- a. **Drag out losses** : Drag out is the loss of bath liquids while transferring the workpiece from one bath to another. The costly concentrated chemicals used in the plating baths are lost in the rinse water or on the floor.
- b. **Concentrated liquid wastes** : Pre-treatment and plating bath solutions need to be replaced when the quality deteriorates because of contamination by dissolved metals and insoluble salts. Rinse water baths need to be replaced with fresh rinse owing to build up of concentrations. All these :
- * spent acid baths
 - * spent alkali baths
 - * spent passivation dip baths
 - * rinse waters
 - * spent plating baths

will be dumped into drains, creating environmental hazards.

- c. **Water treatment** : Waste resulting from water treatment, for example, neutralisation, de-watering, detoxification and treatment.

- d. **Solid waste** : Sludge generated during plating operations, for example, Zinc-Cyanide bath, residues and sludge generated after treatment.
- e. **Air pollution** : Buffing of articles, fumes generated from the baths cause air pollution, resulting in occupational health hazards for the work-force.

ENVIRONMENTAL IMPACTS

Corrosive chemicals such as acids and alkalis used in the pre-treatment process have the capacity to eat away the tissues and materials they come in contact with

When the presence of heavy metals such as nickel, chromium and zinc exceeds the toxic limits in a particular environmental medium can gradually accumulate in the body and shows its effects only some years after exposure has begun. Toxic properties include carcinogenicity (cancer causing), nervous disorders and mutagenicity (mutations in the genetic code).

Pollutants from electroplating operations can find their environmental path-ways into soil, air, water, food material, plant and animal tissues. Metals tend to get absorbed easily on surfaces like soil or sediments. Cases were reported that metal finishing wastes damaged natural eco-systems by contaminating the drinking water, destroying the fisheries and its products.

Air pollution problems are encountered owing to the acid mists and toxic fumes generated when cyanide wastes come in contact with acidic effluents because of unmindful dumping of wastes into the sewer lines. Occupational health risks are inevitable for shop-floor personnel if proper precautions are not followed while operating with acids and toxic heavy metals.

Solutions to Minimise Occupational and Environmental Risks

A. For Minimising Occupational Health Risks

Some of the precautions to be taken are:

- * Good housekeeping practices and proper care while handling toxic heavy metals.
- * Use of proper protection devices such as hand gloves, nose masks, shoes, goggles etc
- * Use of less hazardous alternate chemicals
- * Provision of exhaust systems and ventilation
- * Improvisation of skills in various operations

B. FOR Minimising Environmental Risks

- * Good housekeeping measures to minimise loss of chemicals.

- * Pre-treatment of hazardous effluents to make them non-hazardous
- * Neutralisation of highly acidic or basic effluents before disposal into the sewers
- * Proper lining of the sewage pipelines to protect ground water from contamination

OVERVIEW OF LEGISLATIVE FRAMEWORK

Small scale industries do not require any license. Even registration with the state directorate of industries is voluntary. Registration, however, helps in many ways.

Registration with state directorates of industries helps a unit to obtain all facilities and assistance from government. Registration of small scale units is done in two stages .

- * Provisional Registration
- * Permanent Registration

Provisional registration enables the units to apply for and obtain facilities such as allotment of factory sheds/plots in industrial estates, water and power connections, liberalised financial assistance, machinery on hire-purchase and so forth from central/ state government organisations such as National Small Industries Corporation and State Small Industries Corporations.

In Delhi, a unit then has to obtain a license from the Municipal Corporation of Delhi (MCD) and can then apply for electricity and water facilities. A registered unit can get infrastructure facilities from Delhi Small Industrial Development Corporation (DSIDC)

Concerned Industry Associations will mediate to get all know-how and assistance for small scale industries registered with them. All environmental regulations are equally applicable to small industries also. In case of non-compliance of environmental regulations central/state machinery can intervene in accordance with law. Delhi Pollution Control Committee (DPCC) has the authority to ask the industry to close down and cancel/confiscate their licenses etc

Environmental Legislation

Environmental legislation, including the Water Pollution Act of 1974 and Air Pollution Act of 1981 gave central and state pollution control boards, authority to regulate the activities of industry in relation to the environment. In 1986, a comprehensive Environmental Protection Act was passed by Parliament giving the government wide ranging powers for both pre-emptive and ameliorative action

The role of the Central Pollution Control Board (CPCB) is to identify the polluting sector and advise government and indus-

try on pollution control measures and it even has the power to close down the industry in case of non-compliance with environmental regulations. CPCB is an apex body for all state and union territory pollution control committees. However, the ultimate powers are vested with the Supreme Court of India.

While it is true that the Government of India has moved relatively quickly on environmental legislation, it has not been successful enough in enforcing the regulations owing to lack of enforcement machinery and also because of many loopholes in the law itself.

METHODOLOGY OF RESEARCH

The methodological activity framework followed is shown below.

- * Selected study areas in specific industrial locations in Delhi.
- * Established contacts with industry associations and electroplaters of Mayapuri, Naraina and Anand Parbat industrial areas.
- * Visited a few electroplating units where 'best practices' for pollution prevention are adapted (names cannot be provided as promised to entrepreneur to maintain secrecy of the units)
- * Assessed the current practices followed by a majority of nickel-chrome and zinc platers in the project study area.
- * From the literature survey, identified pollution prevention opportunities in electroplating operations.
- * Surveyed some of the units in the study area to identify scope for implementing pollution prevention practices.
- * Interviewed leading chemical suppliers, electroplaters (ex : Grower & Weil Company, Plate Well Company etc.) and other consultants (such as National Productivity Council) who were the key players in educating entrepreneurs regarding the potential benefits of pollution prevention techniques. Their views were taken as a basis in formulating strategy recommendations.
- * Gathered information regarding the efforts made by pollution control authorities (CPCB, Delhi Pollution Control Committee) in preventing pollution from these units.
- * Selected two units in Anand Parbat Industrial Area as cases of followers of 'good practices' amongst the surveyed units in the study area. One unit was selected from Parwanoo as this unit gives insights into

the importance of quality management in achieving environmental performance and examined one more case study from Madras as suggested by National Productivity Council (NPC) and Ministry of Environment and Forests (MoEF).

- * Identified and analysed the potentials and constraints involved in adoption of pollution prevention techniques by a large number of entrepreneurs for improving the surrounding urban environmental quality. This analysis formed a basis in formulating a strategy for capacity building for improving urban environmental quality with reference to pollution from electroplating operations.

IMPACT AREAS AND ASSESSMENT

This section illustrates the good practices followed for pollution prevention in some electroplating units of Madras, Delhi and Parwanoo. Since none of the units surveyed in Delhi has qualified as best examples, some demonstrated cases of pollution prevention were chosen from Madras.

However, two representative units (best among the surveyed units) in Delhi were studied to understand the pollution prevention potential. The financial feasibility of those initiatives were

studied by conducting trial runs of the prevention measures in the concerned units.

The case study in Parwanoo was chosen to understand the impact at a different scale of operation and when quality management aspects are involved. A detailed description of each of these units is provided in the following paragraphs

CASE I : NICKEL-CHROME UNIT (MADRAS BASED)

Unit I studied in Madras is a small scale job plater and employs about 15 male workers and 3 female workers. They do plating for automobile parts. Besides undertaking job works, this unit also provides services to the large automobile manufacturers on a regular basis. The shapes of the articles vary from big cylindrical to small plates and spikes.

The main plating operations include nickel-chromium plating.

Upon realising the fact that they were losing 55 per cent of nickel and 71 per cent of chromium, the input chemicals, at various stages of the plating operation, the unit agreed to take part in the pollution prevention demonstration exercise

Pollution prevention measures

Table 7.2 shows the nature of the measures taken and the resultant financial and environmental benefits achieved by Unit I

TABLE 7.2 : POLLUTION PREVENTION MEASURES AND THEIR IMPACT

| Measures taken | Nature of the measures | Reason for adopting measures | Environmental/ occupational implications | Financial investments (Rs.) | Monthly savings (Rs) |
|--------------------------------------------------------|------------------------|---------------------------------------|------------------------------------------|-----------------------------|-----------------------|
| Use of fume suppressants in chrome plating | Cleaner production | To reduce air pollution | Reduced exposure to toxic fumes | 400/- | Air pollution reduced |
| Provision of exhaust fans in the chrome plating area | Cleaner production | To reduce air pollution | Reduced exposure to toxic fumes | Nominal | - |
| Drag out reduction | | | | Nominal | 8,500 |
| - conversion of nickel rinse 1 into dragout collection | Change in practice | To reduce chemical loss and pollution | Reduced environmental treatment costs | | |
| - Lower nickel concentration in plating bath | Change in practice | To reduce chemical loss and pollution | Reduced environmental treatment costs | | |

Table 2 continued

| Measures taken | Nature of the measures | Reason for adopting measures | Environmental/ occupational implications | Financial investments (Rs.) | Monthly savings (Rs.) |
|---------------------------------------------------------------------------------------------------|-------------------------|---------------------------------------|--------------------------------------------|-----------------------------|-----------------------|
| - Better component drainage through slow jerking after nickel plating | Change in practice | To reduce chemical loss and pollution | Reduced environmental treatment costs | | |
| - Provision of drain boards between plating and rinse tanks | Change in practice | To reduce chemical loss and pollution | Reduced environmental treatment costs | | |
| - Provision of hangers over chrome drag out to reduce carry over PVC coating of jigs and fixtures | Change in practice | To reduce chemical loss and pollution | Reduced environmental treatment costs | 500 | 1,500 |
| Improved bath life extension measures | Change in practice | To reduce chemical loss and pollution | Reduced environmental treatment costs | 4,000 | 5,500 |
| - Use of DM* water | Process control measure | To improve productivity and quality | Reduced rate of accumulation of pollutants | Nominal | 2,500 |
| - Bath condition maintenance by regular checking | Process control measure | To improve productivity and quality | Reduced rate of accumulation of pollutants | Nominal | |
| - Continuous filtration of bath chemicals | Process control measure | To improve productivity and quality | Reduced rate of accumulation of pollutants | Nominal | |
| Total savings | | | | 4,900 | 18,000 |

* DM Demineralised water;

NPC has demonstrated potential for pollution prevention through various simple in-house measures in Unit-1. These measures have resulted in savings of Rs. 2,16,000 per annum, which is about 18 per cent of their total production cost. The pay back period is also very short. Besides the measures taken (see Table 7.2), the unit was following some good practices on its own such as

- * avoiding losses in energy by keeping the rectifier closer to the plating units and the busbars with fewer joints,
- * storing the spent acids in plastic containers for off-site recycling by some customers; and,
- * using magnets to fish out dropped articles in the plating bath thus avoiding unnecessary losses owing to coating on the dropped articles.

Using all these measures, they were able to cut down 50 per cent of the pollution load to the environment.

Some short-term and long-term measures suggested by NPC were not implemented because of the following reasons:

- * second drag out tank installation was not implemented owing to lack of space
- * change over to the thyristor control in rectifiers instead of dimmer control owing to lack of reliable suppliers
- * provision of treatment facilities because of financial and space constraints

CASES II & III : NICKEL-CHROME AND ZINC-CYANIDE UNITS (DELHI BASED)

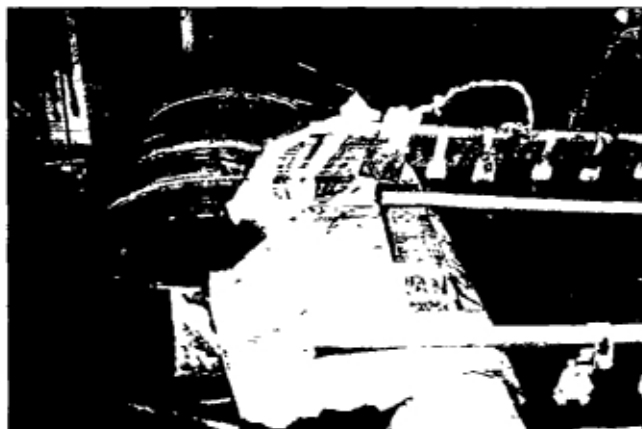
In all the four industrial estates of the study area surveyed, there were no units that followed any good practices. Most of these units are job platers and are unaware of the benefits of pollution prevention measures.

However, from among these units one representative unit each for nickel chrome and zinc cyanide plating operations in Anand Parbat Industrial Area was selected. The criteria for selection of these units, are based on the initiatives they have taken in adopting some measures though not quite up to the mark, for reducing losses. Some trial runs were conducted for preventive measures that are economically viable.

Unit 2 is a nickel-chrome plating unit and Unit 3 is a zinc-cyanide plating unit in Anand Parbat Industrial Area.

Unit II : Nickel-Chrome

Unit II is a family owned enterprise and does rack plating and



Plastic Drain Board Drag out Recovery Process adopted by some has not been proved very successful

employs about 18 people – four in the buffing section, eight in the polishing unit and six electroplaters. Two or three women are employed in the polishing section to do light jobs.

Pollution prevention measures

Though this unit has initiated two prevention measures by installing a still rinse bath and a drag out collection tank on their own, they are highly inefficient, continuing to lose valuable chemicals.

For air pollution reduction they add fume suppressants to the chromic acid bath. The unit has installed a powerful exhaust system behind the buffing machine.

Unit III : Zinc-Cyanide

This unit does both rack and barrel plating employing about five workers. The production process takes place on a land area of 30 sq.m. Small metal strips, bolts and small iron pieces are plated on job order basis. No women workers are engaged in this unit.

Typical of any zinc-cyanide unit, the rinse water and the effluent from this unit contains highly hazardous cyanide pollutants.

Pollution prevention measures

This unit has implemented two preventive measures

- a. Installed two still rinse baths and makes up the main plating bath losses using the still rinse bath contents.
- b. Uses perforated basket to collect drag out from barrel plating operation. However, these two facilities are not being used in a proper way.

To understand the scope for further improvement, trial runs for the following three simple, inexpensive pollution prevention techniques were conducted in both the units (Nos. II & III) and financial benefits were also estimated. These techniques are:

- a Hanging technique
- b Eco-rinse technique
- c A combination of hanging and eco-rinse techniques

A description of the above techniques is provided in Annex-II

Savings owing to pollution prevention measures

Tables 7.3, 7.4, 7.5, & 7.6 summarise the findings regarding the potential benefits of using the above techniques

Table 7.3 : Nickel Plating

Number of pieces plated per day : 400

Cost of plating bath (Rs./ litre) : 69.20

| Options | Drag-out saved litre/day | Savings Rs/day | Savings Rs/year | Waste reduction kgs./year |
|--------------------------------------|--------------------------|----------------|-----------------|---------------------------|
| Hanging technique | 4 | 276.80 | 79,718 | 461 |
| Eco-rinse | 2.4 | 166.08 | 47,831 | 276 |
| Hanging & Eco rinse (or still rinse) | 4.4 | 304.48 | 87,690 | 507 |

Source : Unit level trial runs

Table 7.4 : Chrome Plating

Number of pieces plated per day : 400

Cost of plating bath (Rs./litre) : Rs. 27.74

| Options | Drag-out saved litre/day | Savings Rs/day | Savings Rs/year | Waste reduction kgs./year |
|--------------------------------------|--------------------------|----------------|-----------------|---------------------------|
| Hanging technique | 4 | 110.96 | 31,956 | 276 |
| Eco-rinse | 2.4 | 66.58 | 19,174 | 166 |
| Hanging & Eco rinse (or still rinse) | 4.4 | 122.06 | 35,152 | 304 |

Source : Unit level trial runs

Table 7.5 : Zinc Plating (rack)

Number of pieces plated per day: 2,200

Cost of plating bath (Rs./litre). Rs. 25.77

| Options | Drag-out saved litre/day | Savings Rs/day | Savings Rs/year | Waste reduction kgs /year |
|--------------------------------------|--------------------------|----------------|-----------------|---------------------------|
| Hanging technique | 1.7 | 43.81 | 12,617 | 98 |
| Eco-rinse | 1.5 | 26.29 | 7,570 | 59 |
| Hanging & Eco rinse (or still rinse) | 1.87 | 48.19 | 13,879 | 108 |

Source : Unit level trial runs

Table 7.6 : Zinc Plating (barrel)

Number of batches per day: 12

Weight of pieces per batch: 30 kg

Cost of plating bath (Rs./litre): Rs. 25.77

| Options | Drag-out saved litre/day | Savings Rs/day | Savings Rs/year | Waste reduction kgs /year |
|--------------------------------------|--------------------------|----------------|-----------------|---------------------------|
| Hanging technique | 0.78 | 20.10 | 5,789 | 45 |
| Eco-rinse | 0.47 | 12.11 | 3,488 | 27 |
| Hanging & Eco rinse (or still rinse) | 0.86 | 22.16 | 6,383 | 50 |

Source : Unit level trial runs



Hanging Technique

Though the above techniques are highly promising ones, they are worker dependent techniques and are not very popular among the electroplating units because of the following reasons .

- a. Lack of knowledge of these techniques.
- b. Lack of space.
- c. Inadequate control over workforce for adopting the techniques

CASE IV : NICKEL-ZINC UNIT (PARWANOO BASED)

Unit IV based in Parwanoo is a medium scale feeder unit which plates a standard product, watch components. Nickel and zinc plating are part of precious metal plating. Quality maintenance is the main drive behind achieving pollution reduction. The general process flow is similar to the nickel and zinc plating operations described earlier.

Some of the good practices adopted are as follows .

- * High power exhaust for dust collection in buffing section.
- * Maintenance of plating bath chemistry by using de-ionised water, continuous filtration of bath solutions, periodical testing in the laboratory, rinse water recycling
- * Drag-out reduction by eco-rinsing
- * Continuous R&D on jigs and fixtures shape to reduce rejection rate of articles plated.
- * Better stirring of bath chemicals for even plating.
- * Hi-power exhaust in solvent degreasing area.
- * Judicial use of water using spray rinsing.
- * Final effluent treatment before disposal.
- * Less distance between rectifier and plating baths.

These are some of the best practices followed in Unit IV. Unfortunately the financial aspects of these measures were not made available in this unit.

In the next section, an analysis of the issues such as replicability, positive and negative factors in the implementation of good practices and aspects such as measures to be taken for sustainability are discussed. These are summarised in Annex. III.

ANALYSIS OF THE RESEARCH FINDINGS

GENDER ISSUES

The number of women employed in electroplating operations is highly negligible. The production process demands experienced labourers on a regular basis, since most of these units operate on a day to day job order basis. Therefore men are preferred in the plating sector.

In all the units surveyed, women and children are employed only for works such as assembling the articles for plating, final cleaning and packaging. Since these are considered lighter jobs women are offered less remuneration. For example a person in the plating line would be getting something like Rs.1,500 per month whereas, women in a final polishing and packaging section would get about Rs 900 per month.

As far as occupational health risks are concerned, it is only the men who are at risk compared to women. With regard to general pollution problems such as ground water pollution, bio-accumulation through contaminated food, can impact women's health as equally as men's health. Besides these effects, women's reproductive health is also susceptible. An unborn baby can contract the ailments if the mother's health is affected by heavy metal contamination.

Applicability of Good Practices - An Analysis

In the study area, two types of operational conditions were observed: those which were operating in authorised locations (Naraina, Mayapuri and Wazirpur) and those which were operating in unauthorised locations (Anand Parbat Industrial Area) in the midst of congested residential localities. In both cases, the growth of these units was quite unplanned, thus hampering any kind of centralised treatment facilities that can otherwise be installed.

The Indian electroplating sector is dominated by small and medium enterprises which execute mostly job plating for large scale industries such as automobile industries. To avoid pollution problems large industries prefer to get such services from these small units. However, in the wake of the increasing emphasis on TQM (Total Quality Management), the large scale units are going in for their own captive operations.

Waste minimisation and pollution prevention practices have been well understood and demonstrated for the electroplating sector world-wide. But in a developing country, there are a good number of barriers rather than potentials for implementation especially in the small scale sector.

Approach adopted for waste minimisation

In the study area, the waste minimisation and pollution prevention measures were taken by the industry as part of the dem-

onstration exercises conducted by the technical consultants (of NPC) for the Ministry of Environment sponsored project.

An analysis of the approach indicates that the demonstration exercises were taken up to motivate the entrepreneurs and to test the financial and environment viability of such initiatives. While such an approach was essential to bring in the required change, in the absence of a systematic approach for wider dissemination, the impact seems to be limited to units where demonstration exercises were conducted

Analysis of the barriers for replication

Of the several options identified for pollution prevention, the Madras units have implemented only a few source reduction measures such as

- a Process bath maintenance
- b Material substitution
- c Drag out reduction and recovery
- d Improved rinsing techniques
- e Improved housekeeping measures
- f Energy conservation measures.

Some of the other options such as heavy metal recovery techniques, replacement of cyanide baths with acid baths and such-like were not adopted, as these units were not ready to make such high financial investments.

From the analysis of the waste minimisation efforts displayed by all the four case study units, the following conclusions can be drawn

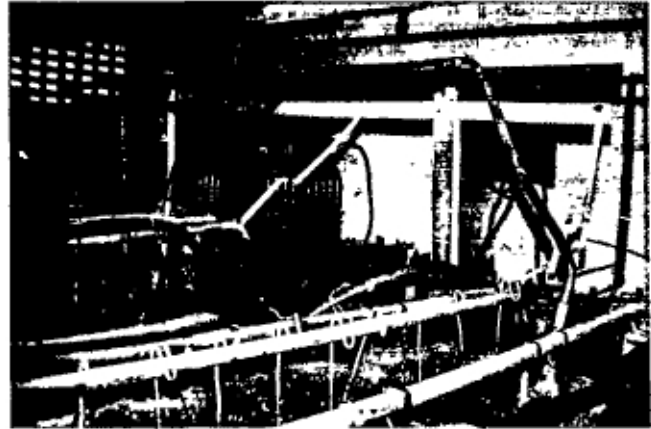
A majority of the initiatives are:

- a Aimed at reducing about 50 per cent pollution load
- b Easy to operate, low investment options with less pay back period
- c Having high potential for financial savings
- d Not aimed at recovering or treatment of chemicals.

In short, the barriers for replication of these initiatives can be listed as given below

i. Attitudinal problems

The common fear amongst small scale entrepreneurs is that any additional investment towards pollution reduction would be a financial burden to them. Besides this, the "Why me" attitude



Drag out Recovery by hanging is an improvement to earlier method

also is hampering any positive initiative in this direction. As long as the profits they can generate are substantial, environmental problems will not be a major priority.

ii. Lack of awareness

The opportunity to get information on pollution prevention and waste minimisation techniques and their benefits is very minimal for a small scale entrepreneur. Even if available, it would be mostly general information. Though seminars and workshops provide such opportunities, these are not attended by small scale entrepreneurs. So far no special efforts have been made to address this problem.

iii. Policy and regulatory barriers

In the absence of pollution control taxes, it is not an attractive proposition to recover chemicals. Especially in the case of chrome recovery, the entrepreneurs are finding it cheaper to buy chromic acid at a rate of Rs. 120 per kg than recovering it. While taking policy decisions on excise duties, levies and so forth, these factors should be given due consideration.

Irrespective of the variations in the type and nature of plating operations, the discharge standards to be met are fixed (Annex-IV). In order to promote pollution prevention practices standards have to be based on the nature of pollutants generated and the limit for heavy metal load and wastewater generation should be based on the unit area plated.

iv. Financial constraints

Most of the small scale enterprises run on lower profit margins and the regularity of cash flow is quite uncertain. The change over to cyanide free baths, installation of heavy metal recovery system and demineralised water generation system etc. were not adopted by the units owing to financial problems.

v. Information and technology barriers

Ion exchange systems for heavy metal recovery is one of the

viable solutions for heavy metal pollution problems. However because of lack of information on the availability of such systems as per the need of the entrepreneurs, these ion-exchange systems are not popular in the electroplating sector. No attempt has been made so far to utilise the potential of this technology either for individual use or for collective use.

Very little information is available to the small scale entrepreneurs on alternative, less hazardous chemicals for substitution and their availability in the market.

vi. Lack of trained workforce

The workforce employed in these units are mostly untrained and ignorant of health impacts arising out of improper handling of chemicals, spillages and emissions. For any waste minimisation programme to be successful, training and motivation of workforce is essential

vii. Lack of quality control

The use of demineralised water reduces the plating bath contamination process and improves the quality of plating. Unfortunately in small scale job operations demineralised water plant installation is expensive and therefore quality maintenance is very minimal

Besides this, there are no cost effective monitoring equipments available to maintain the plating bath composition. Therefore, it is essential to promote quality plating in these units by providing the quality control equipment / devices at an affordable price.

In India, most of the demonstration studies are striving to achieve 50 per cent load reduction to environment by following simple prevention techniques. Removal of the remaining 50 per cent load through recovery (through ion exchange), recycle (through reverse osmosis, electro dialysis techniques) and treatment is highly cost prohibitive and needs a great deal of articulation to design alternative means of achieving a pollution free environment. One such initiative was attempted by Anand Parbat Industrial Area. The story goes as follows :

Electroplating units have started coming up in Anand Parbat area since 1940. Besides electroplating, anodisation, printing, painting, solvent extraction are also housed in the congested lanes of Anand Parbat Area. Since the 1980s, as environmental regulations started becoming stringent, the electroplating units were constantly disturbed by being served with notice to vacate or by stoppage of electrical supply.

Being situated in an unauthorised area, the entrepreneurs take a more pro-active role when compared to their counterparts in the authorised areas. Since the late 1980s efforts are on to get a Common Effluent Treatment Plant (CETP) constructed in that area so that they can continue to stay there.

According to Mr. Tandon, the President of the Anand Parbat Industry Association, the electroplaters have got together to get the treatment plant design made by a renowned research organisation in central India. A technical feasibility study was also sponsored by them for the same and funds earmarked for the CETP.

In spite of all these efforts, the proposal has not made any progress so far because of bureaucratic procedures and delays

The other side of the story is that a common effluent treatment plant operation is not a feasible option for that area as it will be located very far away from the units owing to lack of space. Many uncertainties are involved in that operation and the regulatory authorities are not very keen to approve the proposal nor are they in a position to offer alternative suggestions for moving out to a new location.

In the wake of the recent Supreme Court decision, it is highly unlikely that government approves any such initiative. But at the same time displacement of so many enterprises and dislocation of hundreds of livelihoods is not desirable. One has to wait and see whether there will be a major turn in the story. Till that point, pollution prevention is the immediate solution that electroplaters have to adopt.

From the above analysis it is very clear that the barriers for replication or for wider acceptability for pollution prevention measures have to be overcome by making strategic choices on all fronts such as technology, awareness, public pressure, regulatory mechanisms, training, skill development, quality management, resource utilisation and R&D.

FORMULATION OF NATIONAL STRATEGY

CURRENT EFFORTS

Traditionally environmental problems in small scale industries are largely dealt with by the command and control principle. But this mechanism has failed miserably as it is physically impossible to have control over such vast numbers with wide variations in operational practices and geographic distribution.

Of late, the government is taking a more cooperative approach in dealing with these units. The government sponsored demonstration programme for pollution prevention (the DESIRE programme) and the initiation of Waste Minimisation Circles (just like quality circles) are a few such initiatives in this direction.

In spite of all these efforts, the change is quite slow and the desired multiplier effect has not yet been achieved owing to the inherent constraints associated with small scale units.

At the national and state levels, there is a great need for a clear and explicit policy statement to promote cleaner production. This must be complemented by the required legislation, institutions for monitoring and agencies for implementation.

RECOMMENDATIONS

Regulatory measures

- a Licenses . Since the pollution load generated per unit production is quite high in small scale units compared to medium and large ones, no new units should be encouraged to come up in the small scale sector
- b Standards : To support the above measure, the discharge standards need to be modified to load based standards thus allowing individual units to take up measures as per their production capacity. Specified limits have to be fixed for unit production, and these should be based on easily verifiable and monitorable environmental targets.
- c. Incentives . Incentives should be granted to only those units whose resource consumption and waste generation factors are below certain specified levels.
- d .Financial schemes . Preferential financial assistance should be given to proposals that give priority to waste minimisation measures rather than for end-of-the-pipe pollution control proposals.
- o Pricing policy Prices of essential resources such as water, chemicals need to be hiked to a level that justifies waste minimisation and recovery of chemicals and resources becomes more economical than investing in fresh materials

Institutional support

It is essential to strengthen the capabilities of existing institutions working in the area of waste minimisation for the small scale sector. It is also essential to create more institutions which can provide requisite support. Primarily the role players could be chosen from

- * Academic institutions
- * Private consultants
- * NGOs (technically capable)
- * Advocacy groups

Technology development

Technical and research institutions have to be brought in to identify, develop, evaluate and advocate suitable low-cost, indigenous technologies, techniques and devices for operational requirements, monitoring, process change and treatment requirements

Training and skill development

The most urgent need is to promote systematic technical education and develop a cadre of professionals to implement cleaner production methods. Skill development institutions for small scale industries have to be promoted.

Access to information and awareness

The two major hurdles quite often raised by professionals in waste minimisation programmes are 1) Attitudinal problems 2) Lack of awareness about benefits of waste minimisation. Adequate measures should be taken to break these two barriers by making information more easily accessible and through more demonstrative examples. Again more role players should be brought in for quick results.

Pressure from stakeholders

Large industries, the general public and consumers being the main stakeholders, voluntary compliance in the units can be brought in by them by insisting on quality and environmental performance.

NATIONAL STRATEGY

As was already mentioned, the DESIRE Programme (of NPC) and the Waste Minimisation Circles Programme (of Ministry of Environment) have been able to achieve some success, but still limited to the units where it was demonstrated.

Neither of the programmes could bring in the required stimuli to initiate voluntary action amongst the industry circles. The failure could be attributed largely to the fact that both the programmes have major emphasis on demonstration rather than on dissemination and materialisation of benefits into clear-cut categories that are environmental (including regulatory) and financial.

Provision has not been made for effective dissemination through audio-visuals and on-the-job-training programmes. Accessibility to demonstrated units was not very encouraging. Spokespersons for Waste Minimization and Pollution Prevention programme have to be created from within that sector, whose words hold more value than a consultant's.

To promote pollution prevention practices on a wider scale, a model strategy can be formulated as given below.

A model strategy for pollution prevention

Traditionally environmental consultants are experts in providing expensive end-of-the-pipe solutions by suggesting retrofitting technologies and practices. The business potential for environmental management through waste minimisation and pollution prevention practices have not been explored by these

consultants. Therefore state-of-the-art technologies and materials available in the market are also based on end-of-the-pipe solutions

So far it has been amply displayed through demonstration exercises that pollution prevention initiatives are environmentally and economically viable. The next strategic step should therefore be to evolve the policies, environmental consultancy services, R&D programmes for technology and material development driven by a pollution prevention approach.

The basic assumption behind this proposed model strategy is that if the business potential for prevention based environmental management consultancy services is realised, it can trigger off the market demand for indigenous technologies and alternative less hazardous materials which can cumulatively help promote cleaner production. The proposed model strategy has a five pronged approach, the details of which are provided in the following paragraphs.

The apex body to execute such programmes should be either Central or State Pollution Control Boards preferably in association with the Ministry of Environment.

Demonstration of cleaner production practices

Demonstration units should be established preferably that operate under the control of municipal governments or industrial development corporations or small scale industrial training centres. The advantage is that these units are more easily accessible for on the job training and would be willing to share information with other units.

Dissemination of technical package

Training programmes and workshops should be organised to disseminate technical packages on best practices for pollution prevention in the electroplating sector to practising environmental consultants, technical organisations, technical NGOs, academic institutions and other interested groups. These groups may further disseminate the knowledge or help the entrepreneur implement them.

Here the dissemination of technical packages to these consultants plays a key role in :

- a. Providing the cleaner production initiatives a business like approach
- b. Making this approach successful
- c. Driving the environmental technology and material supply market to cleaner production requirements.

Conducting skill development programmes

Regional training centres should be opened to improve skills of floor personnel to implement pollution prevention practices.

These could be set up in Industrial Training Institutes or in Small Scale Industrial Training Centres.

Policy Interventions

At the regulatory level, pollution prevention initiatives should be encouraged by providing permits, licenses, soft loans and awards, differential standards for polluting and non-polluting units and such other measures.

Development and dissemination of training modules

Audio-visual based awareness and training modules should be evolved for various role players, especially entrepreneurs. These programmes should be updated on a regular basis. Wider publicity through the media should be promoted to reach small scale units. On-the-job training facilities, data-banks on the latest R&D for technology improvement and material substitution should be made accessible to small scale units.

It is anticipated that by adopting the above model, a cadre of professionals can be trained to undertake pollution prevention initiatives in companies, thus triggering off a chain reaction on all fronts such as technology, material development and ultimately achieve the multiplying effect.

Conclusions

Traditionally, electroplating operations, especially small scale operations, are an important source of pollution on account of the metals, chemicals and processes they involve. The most useful approach for pollution control in electroplating operations is:

- a. Avoidance of waste generation and reduction whenever possible.
- b. Recovery and recycling of waste streams.
- c. And finally, treatment and disposal as a last step.

Since the benefits of such an approach were not well understood, the pollution control strategy in India is so far largely dependent on end-of-the-pipe solutions, that too, only when pressurised for regulatory compliance.

A few efforts made by environmental agencies in the past and in recent times have resulted in a handful of demonstrative cases which were centred around simple waste avoidance and reduction measures. However, only those measures which gain good financial returns were practised in a sustained way. This clearly shows that economic feasibility of a "good practice" gains weightage over a solution which gains only environmental benefits.

This may not be true of some motivated entrepreneurs, but then they seem to be handicapped with lack of proper information, technical guidance and consultancy services, or sometimes because of bureaucratic hurdles.

An analysis of the pollution demonstration exercise carried out by NPC clearly shows that 50 per cent pollution load can be avoided straightaway by following simple drag out reduction measures such as hanging technique, drag out board installation, eco-rinse techniques, coating of jigs and fixtures and a few energy conservation measures.

Even these simple measures to reduce 50 per cent pollution load are not being replicated widely, not to talk of the remaining 50 per cent pollution load which can be avoided only by using expensive recovery and recycling techniques such as reverse osmosis, electro-dialysis etc. The most promising technique for recovery being the ion-exchange technique, the information regarding its applicability, cost-benefits and so on, are generally not made available to the entrepreneurs.

The barriers for the adoption of waste prevention measures seem to be multi-pronged, ranging from attitudinal barriers to lack of such entities as awareness, information, space and workers' cooperation, indigenous inexpensive technologies, adequate regulatory and public pressure, and low cost of resources.

To overcome these barriers, the strategies to be followed should take into account all those influencing parameters and should aim to promote voluntary action amongst the entrepreneurs. Besides setting up demonstration units, the strategy should include the dissemination of the technical packages to environmental consultants. The business like approach of these consultants is expected to boost the demand for other support services for cleaner production.

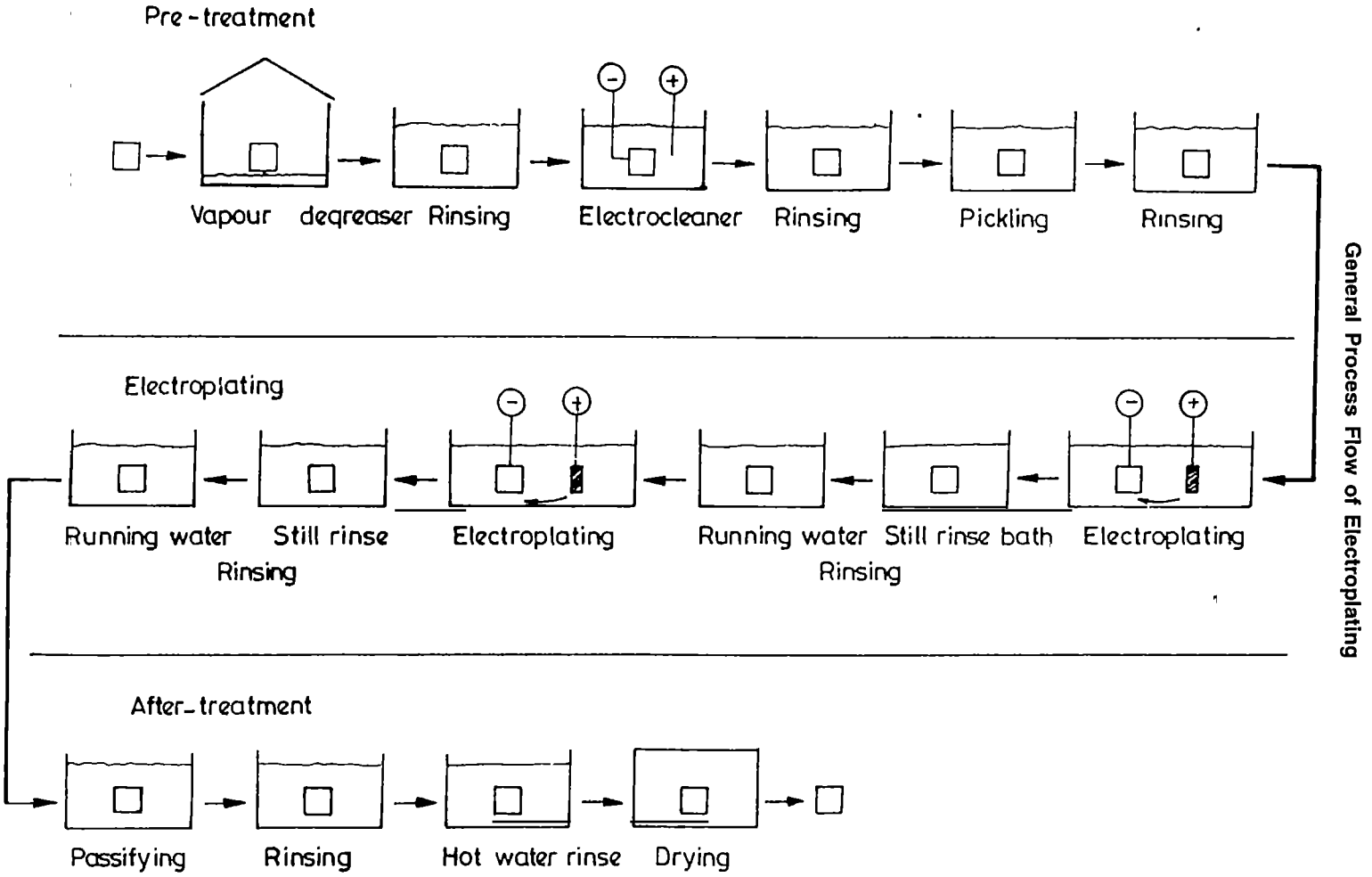
Simultaneously, the strategy should be to conduct skill development programmes for the workforce, make policy interventions in favour of cleaner production and finally to make available the information to a wider audience through seminars, workshops, audio-visuals and print media and databanks.

Until these barriers are overcome, the main effort should be to reduce 50 per cent pollution load through simple measures and then to progressively move towards achieving 100 per cent results through recovery and treatment practices.

Capacity building through training and institutional strengthening is considered to be the potential gateway to enter into this pollution prevention game.

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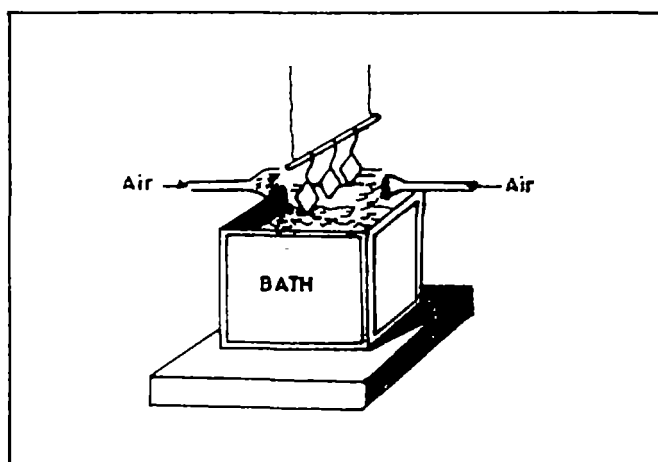
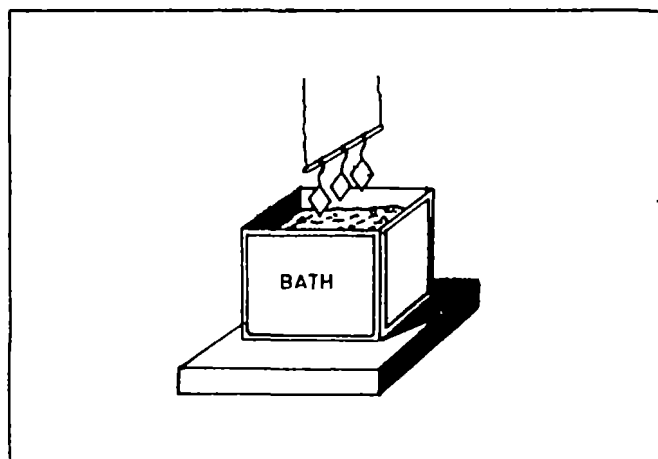


Hanging technique

Rack plating : The rack with workpieces should be placed above the plating tank or drag-out tank for dripping

Barrel plating : The workpieces should be placed long enough in a perforated basket for dripping. In all cases, sufficient dripping (at least 20 seconds) should be allowed.

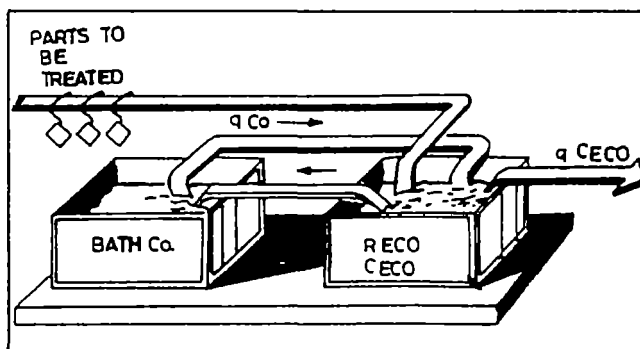
The hanging (dripping) technique reduces the drag-out by 83 percent. Less chemicals would be discharged through the rinse water and less waste water would need to be treated. Only then will the consumption of chemicals decrease



Eco rinse technique

ECO (ie. "economical rinse") rinses are still rinses in which the workpieces are immersed in the rinse tank before and after treatment in the plating bath. Drag-out is lowered to 50 per cent because the same quantity of liquid is transferred to the treatment bath (by the untreated pieces).

Advantages are equal to the hanging technique. By implementing the eco rinse technique, treatment costs can be saved and the consumption of bath chemicals decreases



POTENTIALS AND BARRIERS FOR REPLICATION OF WASTE MINIMISATION PRACTICES

1. Drag-out reduction measures

a. Conversion of 1st rinse tanks into drag-out tanks

- managers need to be convinced of the benefits
- dependent on workers using it.
- in case of zinc plating savings through recovery are not so attractive when compared to buying new chemicals.
- investment is nominal.
- high financial returns in case of nickel.
- many entrepreneurs try to avoid it as it is an additional process step
- replicability is less due to space restriction and lack of understanding of the benefits.

b. Hanging Techniques

In spite of having potential for replicability this technique is not becoming popular due to:

- additional space requirement.
- varying shapes of articles doesn't permit a fixed system of hanging.
- dependent on worker's involvement/motivation.
- mechanised techniques not affordable.
- indigenous methods not developed adequately for different needs.
- requires motivation.
- lack of awareness.

c. Spray Rinse Technique

- easy to operate.
- high impact in pollution load reduction.
- main hurdle is non-availability of suitable devices.
- lack of awareness among entrepreneurs.

d. Eco-Rinse Technique

- extra process step for workers.
- depends on how motivated the workers are.
- lack of awareness is another hurdle.
- high potential for reducing loss of chemicals.
- high potential for reducing loss of chemicals.
- low investment costs.

2. PVC coating of Jigs & fixtures

- unaware of losses through jigs and fixtures.
- need to be adapted as per the individual requirements.
- motivated work-force can contribute significantly.
- not a common practice.

3. Use of Fume Suppressants and Exhaust Fan in Chrome Plating

- not aware of health hazards involved.
- misconception that it would cost them extra money.
- dependent on management's priorities for wealth or health.
- less motivation from chemical supplier.
- use of polypropylene balls to cover the surface of the bath liquids is not yet popular in India.

4. Improved Bath Life Extension Measures

a. Use of demineralised water in critical areas

- change in practice not a welcome suggestion.
- central supply facilities are not available
- not so popular practice.
- not aware of the repercussions of not using demineralised water for plating and rinsing operations.

- quality maintenance is not a pre-requisite in many small scale units.
- cost benefits are not known,
- do not want to invest in.
- no incentives from regulatory authorities.

b. Bath chemistry maintenance

- no in-house laboratories for regular monitoring.
- not aware of extent of losses.
- non-availability of easy to use testing procedures, devices
- dependent on outside laboratories.

- quality not a priority.

- unskilled work force.

5. Use of Alternate Non-hazardous Chemicals

- involves capital investments for switch over to cyanide free plating.

- apprehensions about quality of plating.

- CN based plating easy to operate.

- uninformed of energy savings.

- environmental improvement least priority.

- resistance to change

**STANDARDS FOR ELECTROPLATING SECTOR
ENVIRONMENTAL PROTECTION ACT - 1986**

| Industry | Parameter | Standards |
|---------------------------|---------------------------------|----------------------------------------------------------------------------------|
| Electroplating industries | | Concentration not to exceed milligrams per litre (except for pH and temperature) |
| | pH | 6.0 to 9.0 |
| | Temperature | Shall not exceed 5°C above the ambient temperature of the receiving body |
| | Oil and Grease | 10 |
| | Suspended Solids | 100 |
| | Cyanides (as CN) | 0.2 |
| | Ammonical Nitrogen (as N) | 50 |
| | Total Residual Chloride (as Cl) | 1.0 |
| | Cadmium (as Cd) | 2.0 |
| | Nickel (as Ni) | 3.0 |
| | Zinc (as Zn) | 5.0 |
| | Hexavalent Chromium (as Cr) | 0.1 |
| | Total Chromium (as Cr) | 2.0 |
| | Copper (as Cu) | 3.0 |
| Lead (as Pb) | 0.1 | |
| Iron (as Fe) | 3.0 | |
| Total Metal | 10.0 | |

Integrated Study on Wetland Conservation and Urban Growth : A Case of Calcutta's Wetland

Institute of Wetlands Management and Ecological Design, Calcutta

INTRODUCTION

OBJECTIVES OF THE STUDY

The East Calcutta wetlands are peri-urban wetlands near the metropolis of Calcutta. The functional use of the East Calcutta wetlands has developed it into a unique man-made eco-system. The area has been identified with waste recycling practices. Waste recycling not only provides fish, vegetables and crop production throughout the year but also supports low cost urban sanitation and spill basin to reduce water-logging of a congested metropolis like Calcutta.

Such waste recycling practices in these natural wetlands have been evolved by folk culture through indigenous methods. This traditional approach may be useful in alleviating urban sanitation problems in many other cities and towns of the third world countries.

However, the East Calcutta wetlands are threatened by the continuous expansion of the city of Calcutta. The present study has attempted to identify environmental management practices and has helped in designing a capacity building programme for the implementation of environmental management plans through such practices in other cities/towns.

AN OVERVIEW OF CALCUTTA'S WETLANDS

The East Calcutta wetlands stretch across the eastern margin of the city of Calcutta. These peri-urban wetlands lie between 22° 25'N and 22° 30'N latitude and from 88° 24'E to 88° 35'E longitude. Physiographically the region lies between the River Hooghly in the west and the River Bidyadhari to the east. These marshes and waterbodies are the results of intricate drainage patterns over the moribund delta. Till the nineteenth century the Bidyadhari River flowing over the region was active and tidal. The region actually turned into a spillway basin with the incursion of saline tidal water and hence is popularly known as salt water lakes. With the decay of the River Bidyadhari the eco-system has been greatly modified.

In 1928 the River Bidyadhari was declared dead by the Irrigation Department, Government of Bengal. In the early thirties of this century a storm water flow (SWF) channel was excavated by B N Dey, the then Chief Engineer, Calcutta Corpo-

ration, to drain the sewage water of the city and was connected with the Kultigong and ultimately drained by the River Raymangal into the Bay of Bengal. Later on to facilitate efficient drainage a dry weather flow (DWF) canal was laid parallel to the SWF. This change in the drainage layout resulted in the development of a changed eco-system linked with the environment of the city of Calcutta. The entire domestic sewage of the city of Calcutta (estimated 680 million litres/day) runs through a system of principal and ancillary channels passing through the East Calcutta wetlands. These flows are utilised in the sewage treated fisheries (STF) for pisciculture as nutrients and the wetlands purify the sewage water through a natural process of oxidation, radiation, biological breakdown of organic waste and pisciculture. The tropical climate with moderately high temperature and abundant solar radiation (250-600 langley's/day) and shallow depth of water (less than 1m) have facilitated the evolution of this unique eco-system. Interestingly, these complete ecological processes have been understood by the folk fishermen of this wetland region and experimented upon to generate resources and employment.

ECO-SYSTEM AND RELEVANCE OF THE STUDY FOR WETLANDS CONSERVATION

The East Calcutta wetlands are physically identifiable with the deltaic floodplain wetlands, generated by the intrication of drainage channels related to delta-building. The natural decay of the river systems has resulted in the changing aquatic environment. The wetlands eco-system has also been interfered with by the anthropogenic activities and has deteriorated. The biodiversity of these wetlands had been lost many centuries back. According to the Asian Wetland Bureau (1989) the Salt Lake Swamp (the East Calcutta Wetlands) has been too degraded to merit any special conservation effect. But as mentioned earlier these wetlands have acquired unique importance integrated with urban environmental and peri-urban resource management. These peri-urban wetlands fulfil the criteria for identifying Wetlands of International Importance (Ramsar Convention) that these are of substantial value in supporting human communities dependent on the wetlands. In this context, such support would include :

- provision of food, fibre or fuel
- or maintenance of cultural values

- or support of food chains, water quality, flood control or climatic stability.

The functional use of the East Calcutta wetlands for sustainable development has become the focal point for delineating the wetland area. The area has been identified with the Waste Recycling Region. The Waste Recycling Region includes the mouzas where anyway the sewage or garbage wastes are being utilised either for fish farming or crop farming. This Waste Recycling Region covers nearly 11032.23 ha. area.

DEFINING THE WETLANDS AND RELATED ATTRIBUTES

Though there has been attention to the study of wetland ecosystems, there is yet no single, universally accepted definition of wetlands. This has been due to wide diversity in the nature of the wetlands. However, a definition of the wetlands has been outlined by the 1971 Ramsar Convention. (WWF, 1992)

The wetlands are defined as "area of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or saline including areas of marine water, the depth of which at low tide does not exceed six metres". Moreover, the wetlands "may incorporate riparian and coastal zones adjacent to the wetlands and islands or bodies of marine water deeper than six metres at low tide lying within the wetlands". This definition appears to be the most comprehensive one extending to a wide variety of habitat types including rivers, coastal areas and even coral reefs. Identification of these distinctive characteristics will be useful in designating a wetland. These are : (1) when an area is permanently or periodically inundated, (2) when an area supports hydrophytic vegetation; and (3) when an area has hydric soils. By all criteria the Salt Lake Swamp (East Calcutta Wetlands) can be identified as wetlands.

POST INDEPENDENCE PERIOD

Since the Partition of India, there has been an unprecedented pressure of population over the metropolis of Calcutta creating an urgent need for the acquisition of new land for urbanisation. The growth rate for Calcutta's urban population since then has increased phenomenally with refugees from what was once East Pakistan and is now Bangladesh. In the early fifties, as quoted in the West Bengal Assembly, nearly 5.17 lakh families had officially migrated from East Pakistan, an additional number had entered illegally. Out of the total nearly 2.45 lakhs of families demanded house building loans. Proper housing provision lagged far behind this rapid influx of immigrants. On the other hand economic activities in Calcutta's city increased but no such growth was seen in any other city in the State. Thus, following the natural laws of economic and geographical agglomeration new entrants to the state tended to converge on Calcutta city to maximise the benefits of employment and income generating opportunities. The scarcity of urban land has forced them to settle down in outlying areas on the periphery with access to road and rail transport. Howrah city along

the western bank of the Hooghly prevents the expansion of Calcutta westwards. Howrah city could have been developed into a twin city had there been more bridges over the Hooghly connecting it with Calcutta.

The city has expanded from north to south to accommodate the immigrants and the spill over population of the city. Most of these areas are inhabited by dwellers dependent on the core city for education, services, livelihoods, better health care facilities etc. With the continued increasing pressure on the railway and roadway transport system it has become virtually impossible to cope with the tremendous pressure of the daily commuting to and fro.

Since 1960-61, the Calcutta Metropolitan Development had been subjected to various planning decisions. There had been a frantic search for alternative directionalities as the land use of the city had become ungovernable with unbearable density. The first choice was to expand the city area to the east on the marshy tract of the northern salt lake area. Following a BDP (Basic Development Plan) nearly 17,333 acres was to be acquired for developing a new township. Later, an estimated area of around 4 square miles was reclaimed and the new Salt Lake City was established mainly to provide housing facilities to urban people. This was certainly a shift in the directionalities of the city area which had been earlier in the north-south alignment following the eastern railway track on the east bank. The construction of the Eastern Metropolitan bypass along the eastern fringe has opened up the possibility of infringement on the wetlands further towards the east. With the existence of this acute problem in maintaining this infrastructural framework, the vast East Calcutta wetlands have thus been brought under focus of urbanisation besides the present level of utilisation as a vast area for sewage and garbage disposal and area for sewagefed fisheries and agriculture.

METHODOLOGY OF THE STUDY

Generation of data base and information appears to be very useful in outlining methodologies. Capacity building nowadays is considered as state of the art in time-development-process for understanding the problem in depth. Capacity building will attempt developing a holistic approach to training with focus on strengthening the capacity of national, regional and local institutions of training.

In this study, a comprehensive method for collection of data, analysis of research inputs and formulation of strategies has been adopted.

A detailed report has been prepared on the East Calcutta wetlands to study and understand the age-old waste recycling practice both conceptually and practically. An attempt has been made to study the evolution of the practice in historical perspective related to the growth of the city of Calcutta. Present mechanisms of operation in terms of technical inputs, institutional and legal framework, demographic situation, resource genera-

tion, role of different interest groups/NGOs and gender aspect have been discussed. The objectives of the best practices are highlighted for sustainable use and potentiality of their replicability and scaling up

The study is also intended to formulate a national strategy towards the protection and utilization of periurban wetlands. The low cost technology of oxidation pond for urban waste water treatment will open up a new vista for urban sanitation in the Third World countries in particular. Modification of present policies and legal framework has been suggested for effective implementation of this model for sustainable use.

THE WETLANDS IN EAST CALCUTTA

ROLE OF WETLANDS

It is now universally accepted that wetlands, far from being the wastelands of past perception, can have a wide range of valuable functions which provide goods and services to mankind. The essential ecological roles of wetlands are converted into important benefits to mankind through the relevant ecosystem elements and functions

The wetlands are ecotones since these are transitional from terrestrial to deep water aquatic systems. Such transitory location often leads to high diversity in wetlands. Mitsch and Gosselink (1986) considered the wetlands as amongst the most productive ecosystems on earth. In recent years the manifold values of wetlands have been identified (Maltby, 1986). These are: i) Genetic Conservation, ii) Water Treatment, iii) Nutrient and Heavy Metal Removal, iv) Freshwater Fisheries, v) Flood Mitigation, vi) Tourism, vii) Wild Life Habitat, viii) Energy and Carbon Dioxide Storage and Release of Oxygen etc.

Serial determination of the probable value of wetland functions and uses has been indicated in Table 8.5. The East Calcutta wetlands do also possess all such values. In a recent judgement of Calcutta High Court in the case *PUBLIC-VS-State of West Bengal*, the values of East Calcutta wetlands have been highlighted. The court observed that "Wetlands being a bounty of nature do have a significant role to play in the proper development of the society be it from environmental perspective or economic perspective. Pollution-wise this metropolitan city of Calcutta tops the list in the country. Can we in this city further endanger the environment by reclaiming the nature's gift to mankind when, in fact, such a reclamation is only for the purpose of expansion of the satellite township on the eastern fringe of the city of Calcutta?" (CLJ, 1993).

AREA OF WETLANDS

The East Calcutta wetlands lying on the eastern fringe of the city of Calcutta between lat. 22° 25'N - 22° 30'N and long. 88° 24'E - 88° 30'E, stretch over an area of about 11,000 ha

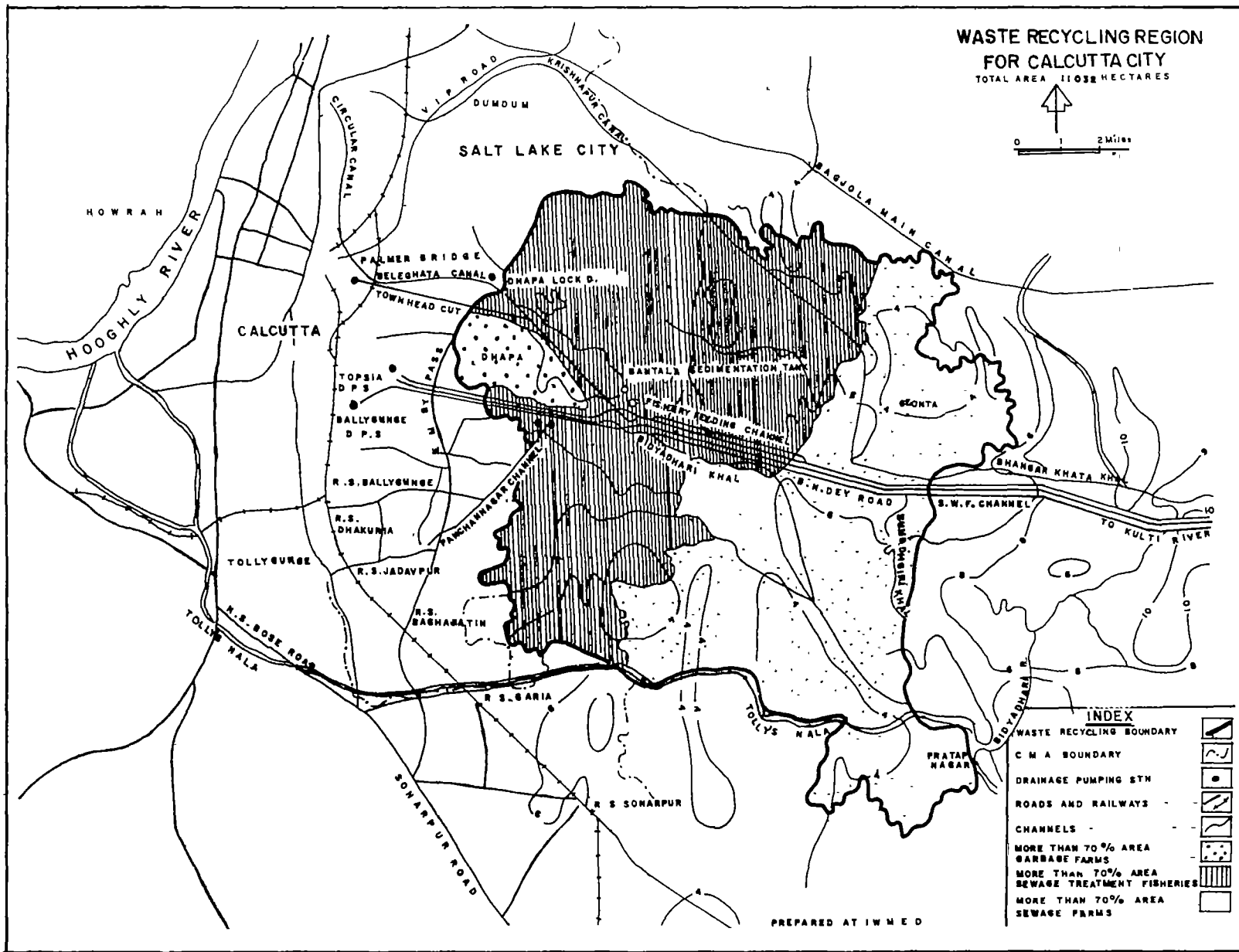


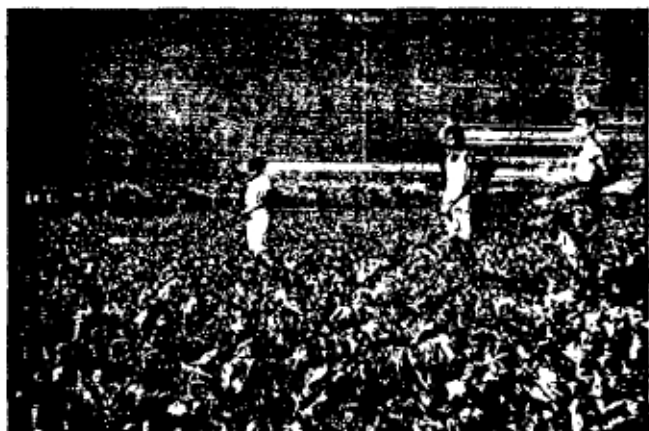
East Calcutta Wetlands

Though Calcutta's location was the least likely place for a metropolis the proximity of the wetlands came to the rescue of the city's environment in a later period. Calcutta grew as a metropolis without any sewage treatment plant and all its sewage was drained through the wetlands and garbage was dumped on the wetlands. The wetlands played a significant role in treating the sewage and in turn converted the municipal wastes into resources. Three distinct transformations into wealth are evidenced in the use of this garbage and sewage, namely, 1) Garbage Farming (GF), 2) Sewage Treated Fisheries (STF) and 3) Sewage Farming (SF).

GARBAGE FARMING

- i) A study of IW MED (1986) (village-based) reveals that out of a total of about 720 23 acres of agricultural lands, about 393.78 acres utilise municipal garbage and sewage for farming, either partly or fully. Production of vegetables (about 11 to 16 crops produced per year) and fruits together with paddy cultivation are carried out on garbage and sewage-fed farms.
- ii) The garbage farms in Dhapa cover an area of about 800 acres, comprising nine villages of Dhapa, Hatgachha, Boinchtala, Shahababad, Durgapur, Anantabadal, Arupota, Khanaberia and Chowbagha. The practice of garbage-dumping and farming dates back to the 1870s and the entire ground level has been raised by 1.5 to 2 metres or so at present, after continuous garbage dumping for a period of more than 100 years. The average annual increase of the ground level is about 6 mm, composed entirely of consolidated garbage.
- iii) The unique system of garbage dumping by leaving long strips of waterbodies in between two dumping grounds, has resulted in the development of alternate strips of garbage filled areas (to be utilised for garbage farming) and strips of waterbodies (containing





Vegetables produced in Garbage Farming meet 30% of city's demand

sewage for irrigation of the crops and vegetables produced on such garbage farms).

- iv) There are about 2490 farm plots in the Dhapa area practising garbage farming, ranging in size from 5-30 cottahs (1 cottah=720 sq ft). Usually 2-3 main crops are grown in the area, namely, cauliflower (in winter), ridge gourd (in summer) and maize (in autumn). According to the season, however, a variety of secondary crops are also grown along with the main crops. About 11-16 varieties of crops can also be grown in certain plots.
- v) At present the Calcutta Municipal Corporation owns the entire Dhapa Region with all the farmers being tenants or sub-tenants. The entire responsibility of farming operations, marketing, rent payment and so forth lie with them. The rent of the land varies from Rs.1800 to Rs.2400 per acre per year, depending on the number of crops cultivated and the productivity thereof.

The present area of garbage farms in Dhapa covering about 315 ha and under the direct control of the Calcutta Municipal Corporation (CMC) has been subjected to intense pressure owing to rampant urban sprawl. The best solution therefore lies in introducing proper legislation in order to prevent further destruction of these wetlands. The CMC along with other competent authorities should move for a "Wetland Protection Bill" to save the wetlands.

SEWAGE FARMING

Paddy cultivation, utilising nutrient-rich fishery effluent as irrigation is also prevalent here. Such cultivation is known as Sewage Farming. Such farming covers nearly 4888 ha. area. *Aman* (during rainy season) and *Boro* (during winter season) are grown. The production of *Aman* is about 8 quintals per acre (nearly 2000 kg per ha) per year and that of *Boro* is about 10 quintals per annum. However, compared to the production

from the adjacent fisheries which produce fish all the year round, the overall production from the sewage-irrigated farms is poor. This is because about half of the *Aman* land (which is not suitable for production of *Boro*) lies fallow after the first harvest.

On the whole, about 5000 ha. of lands in East Calcutta are covered by sewage-farms (fishery-effluent irrigated agriculture) and provide about 11-16 crops every year. The daily average production of fresh vegetables is about 147 tonnes, growing about 15 times, besides a variety of paddy. (Table 8.4)

TABLE - 8.1 YIELD OF VEGETABLES PER YEAR IN A ONE-ACRE FARM (AVERAGE OF 10 FARM PLOTS)

| Name of Crops | Yield |
|--------------------|--------------|
| Cauliflower | 15,000 heads |
| Ridge Gourd | 45 Quintals |
| Maize | 45 " |
| Radish | 45 " |
| Yam | 70 " |
| Brinjal | 90 " |
| Bottle Gourd | 240 " |
| Bottle Gourd Plant | 126 " |
| Pumpkin | 180 " |
| Pumpkin Plant | 30 " |
| Bitter Gourd | 9 " |
| Spinach | 90 " |
| Pui | 108 " |
| Danta | 90 " |

Source: Growing Vegetables on Garbage : A Village Based Experience, Nov., 1986, Published by IW MED, Calcutta

SEWAGE TREATED FISHERIES

- i) Sewage-fed fish culture in the wetlands of East Calcutta might have originated a long time back in the nineteenth century than is generally supposed to be. The person who took lease of a piece of land (Dhapa Square Mile) in this part of the city evolved a unique garbage disposal plan in order to cultivate the lands (garbage farms) as well as produce fish. Thus, elongated finger-like waterbodies or ponds are left in between large tracts of farm lands (garbage farms) so that water could be stored to be utilised for irrigating the crops in the adjacent lands. Such fish culture could be the sewage-fed type

- ii) Since 1850 the wetlands of Calcutta were reclaimed for brackish water aquaculture. The source of water was the tidal river Bidyadhari. Such *Nona Bheries* used to produce salt water fish namely, *bhetki, parse, bhongor, prawns*, shrimps etc. proved to be a very lucrative occupation, the yield being 148 kg per ha.
- iii) With the silting up(officially declared dead in 1928 by the Irrigation Department of Bengal) of the river Bidyadhari, the entire area became a vast derelict swamp.
- iv) Subsequently, with the entry of increasing volumes of sewage from the city of Calcutta into these areas, the original salinity of 800-1200 ppm. dwindled to 500-600 ppm. Thus an ideal condition for fresh-water fish culture was initiated.
- v) In 1945, an area of 11,570 acres was used for sewage-fed fisheries, yielding an average of 3.40 quintals per acre. By 1985, however, this area has reduced considerably to only 7500 - 8000 acres. On the other hand, the yield of fish has increased from 3.40 to 10 quintals per acre with scientific management. The main fish produced are *rahu, katla, mrigal, carp, tilapia, prawns* etc. - about seven varieties.
- vi) Sewage-fed brackish water aquaculture has flourished since 1960 in estuarine areas, 30 km. east of Calcutta (WBSLUB, 1984). These systems use city sewage that drains into the river Kulti.

The fisheries taking in raw sewage as an input, release a highly purified nutrient-enriched effluent through an internal grid of drainage channels, excavated and maintained by entrepreneurs. They are again utilised for irrigating the crops and paddy grown in adjacent garbage-farms. At present there are about 176 sewage-fed farms, the holding pattern being 10 acres to 200 acres.

Calcutta's immense urban waste output of about 680 million litres per day is thus treated naturally - a unique cost-effective system.

The sewage-fed fisheries are considered to be the world's largest single such system of sewage treatment. Along with sewage treatment, stereo-breeding of fish is another technology which can be exported. The fish produced in this method meet about ten percent of Calcutta's fish supply. Sewage treatment ponds range in size from 10-30 acres, but may also be as large as 200 acres.

Stocking density of such fisheries (sewage-treatment fisheries) varies from 3 to 8 tonnes per ha. With adequate management

and technological support it may even reach 10 tonnes per ha. It must be noted that low concentration of trace metals in Calcutta's sewage and the natural protection provided by the abundant water-hyacinth restrict the transport of metal from the sewage to the fish. Table 8.2 shows the amount of treatment.

TABLE - 8.2 IMPROVEMENT OF WASTE WATER QUALITY THROUGH IN SEWAGE TREATED FISHERIES

| Characteristic | Inlet | Outlet |
|----------------|-----------------------------------|----------------------|
| B.O.D | (ppm)120-150 | 20-30 |
| D.O. (ppm) | 0 | 5-7 |
| pH | 6.5-7.5 | 6.5-7.5 |
| Coliform Count | 10 ⁵ - 10 ⁷ | 10 - 10 ² |

Source: D.Ghosh - 'Calcutta . Fisheries for Sewage Treatment in Science-Technology. Focus - June-July, 1988.

It is thus proved that the sewage treated fisheries improve the water quality to an extent which may be comparable with a well-managed stabilisation tank, in addition to which they produce a fish yield of 3-7 tonnes per ha in a moderately efficient tank.

TABLE-8.3 THE OWNERSHIP PATTERN OF PISCICULTURAL LAND IN EAST CALCUTTA.

| Type of Holding | Area (Acres) | Percentage |
|-----------------------------------------|--------------|------------|
| Private | 6520 | 93.14 |
| Co-operative | 60 | 0.86 |
| State Fisheries Development Corporation | 420 | 6.00 |
| Total | 7000 | 100.00 |

Source: Directory of Sewage-Fed Fisheries in East Calcutta, Directorate of Fisheries, Govt. of West Bengal

Pisciculture is a more labour-intensive and profitable activity than vegetable and paddy cultivation in the same area. Today Calcutta's yearly fish requirement is about 1.6 lakh tonnes, but the supply is a mere 50,000 tonnes, out of which 33,000 tonnes comes from other states, contributing 65 percent to 70 percent. The state's fish production has increased more than 8 tonnes per acre in the past thirty years. However, the fish supply from other districts of West Bengal to the city of Calcutta has



Sewage Feeder Canal

declined from 17 percent in 1947 to 4 percent in 1981. At present, the fish supply from the East Calcutta wetlands to the city has declined from 12,720 tonnes a decade ago to 4,000 tonnes (10 percent of fish supply). This trend calls for the protection of the fish ponds in the wetlands of East Calcutta.

THE TECHNOLOGY OF SEWAGE-TREATMENT FISHERIES (S.T.F.)

Pisciculture in sewage requires a unique environment because it should neither be an impounded waterbody nor a flowing stream. Waste water which is released intermittently is detained in the shallow ponds for a definite period in order to allow the cycle of nutrient recovery in the aquatic food chain to be completed.

The importance of a drainage outfall system is thus great in sewage-fed aquaculture. Domestic sewage and storm water from the city of Calcutta are mostly carried through combined sewers. The outfall drainage channels were separately designed for 'dry weather flow' (DWF) and 'storm water flow' (SWF) channels. The population covered by the outfall channel capacity is 4 million, over an area of about 94.5 sq km.

The DWF channel starts from Topsia Point A, covering a length of 32 km to reach the river Kulti Gong at Ghusighata. At a distance of 6.4 km from Topsia Point A, the outfall channels are connected with the sedimentation tanks at Bantala (constructed in 1943). The design capacity of the DWF channel is 387 cusecs (14.3 cu m/sec.) which accounts for 296 cusecs of waste water generated by an assumed population of 4 million, allowing for a water consumption of 50 gallons/capita/day. Since river Kulti Gong is a tidal river and its water level is higher than that of the drainage canal for a part of a day, the gates at the mouth of DWF are closed to stop entry of river water into the drainage canal- a period called Tidal Lockage.

The SWF channel, covering an area about 150 sq. km, begins at Ballygunge Drainage Pumping Station for 34 km to reach

river Kulti Gong. The original capacity of 2011 cusecs was subsequently revived to 4966 cusecs.

The main purpose of the SWF channel was to carry storm water of the city along with its parts to adjacent urban and rural areas.

In Sewage Treated Fishery, raw sewage enters through an inlet into the septic zone from where it flows into the eutrophic zone where fish grow and develop for about 10-15 days and from there it goes out through an outlet. It is to be noted that the water in the eutrophic and outlet zones possesses a much lower E-Coli and BOD value and a considerably higher DO value than the septic zone through the natural biological process allowing the production of fish. The depth of the sewage-fed tank is about 3 ft. (50-150 cm) with a flat bottom, allowing the entry of the sun's rays which kill much of the bacteria and allow the algae to photosynthesize.

Waste water or sewage is introduced into the fish ponds in limited quantities at intervals and is similarly released. However, when these ponds are large (more than 40 ha), the waste water flow is almost continuous for about 15-21 days. It must be borne in mind, however, that the dissolved oxygen level should be maintained, so that fish do not die. The fish require dissolved oxygen in the pond for their survival.

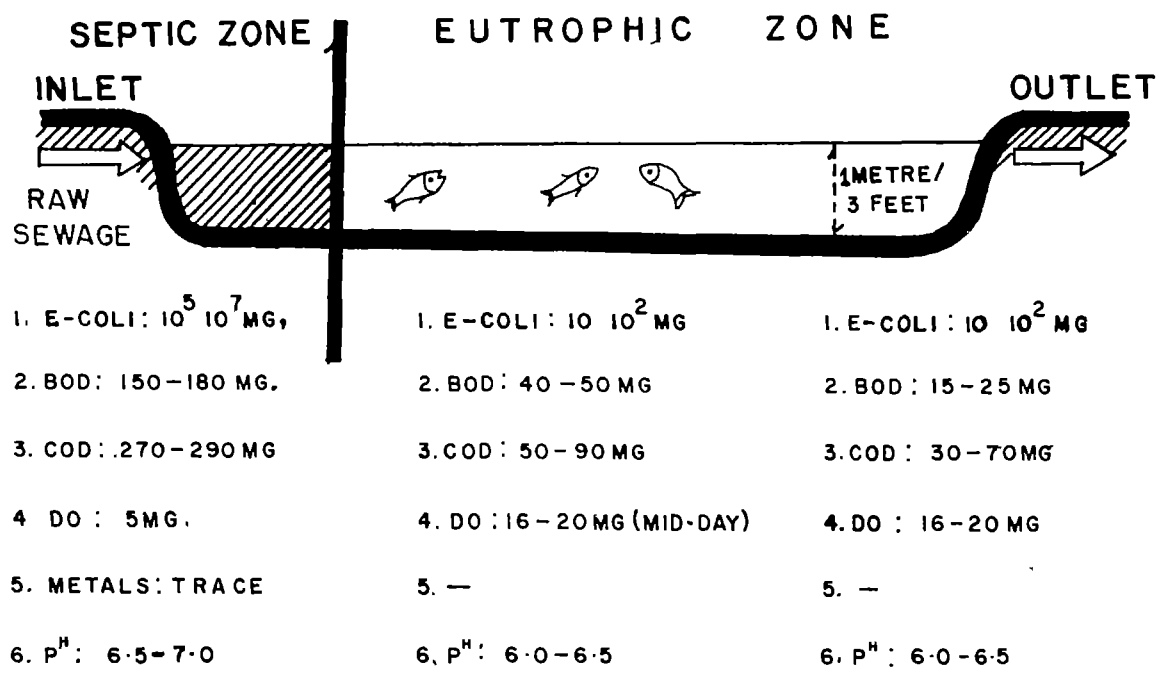
There are basically two ways in which the organic content of sewage influence fish production - (a) Indirectly through mineralisation (the rate is higher in warmer climates) of the organic material to provide inorganic nutrients to the algae or phytoplankton, which can, in its turn, be used as a source of food by appropriate fish species, and (b) through direct consumption of the waste as food.

Table-8.4 shows the five major phases (each involving one or more activities), characterising the sewage-fed aquacultural system.

TABLE-8.4 PHASES OF STF CULTURE

| Phase | Activity |
|-----------------------|--------------------------------------|
| Pond preparation | a) Pond draining |
| | b) Sun drying |
| | c) Desilting silt traps |
| | d) Tilling |
| | e) Repairing dykes |
| Primary fertilisation | a) Filling with sewage |
| | b) Facultative |
| | c) Stirring |
| Fish stocking | a) Test fish |
| | b) Fish stocking proper |
| Secondary | a) Filling with sewage fertilisation |
| Fish harvest | a) Net selection |
| | b) Team management |
| | c) Haul disposal |

CHART ON SEWAGE TREATMENT FISHERIES IN EAST CALCUTTA



ADVANTAGES OF SEWAGE-FED FISHERIES

- a) The large algae production from sewage oxidation ponds or those fed by effluents can be utilised either by directly stocking into these (provided they can tolerate the difficult environmental conditions that occur).
- b) The algae can be harvested and used as a protein-rich additive to compound diets for fish or other domestic animals
- c) The appreciable disinfection effects of such fisheries cannot be overlooked. The community production system found in fish ponds appears to have no coliform bacteria(including the enteric or pathogenic types). Thus each drop of water is purified raw sewage.
- d) The air quality is also improved. Thus, the wetlands are considered to be the 'lungs of the city'(Fig.6). The atmosphere is free from dust and imbued with oxygen produced by the multitude of pond algae and macrophytes' respiration. Dissolved oxygen (DO) ranges between 2-5 ppm. (early morning) to 20 ppm. (mid-day) with variation of temperature of 30-35 C. under pH condition of 6.-6.5 which is comparable with the finest eutrophic lakes. The villagers have been using the pond water for domestic purposes for the last 50 years with no record of epidemic or enteric diseases.

The sewage-treatment fisheries act as an excellent stabilisation pond. The reduction of BOD and coliform bacteria has been remarkably high, even 99 percent in some pathogene bacteria. The metal ion contents also appear to be very low (less than 0.1 ppm) for copper, lead, zinc, nickel, chromium and cadmium

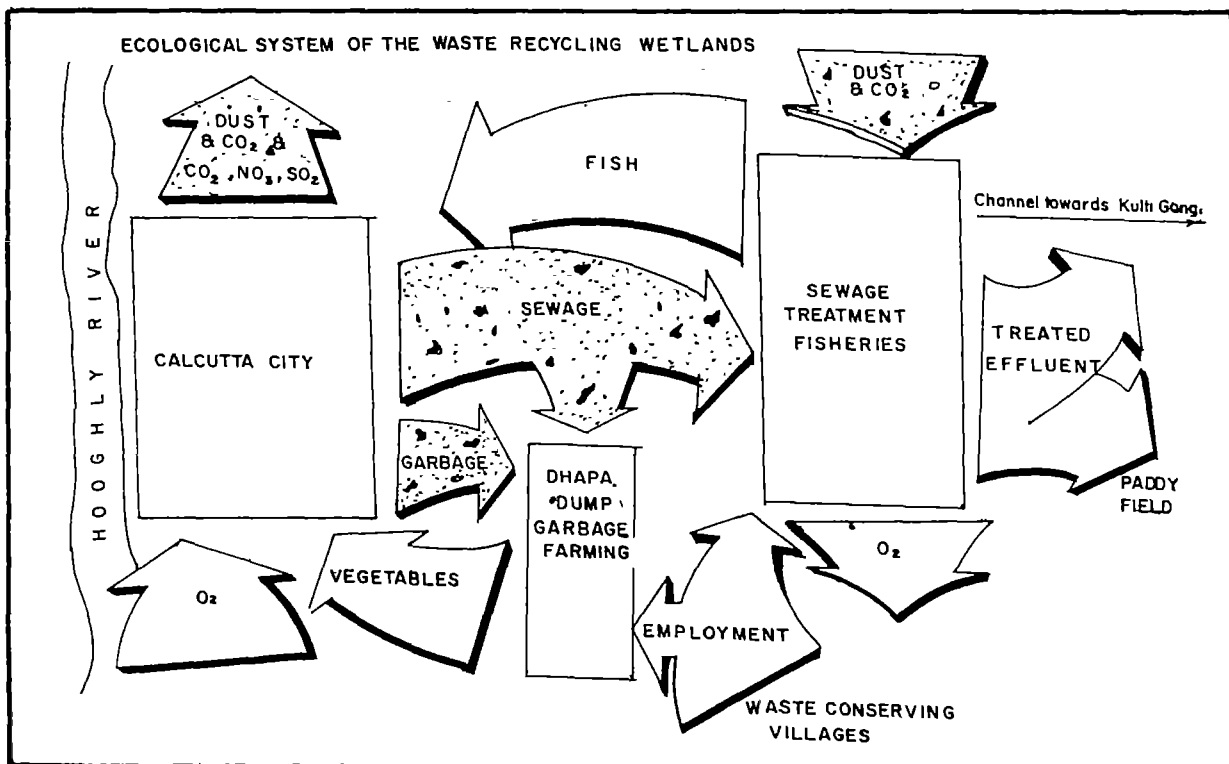
- e) The sewage-treatment fisheries provide nutrient-enriched safe effluent for irrigating the crops and paddy in the adjacent farms.
- f) Undoubtedly sewage-treatment fisheries prove to be the low-cost natural way of sewage-treatment and this sanitation technology can even be exported.

VALUE OF EAST CALCUTTA WETLANDS

As already mentioned, the East Calcutta wetlands provide the four major elements of natural resources, and that too, free and in a purified form - i) sunshine, ii) air, iii) land, and iv) water.

The value of flood plains and marshy tracts may thus be stressed upon This holds a key to sustainable use of a resource base Hence, land and water management practices hold much value

The underground water-table of the wetland area is recharged through natural seepage, both from precipitation and percolation (through drainage channels to a certain extent) in the sub-surface layers. Thus, the area may serve as a potential



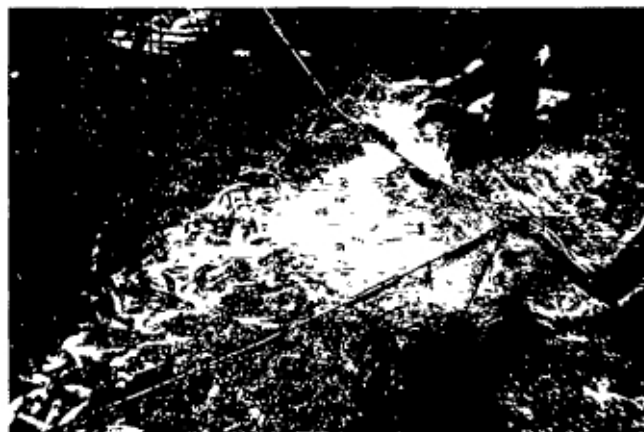
area for groundwater development to cater to the water needs in the irrigation, domestic (drinking, bathing) and industrial sectors alike - in case of paucity of water arising in the near future subsequent to further reclamation (for various purposes) of the wetlands.

The East Calcutta wetlands act as an ideal Waste Recycling Region located beyond a mere 5 km. from the city centre and covering an area of about 11000 ha. A completely natural and indigenous method which is also cost-effective is employed here, serving about 1 lakh people in the fringe area.

EMPLOYMENT GENERATING ACTIVITIES

The main occupation of the wetlands may be enumerated as follows:

- i) Farming - Vegetables and paddy are grown. Each acre of agricultural land has on an average, mandays of 2.48 persons throughout the year. On the basis of the annual crop calendar, the annual productivity of vegetables is calculated to be at 1500 quintals per acre. Vegetable production is about 10,000 tonnes per year and paddy production about 24,000 tonnes per year.
 - ii) Fishing - About 10,000 people are employed. Each acre of sewage-fed fisheries has mandays (on an average) of 3 persons throughout the year. The yield is about 10 quintals per acre. Although the area of sewage-fed fisheries has decreased from 11,570 acres in 1945 to about 7,500 - 8,000 acres, the productivity has increased from 3.39 quintals to about 10 quintals per acre - owing to effective management practices.
 - iii) Rag-picking employs about 20,000 to 25,000 people.
 - iv) Skinning of carcasses, tanning hides, shaving wool and hair etc. - About 10,000 to 15,000 workers are engaged in retrieving dead flesh, bones and hooves which are usually converted into fertiliser, cosmetics. Again the CLC - a big leather complex is also expected to be set up near this zone. This integrated leather complex will come up at Karaidanga, by assimilating about 550 scattered tanneries which are now mostly located at Topsia, Tiljala and Tangra and employ about 20,000 and 25,000 people.
- The State Tanning Industry earns valuable customs (both national and foreign exchange) by supporting an equally large population in wholesale and retail concerns and sale outlets. A single integrated waste-treatment plant covering about 1,000 acres has also been proposed for Karaidanga.
- v) Ancillary activities - Transportation, packaging, wholesale and retail marketing of products also employ a large population.



The yield in fish pond is about 10 quintals per acre.

On the whole, about 3 lakhs mandays per year of rural employment in these wetlands has been calculated. Because of the age-old traditional practices of the local people, there has been a steady development of village communities and an economic stability has set in these fringe areas.

INSTITUTIONAL ARRANGEMENT AND PARTNERSHIPS

A Report on the Status of Wetlands in Asia by the Asian Wetland Bureau has outlined the East Calcutta Wetlands as one of the most seriously threatened wetlands in Asia. The East Calcutta wetlands are even considered to be already too degraded to merit any special conservational effort.

The scenario has become complex with the conflicting role of different institutions in this area. As long as it is claimed that the best practices (in the Ramsar term wise use) carried on in the East Calcutta wetlands are cost-effective, the system needs to be protected from any external hindrance. Along with this protective plan appropriate measures should be taken to facilitate this indigenously evolved wise use with the participation of concerned institutions.

Conflicting interests are prevalent in the East Calcutta wetlands like any other wetlands. It is necessary to promote certain measures or procedural steps from legal perspectives for protecting the available and reversible wetlands. Along with the policies, strict legislation must be enacted at the State or Central level for the purpose of conservation. Though the introduction of the strict legal regime may be useful, it is also necessary to motivate the people in understanding the threat vis-a-vis the wise use of the wetlands. Experiences will show contradictory attitudes of different departments competing with each other for projects and associated funds, as has happened in some African countries like Guinea-Bissau. In such a conflicting situation a strong legislative framework can even be used by NGOs and other pressure groups to mitigate the destruction of wetlands.

A look into the role played by different institutions in East Calcutta wetlands reveals several agencies/institutions playing the role of actors in the East Calcutta wetlands. These are namely - Department of Forests and Environment, Department of Fisheries, Department of Irrigation and Waterways, Calcutta Municipal Corporation, Calcutta Metropolitan Development Authority, Department of Rural Development, Panchayats and Zilla Parishads, Department of Land and Land Records, Institute of Wetland Management and Ecological Design under Government of West Bengal and Geological Survey of India, Zoological Survey of India and Botanical Survey of India under the Government of India.

Of these again, a few departments such as Fisheries, Irrigation Waterways, CMC and CMDA play important roles. Their objectives are manifold. These include wastewater utilisation in fisheries, garbage farming, wastewater use for crop farming, drainage, sewage and irrigation. The role of different institutions in the management of East Calcutta Wetlands can be revealed from Table 8.6

The Department of Irrigation & Waterways control all the channels passing through the East Calcutta wetlands. The sewage fed fisheries use the sewage water from the DWF/SWF channel which carry all the municipal sewage under the monitoring of the Irrigation Department. Even during the monsoon season, the fisheries do not get the required sewage water at regular intervals. The Irrigation Department considers the drainage to mitigate waterlogging in the city as priority. If the gauge level is maintained at a high level by locking the gates to feed the fisheries channel, it may adversely affect the drainage resulting in waterlogging with the sudden monsoon outbursts. Thus proper monitoring is needed, particularly by the Irrigation Department to ensure the regular supply of sewage to the fisheries and to maintain the gauge level throughout the year. A new outfall channel to the Kulti Gong has been proposed by CMDA to regularise the sewage supply and to facilitate the drainage outlet.

According to the Fisheries Department, the state-owned fisheries are well managed and are producing at a low cost level. Though the proportion of state-owned fisheries is very low (about 6 percent), the efficiency of these fisheries is mainly due to regular financial support. It has been surveyed that over-exploitation of some particular fishery ponds in the wetland occurred, which should be controlled by temporarily withdrawing fishery activities under the supervision of the concerned authority. Financial incentives should be propagated to increase the efficiency of privately owned as well as state-owned fisheries through possible technology inputs.

Though most of the delineated areas of East Calcutta wetlands lie outside the Calcutta Metropolitan District, CMDA has prepared a drainage development plan of the area. Many other projects on the fringe of the wetlands have also been undertaken by CMDA. The Waste Recycling Region has also been delineated based on an earlier survey made by IW MED. This

includes the area where sewage water is used either for fisheries or crop farming.

It is urgently required to delineate the area of East Calcutta wetlands as a statutory authority. In 1993, CMDA brought out a report suggesting the establishment of a Wetland Conservation Authority for the State of West Bengal. No such step has yet been taken by the State Government, only the Ministry of Environment and Forests (MOEF), Government of India mooted a proposal to declare the East Calcutta wetlands as a Ramsar site. Such a declaration without constituting any authority for conservation will be of no help. The Authority, if constituted, shall make out an Environmental Management Action Plan (EMAP). As reported such authority has been vested with the District Magistrate of South 24- Parganas, but neither action plans nor projected land-use plans have been worked out.

It is of utmost importance that one department being the designated as nodal agency oversee the working of the various developmental departments such as Fisheries, Agriculture, Rural Development and Irrigation. This would make it easier to sort out the differences, if any, between the departments whose interests are conflicting on the use of wetlands. The Department of Environment may be entrusted with this responsibility. Moreover, the institutions may be chosen to co-ordinate the government departments with the NGOs and the other pressure groups. IW MED under the umbrella of the Government of West Bengal, with an autonomous setup can do the job most effectively.

LEGISLATIVE AND REGULATORY FRAMEWORK

OVERVIEW

India is a contracting party to the Ramsar Convention and it is obligatory on her part to protect and conserve the wetlands. In India, there is no single central/state legislation relating to wetlands. However, there exist some legislations which have a direct or indirect bearing on wetlands protection and conservation. The weakness in the legislation on wetlands lies in the absence of any comprehensive law on wetlands. No statutory authority has been created for wetlands under any legal framework to oversee protection, conservation, management and to take appropriate penal measures for the violation of laws and regulations. Though different laws provide a number of avenues to seek redressal of environmental wrongs, it is difficult to serve the specific cause of wetland protection. There are two broad types of approaches to obtain correction of environmental injustice in the courts. The first is the traditional approach using the law of torts or civil wrongs. In most cases such legal procedures can be expensive and time consuming. The court will seek equitable justice for all parties to an action. This means that the court is unlikely to rule in favour of the plaintiff if the cost to deal with the environmental problem is clearly in excess of the benefits that would result from the solution. The second approach involves collective action based on shared goals among a group of people. In many cases these

are dividend paying. In this approach either an organisation is found for the purpose of conducting a suit of interest to many people, or the suit is undertaken by an organisation already in existence that specialises in this type of environmental law action.

EXISTING LEGAL FRAMEWORK

Though legal alternatives are available it is no less justified to enact comprehensive laws on wetlands. The need for such legislation was raised in the Wetlands Legislation Workshop organised by the British Council in Calcutta on 27 and 28 February, 1995. The existing laws in India which have direct or indirect bearing on wetlands protection and conservation can be examined to determine the extent of their influence.

1. The Wildlife Protection Act, 1972 (53 of 1972, later amended in 1982 (23 of 1982) and 1986 (23 of 1986) provides for the establishment and management of Sanctuaries (s.18), National Parks (s.35), Game Reserves (s.36) and Closed Areas (s.37). The Act also provides for an administrative regime to manage these protected areas and in its various schedules, lists many plant and animal species that are wholly or partially dependent on wetlands.

Some of the sanctuaries and national parks that have been created by state and central governments after the enactment of this Act incorporate important wetland sites within their designated areas. The Act no doubt enacted with laudable motives has fallen short of attaining its objectives.

2. The Water (Prevention and Control of Pollution) Act 1974 (No. 6 of 1974) and later on amended in 1990 with basic objectives of maintaining and restoring the cleanliness and wholesomeness of national aquatic resources by prevention and control of pollution.

Section 2(j) of the act reads as follows :

"In this Act unless the context otherwise requires, a 'Stream' includes i) river, ii) water course (whether flowing or for the time being dry), iii) inland water (whether natural or artificial), iv) subterranean water, v) sea or tidal water to such extent or as the case may be, to such point as the State Government may by notification in the official Gazette specify in this behalf"

"Wetland" would also clearly be included (in terms of *inland water*) in the above broad definition of 'stream' for the purposes of the Act. Thus the Central Pollution Control Boards have the power to obtain information and to plan a comprehensive programme for the prevention, control, or abatement of pollution of 'wetlands', and secure the execution thereof.

The implementation of the Water Act, however, is not possible so long as the Central Board does not lay down the level of wholesomeness of water for a particular wetland or where the standard has been laid down, if the State Boards do not take adequate steps for the maintenance of those standards, the appropriate remedy would be to file a writ petition on the ground of violation of fundamental right to life which as per aforesaid decisions would include the right to a clean, pure and unpolluted environment, praying for a *writ of mandamus* against the appropriate authority.

3. The Forest (Conservation) Act, 1980 (No. 69 of 1980) and Forest Conservation Amendment Bill, 1988 stipulate, without any special reference to wetlands within forest land, the conditions for conversion of any forest land for non-forestry purposes. While the conditions, subject to clearance for carrying out such conversion by appropriate authority are specific about the rules for compensatory afforestation, they do not refer to any such compensation for wetland areas that may be undergoing degradation/drainage/other changes due to development projects.
 4. By notification dated 19 February 1991, under section 3(1) and section 3(2)(v) of the Environment (Protection) Act, 1986 and Rule 5(3) (d) of Environment Protection Rules, 1986, the coastal stretches of seas, bays, estuaries, creeks, rivers and back waters which are influenced by tidal action (in the landward side) up to 500 metres from the high tide line (HTL) and the land between the low tide line (LTL) and HTL has been declared as Coastal Regulation Zone (CRZ). It is also clear that most important coastal wetland sites within 500 metres of HTL would fall within the purview of Category I (CRZ-I).
 5. Section 3(a) of the Land Acquisition Act 1894 (No. 1 1894) defines the 'land' - "The expression "land" includes benefits to arise out of land, and things attached to the earth or permanently fastened to anything attached to the earth".
- It is well established in a Court of Law that the term "land" includes land covered with water. A pond or a pool of water comes under the caption "land covered with water" and is "land" for the purpose of the Act. It is thus clear that "wetlands" would come within the purview of the Land Acquisition Act of 1894 and can be acquired by the state for public purpose on payment of adequate compensation.
6. The West Bengal Town and Country (Planning and Development) Act, 1979 has empowered appropriate authorities, including urban development authorities to call for return under Section 46(1) with respects to any development work, foreseeing change of wetland

area. It has emphasised that no permission for filling of tanks, ponds, water bodies, marshy land etc. will be given if it is considered necessary for being used as a) public waterbody, b) maintaining drainage facility, c) fire fighting purposes, d) environmental and ecological reasons, e) piscicultural purposes. This provision for the first time in India offered categorically a directive against wanton conversion of any wetland area

7. The Indian Fisheries Act, 1897 was enacted to regulate certain matters relating to fisheries. This Act has not been repeated by state/central legislatures and therefore continues in operation. Some Indian States, however, have adopted the Indian Fisheries Act with some modifications.

In 1984, the West Bengal Inland Fisheries Act (excluding small water bodies) was implemented to achieve proper use of water. In this Act though the protection of wetland areas was intended, the term 'proper use of water' was not very specific. By another amendment, dated 5 December 1985, the Competent Authority was authorised to take over the management and control of any tank for the purpose of proper utilisation thereof under Section 8(1) of the West Bengal Inland Fisheries Act, 1984 (West Bengal Act 25 of 1984).

A few other cognate Acts or Rules pertain to the management of wetlands. For instance, wetlands, or any part of such area which are forests and notified as "forest lands" earlier would come under the purview of all the provisions of the Indian Forest Act, 1927, the Forest Conservation Act, 1980 (and Rules, 1991)

Where management of cattle has to be done in wetland areas, the Cattle Trespass Act, 1871, would be applicable. The area on which it will apply has to be notified separately.

Where villages exist inside wetland areas, Article 243 (b), Schedule XI of the Constitution will apply. This is the 73rd Amendment of the Constitution after which most states have passed new Panchayat Acts. The Panchayat Acts vest the power of management of common lands and water in Panchayats. Any management plan for wetlands, in which Panchayats are involved, shall take cognizance of these statutory bodies. Joint Protected Area Management or Eco-Development Programmes need to take this into account.

In so far as the constitutional power of the central and state governments to protect the wetlands is concerned, this is distinctly applicable through Article 31A of the Constitution which permits acquisition for public purpose and Entries 17(a) and (b) of the Concurrent List III which provide the power to legislate for protection of forests and wildlife to both the central and the state governments.

The above documentation reveals that within the existing legal framework, the protection and conservation of wetlands can be

made, though it deserves to enact a comprehensive legislation for the wetlands. Even in cases of notified wetlands of national importance, like the East Calcutta wetlands, any strict legislation for conservation is yet to be framed.

WETLANDS MANAGEMENT ISSUES

The East Calcutta wetlands stand as a unique eco-system, highly fragile within the periphery of the expanding metropolis. These wetlands had been playing a crucial role as natural drainage basins for the sewage of the city of Calcutta and as dumping grounds for urban solid waste. These wetlands receive the sewage and garbage and in return provide a significant part of its requirements of fish and vegetables. Their role cannot be evaluated in economic terms alone. They play a significant role in treating the sewage of Calcutta in a natural and indigenous method of recycling without maintaining any sewage treatment plant. They may provide a foremost example of a low cost alternative in municipal waste recycling in the city's backyard.

These wetlands (particularly fisheries) are shrinking due to anthropogenic interference. From more than 20,000 acres in the sixties, today they have already been reduced to a mere 10,000 acres. Even more thrust is directed for the shrinkage of these wetlands. This had been continuing for the last several decades, even centuries.

Calcutta being the trade centre of the whole of eastern and north-eastern India, it needs continuous expansion with the growth of trade, industries and urbanization. The western side of the city is embanked by the river Hooghly, which excludes all possibilities of expansion towards the western side. The city gradually becomes elongated from north to south with a ribbon like development while vast stretches of land on the eastern side of the city remain unutilised as wetlands. The history of the development of the city of Calcutta will reveal that the city was grounded on the eastern levee of the River Hooghly with an expanse of flood plain wetlands on its eastern periphery. The city expanded towards the east by the process of land filling the basins and marshes which later impeded the natural drainage. In the last century and early part of this century, the river Bidyadhari was active and the problem was hardly felt. But since the 1930s the problem has been accentuated.

Since 1960-61 the CMD had been subjected to various planning decisions. There had been a frantic search for alternative directionalities as the land use of the core city had become ungovernable with unbearable density. The first choice was to expand the city to the east on the marshy tracts of the northern Salt Lake area. This was certainly a shift in the directionalities of the city area which had been earlier in north-south alignment following the Eastern Railway track on the east bank. The construction of E.M. Bypass along the eastern fringe opened up the possibilities of infringement on the wetlands further towards the east.

THREATS TO WETLANDS

The wetlands of the southern Salt Lake serving as drainage basins of the city core now have been threatened with the decision for the setting up of New Calcutta in nearly 186 sq. km. area of Sonarpur, Baruipur and Bhangar police stations. Serious questions have been raised on the rational land use of the area for the sprawling city. Environmental and ecological considerations suggest a judicious use of these wetlands, if not protective at all. The values and functions of these wetlands must be understood properly before the blueprints of development shall be imprinted upon them.

Such conflicts between urban development and the wetland ecosystem have been operative for a long time. The conflicts must either be resolved or mitigated by judicious use leading to best practices. Sustainable development has become a keyword for the utilisation of resources on ecological consideration. The East Calcutta wetlands had been recycling the municipal sewage and solid wastes in a novel way for resource generation. In these shrinking and decaying wetlands thrive traditions of resource conservation and environmental protection which can lead to harmonious development of the city and its fringe.

PROBLEMS

Various other problems arising out of reclamation of land for different purposes namely, residential, industrial and agricultural (scientific management) in the wetlands may be enumerated thus responsible for the decay of a natural runoff system. It is a fact that the existing network of canals and channels have become inefficient, resulting in retention of stormwater and effluent within the city area even in the dry months.

The underground sewers constructed in the British period are now age-old and obsolete. Renovation costs have escalated.

The badly laid culverts of the rail-tracks and the newly constructed (1980) Eastern Metropolitan Bypass (EMB) directly impede overland drainage from west to east, following the natural slope of the land.

Health hazards may arise because of waterlogging in the city area.

Occupational displacement of a large population (engaged in various activities) will occur creating social tension. Allied with this, there will also be a reduction in the production of fish, vegetables to be supplied to Calcutta's market.

CONSERVATIONISTS VS. EXPANSIONISTS

Nevertheless, the common arguments of planners and politicians and even environmentalists is that - "We cannot afford



The sprawling city raises a conflict between urban development and the wetland eco-system

not to develop". They stress the basic fact of over population (including a large number of immigrants not only from Bangladesh, but also from other neighbouring states for example, Bihar, Orissa etc.) and lack and breakdown of existing civic, infrastructural facilities of the age-old city (viz., drainage and sewer system, accommodation/housing, open space, transport, employment etc.) Thus, the East Calcutta wetland areas may be encroached upon for new built-up areas along with provisions of basic infrastructural facilities. This would, on the whole, upgrade not only the civic and economic life of the local community, but also their social outlook.

Thus, "development policies must widen people's options for earning a sustainable livelihood, particularly for resource-poor households and in areas under ecological stress" (World Commission on Environmental Development). For formulating plans, the CMDA is considered to be one of the principal authorities with reference to the eastward expansion of Calcutta City. The CMDA has formulated a plan for this viable area. Along with the reclamation of part of the wetlands for residential purposes and industries to a certain extent, the 50-year long traditional "best practices" must also be conserved. Thus garbage disposal should be limited to selected portions of the wetlands (later to be converted into green belts). CMDA proposes to use the derelict water courses of Dhapa for garbage-filling with scientific operation in order to minimise pollution.

The more common issue voiced by the conservationists is the problem of natural drainage which follows the natural slope of the land (from west to east - i.e. from the high levee of Calcutta city towards the low gradient wetlands to its east) arising out of the construction of the 17.6 km. long Eastern Metropolitan Bypass on the city's eastern outskirts. This fact, however, is rendered unimportant by the expansionists' view since they point to the fact that about 326 sq ft of culverts are already provided for cross-drainage and there are provisions for

about 1008 sq ft of bridges - which would facilitate the city's overland flow. They state that this provision is more than adequate as per normal engineering practices

The CMDA has counteracted another vital issue raised by the conservationists that the area of the water reservoir in the low-lying wetlands has been reduced with the creation of new townships. They state that since the filling up of the township of Salt Lake and Baishnabghata - Patuli has been done by borrowing earth from the nearby burrow area the total reservoir capacity of accumulated water has not decreased. In fact, these burrow areas being of greater depths, can accumulate more water.

Thus, leaving aside certain areas exclusively for garbage-disposal and fisheries, the East Calcutta wetlands may be developed for future residential and industrial purposes.

The CMDA has introduced a very tentative outline development plan for east Calcutta, dividing it into six zones. A brief outline of the proposed landuse of CMDA is as follows :

| Zone | Area in Acres | Land Use |
|--------------|---------------|------------------------------------------------------------------|
| 1 | 4550 | Agriculture, big waterbodies, (2,000 acres and above) |
| 2 | 1037 | CMDA Township |
| 3 | 3768 | Agricultural and residential |
| 4 | 2303 | Agricultural and residential |
| 5 | 1450 | Administrative Complex, Garbage Disposal |
| 6 | 270 | Open-type Insitutions, being waterbodies (2,000 acres and above) |
| Total | 13378 | |

PROPOSED RESIDENTIAL AREAS

The New Calcutta Township, covering an area of about 186 sq. km. at Sonarpur, Baruipur and Bhangar police stations, has been proposed. Other township areas in zones 3 and 4 are also to come.

PROPOSED INDUSTRIAL COMPLEX

Since it is economically viable to set up a large and single tannery complex by assimilating about 550 odd small tanneries scattered mainly in the areas of Topsia, Tiljala and Tangra, a CLC (Calcutta Leather Complex) is proposed to be set up (covering an area of 1000 acres) at Karaidanga . A single common integrated effluent-treatment plant is also to be set up here It would be economical on one hand and would reduce pollution (from the numerous scattered tanneries) to a great

extent. Karaidanga is located just outside the Waste Recycling Region of East Calcutta wetlands. The treated effluents from the tannery complex will be certified by a German firm to be free of pollutants. And then the effluents will be allowed to drain into the SWF channel. At present the effluents from the tanneries in East Calcutta are flowing through the SWF channel untreated. Distinctly the Karaidanga tannery complex will help in mitigating the pollution of SWF. Moreover the project site had been earlier requisitioned for refugee settlement in the late fifties. Since then the land has been reclaimed for paddy cultivation. However a part of the project site includes a few bheries and should be retained as wetlands.

CONFLICTS

In all types of environmentally related conflicts, one observation is common:lack of information and lack of understanding on the part of some or all parties to the conflict is an essential ingredient in the mix of factors fomenting the conflict. Such observation also holds true for the wetlands where multitudes of conflicting interests dominate.

ENVIRONMENTAL EDUCATION

Environmental education may resolve this lack of information and lack of understanding among the conflicting parties. Environment is essentially a partnership programme in which an individual plays a pivotal role If individuals become environmentally aware and educated, the society and the government are automatically educated, because the latter two are only an extension of the individual.

The Tbilisi Declaration, 1978 has identified the categories of environmental education objectives as:

- Awareness To help social groups and individuals acquire an awareness and sensibility to the total environment and its allied problems.
- Knowledge To help social group and individuals gain a variety of experiences in and acquire a basic understanding of the environment and its associated problems.
- Attitudes To help social groups and individuals acquire a set of values and feeling of concern for the environment and the motivation for actively participating in environmental improvement and protection.
- Skills To help social groups and individuals acquire the skills for identifying and solving environmental problems
- Participation To provide social groups and individuals with an opportunity to be actively involved at all levels in working toward resolution of environmental problems

Wetlands management issues are closely related to environmental education. People's views on environmental matters are typically based on information rather than direct observation. This has made it possible for special interest groups to spread distorted views of environmental issues by manipulation of the availability or content of information.

East Calcutta wetlands have drawn the attention of the citizens through a long-drawn legal battle against the Government of West Bengal by one NGO (People's United for Better Living In Calcutta) to resist the encroachment on wetlands for the setting up of a World Trade Centre

In the late fifties the conflicts between the bheri-owners and bheri-labourers led to forcible attempts to reclaim the bheris into paddy lands. It needed long persuasion to understand that it was the bheri-owners not the bheris that should face the might of distributive justice. This awakening of the people that the fishery is the most efficient eco-system in the East Calcutta wetlands has guaranteed the protection of these wetlands against the market forces

POLICIES AND STRATEGIES

Appropriate policies will be necessary for the management of wetlands and strategies are to be evolved for the protection of these wetlands. The market forces are strongly operating with rising land values in the city fringe areas. Many fishery owners are tempted to sell their fisheries for immediate profit. The land speculators and promoters have become a strong lobby, both economically and politically to interfere with the status of the wetlands. The attitude of the state government is also elusive and not clear. The government must consider necessary action for conservation, otherwise the conservation of wetlands may result in:

- i) Loss of the tradition of urban waste recycling, which in turn may affect urban sanitation;
- ii) Loss of fisheries which in turn may affect supply of fish to the city of Calcutta;
- iii) Loss of a natural system of sewage purification;
- iv) Loss of macrophytes and algae, resulting in decrease of oxygen content in the air;
- v) Loss of wetland flora and fauna, affecting bio-diversity;
- vi) Loss of detention and spill basins which in turn results in waterlogging of the city and silting of Kultigong and drainage outfall channel;
- vii) Social tension and conflicts owing to loss of primary activities;
- viii) Increased pollution and silting of the outfall channel which may even affect the ecosystem of mangrove forests in the Sunderbans

THE GENDER ASPECT

THE ROLE OF WOMEN

The role of women in developmental programmes has been assigned greater importance in a progressive society. In the field of environmental conservation the gender bias has been tilted where the women play the key role (e.g. in Forestry - Chipko Movement). From a cursory view it appears that there exists a gender bias regarding people's participation in the various best-practices found in this wetland area.

The main employment of this wetland area particularly in the fishing activities is male dominated. In agricultural activities also, the participation of female workers is poor. Census data (1981) show that the total main workers in the Mouzas under Police Station Bhangar, where STFs are found is 3899 of which only 330 are female workers (i.e. only 8.46 percent).

The total number of women associated in the best-practices found in East Calcutta wetlands as cultivators, agricultural labourers and as other workers is 319 in the referred Mouzas within Bhangor Police Station while the number of male workers is 3551. In the 10 Mouzas under Sonarpur Police Station in the East Calcutta Wetlands area where STF is practised, the percentage of women labour participating as main workers of the total main workers is also as low as 7.89 percent (total male main workers is 2154 while total female main workers is just 170).

In the sewage farms, in this wetland areas, the participation of female labour force is relatively low, (just like the case of sewage treated fisheries). In the three Mouzas under Bhangor Police Station, where SFs are found, the percentage of female to male workers is just 4.64. In case of the other 10 Mouzas, under Sonarpur Police Station, where SFs are mainly found, this proportion is 6.49 percent.

Actually women are mostly associated with tertiary services namely, marketing of vegetable products, fish products and so forth.

THE STATUS OF WOMEN

An attempt has been made to explore some of the experiences of Scheduled Caste women (since they comprise the majority of the female population) in the study area, in order to identify the spheres which might take care of their socio-economic abilities/disabilities both at home and outside.

A descriptive analysis of the status of women is related to the following aspects: a) Education; b) Labour Force Participation; c) Paid Work and Household Work; d) Autonomy and Decision Making; e) Food, Nutrition and Health; g) Knowledge, Attitude, Practice and Autonomy in Family Planning; h) Participation in Organisation; i) Perception of Discrimination with regard to Caste. The 13+age group has been taken in consideration.

a) Education

It is found that almost half of the female population is deprived of formal schooling, the main reasons being poverty and gender discrimination. A girl-child is deprived of education because of demand for household work and early marriage.

b) Labour-force Participation

As is typical for the lower-caste groups in our country, the majority of the people belong to landless households. The households again, are dominated by male earning members, ranging from 2-5 members per household.

Working women comprise less than half of the population (about 30 percent), of which widows, divorcees and separated ones (being female heads of households and compelled to earn) assume a majority.

It is interesting to note that all women engaged in paid labour belong to the unorganised sector. They are self-employed as egg, fish, rice or vegetable vendors, while the rest belong to the category of domestic servants, piecemeal workers, agricultural day labourers etc.

Income on a daily or weekly basis is the usual norm and so meagre that a hand-to-mouth existence is only possible, with no savings whatsoever. There is thus, an urgent need for providing remunerative work among the womenfolk. Lack of opportunities (and even awareness to a certain extent) is often revealed in their complaints - "We do not work because there is nothing available"

c) Paid Work and Household Work

It is found that the women spend only one to five hours per day in outside work (paid), the main reason being their commitment to household work (where they spend 10+12 hours per day).

d) Autonomy and Decision-Making

In order to judge the women's status in the household, their decision-making empowerment, both about personal and family matters were probed into. It was found that in both the cases their powers were limited since the senior members, parents, in-laws and husbands of the household were the sole authority in such matters.

e) Food, Nutrition and Health Status

It is found that in general the majority of the women consume vegetables daily, but intake of milk, eggs, fish, dal and other nutrients is usually lacking in their day-to-day diet.

As a result, illnesses are common which often include high fever and congestion, gynaecological problems, gastro-enteritis, body pain and inflammation etc. It is an encouraging

feature to note though that most of these sick women visit doctors regularly.

f) Knowledge, Attitude and Practice in Family Planning

In general women have little say in family planning methods. Even if family planning measures are adopted, female sterilisation has a preponderance over male contraceptives and sterilisation.

g) Participation in Organisation

In the light of recent legislation pertaining to reservation of 33 percent of village-level administrative position for women, women's status in the public sphere is revealed by their participation in political, governmental and non-governmental organisations.

It is such that women's participation in political or social organisations is almost absent in all age-groups. However, some women in the younger age-group (26-35 years) have become active organisationally, (in spite of familial restrictions and long gruelling hours of household work)

h) Discrimination

It is found that untouchability and related forms of discrimination (ills of our society) are experienced in villages where there are hierarchies among the sub-castes in the Scheduled Caste Group (viz. the Padmaraj Groups are considered superior to Bagdis, Dhobas and Napits). General awareness has to be created by educating the masses in order to eradicate this disgraceful and evil practice of the society. It is heartening, however, to see that the womenfolk are not in favour of discrimination.

Though the East Calcutta wetlands lie close to the city of Calcutta, the infrastructural facilities prevailing in the region are very poor. In such a backward set-up, the social environment is also not very conducive for the awakening of womenfolk. Such backwardness has been reflected in the status of women like womenfolk elsewhere in rural India. It has been universally recognised that the education of the girl child in a region is a positive index not only for social upliftment of women but also signifies economic development of the region. On the other hand, all social maladies and gender discrimination are eliminated in the long run with economic development. It has become urgently necessary to strive for an appropriate policy for the upliftment of the status of women in East Calcutta wetlands. This cannot be framed in isolation for a micro-region of East Calcutta wetlands, but must be advocated for the whole nation or at least for the State of West Bengal.

As the Scheduled Caste women comprise the majority of the total women, they should be given special incentives for compulsory education, both formal and informal, before marriage. They should also be provided with income opportunities through gainful employment in different economic activities to make

them economically independent. Through such activities the womenfolk will earn a status of gender-equality and the discrimination and atrocities against women will be eradicated. Reservations for the women in Panchayati Raj institutions has opened up opportunities for women in public and social life enabling them to take part in decision making, both at household level and community level. The participatory role of women will usher in a prosperous future for all in the long run.

IMPACT AREAS AND ASSESSMENT

BENEFITS OF THE PRACTICES

Why has such recycling of city wastes been considered as best practices under the wetlands system? The concept of city waste as pollutant is an urban view. Waste as a resource is a rural view because pollution to one living system will provide nutrients for others. Hence, urban wastes can be converted to resources for the livelihood of rural folk.

The importance of waste recycling is not limited to economic terms. The city of Calcutta has no sewage treatment plant to day. Two giant settling tanks at Bantala have never functioned for more than a decade and were abandoned. The system in particular, could not compete with the stabilisation ponds for STF, which appear to be cost effective in a developing country like India. Such a model stands as a low-cost alternative for other developing countries.

Through such discharge to the eastern wetlands the city environment becomes free of raw wastes. What is the status of environment over the East Calcutta wetlands, where all the sewage channels converge? One will be overwhelmed with the air quality and water quality of the wetlands where each drop of water is purified raw sewage. The atmosphere is free from dust and imbued with oxygen produced by a multitude of pond algae and macrophytes respiration. Dissolved oxygen ranges between 2.5 ppm (early morning) to 20 ppm (mid-day) with variation of temperature 30°C - 35°C under pH condition of 6 - 6.5. Such conditions can be comparable with the finest of eutrophic lakes. The villagers have been using the pond water for working and bathing for the last 50 years and there has been no record of epidemic of enteric diseases. STP acts as an excellent stabilisation pond. The reduction of BOD and coliform bacteria has been remarkably high, even 99 percent in some pathogenic bacteria. The metal ion contents also appear to be very low (less than 0.1 ppm) for copper, lead, zinc, nickel, chromium and cadmium.

The economic activities carried on the East Calcutta wetland areas, thus, can be divided into three activities as agricultural activity, piscicultural activity and rag-picking activity. In terms of economic viability, all the three activities are quite regular in respect to West Bengal. Moreover, resources are not optimally utilised in agricultural and fishery activities as both are performed following age-old indigenous methods. But the uniqueness of these two practices is the utilisation of bio-

degradable and non-biodegradable nutrients. The use of nutrient-rich sewage water in fishery ponds to help the quick algal growth is a natural process, free from any usage of modern technology. In the case of agriculture, the water from the fisheries is used for irrigation since it has a high level of BOD. The vegetable farming is also accentuated on the lands acquired from the low wetlands through garbage dumping. With the existing amount of compost elements, highly rich in nutrients, the vegetable cultivation is a success with nearly 14 types of vegetables and production of 1500 quintals per acre. Thus the utilisation of city sewage and garbage, has made this economic activity unique in some sense.

INNOVATIVE PROCESSES FOR TRANSFER

Recycling of wastes into resources in the periurban wetlands, though a unique feature of East Calcutta wetlands, may be replicated under identical conditions particularly in Third World countries. It has been reported that many countries in the world, even the developed countries have evolved such utilisation of municipal wastes. Sewage-fed fisheries or aquaculture has been reported in China, Indonesia, Israel and at several places in Germany. The Calcutta Sewage Fisheries are a natural sewage system, a system for a city that lacks a conventional treatment plant which may be successfully replicated for other areas in Calcutta Metropolitan Area and also other metropolitan areas in India. It has been suggested that Calcutta Metropolitan District should develop a combined waste water treatment and recycling system including fish production; because a system, based on solar energy and the fertilizing capacity of waste water is ecologically sound and should generate good income to pay back capital and money expenses.

It has now been recognised that the model of Calcutta Sewage-fed Fisheries has significant implications for areas all over India. From the report of the Central Pollution Control Board, it appears that the largest source of riverine pollution in the country is untreated municipal sewage discharge. The volume of sewage generated in the cities around the Ganga Basin is about 3 million cubic metres per day of which less than 20 percent is treated and the rest discharged into the river directly. It has been proposed that establishment of sewage-fed fisheries including treatment and use in aquaculture appears to be an economically feasible means of decreasing riverine pollution in the Ganga Basin. The sewage treatment plants are considered too costly for a country like India. In the Calcutta Metropolitan Area where a replica of East Calcutta wetlands, namely, a sewage-fed fishery has been attempted to treat the raw sewage.

East Calcutta wetlands area along with its ecological system and all its existing best practices is unique in the sense of recycling of garbage and city sewage in an indigenous, age-old method. With utilisation of industrial sewage, a well-managed sewage-fed fisheries is an ongoing system at Mudiali in South Calcutta on the fringe of the river Hooghly in the Calcutta Port Trust Area.

MUDIALI FISHERMEN'S COOPERATIVE SOCIETY

In a recent effort, an outstanding example of recovery and management of a wetland has been set by a fishermen's cooperative known as the Mudiali Fishermen's Cooperative Society Ltd (MFCS). The MFCS has obtained about 70 ha of wetlands from the Calcutta Port Trust. The Calcutta Port Trust granted the MFCS fishing rights in the wetland area and implementation of necessary modification related to fishery activities. This wetland is situated in the industrial south-western part of the CMC area and to the south of the river Hooghly. The area known as Mudiali, was previously part of the Garden Reach Municipality. In 1983, it was merged with the CMC area. In the process, a part of the wetland area has been filled up and recovered by MFCS. At present, the MFCS wetland covers an area of about 70 ha. The culturable water area of 65 ha, comprises three tanks ranging in size from 11 to 16 ha each, three tanks between 5 ha and 8 ha each and some smaller ones.

Of the leased out wetlands to MFCS by CPT 48 hectares receive waste water from the adjoining 152 industries (Table 8.7) and domestic establishments. This area includes five important jheels (water bodies) namely, 1. Crocodile Jheel (9.3 ha), 2. Taltala Jheel (14.0 ha), 3. Khudi-I Jheel (8.0 ha), 4. Khudi-II Jheel (11.7 ha) and 5. Loha Jheel (5 Oha). The depth of these jheels is less than 1 m.

Raw waste water is drained to the jheels at the north eastern end of the Taltala Jheel through multiple inlets. After passing in a series through Khudi-I, Khudi-II and Loha jheels the waste is discharged into Manikhali Canal joining the River Hooghly. The Crocodile jheel is, however, a single compartment water body fed by waste water at the north eastern end while the effluent from this jheel is drained into the River Hooghly through Netaji Subhas Dock of Calcutta port.

The physico-chemical water quality of these jheels has been analysed and presented in Table 8.8. The base line data will show remarkable improvement in water quality of raw sewage at a low cost. Such performance has been evaluated in Table 8.9 for all the jheels. On the other hand these jheels are producing fish and generating good income for the fishermen under the cooperative. Total fish production in these jheels has been shown in Table 8.10.

NEERI (1995) has studied in detail the problems caused by excessive nutrients, higher BOD, higher COD, higher concentration of heavy metals and imbalance of planktonic growth. All these problems lead to reduction in the productivity of the ecosystem. These problems could be overcome through improvement in the quality of water inflowing the wetlands. This demands primary treatment of raw sewage entering the wetlands. For such treatment the following measures may be undertaken:

- i) Waste-stabilisation ponds for pre-treatment of waste water
- ii) Use of macrophytes as toxicant absorber in jheels to reduce the heavy metal levels

- iii) Mixed culture consisting Tilapia, mossambica and India's major carps namely, Catla Catla, Labeo rohita, C Mrigala and Cyprinus carpio to improve the jheel water quality

- iv) Bio-gas generation using macrophytes as resource.

With the adoption of such appropriate indigenous technology the raw sewage can be treated in any peri-urban wetlands at a low cost and will also generate income and food resources for the local people.

STRATEGIES FOR CONSERVATION OF INTEGRATED WETLANDS SYSTEM

NATIONAL STRATEGY FOR CONSERVING WETLANDS

World Conservation Strategy in 1987 recognised the significance of wetland ecosystems as key life support ecosystems. Since then the perception of wetland management has undergone qualitative change. It has now become imperative to have a well defined strategy for the conservation of wetlands and to draw the action plans on the basis of identified thrust areas.

The Asian Regional Meeting of the Contracting Parties of the Ramsar Convention, held in New Delhi from 23-25 March 1995, also recognised the importance of wetlands in Asia as life support systems in sustaining the human population. The meeting credited the wetlands in Asia with a very high biological diversity and productivity and noted the high levels of threat to wetlands from encroachments, degradation of catchments and pollution. The meeting called upon the national governments to undertake 19 point actions for conservation and wise use of wetlands.

In this context, it has become obligatory on the part of the Government of India to evolve a national strategy for conservation of wetlands in Asia, as India is a contracting party to the Ramsar Convention. In July, 1992, it was decided to prepare a Strategy and Management Plan (SMAP) for conservation of wetlands by each state after due consideration of its natural resources characteristics and for addressing the problem of specific eco-systems. The scope of SMAPs will depend upon the nature of conflicts it has to resolve, the financial affordability and willingness of the people. It is clear that no single strategy and management action plan will be effective for conservation of wetlands in a vast country like India having so many different ecosystems. The Department of Environment, Government of West Bengal has prepared a Strategy and Management Action Plan for conservation of wetlands in West Bengal. This SMAP has largely corroborated the guidelines of the Ramsar Convention for judicious use of wetlands as accepted by the Government of India. It includes inventorisation of wetlands, identification and monitoring of wetlands of importance, environmental issues in wetlands including the threats,

management of wetlands, wise use promotion and traditional wetland practices. The document on Strategy and Management Action Plan in West Bengal will be used in formulating the National Strategy for Conservation of wetlands. The Action Plan as suggested for East Calcutta wetlands in this study is based on recommendations of SMAP prepared by the Department of Environment, Government of West Bengal.

NEED FOR CONSERVATION OF EAST CALCUTTA WETLANDS

The planning of East Calcutta Wetlands has been intimately related with the growing metropolis of Calcutta. The colonial build-up of the city on the most unsuitable terrain restricted the growth on all sides. Calcutta never grew like any other city of the west, as the urbanisation in the Third World was not a spontaneous process, but an integral part of industrial growth. With such haphazard urbanisation and influx of labour from its vast hinterland, Calcutta, by the middle of this century developed into a city of slums. With the Partition of India this premature metropolis was confronted not only with socio-economic degradation but also with environmental degradation. In the sixties, the environmental awareness was poor and the wetlands to the east were considered only marshy wastelands. Though the role of the wetlands as a waste recycling region was practised, the value of such practice had not been appreciated much by a large section of the people. But with growing awareness of the role of these wetlands various authorities have modified their activities

The CMDA plan for metropolitan development between 1990-2015 AD records that investment need has been assessed on various environmental aspects including regulatory measures for controlling air, water, noise pollution and waste recycling areas and resource measures. The role of the East Calcutta wetlands as waste recycling of raw sewage of the city of Calcutta has been taken into account. CEMSAP has also been preparing an Environmental Management Plan (EMP) where the role of wetlands vis-a-vis urban development will be reviewed. The Metropolitan Development Plan for 1990-2015 by CMDA also expresses concern on the unabated encroaching on wetlands, water bodies and green belts in the periurban areas.

A study has recently been done on problems and prospects of Calcutta's growth (Ghosh, 1992). This study has accounted for the loss of wetlands and environmental degradation if there is each and south-eastern extension of city-periphery. This observation is of utmost importance under the unique topographical and environmental situation in Calcutta. Table 8.11 enumerates the situation with reference to different parameters.

SUSTAINABLE UTILISATION OF EAST CALCUTTA WETLANDS

Integrated resource recovery systems and waste recycling regions in the fringe areas of East Calcutta wetlands are new

concepts in urban planning. Urban waste can be used in sewage-fed aquaculture and agriculture for improved sanitation in order to provide food and employment to a wide section of the population. Though the system is informal, the Calcutta wetlands demonstrate the viability of such a system.

Expansion of the city of Calcutta being restricted in the west, north and south, its eastward expansion by way of draining and raising the level of wetlands may appear as an easy solution to the urban planner. Immediate planning, on the other hand, is needed to preserve the heritage of the wetlands of East Calcutta (best practices zone) which are gradually being lost owing to urban expansion. This creative heritage which is the world's largest system of resource-recovery practices, is not only a unique example of its kind in India but also in the whole world.

It may be appropriate to plan for the preservation of Calcutta's wetlands through the Biosphere Reserves Programme undertaken by the Government of India. Such planning is based on definite spatial planning of Biosphere Reserve Areas. A special task force convened jointly by UNESCO and UNEP in 1974 in Paris recommended a zoning pattern comprising a "core area", "buffer-zone" and an outer "transition zone". This is more viable if applied to planning of the East Calcutta wetlands because of its close proximity to dense human settlement.

Thus, a unified plan should be drawn up on the basis of all four sub-systems of waste recovery in the wetlands viz.,

1. Garbage farming for vegetable cultivation
2. Sewage-fed fisheries
3. Sewage-fed brackish water aquaculture
4. Effluent utilisation in paddy cultivation

The effective maintenance, monitoring and upgrading of the wetlands is thus recommendable. The seasonal requirement of sewage/wastewater must then be provided to ensure improved utilisation and management practices.

Balanced growth of East Calcutta wetlands is recommended for maintaining the existing "best practices" together with future developmental works for infrastructural facilities. It has to be borne in mind, however, that the planning policies should be such that they should ensure long-term stability and sustained resource availability in the region.

COST BENEFIT ANALYSIS - SALT LAKE MODEL

Calcutta, once a premier city of eastern India, gradually became an over-populated city with all its adverse consequences. With the establishment of the city as a port city the export-based industries gradually developed like the jute industry. The expansion of these income generating activities caused a huge increase of migrant people.

After Independence, the influx of refugees from East Pakistan aggravated the problem of over-population. Afterwards in the following decades, rural poverty in the adjoining provinces of Bihar, Orissa, and other states forced people to migrate to this city in search of employment. From the records of the Legislative Assembly in West Bengal, it can be quoted that in the early fifties, 5,16,638 families had migrated illegally. Nearly 2.40 lakh families out of the total had asked for house building loans. Thus, rehabilitation problems were some of the deepest concerns in the State for the next two decades after Independence. This crucial problem of rehabilitating the migrants pressure put on the physical limits of the city (West Bengal State Assembly Proceedings, February, 1953). Thus, the West Bengal Government took the decision of reclamation of swampy salt lakes in the eastern fringe of Calcutta (which was a portion of the presently existing wetland areas in East Calcutta) to turn the entire area into settlement colonies for refugees.

The actual work of planning for development of the Salt Lake started in 1947, when a committee was set up to examine the drainage problem in Calcutta. The Master Plan Technical Committee, in its report pointed out the drainage problem mainly because of the silting up of the upper portion of the river Bidyadharti and Matla. The reclamation of the northern salt water lake was a follow up action of the Master Plan Technical Committee. Dr. BC Roy, the then Chief Minister appointed a Dutch Engineering Company, NEDECO to suggest an alternative path to reclamation. One of the main parts of the project under the supervision of NEDECO was reclamation of about 4 square miles of the northern Salt Lake for human settlement which was focussed in the general outlines of the preliminary report prepared in 1953.

A people's protest was organised against the acquisition of 17,333 acres of cultivable and fishery lands in the district of 24 Parganas mainly under the Police Stations Dumdum, Bhangor and Rajarhat. It was estimated that the acquisition would cause deployment of nearly 10,000 labourers engaged in fisheries with a loss of annual supply of 62,53,000 kg of fish to the Calcutta market. Moreover, this would cause a fall in paddy production to about 5,8000 kg annually. Lastly, there was a serious problem of rehabilitate nearly 30,000 people who were likely to be evicted from their huts and houses under the North Salt Lake Development Scheme.

The official estimate for the housing scheme alone was 2400 acres and accommodating 1.5 lakh people. The cost of reclamation of lands was estimated at Rs.6.3 crores and the cost of providing infrastructural facilities was estimated at about Rs.7.1 crores (cost for providing water, for construction of road, drainage, sewage ways, street lighting etc.). Thus, the cost for development was estimated at about Rs.13.4 crores.

From the point of view of costs, one can calculate all the disutilities arising from i) the acquisition of cultivable and fishery lands, ii) problems of nearly 10,000 labourers engaged particularly in fish cultivation, iii) fall in production of fish and

paddy, iv) eviction of nearly 30,000 people already settled in this area, v) problems related to the treatment of city sewage through a natural least-cost process by sewage fed fisheries and sewage fed farms, vi) lastly, the real cost of developing the suggested area of North Salt Lake with the provision of all better infrastructural facilities which was estimated at Rs.13 4 crores.

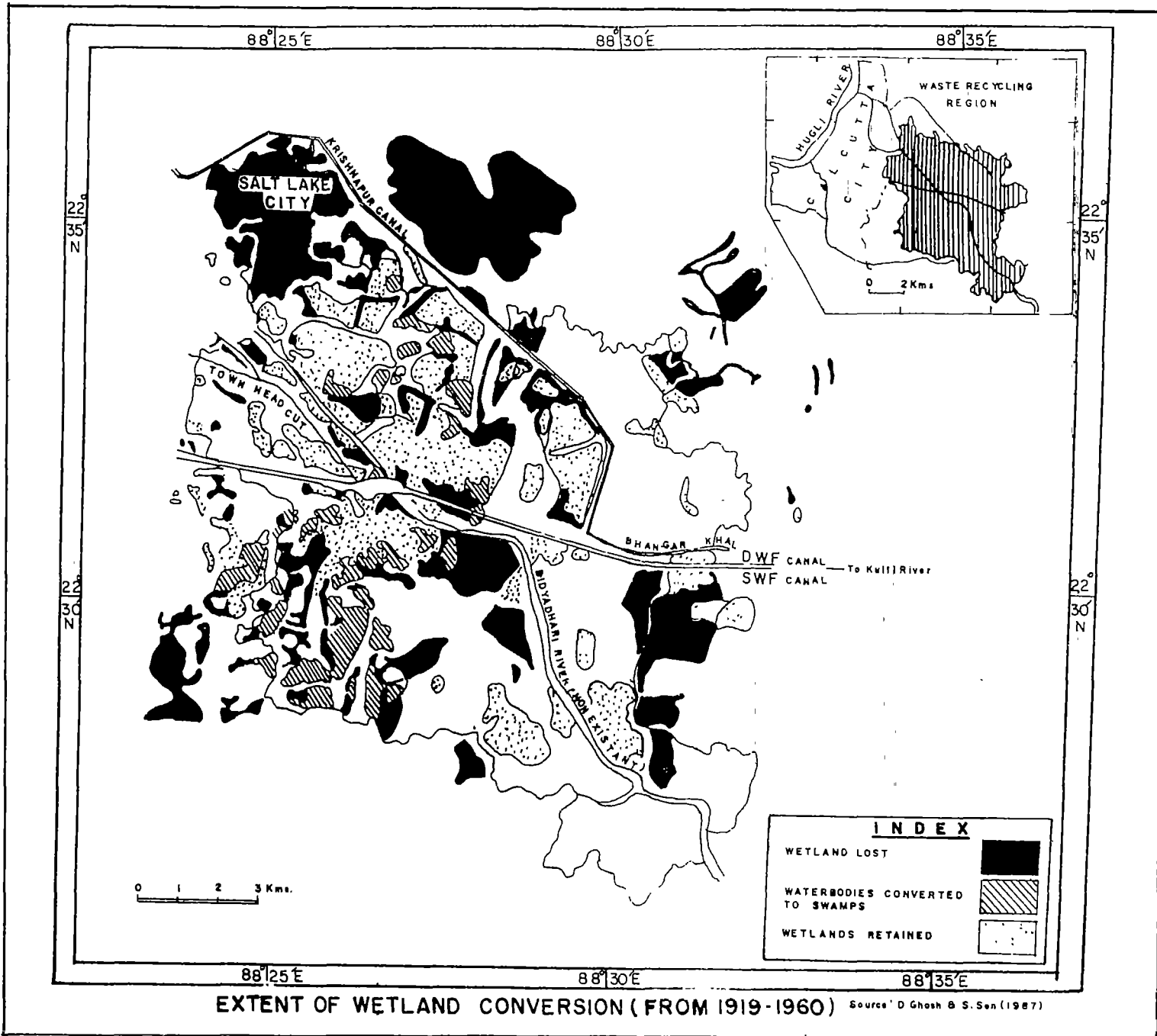
On the other hand, on the benefit side, we get i) housing facilities for nearly 1.5 lakh people in a planned township near Calcutta city at a cost of 57 crores. Considering the economic, social and environmental costs in total, the benefits appear to be less.

For the existing wetland areas on the eastern side of Calcutta, another urbanisation programme can be undertaken following the Salt Lake Reclamation Scheme. This urbanisation scheme will cost all the same components as have already been accounted for the already developed Salt Lake City area on a large scale. There are nearly 175 fish ponds in East Calcutta wetlands comprising 7000 acre in total, with more than 10,000 people are engaged in fish cultivation. In sewage-fed farming in this area, about 10,000 tonnes of vegetables are being grown annually with an equal number in employment. In rag-picking activities, about 20,000 to 25,000 people are engaged. Moreover, the drainage and garbage disposal system of Calcutta city has a direct linkage with the existence of this wetland area, which can be thrown out of gear with any further urban agglomeration in this area disturbing this system. Lastly, the value of the natural treatment procedure of the city sewage through STFs and SFs is very high from the viewpoint of environmental perspectives. This value is in real cost terms, also high if we consider the establishment of a sewage treatment plant to treat this city sewage.

Thus, it can be concluded that the immense benefits from the East Calcutta wetlands always raise the strong point against any further encroachment of land in this area disturbing the age-old natural system. With any further steps towards urbanisation of this wetland area, the existing system will break down causing the direct and immediate problem of disposal of garbage and sanitation of Calcutta with health hazards, regular waterlogging during the rainy season. Secondly, all the benefits coming from the existing practices will disappear with the breakdown of the practices. Lastly, the ecological balance of the city and its suburbs may break down with a huge amount of sewage and city effluent cleared in an untreated manner.

WETLANDS MANAGEMENT

The wetlands management requires an understanding of the scientific aspects of wetlands, balanced with legal, institutional and socio-economic realities in order to protect this valuable eco-system and prevent further encroachments. A sustained natural resources development based on the principles of ecology, energy conservation, economics and employment generation is urgently needed in East Calcutta wetlands.



The objectives of the wetland management for sustained development will be:

- i) waste water utilisation for pisciculture
- ii) waste water utilisation for crop culture
- iii) improvement of water quality through biological recycling
- iv) control of waterlogging in the city and drainage easement
- v) water storage and recharge for ground water
- vi) wild life conservation for bio-diversity
- vii) reduction of atmospheric pollution through silting and deposition of the pollutants
- viii) sediment and erosion control
- ix) research for baseline information and desirable landuse.

The wetland management, almost anywhere in third world countries will have to confront three primary deficiencies. These include:

- a) Awareness gap
- b) Lack of appropriate policy
- c) Absence of engineering application of wetland uses

All these criteria must be taken into account for the preparation of a management plan of East Calcutta wetlands

The successful implementation of an action plan in the wetlands requires:

- i) establishment of institutional arrangement which will allow those concerned to identify how wetland conservation can be achieved and how wetland priorities can be integrated in the planning process,
- ii) establishment of mechanisms and procedures for incorporating an integrated multi-disciplinary approach to planning and execution of projects, concerning wetlands and their support systems in order to secure wetland conservation and sustainable development,
- iii) review of existing legislation and policies which affect wetland conservation,
- iv) increasing the awareness and understanding of decision-makers and the public of the full benefits and values of wetlands.

- v) review of traditional techniques of wise use, and elaboration of pilot projects which demonstrate wise use of representative wetland types.

Significant knowledge now exists amongst the people of East Calcutta wetlands for using wetland attributes to obtain renewable resources. A wealth, of creative knowhow has been retained in the oral tradition. It is imperative to study this knowhow substantially and to disseminate the knowledge for application in similar other wetland areas.

It is important to note that even if a project is economically viable and technically sound it has to be ecologically balanced and socially acceptable. It had been experienced that a number of basic management plans did not work because people failed to accept or conform to the recommended land use. To enhance the resource potential of the wetlands eco-friendly advanced technology will be desirable. But any change envisaged must be linked with the preference of the people and their participatory role be guaranteed. Simultaneously, appropriate coordination with the existing development agencies will have to be established.

After the preparation of a comprehensive Management Plan, the respective components of such a Plan must be transparent to all concerned agencies for review. Thereafter in project form the components of the management plan will be implemented by the concerned agencies/departments, either in full or in stages. All these management plans shall be integrated with the District Plans/Rural Development Programmes. Initial financial assistance will come from the District Plan Infrastructure. The South 24 Parganas District Magistrate has become the designated authority of the East Calcutta wetlands though a few mouzas under Salt Lake Police Station are included in North 24 Parganas District. The transfer of such mouzas to South 24 Parganas District is being considered. Moreover, a few mouzas have been included in CMC and CMDA area. The District Authority of South 24 Parganas will be authorised to incorporate the management plans in the District Plan for sustainable development of resources of East Calcutta Wetlands.

ACTION PLANS

I. Rapid Appraisal Survey (RAS)

It is necessary to develop a Rapid Appraisal Survey for comprehensive information for rational evaluation of East Calcutta wetlands. The system of classification will have to be simple and will not necessarily follow extensive and rigorous systems of classification (Deptt. of Environment, Govt of West Bengal, 1953) They can be.

- a) area and location
- b) use of attribute of the system
- c) its generic nature.

To start with a landform/geomorphological map showing the landuse, drainage lines and the trend of wetland transformation is urgently needed.

II. Management of Municipal Solid Wastes (MSW)

A part of the East Calcutta Wetlands is being filled in with solid wastes from the city. This land-filling practice was begun in 1865 when a square mile area (2.59 sq.km.) in the Salt Lakes (Dhapa) was acquired and handed over to the municipal authorities. Besides Dhapa other dumping grounds are located at Bantala, Nowpara, Kadapara etc. Objections were raised by some people/NGOs against acquisition of the wetlands and marshy lands in Kalikapur, Barakhola, Jagarpota, Mukundapur, Dhalenda, Chowbhaga, Boinchtala and western Dhapa (as proposed by CMDA)

After evolution of such dumping grounds with heavy compactness and with adequate operational and engineering measures to maintain some drainage the filled-up lands are used as 'green belts'. As the existing land-filled sites of Calcutta Corporation will serve for another five to six years a total of about 660 ha of land would be required for the next 20 years (assuming an average depth of fill of 2 metres). While the CMC can go on filling the water courses, the CMDA should abandon the garbage dumping ground near the Eastern Metropolitan Bypass and its connectors, consolidate the land spread with the top soil and landscape the entire area.

A separate scheme is needed to distribute the city garbage according to the demand at each farm plot head in Dhapa and other dumping grounds in order to facilitate garbage-farming of vegetable and paddy.

III. Construction of Drainage Grids for STF (CDG)

The role of East Calcutta wetlands in waste recycling and resource generation (Pisciculture) has already been highlighted. The sewage treated fisheries (STF) and sewage farms (SF) based on effluent from the fisheries are the dominant landuse in the region. The system on the other hand purifies the raw sewage and absorbs pollutants from Calcutta Municipal area to create a clean and healthy environment. It is necessary to regulate the supply of sewage and meet the requirements of STF and SF. An optimum drainage grid to run the SFT and adjoining SF (for providing a continuous flow of sewage), along with a feasibility study of the secondary resource system based on the total range of bio-mass (viz. water hyacinth, sewage sludge and total waste) need to be designed. One drainage canal will be excavated in Tollygunge-Panchannagram basin and will carry sewage water of South-Calcutta.

IV. Application of New Technology in Designing the Lagoons

The fish ponds in East Calcutta wetlands act as ideal stabilising and oxidation ponds. Detritus, nutrients and pollutants are

deposited in these ponds from the raw sewage. The control of microphytes and desilting of the lagoon are necessary pre-conditions for the maintenance of dissolved oxygen in the pond at desired level for stocking the fish. Pre-treatment of sewage is also desired to regulate the BOD level. Otherwise over nitrification may result in infestation of submerged and free floating weeds that lead to hastening the process of swampification. Desiltation mechanism will also be designed for these ponds. Bio-technology/Bio-coil method may also be employed for pre-treatment of the sewage and optimum production of resources. This will in a useful way treat the city's waste, recover its nutrients to produce food and provide employment for the fringe area community.

V. Modernisation of the Fisheries

A proper understanding of complex relationship of food chain and patterns of energy flow in the ponds will help in formulation of policies for stock manipulation. The vast load of detritus available in the ponds and also the eutrophic character of the ponds will help continuous high rate of production by stocking detritus-oriented fishes, namely, *Cirrhinus mrigala*, *C. reba*, *Labeo rohita*, *L. bata* etc. The sustained fisheries development requires both micro and macro planning approaches. The micro-planning approach is project-oriented and involves investment in a carefully planned manner. Side by side with the micro-planning greater attention will be given to macro-planning namely, the sectoral development. The major issues under sectoral development are:

- i) Co-operative development, ii) credit and subsidy scheme, iii) changes in lease period (tenurial) policy, iv) technology transfer, v) marketing, vi) education and training, vii) insurance scheme, viii) socio-economic consideration.

VI. Bio-gas Generation and Manufacturing of Compost

It has already been identified that the land-filling will not be a viable alternative for the treatment of municipal solid wastes in the coming years due to the shrinkage of wetlands. It is necessary to treat the municipal solid wastes in various other methods.

With bio-chemical treatment these solid wastes can be converted into compost. Now there exists a global demand for organic manure. The production of compost will meet the growing demand of the agricultural sector. The bio-gas generation on a small scale will also be the other efficient utilisation. CMC has undertaken a project for the generation of power through bio-gas plant in the Dhapa Dumping Ground in collaboration with private entrepreneurs. This will open a new vista in the development of East Calcutta wetlands.

VII. Welfare Schemes for the Waste Recycling Community

The rag-pickers are the poorest of the poor people in the East Calcutta wetlands region. They are prone to many environmen-

tal and health hazards. Most of them have no shelter. These people also earn very low wages and are exploited by the middlemen. Appropriate health care facility and shelter may be rendered to them as social benefits. Similar benefits may also be given to other backward communities of the region engaged in other activities.

Education and training including technical counselling may also be arranged for the people engaged in pisciculture and farming. Education will certainly elevate skills and resource generation.

VIII. Build-up of Infrastructural Facilities

Infrastructural development is considered the index of development for resource potential. The region lying so close to the great metropolis is even today very backward in infra-structural facilities. Except the B N. Dey Road passing over the region there are no other cross roadways serving the region. Economic development is based on better communication and transport. But the development of transport may also bring in market forces which will threaten the wetlands. Most of the area in the wetland region has no electricity. The progress of the rural electrification programme is at a snail's pace here. Development of rural electrification will be the pre-condition for application of new technology in the waste recycling region.

IX. Promotion of Tourism and Recreational Centre

The East Calcutta wetlands provide vast stretches of waterbodies, so close to the city with excellent ambient quality of air. Tourist cottages and recreational day centres may be developed on some selected water-fronts. Natural parks may be created under a social forestry programme and bio-diversity be maintained. One ecological centre may be established to explain the bio-diversity and the wetland eco-system. Recreational facilities will be developed without encroaching the wetlands and interfering with the eco-system. Nicco-Park like promotional development is not desirable here. Nature-loving people and environmentalists are likely to visit such places. In winter the management of the park as a sanctuary of migratory birds/waterflow will add tourist attraction in the region and augment the income of the local people.

There can be a new dawn on East Calcutta wetlands.

The backyard swamps of Calcutta will promise a better future not only for the region but also for the city of Calcutta with a glorious tradition of waste-recycling practices in the long run. Such traditional practices moulded in appropriate technology will not only prove its sustainability but also its worthiness in generating wealth for the society.

CAPACITY BUILDING AND INSTITUTIONAL STRENGTHENING

The Capacity Building for Human Settlement has been recognised by the U.N. Conference on Environment held in Rio-de-

Janeiro in 1992 as one of the principal objectives to achieve sustainable development. The uncertainty in the living system will increasingly become dominant in which all governments and communities confront themselves. In order to cope effectively with uncertainty all institutions/communities must take on the characteristics that allow natural systems to service in the face of uncertainty: resilience. The means of resilience require to have at least two components i) a quick response adaptive capacity and ii) future options not foreclosed.

Capacity building is thus a guarantor for sustainable development. Capacity building may be approached in various ways. The quick response capacity is built into organisations through a series of workshops, attended by a mix of analysts, administrators, managers and field staff. Base line information will be collected to make the model more realistic. The aim will be to build into the client organisation the capacity to develop an ongoing programme of model building and simulation that affects policy, generates new data and finally leads to a new round of modelling. Continuous assessment is made to ensure that the institution/community keeps very careful track of developments in the most important indicator variables and responds quickly and appropriately with management innovations to adapt to new situations in the managed system.

The 'best practices', in East Calcutta wetlands involve sewage treated fisheries, garbage farming and sewage farming. These practices have become sustainable based on recycling of urban wastes in the spillway basin of the Bidyadhari river. The changing aquatic environment in these wetlands had been intimately linked with sewages of the city of Calcutta draining through these wetlands.

The technology of sewage treated fish culture mainly involves: i) characterization of sewage quality ii) prestocking fertilisation with primary treated sewage iii) dilution of sewage with freshwater in appropriate ratios depending on BOD of sewage, iv) stabilisation of the fish pond v) intensive and judicious stocking of Indian and exotic fish fingerlings vi) post-stocking fertilisation using sewage in small doses and monitoring of DO of fishpond water vii) periodic harvest of 1 kg fish, viii) final harvesting after 12 months.

STF is likely to be linked with the urban sanitation programme. In many parts of India derelict wetlands are being used as municipal sewage receptacles without any formal design. In biological methods for waste water treatment, the use of shallow (depth 1m) oxidation ponds allow water to be purified by the action of aerobic bacteria and algae. Such ponds use solar radiation for photosynthesis and the organic material is used for both bacterial and algal growth, effectively reducing BOD level and also coliform organisms.

The sewage treated fishponds of East Calcutta wetlands resemble closely stabilisation ponds. This indigenous technology is not an advanced one, conceived by the local fish farmers without any proper training. It will be appropriate to build capacity

for the 'best practices' model in East Calcutta wetland. In recent years in USA detailed studies have been made on the use of wetlands for water quality improvement. A design manual for the use of wetlands for municipal water has also been published (EPA, 1988) The technology devised by fisherfolk in East Calcutta wetlands may be a preferred low-cost technology for urban sanitation in developing countries. However it will be more useful to design sewage treatment plants so that they are sensitive to the incremental nature of sewage availability (Ghosh D, 1990)

A novel bio-coil technological system for sewage water treatment has been suggested. The technology has been offered by Biotechna Environmental Limited of London, which treats polluted water to produce biogas, clean water and micro-algae, which are useful as bio-fertiliser and feedstuff for animal and fish. The special feature of this photosynthetic technology is a closed and transparent photobioreactor in which pre treated sewage water inoculated with specially selected algae seed culture is circulated. The growing algae feed on the nutrients and are easily collected. Bio-coils are now in operation at Stoke Bardolph for nutrient removal of Severn-Trent. It is claimed that this system climates the problem of sludge and heavy metal accumulation. This system serves to capture the sewage water at source and turn it into solid feedstuff that can be packaged, stored, transported and distributed whenever needed. A project to produce the blue green algae *Spirulina*, similar in principle to the Bio-coil has been in operation since 1993 in the Institute of Wetland Management and Ecological Design. The expertise achieved in the *Spirulina* Project may be available for Bio-coil technology. This innovation will open new vistas in the use of East Calcutta wetlands more productively maintaining the eco-systems.

CAPACITY BUILDING FOR THE INSTITUTIONS

Many interests have a stake in the wetlands. Different institutions play key roles in the management of the East Calcutta wetlands. The most important task is to co-ordinate the various activities that are being taken by different agencies like the Department of Fisheries, the Department of Irrigation and Waterways, the Department of Agriculture, the Calcutta Municipal Corporation, the Calcutta Metropolitan Development Authority, the Department of Rural Development, the Panchayat and Zilla Parishad etc. It is necessary to create an appropriate authority for the management of wetlands which will coordinate different departments and seek institutional support from organisations like UNEP, World Bank, IUCN, Ramsor Bureau, ADB, ODA and so forth for the implementation of management action plans in the wetlands. The East Calcutta wetlands has become a global issue and needs support for the survival of the largest sewagefed agro-ecosystem in the world

Capacity building for different institutions/departments would be to assess the participatory role of such institutions/ departments. Participatory techniques will be helpful in assessing the nature of the problem as well as the reality, feasibility, prac-

ticality and acceptability of potential solution. IW MED believes that people affected by the environment, (wetland) need to be involved and to feel that they have a stake in the process of developing strategies and action plans to improve it, in order to achieve a greater degree of sustainability. The experience earned by the people of East Calcutta wetlands in evolving a unique system of waste recycling is likely to be disseminated as the most appropriate technology. Such a model for urban sanitation on the one hand and resource generation on the other hand may be upscaled. The important innovation for dealing with the complex eco-system of East Calcutta wetlands would be for the Government at all levels to employ interdepartmental, inter-disciplinary integrated systems modelling to evaluate alternative environmental management policies.

CAPACITY BUILDING FOR TRAINING MATERIALS

Capacity building is also necessary for monitoring and evaluation of impacts of best practices in other areas, both on a national and global scale. Operations evaluation will identify the principal determinants of sustainable development.

Capacity building is not only for institutions/departments. Every individual in the hiring system has his stake to resolve the problem. His experiences with earned skills may not always guide him in resolving the same. But experiences from other practices in different parts of the world will largely benefit him. The documentation of different aspects of the best practices will form a store for dissemination of appropriate technology and methodologies.

The role of policy makers, administrators and managers appears very crucial in the management of practices and other related environmental, economic and social issues. On many occasions these persons have preconceived ideas which are not eco-friendly. Sometimes they consider their decisions final and binding flouting all norms and ignoring the base line situation. Value orientation in the attitude and perception of these people will reinforce the role of the institution in arranging workshops, seminars, field visits and social mixing at the local level for awareness and education.

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TABLE 8.5

SERIAL DETERMINATION OF THE PROBABLE VALUE OF WETLAND FUNCTIONS AND USES

| Function/Use | State of Nature | Variable |
|------------------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Flood mitigation | Rainfall ++ | Flood occurrence and severity |
| | Flood occurrence and severity, physical characteristics of the area ++ | Level of mitigation |
| | Level of mitigation, location and value of assets to be protected ++ | Value of this level of mitigation |
| Toxicant removal | Concentration of toxicants in the inflow, wetland characteristics | Capacity of the wetland in reduce the concentration of the toxicants in the outflow to below a particular level |
| | Toxicant reduction capacity, concentration of toxicants in the outflow ++ | Change in crop production downstream if concentration of toxicants reduced below a particular level |
| | Change in crop production, demand for and supply of this crop and of/for complements or substitutes | Value of in increase production |
| Fish production | Fishing effort, rainfall ++ | Amount of fish produced |
| | Demand for and supply of fish of this type and of/for complements or substitutes | Value of this production |

Source: Compiled by the Author

TABLE 8.6

THE ROLE OF DIFFERENT AGENCIES IN THE MANAGEMENT OF EAST CALCUTTA WETLANDS

| Institution | Role played for | Objectives |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Dept. of Environment & Forests | Environmental protection | Environment |
| Dept. of Fisheries | Supplying technical and other inputs for fisheries | Management |
| Dept of Irrigation & Waterways | Maintaining the channels and monitoring the distribution of sewage water to fisheries and agriculture | Action Plan |
| Dept of Agriculture | Supplying inputs for farming both crops and vegetables | for |
| Calcutta Municipal Corporation | Conversion of garbage wastes (solid) into energy and resources, controlling the sewage outfall and also holding the rights of land of garbage farms in Dhapa | Sustainable |
| Calcutta Metropolitan Development Authority | Implementing the sewage development and drainage plans and also the authority of urban development in C.M.D. | Wise |
| Dept. of Rural Development | Providing resources for infra-structural and integrated rural development | Wise |
| Panchayats/Zila Parishad | Implementing different development plans, monitoring the people and institution for participation in development programme | |
| Dept. of Land and Land Records | Outlining the legal rights vested in the holdings | |
| G.S.I./Z.S.I./B.S.I. | Researches on landforms/structures, bio-diversity and monitoring for the ecological balance | Use |
| I.W.M.E.D. | Surveying and monitoring wetland information systems and also advising in decision making in technical matters as and when necessary | Use |

TABLE 8.7
WASTEWATER SOURCES CONTRIBUTING TO THE WETLANDS (MFCS)

| Sl No | Type of Industries | No. of Industries | Wastewater Flow (m/day) (Approx) |
|-------|--------------------------|-------------------|-----------------------------------|
| 1. | Engineering Industries | 65 | 1728.6 |
| 2. | Chemical Industries | 26 | 15489.6 |
| 3 | Godowns/Garages | 42 | 1505.6 |
| 4 | Institutions | 4 | 2015.6 |
| 5. | Miscellaneous Industries | 15 | 1050.6 |
| | Total | 152 | 21790.0 |

Source E I A for Wetlands, NEERI, 1995

TABLE 8.8
BASELINE DATA : PHYSICO-CHEMICAL WATER QUALITY (MFCS)

| Parameters | Raw Sewage | Crocodile Jheel | | Taftala Jheel | | Khudi-I Jheel | | Khudi-II Jheel | | Loha Jheel | |
|---------------------------------|------------|-----------------|-----------|---------------|-----------|---------------|-----------|----------------|-----------|------------|----------|
| | | Influent | Effluent | Influent | Effluent | Influent | Effluent | Influent | Effluent | Influent | Effluent |
| Temperature (C) | 28-29.5 | 29-29.5 | 29.5-30 | 27.29 | 27.28 | - | 26.5-27 | - | 26-27.1 | - | 26-27 |
| pH | 5-6.7 | 7-7.1 | 7.1-7.5 | 7.2-9.3 | 7.3-8.3 | 7.5-8.0 | 7.5-9.0 | - | 7.5-8.6 | 7.2-8.6 | 7.2-8.6 |
| Alkalinity (CaCO ₃) | 424-430 | 435-440 | 364-380 | 180-240 | 172-240 | - | 204-302 | - | 176-294 | 170-250 | 164-232 |
| Chlorides (Cl) | 359-380 | 340-357 | 324-339 | 226-276 | 226-301 | - | 280-286 | - | 261-281 | 250-270 | 221-259 |
| Total Solids | 1046-1084 | 1156-1160 | 932-1088 | 844-1018 | 930-1018 | - | 850-982 | - | 682-982 | - | 736-898 |
| Suspended Solids | 62-82 | 38-40 | 7-70 | 116-156 | 116-164 | - | 80-204 | - | 76-146 | - | 53-108 |
| Dissolved Solids | 984-1062 | 1118-1120 | 895-1023 | 728-862 | 728-862 | - | 774-778 | - | 752-778 | - | 629-790 |
| Total Volatile Solids | 238-302 | 220-222 | 124-202 | 170-280 | 170-289 | - | 204-266 | - | 198-270 | - | 176-330 |
| Dissolved Oxygen (DO) | 1.5-1.7 | 1.7-2.7 | 3.2-10 | 5.6-7.5 | 8.6-12.7 | - | 10-12.9 | - | 9.8-10.8 | 8.5-8.9 | 8.7-9.5 |
| BOD | 30-70 | 140-142 | 11-27.4 | 28-33.5 | 21.5-33.5 | - | 21.5-28.5 | - | 16-26.5 | 15-25.2 | 10-24.5 |
| COD | 74-208 | 373-375 | 30-67 | 119-171 | 97-161 | - | 59-126 | - | 29.7-120 | - | 29.5-89 |
| Ammonia (N) | 6-7 | 4.2-5.9 | 3.2-5.7 | bdl-1.8 | 0.5-1.8 | - | 0.5-2.8 | - | 0.5-2.8 | - | 1-2.3 |
| Nitrate (N) | 9.4-9.6 | 3-8.2 | 0.30-7.5 | 0.95-1.02 | 0.7-1.4 | - | 0.7-6.55 | - | 0.7-5.85 | - | 0.7-3.98 |
| Total Nitrogen (N) | 61.0-62.5 | 30.8-31 | 33.5-33.8 | 18.2-31 | 31.31.5 | - | 15-18 | - | 13.2-15 | - | 7.5-10.5 |
| Phosphate (P) | 0.085-0.86 | 0.53-0.55 | 0.03-1.60 | 0.4-5.30 | 0.13-4 | - | 0.30-0.82 | - | 0.29-0.36 | - | 0.15-3.2 |
| Sodium (Na) | 230-240 | 240-275 | 245-280 | 230-250 | 220.260 | - | 220.206 | - | 195-220 | - | 160-180 |
| Potassium (K) | 8-9.6 | 10-11.2 | 10-15 | 10-11.2 | 8.2-14.4 | - | 6-8 | - | 5.8-7.4 | - | 3.8-6.4 |

All values of physico-chemical parameters except pH and temperature are expressed in mg/L.

Source: E.I.A. for Wetlands, NEERI, 1995.

TABLE 8.9
PERFORMANCE EVALUATION OF WETLANDS (MFCS)

| Wetland | Influent BOD mg/l. | Cumulative & of BOD removal | Surface BOD loading rate (kg/hr/day) | Cumulative fecal coliform removal efficient (%) |
|-----------------|--------------------------|-----------------------------------|-----------------------------------------------|----------------------------------------------------------|
| Crocodile Jheel | 140.0 | 85.7 | 91.6 | 26.67 |
| Taltala Jheel | 77.0* | - | 131.1 | 99.4733 |
| Khudi-I Jheel | 27.2 | 64.68 | 83.4 | 99.9906 |
| Khudi-II Jheel | 23.2 | 69.87 | 69.3 | 99.9947 |
| Loha Jheel | 15.0 | 80.52 | 58.3 | 99.9980 |

*Flow composited average BOD of five outfall (KR-1, Univ.-1, HP-1, Hide-1)

Source: E.I.A. for Wetlands, NEERI, 1995.

TABLE 8.10
FISH PRODUCTION (MFCS)

| S.No. | Wetland | Water Area (hectares) | Total Fish catch (tonnes) | Annual productivity per hectare (tonnes) |
|-------|-----------------|--------------------------|---------------------------------|---------------------------------------------------|
| 1. | Crocodile Jheel | 16 | 39.50 | 2.47 |
| 2. | Taltala Jheel | 14 | 69.00 | 4.93 |
| 3 | Khudi-I Jheel | 8 | 56.00 | 7.00 |
| 4 | Khudi-II Jheel | 11 | 40.00 | 3.64 |
| 5 | Loha Jheel | 5 | 39.00 | 7.80 |
| | Total | 54 | 243.50 | 25.84 |

Source: E.I.A for Wetlands, NEERI, 1995

TABLE 8.11
PROBLEMS AND PROSPECTS OF CALCUTTA'S GROWTH

| Sl. No | Parameter growth | East and South-eastern | Northwards growth |
|--------|------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Environmental consideration valuable ecosystem and waste treatment facility. | Loss of wetlands; increases air pollution; destroys | The wetland ecosystem remains intact. |
| 2 | Drainage; flood/water-logging and health hazards | Reclamation and urban constructions cause major loss of drainage outfall basins. Less facilities for disposal of rainfall excesses; increasing health hazards | Wetland facilities in the eastern metropolitan fringe can be utilized |
| 3. | Water supplies | Increasing mineralization and hardness of water; unpredictable salinity in ground water. Consequent need to tap and treat Hugli water. | Prolific ground water supplies major basin; lesser pumping costs and mineralization problems (only iron removal called for); safe and potable for human beings |
| 4. | Sewage/treatment and solid waste disposal | Natural Dhapa system being lost by reclamation. Calls for costly treatment plants. Gradual loss of garbage disposal sites as well. | Natural facilities retained. Additional system can be designed in eastern metro fringe wetlands. |
| 5. | Economic products | Rich fish haul as primary source of protein rapidly dwindling. Vegetables growing areas also likely to be usurped for urban construction ultimately. | Fisheries development can be further strengthened with State/Panchayat control; more or vegetable mixed farming products. |
| 6. | Hinterland and communication | Away from the city's hinterland increased freightage and communication/traffic problems in core Calcutta. | Nearness to hinterland easier disposal of trans-Hugli facilities shall need strengthening of North communication corridors. |
| 7 | Social factors | Loss of primary sector livelihood (fisheries, farming, etc). Increasing tertiary sector problems. Control by land speculators to take over reclaimed land parcels at the cost of middle and lower economic classes. | Distance from core will discourage such speculators. Cleaner urban development, better health due to lesser drainage congestion and lower preventive health costs etc. Greater land/water based employment in primary sector. |

| Sl. No | Parameter growth | East and South-eastern | Northwards growth |
|--------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| 8 | Hugh Conservancy | Larger extraction of water for urban supplies with consequent flow reduction and increased pollution and salinity; in turn, escalating cost of treatment. | Trapping Hugli avoidable Northwards reach of river less polluted with lesser tidal salinity. |
| 9. | Land | Only by reclamation at high cost and degradation of system. | Good lands available in Kalyani-Haringhata zone. Dairy to be shifted to east Calcutta reclaimed zone. |

Source: Ecology and Environment of Calcutta, A. Ghosh, Government of West Bengal, 1992.



Sustainable Urban Development : A Case of New Bombay (NAVI MUMBAI)

City and Industrial Development Corporation, Navi Mumbai

BACKGROUND

Some of the main factors responsible for the present state of affairs in Bombay are embedded in its physical form. The majority formal sector jobs in Greater Bombay are located in its island part at the southern tip. This is because the development of the city began with the construction of a Fort at the southern tip of the island, very early in the life of the city. Through successive periods of history this area has been accumulating newer activities to finally become the present day Central Business District (CBD) of the city. The eastern side of the island part provides deep waters and an excellent natural harbour, as the result of which, development of the Port and consequent trading facilities took place here, accompanied by the growth of industries, which also chose to locate themselves in the island part.

THE REGIONAL SETTING

Recognizing the need for planned expansion of Bombay in the wider context of a metropolitan influence zone, the Maharashtra Government appointed the Gadgil Committee in 1965 to report on the steps that should be taken to achieve planning in a regional context. Following on its recommendations, the Bombay Regional Planning Board (BMRPB) was set up in 1967.

While deliberating upon the Bombay Metropolitan Regional Plan in early 1970, BMRPB had before it three alternative scenarios of growth for the Region. It could be a linear corridor plan or it could be a series of medium sized New Towns, around the Bombay Metropolitan, forming a sort of a circular ring road or it could be a Single New Counter Magnet of Metropolitan size (BMRPB-1973). Out of the three, the last alternative had the best potential for sustainable growth, both for itself as well as for the already congested Bombay Metropolitan. The new metropolis was expected to be 'Capable of absorbing large numbers of tertiary sector jobs' (BMRPB op cit p XXVII). This metropolis, later named as New Bombay, was expected to hold a population of two million by the year 1991, thus relieving Bombay from further congestion and also preventing rapid & unregulated growth of other small towns in the region¹

FORMATION OF CIDCO

To implement the twin city recommendation of the BMRPB, the Government of Maharashtra set up the City & Industrial Development Corporation (CIDCO) under the Indian Companies Act, in March 1970. CIDCO is wholly owned by the State Government. It has been designated as the New Town Development Authority (NTDA) under the Maharashtra Regional & Town Planning Act (MRTP Act) for the New Bombay Project. Simultaneously, the State Government notified 166 sq. Km. of privately owned land in 86 villages in the area across the creek for acquisition. Along with it, the State Government land located in these villages was brought under CIDCO's control for effective planning and development of the city of New Bombay. While as NTDA CIDCO was to prepare and administer the plan, the Government, by a separate order entrusted to it also the works of plan implementation and provision of urban services. Services will be transferred to a local body when it is established and is ready to take over this responsibility. New Bombay and other new towns, were to be self-financing by tapping financial sources other than the State ex-chequer. These included private capital and value-addition to land.

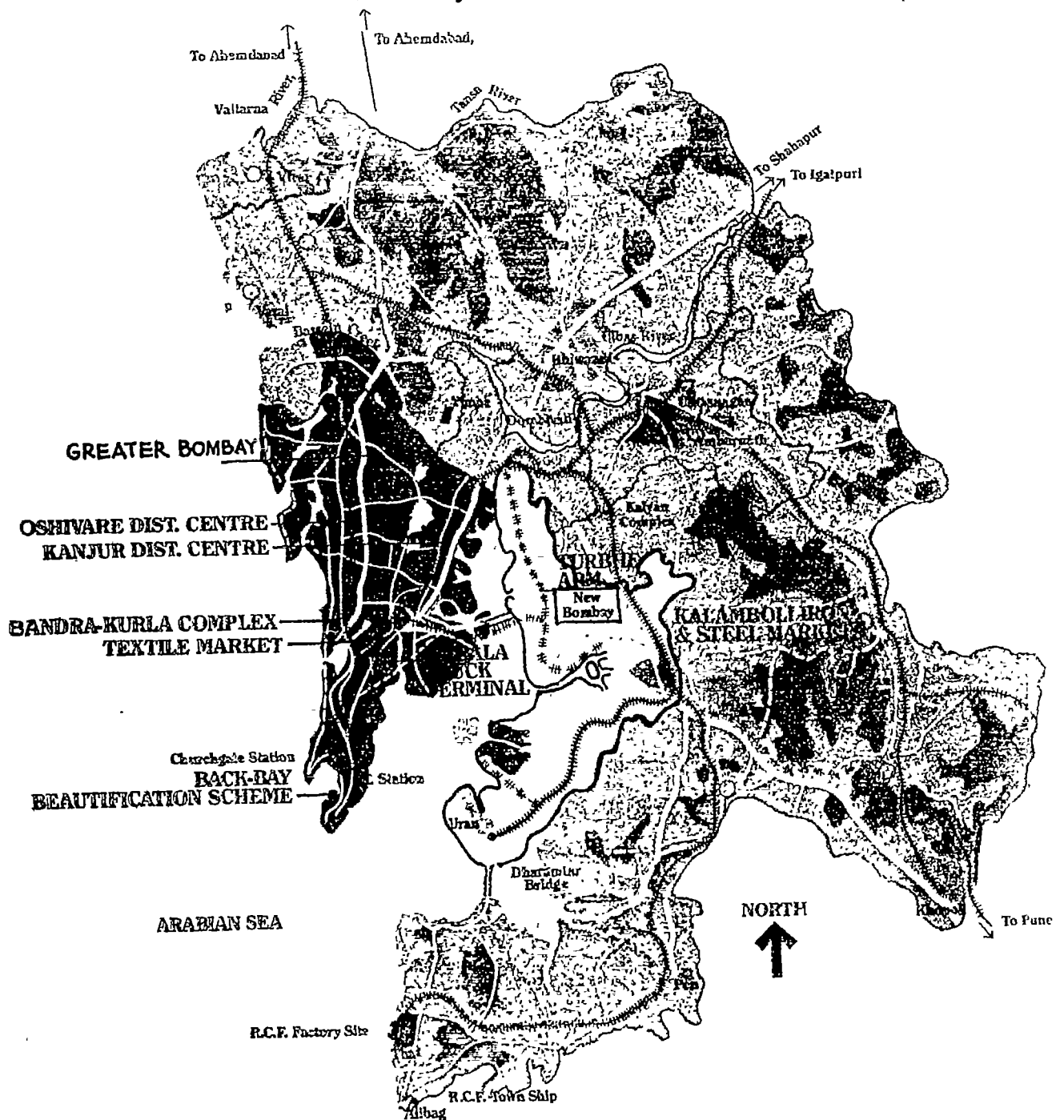
SITE OF THE NEW CITY

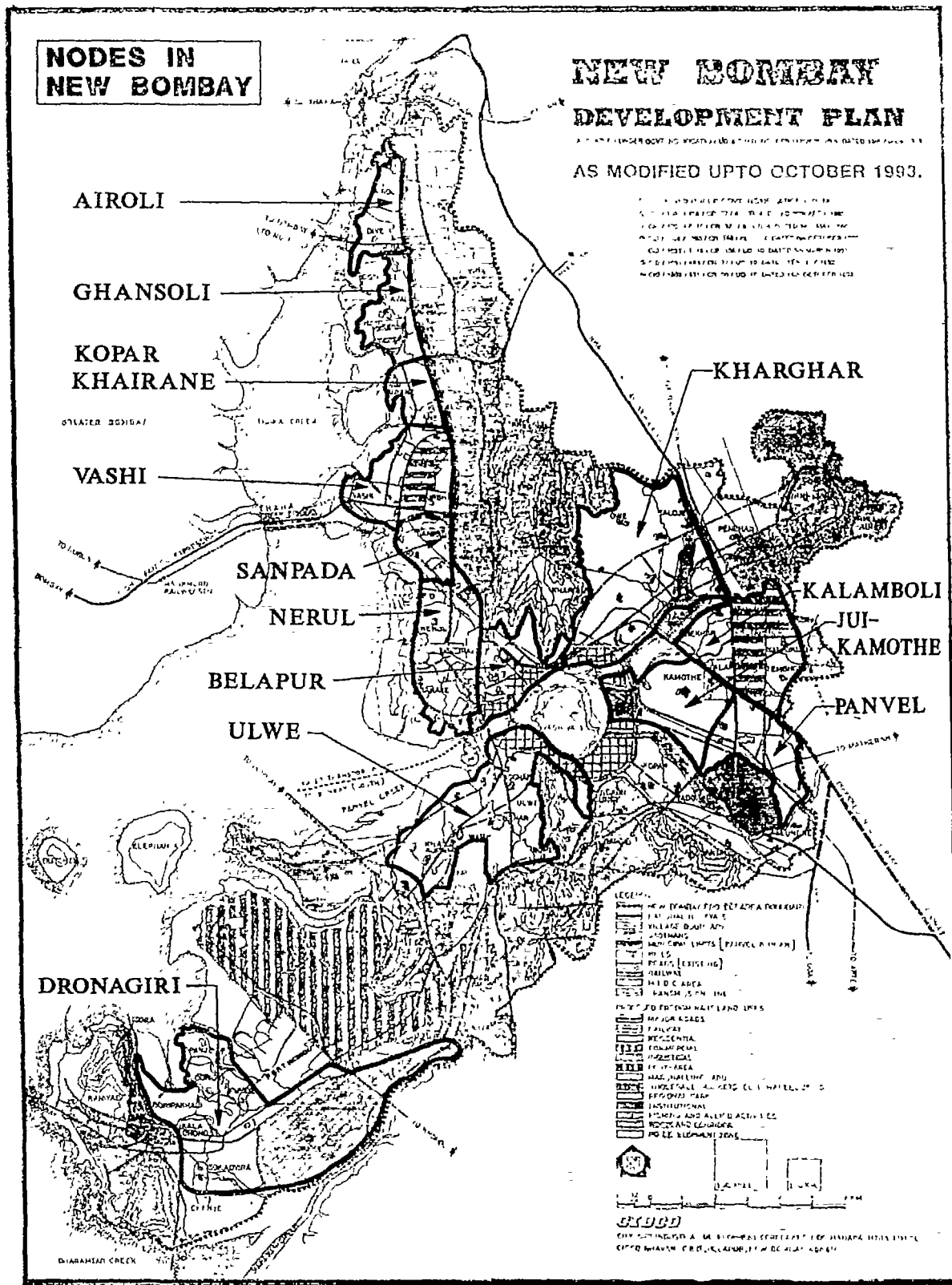
BMRPB recommended the location of the new metropolis within the BMR itself, primarily because any other location would defeat the basic objective of decongesting Bombay. A new city located away from the existing metropolis would have required more effort, it would have also lost the benefits of agglomeration economy which its location closer to Bombay would have assured. While deciding the location within the BMR, BMRPB focussed on the following criteria:

"...The new location must be able to provide all the necessary inputs for Metropolitan Development, must provide scope for its extension over the hinterland area when such a contingency arises in future, and must also be able to exploit the growth potential created by major development projects already initiated in the region. Above all, the location for the New Metropolis must not be drab, and must offer a variety

¹ In 1971, there were 10 Municipal Towns and 8 non-municipal towns in the region. Some of the towns like Thane & Ulhasnagar had a population of over 100,000 and were rapidly growing and were in the process amalgamating the smaller adjoining towns.

REGIONAL PLAN FOR BOMBAY METROPOLITAN REGION





in its setting & an aesthetic potential for being exploited while molding the city plan..."(BMRPB op cit p XXVII)

Trans-Thane Creek (TTC) and the Trans-Harbour area extending up to Panvel was selected as the site of New Bombay, as it fulfilled all the requirements laid by BMRPB. Geographical location of this area vis-a-vis the existing Bombay, and its metropolitan region is shown in Figure 9.1. Area of New Bombay including the Municipal townships of Urban & Panvel, is 344 sq km. The area comprises marshy lands along the Thane-Creek, hills of the Sahyadri Range and generally east and west sloping land.² The hills rise up to a height of 235 mtrs

ENVIRONMENTAL CONSIDERATIONS AND THE SITE OF NEW BOMBAY

The Bombay Metropolitan Regional Planning Board (BMRPB), while stressing the physical and economic suitability of the site had also highlighted its aesthetic and amenity values. It, however, did not consider two major environmentally negative aspects of the site. Its location between two existing industrial areas exposes the site to risks of high air and water pollution as well as to the risks on account of industrial disasters. A recent study has enumerated over 1200 industrial units of different sizes in the area. Some of the industrial units are highly polluting. They collectively discharge over 500,000 M /day of waste water and large amounts of SO, NO and TSPM (Govt. of Maharashtra (GOM), 1994a).

Pollution effects are further compounded by the peculiar geographical location of the city. Vast plane surface i.e. creek and low lands, bordered by the curved (concave towards Bombay) Sahyadri range, provides a good trapping ground for pollutants both from Thana Belapur Industrial Area (TBIA) as well as from Chembur area across the creek. Large land-fill (Deonar) on the Bombay side of the Thane Creek further worsens the situation. Incineration of waste at this site results in large amount of smoke which due to easterly wind, settles over the Thane Creek and beyond over some of the residential areas of New Bombay.

Study conducted by the Govt of Maharashtra (ibid) further identified that use of fire/explosion prone chemicals such as ethylene oxide, kerosene, LPG etc. can be potential sources of industrial disaster or toxic pollution. Other toxic chemicals used in TBIA are Ammonia, Chlorine, Hydrogen Sulphide and oleum/sulfuric acid (GOM, 1994a).

Second environmental consideration that was overlooked was the large scale reclamation which will be necessitated. Nearly 27 sq km of land consisted of salt pans and many more sq.km. consisted of low lying marshy land. Their reclamation has two

major consequences. Firstly, large amounts of sand and debris will be required for reclamation which may lead to disturbance to the fauna and flora found in the littoral zone. Second, modifying the natural drainage may lead to flooding, if proper and adequate storm water drainage network is not provided. Some of the negative aspects of the site of New Bombay have been mitigated by proper strategy and planning, as will be seen in subsequent sections of this study.

Third environmental consideration is the passage of major highway (Bombay-Pune Highway), right through the heart of the new city. Nearly 18 km. of this very busy highway passes through the city. According to a survey conducted in 1994, traffic load on this highway is 27,830 vehicles.

PLANNING OF NEW BOMBAY

New Bombay city is perhaps the largest New Town anywhere, and hence experiences gained while planning for this city are expected to be of use to other places, especially in the developing world. While preparing the New Bombay Development Plan (NBDP) in 1973, the following main principles were followed:

- a. Poly-centric pattern of development;
- b. Development to be undertaken through land banking by acquisition of the entire notified area of New Bombay. This is to exercise better control on overall environment as well as to use land as the main resource for development.

PROJECT OBJECTIVES

The main objectives of creation of New Bombay included not only provision of a better urban environment in New Bombay, but also a consequent improvement in the environment of Bombay. These objectives³ are given below:

- to reduce the growth of population in Bombay city by creating an attractive urban centre which will:
 - a. absorb the immigrants who will otherwise come to Bombay
 - b. attract some of Bombay's present population so that overall population of Greater Bombay can be contained within a manageable limit.
- to support the state-wide Industrial Location Policy which will eventually lead to an efficient and rational distribution of industries over the State and a balanced development of urban centres in the hinterland
- to provide physical and social services, raising the living standards and reducing the disparities in the

² Sahyadri range which runs almost parallel to the Thane Creek divides the New Bombay area into two parts. One part drains towards east into the Thane Creek and the other one drains towards west into the Panvel Creek.

³ Source: New Bombay Development Plan of 1973.

amenities available to the different sections of the population

- to provide an environment which would permit the citizens of New Bombay to live fuller and richer lives in so far this is possible, free from the physical and social tensions which are commonly associated with urban living.

To fulfil the above objectives, planning has been used as a tool. More specifically the concept of poly-centric development, and the planning norms including land-use, population-job ratio and Development Control Regulations etc and plan implementation, have all been used to develop an ever sustaining city. In the remaining part of this section, the planning concept and planning norms are described in greater detail

PLANNING OF NEW BOMBAY

The main problems facing Bombay can be attributed to its peculiar physical form and the concentration of jobs at one single place. These lacunae necessitated that a different planning concept should be the basis for the city of a New Bombay. Thus the fundamental concepts of spatial planning adopted for New Bombay are. polycentric pattern of development; spatial dispersal of employment centres; and use of land-use zoning and development controls as tools for better environment creation.

Availability of this infrastructure and the lessons learnt from the Bombay situation gave rise to the concept of polycentric pattern of development. New Bombay was conceived as a series of Nodal Concentrations strung out along Mass Transport axis. There were to be 14 such centres, referred to as 'Nodes', each having restricted size and separated from the next by open spaces. Each node is planned to contain accommodation for all the income groups. The planned city commercial zones were to integrate the TBIA with the emerging Complex.

While each node is planned to have its own residential accommodation, depending upon the location of major employment centres, each node is also planned to be a self-contained township with all necessary urban amenities. Nodes are subdivided into sectors that are delineated along roads which are further divided into residential condominiums. Each node is planned to have a complete set of social facilities such as schools, community centres, religious facilities, hospitals, gardens and play grounds, etc. and public utilities such as fire stations, police stations, transport terminus, post offices, water storage reservoirs, sewage treatment plants, electricity and telephone substations, etc

DISPERSED WORK CENTRES

While planning for the decongestion of Bombay, industrial location policy in Maharashtra was seen as a tool to disperse industrial jobs throughout Maharashtra. However, the office

jobs couldn't be dealt with so easily, for the simple reason that a lot of prestige is attached to such areas. Hence, the office jobs needed to be redistributed in BMR itself, in regions like New Bombay, Bandra-Kurla complex, etc. Again, the extent of their shifting would depend on how prestigious these areas become. Thus, a very attractive location was to be chosen in New Bombay, and the choice was the prestigious Water Front Development. The Central Business District (CBD) of New Bombay is planned around the Waghivali lake encompassed by land. This area is planned to be accessible by the inner and outer ring roads, the commuter rail corridors, and also by Water Transport.

The employment centres as described above are spatially well dispersed to:

- a) avoid uni-directional flows of traffic during peak hours, as experienced in Bombay, causing traffic congestion, and
- b) to place the work centres in close proximity to residential areas, thereby reducing work trips and travel time.

Locations, while dispersed spatially, are also chosen with reference to the existing and future availability of infrastructure, location of Port and ONGC, and keeping in view the economies of agglomeration.

NEW BOMBAY DEVELOPMENT PLAN (NBDP)

Land-use zoning was used as a tool for creation of better environment in New Bombay. There was perceived to be a possibility of serious error while translating the objectives of New Bombay into land-use plan, the effect of which could be disastrous. For this reason, it was planned to keep as many options open as possible, instead of laying down prescriptions for the entire plan area at one time. Thus, a Development Plan, indicating the broad land-use zones with the uses permitted therein was prepared for New Bombay (Fig. 9.2). This approach also allowed freedom & flexibility in planning to suit the changing circumstances.

THE CITY STRUCTURE

The basic form of New Bombay evolved with a circular and intense development around the Waghivali lake and with four transport corridors emanating towards Thana, Nhava-Sheva, Taloja and Panvel. Residential areas are centrally placed to serve the three industrial employment centres of TBIA, Taloja, and the Port near Uran. Developments are also proposed along the four mass transit corridors around the lake. Closed circular loop form of transportation is considered very efficient, and fortunately for New Bombay, the Waghivali lake allowed such a development to be proposed. The possibility of creating a large lake using the extensive areas of Panvel Creek including the low lying Waghivali island by putting up a dam is still

under consideration, to achieve high intensity water front development. The presence of Hills and water bodies offered a striking opportunity for the development of the new city.

The NBDP, as first published in October of 1973 and having undergone five subsequent minor modifications till date, is the main statutory framework for guiding the development of New Bombay, supported by the General Development Control Regulations (GDCR) and the Land Disposal Policy, all of which are amended from time to time.

Detailing out of the nodal plans is based on planning norms with respect to densities, land-use distribution and provision of amenities. While the GDCR of New Bombay prescribes building bye-laws in detail, it does not prescribe many land subdivision regulations except those related to provision of open space (15% of layout) and means of access.⁴ However, the planning norms are in-built in the process of planning. The norms as thought of in the NBDP of 1973 are explained below.

Planning Norms as followed in the Planning of New Bombay

Schools: For the expected population of two million, with 16,000 Pre-primary school pupils, 200,000 Primary School pupils, 171,000 Secondary school pupils and 69,000 College going students, 100, 360, 257 and 40 institutions are planned respectively.

Hospitals No of beds required per 1000 population are 4.5 & 0.86 (maternity). The built-up area per bed assumed is 52 sq.m and 45 sq.m with and without staff quarters. Hospitals of minimum economical size of 100-200 beds are assumed.

Town amenities:

- a) Police - One post for every 15,000 population, one Station for every node and Central Station of New Bombay.
 - b) Banks - One bank branch per 10,000 population
 - c) Markets - One site of 2000 sq.m per 20-25,000 population with an average area of 20 sq.m/shop.
 - d) Hotels & Restaurants - As per actual demand.
 - e) Social - Big community halls in each node
- Cinema Halls

- f) Cinema Halls - One cinema seat per 50 people, with a minimum of 20,000 population
- g) Public Convenience- At a rate of 1 unit per 2000 population.

In addition to the above space specific norms, thought was also given to the following:

- a) Social Welfare Institutions such as Remand Homes for boys & girls, Night Shelters near Railway Stations and Wholesale Markets, Institutes for Physically Handicapped and the Blind, Schools for Mentally Retarded Children, Leprosy Homes, and Shelters for Destitute Children.
- b) Libraries and Reading Rooms;
- c) Auditoria for Cultural, Linguistic and other groups;
- d) Swimming pools; two by CIDCO at Vashi & Belapur anticipated and the rest from private sector;
- e) Hostels for working women;
- f) Jail as and when appropriate;
- g) Crematoria: Crematoria to be located near sea and burial grounds on the periphery near the hills. Those existing to be brought to CIDCO standards;
- h) Hawkers' Zones to be resolved;
- i) A large Urban Data Bank or Information System useful for entire BMR, consisting of information on land Ownership, Use, Suitability, Physical Development, Socio-Economic data, Transportation details, Air Pollution data, details of Services & Utilities.

HOUSING

The approach to housing provision adopted by CIDCO has been a complete package of urban amenities. The households wishing to move to New Bombay are offered all their daily necessities within walking distance. Every sector was provided with a Commercial Complex where all the facilities such as Provision Stores, Flour Mills, Hardware & Electrical Shops, Ration Shops, Post Offices, etc were made available. The actual provision of houses has been in the form of Built Houses, Plotted Development for Row & Bungalow plots, development of Sites & Services, developed plots for Co-operative Housing Societies, plots for Corporate & Government Bodies for housing their employees, and now, large plots for Developers.

⁴ This is so because the major development is expected to be undertaken or prescribed by CIDCO itself and also because till date the responsibility of provision of social amenities is vested with CIDCO.

During the initial years of development of New Bombay, there had been a need to offer ready-for-occupation houses to attract residents to New Bombay. The socio-economic survey (CIDCO, 1987) reveals that the reason cited by a majority of residents, who moved to New Bombay, was ready availability of ownership houses. However, with development picking up, co-operative housing societies as well as the private sector were encouraged to build houses. Large scale development by housing co-operatives took place during the late 70s and the 80s. Simultaneously CIDCO provided plotted development for Bungalow sites (New Panvel) & row house plots (Vashi & Belapur). The average size of private houses in New Panvel is 95 sq m, while this figure is 65 sq.m for other nodes (ibid)

With the inauguration of first railway line to New Bombay in 1992, need for inducement diminished as the city started attracting population on its own. This led to great appreciation of land values. Further, the recommendations of the National Housing Policy that Public Agencies should act as facilitators rather than providers of housing, prompted CIDCO to limit its involvement in direct provision of housing, but to continue the same for the lower income groups. Development of houses for the other income groups is primarily left to the private sector. By now, government agencies and large companies have taken up the work of housing their employees. They were given preferential allotment of land. However, since the areas demanded are large, CIDCO evolved the mechanism of granting gross FSI⁵, which has the following advantages:

- a. Less burden on CIDCO for laying infrastructure at individual building level, as now only plot level connections are given (cost of internal development works including roads and open spaces is borne by the plot owners) resulting in saving in cost and effort by CIDCO;
- b. for the plot owners, this meant additional build-up-area, because otherwise FSI would have been available only on net residential area after reserving land for amenities, roads & open spaces; and easily manageable properties.

During 1993, a new scheme of participatory developers was announced for 12 plots of 3 ha. each, where development was expected to be carried out under prescribed conditions. However, the conditions pertaining to the planning aspects are mentioned below:

Scale of these plots for sale to developers, is now being increased to 50 ha. in Ulwe node, where a fixed number of houses are to be built and returned to CIDCO by the developers.

During 1995, a new scheme of registering the demand for Corporate sector offices in New Bombay has been carried out, for Kharghar & New Panvel nodes. Considerable interest was

shown by corporate bodies in this development. Two main features of this scheme are.

1. The companies wishing to shift, establish, and expand their operations in New Bombay, with a minimum annual turnover of Rs.1000 Million each in the last three years, and those employing not less than 100 persons are considered eligible to apply under the scheme.
2. By way of incentive, residential plots at a rate of 50 sq.m per employee is offered on demand, and 25% of the FSI is permitted to be sold to other parties (as built premises) to raise finances for the construction of the office complexes.
3. The office plots are offered at market price, and the residential plots at differential price (depending on the percentage of employees for whom residential plot is demanded), varying from 250% of reserve price⁶ to 1000% of reserve price (or the market price, whichever is higher).

This method of attracting corporate sector has the following advantages;

- it is need-based;
- development is not fragmented as happens in case the plots are sold to developers,
- housing for the employees of the corporate bodies is assured in New Bombay and as far as possible is located closest to the respective offices, reducing trip generation.

SOCIAL INFRASTRUCTURE

In New Bombay, development of social infrastructure is ensured by fixing norms for various amenities such as schools, poly-clinics, creches, community buildings, etc and then providing for the same by land reservations. As against the policy of calling upon large plot holders like housing co-operatives to develop the local amenities, CIDCO itself undertakes these works either directly or through institutions already working in concerned fields.

PHYSICAL INFRASTRUCTURE

Physical infrastructure consisting of roads, storm water drains, solid waste management and sewerage for the city of New Bombay is planned and executed by CIDCO. To spread the costs, however, it is executed in stages. The expenditure on these infrastructure items is enormous due to the land characteristics. As most of the land was originally low-lying flat land, area development as well as foundation costs are higher. Due

⁵ Floor space Index is the ratio of the total built-up-area (of all floors together) to the area of the plot.

⁶ Reserve price is the break-even cost of the development of land per sq. m.

to very poor gradients available, sewerage network has a high cost involving laying of sewerage pipes at depth and consequent pumping to Sewage Treatment Plants (STPs).

Over 50% of the annual total expenditure on New Bombay Project is on account of infrastructure & amenities. It is estimated that at current price, per capita infrastructure investment of Rs. 15,000 & Rs. 1200 for residential & commercial area development is needed.⁷

On an average, the percentage break-up of various infrastructure components out of the total on-site physical infrastructure cost works out to be.

| Infrastructure item | % cost |
|--------------------------------------------------------------------------------|--------|
| a. land development including site clearance, cutting & filling, and levelling | 20% |
| b. Storm water drainage | 25% |
| c. Roads & pathways | 25% |
| d. Water supply | 12% |
| e. Sewerage | 18% |
| Total | 100% |

TRANSPORTATION SYSTEM IN NEW BOMBAY

The transportation system in New Bombay is planned to achieve easy accessibility, reduction in travel time to reach destinations, and reduction in use of multiple modes of transport for reaching a single destination. To achieve the above objectives, Railway is taken as the mode of Mass Transit, which is supplemented by road transport by Public Buses, hired taxis and privately owned vehicles. For the development of railway mass transit, its linkage with transport nodes of Bombay, i.e. Victoria Terminus and Bandra, were taken as essential. For road transport, besides the existing highways, very high capacity arterial roads have also been planned. For inter-urban travel, in addition to the above, Hovercraft and Catamaran services across Bombay Harbour, and Boeing 737 type Aircraft for inter-city travel are also envisaged. Basic framework for adopting innovative modes of transportation is, thus, established.

COMMERCIAL COMPLEXES OVER THE RAILWAY STATIONS

For the first time in India, an effort has been made to utilise the air space above railway stations. The objectives of this concept are:

1. to build commercial complexes above the railway stations, spreading both over the tracks as well as on both sides of the tracks, for providing intensive commercial place which will reduce the dependency on secondary travel;
2. to accelerate shifting of offices from congested areas of Greater Bombay to New Bombay. The general development pace has speeded up phenomenally after the commissioning of railway, with real estate prices going up; and
3. to partly meet the cost of railway infrastructure from the surplus generated from these commercial complexes.

The construction of commercial complexes has already been taken up by CIDCO, over the railway stations of Vashi, Sanpada, Junagar, Nerul and Belapur, which will give rise to saleable built-up commercial spaces of 60,000, 8000, 2000, 6000 and 70,000 Sq.Km. respectively. Each railway station-cum-commercial complex is a complete public building with all public amenities, shops and offices.

The financing method adopted for the first time in the history of railway development in India is a fine example of co-operative effort of the Ministry of Railways, Government of Maharashtra and CIDCO for providing urban rail commuter service. Mankhurd (Bombay) - Belapur (New Bombay) railway, is a unique example of a joint Public-Public venture. The cost for this line is shared by CIDCO (Government of Maharashtra) and the Ministry of Railways (Government of India) in the proportion of 67% and 33% respectively. For raising finance for CIDCO's share, it was allowed to float rail bonds with the approval of the Government of India. The Central Railway also levies a surcharge on passenger tickets for travel between Bombay & New Bombay, and the amount so collected is being deposited with CIDCO, to enable it to repay the bonds with interest over a period of 15 to 20 years.

Thus CIDCO's share of the contribution is proposed to be recovered from :

- a. the appreciated land-values in the areas served by the railway line;
- b. the surplus from disposal of the commercial complexes on the railway stations;
- c. collection of surcharge levied on railway tickets.

LAND ASSEMBLY

Almost at the same time when the project was being notified, a scheme was launched by the Government of Maharashtra,

⁷ With reference to the specific infrastructure investment needs, employment areas in New Bombay are classified into 3 categories such as, (1) MIDC developed areas (with no investment need by CIDCO), (2) the incidental employment arising out of the general development of nodes, (which again doesn't require special investment by CIDCO), (3) the areas designed as major employment centres (to be developed by CIDCO requiring major infrastructure investments by CIDCO).

which prevented further sub division of units and also provided for consolidation of holdings of individual land owners. In the project area this task was started early and was completed covering considerable area in a number of villages. While this did result in some consolidation of holdings and in greater regularity of shape of a holding, the land still was not sufficiently assembled to enable proper planning. Besides the size and shape of a holding, the issue of ownership of land was also crucial for proper and effective planning. It was felt necessary that the ownership of the land should vest in the New Town Development Authority (NTDA). In 1970s the large scale land acquisition of private lands and transfer of Government land to the NTDA was the only option available. Accordingly all the private lands were notified for compulsory acquisition.

DELAY IN LAND ACQUISITION

Though the first set of notifications was issued in 1970, land measuring about 4000 ha. is not yet in possession of CIDCO after 25 years. The delay was caused by stiff opposition from land-owners, inadequacy of infrastructure in the area, lack of logistical support to the land acquisition officers and extreme inaccessibility of some of the lands particularly the salt pan lands. Issue of land acquisition was further complicated by an amendment to the Land Acquisition Act in 1984, which made it obligatory to acquire the lands involved in ongoing cases within two years from the commencement of the amendment, i.e. September 1984. Failure to do so will mean automatic lapse of the original notification and the process will have to start de-novo. In view of this, a decision was taken by the CIDCO in 1984, to focus on those lands which were urgently required and to let the notification lapse in respect of those lands which were not so urgently needed. The latter were the lands earmarked for regional parks or no-development zones. This meant that on September 1986, notification in respect of about 5160 ha of lands lapsed. Delay in land acquisition is exhibited by the fact that as on 1st January 1995, nearly 4050 ha of land is still to be acquired, i.e. over twenty percent of the total land to be acquired.

DISPUTES ABOUT COMPENSATION

Land Acquisition Act provides for a reference to the Civil Court for determination of proper compensation in the event a dispute is raised. A large number of land acquisition awards declared end up in Civil Courts. Civil Courts have enhanced the compensation on the average by about 300% to 400%. This has affected the project in two ways. Firstly unforeseen costs have to be now loaded on to the project, thereby affecting, though marginally, its financial viability. Secondly, it has meant large amount of extra administrative work.

SOCIAL COSTS OF ACQUISITION

In the project area, so far, a large number of families have been affected by land acquisition. Land was their only source of income. Situation is further compounded by the fact that land mostly belongs to uneducated and unskilled people, who

were far removed from the culture of cities. Though large numbers of rehabilitation projects (as will be discussed later), particularly the returning to the original owners the developed land equivalent to 12.5% of the acquired land, has mitigated the adverse effect on the affected families, but the resentment against the project continues.

ALTERNATIVES TO COMPULSORY LAND ACQUISITION

Over the last two decades, some other alternative methods of land assembly have become available. The Land Acquisition Act has been amended to provide for "Consent Award", wherein the acquiring authority can negotiate with the land owner to arrive at an agreed amount of compensation. More important than this is the amendment of the Maharashtra Regional Town Planning Act (MRTP Act). This amendment provides for direct negotiation, without the authority of land acquisition officers, with the land owners. This process, if judiciously followed, can save on time and also eliminates the local resistance to the project.

Besides the alternative method of attaining total ownership, there are also new innovations providing for a participative approach to land development. In one of the methods adopted by Bombay Municipal Corporation, the owners are provided with Transferable Development Rights (TDRs). In this, an owner of land, whose land is acquired for a public purpose gets a TDR, which permits him to use equivalent FSI on any other piece of land of his own ownership or to transfer the TDR to any other land holder. Success of this depends on the efficiency with which it is administered and the extent of TDR market development.

Yet another alternative is to acquire only a certain percentage of land from all owners and use the acquired land for providing public services and also for compensating the owners whose lands have to be per-force fully acquired due to their location etc.

Thus, CIDCO has demonstrated that land could be used as a resource for development with alternatives of total land acquisition (land banking), partial acquisition (Participatory development) and even no acquisition (Transferable Development Rights).

HOUSING FOR URBAN POOR

AFFORDABILITY CRITERIA

Affordability Criteria adopted by CIDCO are threefold. First is the criterion for conventional houses which are given to EWS/LIG on hire purchase basis. In this the purchaser is expected to pay 20% to 33% of the total cost as down payment and the rest as equated monthly instalments (EMI), which are not more than 18% of his monthly income. This criterion is in line with

the one prescribed by HUDCO. Second is the criterion for the serviced sites of CIDCO. Under this, the cost of sites is very low, but the buyers contribution is higher at 33% to 40%. Equated monthly instalments are limited to 13% of the monthly income. Third is the criterion for "Sites & Services" under the BUDP Phases I, II & III. The criterion is as follows:

1. Buyer's initial contribution should not exceed 1.5 to 2 times the mean monthly household income;
2. the EMI should not exceed 15% of the mean monthly income for purchase of a serviced site, and 25% including repayment for optional construction loan.

Income criteria for different size units as applicable since 1993-94, for the BUDP Sites & Services schemes are as follows:

| Plot Area (Sq.M) | Household income(Rs/Month) |
|------------------|----------------------------|
| 24 | up to 915 |
| 28 | 916 to 1465 |
| 32 | 1466 to 2306 |

SOURCES OF FINANCE

Housing for urban poor needs subsidy in some form or the other. Low interest loans from HUDCO and under BUDP is one form of the subsidy. For example, up to 1995, HUDCO has provided Rs. 163.6 million in loans at annual interest rates varying between 5 to 9% for EWS category, and Rs. 524 million at annual interest rates ranging from 7 to 12% for the LIGs. These loans are not by themselves sufficient to provide affordable housing, considering the criteria as above. An important form of subsidy is through provision of developed plots for EWS/LIG housing at below the break even rate. CIDCO charges only 25 to 50% of the break even (RP) rate of land for EWS/LIG houses, depending upon the size of the plot.

HOUSING PROVISION

A recent socio-economic survey conducted by CIDCO (1995) specifically for the residents of BUDP schemes at Airoli and Kopar Khairane bring out certain interesting trends. There is an incidence of 45% resale of plots in Airoli (occupied for nearly 10 years) and of 15% in Kopar Khairane. Forty per cent of the houses are built with locally available material, proving that the provision of Building Materials Markets in BUDP schemes are necessary. Thirty three per cent and twenty per cent respectively of the families in Kopar Khairane and Airoli moved in from Bombay while the remaining moved in from the rest of

New Bombay indicating the predominance of local residents mostly working in the TBIA. About 40% of the families cited the reason for shifting as easy availability of ownership houses while about 10% moved because the houses were nearer to their work place. The average household size of 4.0 and the average earners per household of 1.3 are the same as for the nodes. The average monthly earning of households is Rs. 3500 as against the Rs. 5000 in the nodes.

NEW OPTIONS

A new option of providing built-housing to the lower income groups is through the Participatory Developers Schemes. With this, while playing the role of facilitator as per the recommendation of the National Housing Policy, CIDCO can actually involve the private sector in housing the poor. Under this scheme, the entire 35% built-up-area component of CIDCO's can be utilised for housing the low income groups. Since these houses will be handed over to CIDCO at pre-determined rates, they can be sold to the target groups at affordable prices.

However, it is being increasingly felt that conventional form of built housing is going outside the affordable limits of the urban poor.⁸ Hence, the recent housing policy paper of CIDCO proposed that 50% of the new housing to be created for the lower income groups be created by the serviced sites method, and the remaining by in-fill housing of three-storeyed buildings, where partial tenements are constructed and handed over to people. This is expected to bring down the initial cost of the houses by 50% to 60%. This, in essence, is a vertical incremental house, while the serviced sites continue to be the incremental horizontal housing option. Both, by virtue of their being incremental, are perceived to allow more options to the target groups along with total participation, and at the same time spread the expenditure on the house over a much longer period than a conventional built house.

PROXIMITY OF HOUSING TO INFRASTRUCTURE

The Study Group appointed by the Government of Maharashtra to formulate a scheme for shelter for 4 million slum dwellers in Bombay⁹ recommended that, as far as possible, the rehousing of slum dwellers should be done at the same site considering the economic linkages. In any case, relocation has to be within a distance of 10 kms. and the new site should be equally accessible (Government of Maharashtra, 1995).

Appreciating the economic condition of EWS/LIG, CIDCO planned its Sites & Services programme accordingly. Four locations where EWS/LIG houses or the programme of sites and services have been undertaken have had the locational advantage.

⁸ The cost ceiling on LIG housing fixed by HUDCO is Rs. 80,000/- and it is not any more possible to contain the cost of an 18 sq. m house within this amount.

⁹ The Slum Redevelopment Scheme (SRD) envisages on-site redevelopment of slums in Greater Bombay. This is planned to be made possible by grant of additional FSI, which gives the redeveloper extra saleable apartments for cross subsidising the free housing to the slum dwellers.

Besides proximity to rail head and to the job centres, these sites also have as good an access to social infrastructure as the MIG & HIG housing sites. Such prime locations have related problems of efficiency of the schemes.

High value sites closer to job centres and infrastructure, are always being cornered by organised housing developers and builders. Even if by regulations, intensive development of such sites can be avoided so as to keep away builders & developers, sale by the beneficiaries is almost impossible to stop. An EWS/LIG family can always be lured, particularly at times when the need for ready cash for such a family is high (e.g. at the time of major illness or social obligations like marriage of daughters, etc). In most cases these transfers are illegal, because the Government does not permit such transfers. This problem though not systematically studied in New Bombay, is nevertheless present, but its magnitude is less as compared to Bombay.¹⁰

GAOTHAN EXPANSION SCHEME (GES)

Gaothan (village site) Expansion Scheme was formed to accommodate natural growth of pre-existing village settlements within the project area of New Bombay. This was exclusively a rehabilitation effort, but has, as a by-product, served as a method to provide housing to EWS/LIG. A total of about 50 ha. of land has been distributed under this scheme, providing over 8000 dwelling units generally of a size fitting the needs of EWS/LIG.

PUBLIC-PRIVATE PARTNERSHIP

CIDCO'S ROLE AS A FACILITATOR

Except in the initial years, when it was necessary to provide the nucleus of growth, CIDCO has encouraged participation of Private Sector in the provision of housing. Sale of large area plots, by tender, to the highest bidder is one such approach. A total of about 715 ha. of land had been disposed in this way upto September 1994. It will provide about 33,000 tenements in all. While this method has high efficiency, both in realisation of true value of the land and in ensuring speed and quality of provision of houses, it fails to fulfil the social equity criteria. These houses are high priced and are of larger size, i.e. mainly targeted at the upper MIG/HIG groups. To mitigate this and to retain the benefits of private sector efficiency, CIDCO allots large plots to Co-operative Housing Societies promoted by persons belonging to specific target groups. Under this, a total of 377 plots have been allotted, which will provide about 11,000 tenements. Another way to achieve social equity in the provision of housing is direct participation, but in a modified manner. This is discussed in the next paragraph.

MASS HOUSING SCHEME OF 1987

In the year 1987, CIDCO announced a Demand Registration Survey, to assess the demand for housing in New Bombay and to plan for meeting this demand. Nearly 55,000 applications were received, which were classified into three priorities. It was decided to provide houses to all the 19,500 applications falling in priority I and II. To meet this requirement, without increasing the size of the Corporation, many innovative approaches were adopted.

Three types of consultants were engaged by CIDCO for designing & executing these projects: a) Architects selected through a national Architectural Design Idea Competition, b) pre-qualified Architects, c) selected Developers quoting on turn key basis with their own designs. All these consultants had to prepare their schemes based on the detailed design brief¹¹ and as per the specifications laid down by CIDCO. The Architects together designed and executed about 10,000 houses out of the total of 19,500, that were divided into units of 1000 to 1500 houses. Responsibility of these Architects included all architectural works in respect of the schemes, selection of Project Management Consultants (PMC), and execution of project through CIDCO designated contractor. They were also responsible for the defect liability. Supervision during construction time for the developers schemes was to be carried out by CIDCO appointed PMCs. The Developers were invited to primarily build houses with pre-fabricated technology.

However, the lessons learnt from the housing schemes by demand registration and through planning consultancies are.

- Even though nodal and area preferences were enumerated, actual construction programme had to be modified due to various unforeseen reasons. Thus, together with the changes in locational preference of customers intimated from time to time, have resulted in mis-matches between what was registered and what was finally allotted.
- Lack of consistency in actual carpet area available under various schemes due to different technologies used resulted in lot of embarrassment to CIDCO and unhappiness to the customers¹². For the post-DRS mass housing schemes such as PDS, it is being stipulated that tenements having same built-up area shall have same carpet area as well. The architectural design innovations experimented by the various architects, without taking into consideration the impact of these on the space utilisation pattern in Bombay region has again led to similar dissatisfaction.

¹⁰ In these EWS/LIG housing schemes in Bombay i.e. Oshiwara, Dindoshi & Majaswadi, the distribution of EWS/LIG at time of allotment was 90%, 35% & 58% respectively. The same was only 34.26% & 48% after about 5 to 7 years (Oberoi, op cit).

¹¹ The design briefs specified the number of tenements to be built of various area categories, and the areas to be put to various land-use.

¹² For example, the ratio between the carpet to built up areas of tenements varied from 20% to 40% in respect of pre-fab & architects schemes. Since the customers are charged according to the built-up area, it was felt to be unfair.

- Differential methods adopted by different consultants for calculation of areas have led to estate problems.
- Delays in actual handing over possession of the houses, and the resulting price escalation, led to unhappiness and court cases at times. Even though the demand was registered in 1987, the first batch of houses were handed over only in 1993¹³

The experience is a lesson for efficient handling of such schemes in future.

PARTICIPATORY DEVELOPERS' SCHEME

Architects and Developers' schemes described in the preceding paragraph had some limitations such as lack of incentives to the developer to ensure quality and early completion. This scheme also hindered innovation on part of the developer, thereby losing one of the major benefits of Private Participation, i.e., cost effective alternative approach to accomplish the task. These limitations were sought to be removed in the Participatory Developers' Scheme. Salient features of this scheme are:

- a Builders & Developers of repute, with a minimum turnover of Rs.30 million per year in construction and with a minimum construction of 30,000 Sq.m. in the last three years, were pre-qualified;
- b Each pre-qualified developer was given 3 ha. of developed land. Thirty five percent FSI of the plot was to be used for providing houses as per CIDCO's specifications, at pre-determined rate to be paid by CIDCO. These houses will be marketed by CIDCO.
- c Balance 65% FSI will be used by the developer to plan, design and construct houses as per his perception of the market demand. Out of this, he will be entitled to use 5% for commercial purpose;
- d Work of construction of 35% of built-up-area is to be supervised by the PMC appointed by CIDCO and chosen from a panel, agreeable to the developer.

This scheme has many advantages:

- 1 It successfully allows private sector initiative;
2. It meets the Development Authority's obligations of providing low-cost houses by inducing the developer to cross-subsidise,
3. It relieves the Development Authority of the need for direct intervention in housing provision so that it can focus on land development.

This scheme has such obvious benefits that CIDCO is proposing to enhance its scope by increasing the plot size upto 50 ha.

PRIVATE PARTICIPATION IN MUNICIPAL SERVICES

In the absence of any local authority till January 1992, and thereafter due to lack of financial resources with the newly created NMMC, CIDCO has been providing all kinds of municipal services in New Bombay. NMMC has recently taken over the provision of municipal services in the village site (gaothan) areas, which fall in both New Bombay project area as well as outside it, but within NMMC area. Out of a total population of 535,000 (1991), NMMC provides municipal services to a population of about 156,000. Area wise, the percentage covered by NMMC will be even less, because of high density in village site areas, and more congested development. For the provision of municipal services, CIDCO has relied completely on the process of "contracting out". Broadly, the method is to prepare cost estimates on the basis of predetermined norms and levels of services, and inviting quotations. The most competitive bidder is given the work. This procedure and some of the problems which are encountered in administering the scheme are detailed in the following paragraphs.

CONTRACTING OUT OF PUBLIC HEALTH WORKS

Three major contracts administered by the Public Health Department (PHD) of CIDCO are Sanitation Contracts; including operation and maintenance of Dumper placers; and bulldozing work at dumping sites. For the purpose of sanitation contracts, the entire area is divided into sectors, each covering approximately a population of 30,000 and responsible for handling of about 20 tonnes of garbage daily. General norm is that for each one km. of road length the Contractor should employ three sanitation workers.

Collection and dumping of garbage is entrusted to two contractors, who are provided with 14 refuse compactors and six dumpers placers. They are responsible for transferring garbage from 550 dust bins of 1 Cu. Mtr. volume each and 50 nos of 5 Cu.Mtrs. volume each to the dumping site. At the dumping site, bulldozing contractor levels the garbage. One important aspect of this contract is the operation and maintenance of vehicles. Contract also specifies the labour per vehicle, the route of the contract and the supervision methodology.

COST-EFFECTIVENESS OF PUBLIC HEALTH CONTRACTS

This brings us to the basic issue of cost-effectiveness of public health contracts vis-a-vis the in-house provision of services. Before attempting comparison, it should be borne in mind that there are large number of variables whose values must be known and quantified for any meaningful comparison between

¹³ The speed with which a recent housing scheme for affluent Non-Resident Indians (NRIs) was built (in two and a half years), has raised apprehensions about CIDCO's commitment to the DRS schemes.

the two approaches. These variables include the levels of output in physical terms, quality of output, frequency of service, characteristics of the area like density of housing, and extent and type of open spaces, etc. These variables can't be exactly similar in any two areas so as to set a test project. Therefore, though very approximate, the only way to determine cost-effectiveness of "contracting out" vs "in-house provision of service" is to compare the operation of the first in New Bombay with the operation of the second in the adjoining local authority areas.

For Panvel Municipal Council (PMC), the expenditure for same service in 1991-92 was Rs. 1.15 Million, giving a per capita expenditure of Rs.48. In another adjoining local authority of Thane Municipal Corporation, over 2500 persons were employed for public health works which accounted for 47% of its total staff. Per capital current expenditure on same service by the authority in 1990-91 was Rs. 64. Another authority, though not adjoining, Pimpri Chinchwad Municipal Corporation (PCMC) employed 44% of its total staff on this service and spent Rs.78 per capita in 90-91, on provision of the service (ORG, 1992), while the per-capita cost of Public Health Contract in New Bombay was Rs.29 10.

LEGAL PROVISIONS AFFECTING PUBLIC HEALTH CONTRACTING

Minimum Wages Act and Prevention of Unfair Labour Practices Act (PULP Act), provide for regulation of contracting out of services. The Minimum Wages Act prescribes a minimum wage for different types of workers. It also provides for a contractual levy of 44% on account of contributory provident fund, bonus, leave salary, allowance for uniform etc. Since the legislation puts these limits, there is very little scope of competition in bidding. Further, since the estimates are prepared keeping in view these provisions, prospective contractors can compete only on the element of profit in the total estimates.

In practice, however, the contractors, particularly incumbent ones, quote very low to get the contract and then try to renegotiate. The incumbent contractors, since they have better access to information, are better placed to quote. The PULP Act, has a provision which prohibits contracting out of those services which are permanent in nature. CIDCO, however, is able to overcome this by the fact that these services will ultimately be transferred to local authority and are, therefore, not a permanent item of work, so far as CIDCO is concerned. Nonetheless, this provision is very restrictive and is a remnant of the socialistic era

RESIDENTIAL CONDOMINIUMS

Dwelling units in New Bombay are organised in the form of residential condominiums, each accommodating 100 to 200 units. It is mandatory to form and register condominiums as associations with elected representatives. These condominiums are responsible for maintaining the common built-up and open areas as well as the physical infrastructure within their bound-

ary. A monthly subscription is collected from association members and special contributions are arranged when periodic building repairs or area development works are taken up. A room of 20 to 30 Sq.m., depending on the number of tenements within a condominium, is permitted to be constructed as condominium office, free of FSI. Thus, ensuring participation by the residents in the maintenance of infrastructure at a decentralised level, condominiums have also proved to be cohesive social units where innovative ideas can be introduced. A fine example is being set in this direction in Vashi where women members of resident condominiums have taken the lead to propagate waste segregation at source and vermi-composting

OTHER AREAS OF PRIVATISATION

Contracting out of services is not limited to Public Health only. Services like maintenance of sewerage treatment plants (STPs), collection of CIDCO's dues, maintenance of water supply, development and maintenance of parks & gardens have all been contracted out.

LESSONS OF PRIVATISATION

After enumerating in detail the instances of privatisation, it will not be out of place to list out here the specific lessons and benefits of privatisation. These are:

- i. It has helped to keep the Corporation lean and therefore more professional. Since 1990-1991, there has been less than 5% annual growth in manpower whereas growth in turn-over (measured by expenditure on works alone) is over 63%. This has been possible by appointment of PMCs for construction works and of contractors for municipal and other recurring items of works and service delivery
- ii. This has freed the Corporation professionals to focus on Planning and Land Development work, which, as recommended by the National Housing Policy, is the legitimate work of a Development Authority.
- iii. This has helped to provide indirect employment to a large number of Project Affected Persons (PAPs). There are 24 PAP contractors in Public Health works and over 75 in maintenance of parks & gardens. These contractors in turn employ large number of PAPs as workers.
- iv. This has also led to development of an entrepreneurial cadre amongst the PAPs as is evidenced by the number of independent labour and civil work agencies floated by them
- v. Method has also been more cost-effective, atleast so far as contracting of municipal services is concerned
- vi. Legal framework, unfortunately, is not conducive to more effective performance due to limitation on con-

tracting out regular works, restrictions on regulation of employment of workers etc. For Security Contracts, the employment has to be through State Security Guard Board, which takes away employer's ability to enforce conditions of contract fully.

- vii Propensity of public agencies to accept lowest tender may mean acceptance of unsuitable tenders. Therefore, it is necessary that tender documents are carefully worked out with clear indication that unsuitable tenders will not be accepted

INNOVATIVE APPROACH TO THE REHABILITATION OF PROJECT AFFECTED PERSONS (PAPS)

Rehabilitation is an essential element of all major projects. In the New Bombay Project, the entire land under private ownership measuring about 166 Sq.km. was notified for acquisition which affected a large number of families in 86 villages. Besides rehabilitation of affected families, there was also the issue of integration of these families into the city culture, as they had led, till the arrival of the project, a rural life in its truest sense. Though no socio-economic survey of the villages affected was carried out, it is, in retrospect, now felt that such a survey is essential in all major projects. Not deterred by this initial lapse, however, CIDCO has taken up a comprehensive programme of PAP rehabilitation. This can be divided into:

- 1 Individual Oriented Programmes like stipend for Education, Skill Upgradation through Technical Training Programmes, Employment in CIDCO and other public and private sector organisations, etc.;
2. Village Oriented Programmes like Grant-in-Aid for strengthening the village infrastructure;
3. Compensating by "developed land" for "virgin land" under the Gaothan (Village site) Expansion Scheme (GES) and 12 1/2% Scheme.

INDIVIDUAL ORIENTED PROGRAMME

The main problem for the PAPS was the mis-match of their skills, with the skills required in the urban context. Main activities of the village folk were, of course, rice cultivation, fishing and salt-making. Being in the Coastal belt, fishing has been the major activity which was undertaken in addition to agriculture. Even within this profession, there were a number of sub-divisions. There were 'Kalav Kolis' i.e., those fishing by impounding sea-water by erecting mud embankments on the high-tide flat lands. Then there were 'Vana Kolis' i.e., those who caught fish by spreading nets in the creek lands. And of course, there also were those fishermen who fished in high-seas with the help of trawlers, etc. Besides this, there were village artisans, who were collectively called 'Bara-Valute-dars', which literally translated means, '12 artisans paid in kind for their

,service'. They were Carpenters, Blacksmiths, hair-cutters, cobblers, etc. In view of this very diverse occupation of the PAPS, their education, training, and upgradation of skills was very important.

Besides encouraging college and technical education through stipends, effort has also been to upgrade various skills amongst the PAPS. Short term training in disciplines like driving, plumbing, gardening, carpentry, computer works, electrical works, etc. was given to about 650 persons. Compared to this, persons who benefitted by way of stipend number about 8520. This heavy stress on formal college education, has led to a situation of large number of white-collar job seekers. On the other hand functions like plumbing, electrical works, etc. which are in high demand in a developing city, are not being properly attended to.

In retrospect, lessons have been learnt to stress skill development training more than formal education. Besides this, PAPS are also encouraged to take up petty work contracts from CIDCO. Sanitation & Horticulture contracts are exclusively awarded to PAPS. In the works contracts, works up to Rs.200,000 are given only to registered PAP contractors. To increase the scope of PAP contractors' involvement in development works, 20% of large works (i.e., costing more than 200,000) is also given to PAPS, with a price preference of 10% over the lowest tender for balance 80% of works. This has been possible in land reclamation works and road embankment works. So far 2810 contracts have been given to the PAPS.

STRENGTHENING OF VILLAGE INFRASTRUCTURE

Villages within the project area are provided Grant-in-aid (GIA) for building school rooms, community halls, approach roads, village tanks, toilet blocks, crematoria, storm-water drains, balwadis (creches), drinking water provision, etc. Since these villages are located within various nodal areas, this scheme also integrates their villages into urban life from the infrastructure point of view.

GAOTHAN EXPANSION SCHEME (GES)

Village sites were exempted from acquisition, with the objective of protecting the culture of their inhabitants, as well as also to provide for accommodating natural growth of these families. As the city developed, the pressure on gaothan sites kept increasing not only due to increasing family size of original residents, but also mushrooming of informal housing to accommodate low-income migrants to the city. With a view to accommodate natural growth of affected families not only up to first generation, but even beyond, in 1978, a Gaothan Expansion Scheme was approved by the Government. Salient features of this scheme were:

- 10% of the total acquired land of the village, will be reserved for this scheme. This land will be in close

proximity to the existing sites. Out of this, 50% land will be used for giving housing sites to PAP families, and the balance 50% will be used for provision of facilities.

- Each land owner, from whom atleast 100 Sq.m. land is acquired will be given a site equal to 5% of his acquired land, subject to a minimum of 100 Sq.m. and maximum of 500 Sq.m.¹⁴
- Land given will be charged at twice the acquisition cost plus Rs.5/Sq.m. towards development cost.
- In cases where less than 100 Sq.m. land is acquired from land owners and PAPs who had no land, 40 Sq.m. will be given.
- There was restriction on transfer of this land by the original allottees.

12.5% GES SCHEME

Due to increasing pressure by PAPs for a share in the enhanced value of acquired lands, in 1990, Government further amended the GES, to provide for new scheme of returning to the original owner developed land equal to 12.5% of the land acquired from him. At this stage this scheme was to be applied only to those land owners whose lands were acquired and taken into possession after February 1986. In October 1994, the scheme was further liberalised and was also applicable to all land owners.

IMPLICATIONS

Both the schemes (GES & 12.5% GES), have meant very effective transfer of benefits of city development to PAPs. Nearly 1400 ha. of land is to be transferred to PAPs under both the schemes. Even at the average break even rate of Rs.1200 per Sq.m., the value of the land so transferred comes to a staggering figure of over Rs. 150 billion. While transfer of such benefits before the acquisition of lands would have facilitated the acquisition process and also avoided project delays, these benefits at a later stage are not much beneficial to the project. On the other hand, it has some adverse impacts. Such unexpected costs on the project in its late stage of implementation obliterate the project economics. Low level of infrastructure to be provided for these lands may create sub-standard environmental conditions in the area. Restriction on transfer of the lands by allottee means encouragement to unauthorized transactions, leading both to insecure titles and loss of stamp duty revenue.

ENVIRONMENTAL IMPLICATIONS

As discussed earlier, the very location of New Bombay site entailed two major environmental problems: (a) a vast development area is in the coastal stretch necessitating massive land-reclamation and (b) vast stretch of north New Bombay is sandwiched between the TBIA and the Chembur-Govandi Industrial area and is vulnerable to the effect of industrial pollution. At the same time, building a new town, especially with CIDCO owning the entire land, has facilitated planning of New Bombay in an environment friendly manner and adoption of measures for environmental upgradation. The environmental considerations for New Bombay can be discussed at two levels, those which are within the control of CIDCO and those for which multi-organisational effort is necessary.

CIDCO'S RESPONSIBILITY

The environmental factors under CIDCO's control are broadly the factors concerning the Planning of New Bombay, providing transport & infrastructural facilities, shifting of wholesale markets to New Bombay, land reclamation methods, and lastly, adoption of direct environmental upgradation measures.

NEW BOMBAY PLANNING

The NBDP has been prepared with the following objects, namely (a) to create 14 nodes, each being self-contained in terms of availability of urban amenities, (b) to disperse the work centres and fill the intervening areas with residential pockets each separated from the other by green buffers, (c) to designate and preserve all major green and forest areas as regional parks, and (d) to reserve a minimum of 15% of alal nodal areas as green spaces in addition to the city level green areas. Housing is provided as a package of all amenities, at the time of occupation of the houses. Integrated planning has thus ensured environmental safeguards at macro level and also helped to provide good ambience at household level.

SHIFTING OF WHOLESALE MARKETS TO NEW BOMBAY

It was in the late seventies that the idea of shifting of wholesale markets to New Bombay took shape as a part of the planned effort of decongestion of Greater Bombay, by moving them from congested south Bombay to a more centrally placed New Bombay within BMR. This was sought to be carried out through legislative measures. As part of this, 13 major Agriculture Produce Markets (APM) are shifted from congested Masjid Bandar to Vashi¹⁵ to a 160.0 ha APM complex. As a second step, shifting of the wholesale iron and steel market from

¹⁴ Later on norms were revised to provide that joint holders of land will be allowed up to 100 sq. mtrs. individually but subject to upper limit of 20% of their acquired land. Similarly joint land owners having more than 1 ha. of land will get up to 500 sq. mtrs. of land, subject to 5% of total land acquired.

¹⁵ Under the Maharashtra Agriculture Produce Marketing (regulation) Act of 1963.

Carnac Bundar and Darukhana areas to Kalamboli is planned¹⁶. This market which occupied an area of 30 ha. in Bombay is planned on a sprawling 320 ha. site, combined with the facility of bulk warehousing and railway siding. It is estimated that every day a minimum of 5000 trucks to APM and 3000 trucks to Steel market will be moving. This is also expected to lead to significant economy in the distribution costs of produce with an estimated trade turn over of over Rs 15,000 million annually. While relocating the markets in New Bombay, supporting infrastructure has been provided.

Adequate planning for and provision of supporting infrastructure is expected to facilitate the bearing of the load of market activities in an environmentally safe manner. Simultaneous plans have not, however, been drawn up for the redevelopment of areas vacated by these two markets in Bombay. The land ownership still vests with private parties. However, controls are exercised to the extent that the uses which are shifted and those similar to them, are prohibited to be conducted from these areas. This relevant safeguard has been provided for by way of an amendment to the Development Control Regulations for Greater Bombay. Thus the traders continue to also operate from their offices at their earlier locations, while the operation of handling of goods has been shifted to New Bombay.

INFORMAL SHOPPING

The 750,000 jobs planned for in New Bombay in the formal sector are expected to create the potential for a great number of informal jobs. During the initial years of planning for various nodes in New Bombay, not adequate thought was given to this aspect, with the result that encroachment on wider roads, especially near the planned shopping complexes and transport termini, became a common phenomenon. The impact on citizens has been that the prices of all goods was higher in New Bombay as compared to that in Bombay, as they had to be sold only in big shops. There were mini-markets planned during these years, but shops in these markets soon became unaffordable to the petty hawkers. However, there is now a conscious effort to fulfill these needs by planning for stalls, daily bazars, markets for hawkers/impulse shopping zones and mini-markets. These are located especially near the job centres, railway and bus-stations and in the residential areas. Road sections are now being planned to accommodate linear stretches of markets, considering the preference of traders as well as the buyers for this form. A good example of this is the 5 m. wide reservation on one side of all 35 m. wide roads in Kharghar node. Similar proposal is also on for Dronagiri node. In addition, all sectors are now being planned with space for daily bazars and stalls. Efforts are, however, being made to bring these facilities to a scale matching with the needs.

TRANSPORTATION CONSIDERATIONS

Traffic is a major cause of pollution and thereby of environmental degradation. The report of MEIP brings out the fact that

the traffic pollution is the major cause of concern in the areas around TBIA and Chembur, where the study was conducted, and not industrial pollution. However, measures have been adopted to minimize this form of pollution largely by:

- a. Planning for mass rapid commuter rail network in the early planning period. The large number of commuters travelling by the suburban trains would have required much more road length which would have caused more traffic related pollution on the additional roads. Water transport carrying the affluent that would have otherwise used cars extensively, will also help reduce similar pollution.
- b. Integrating the commercial spaces with the railway stations, CIDCO has been able to utilize the air space above the railway stations, thus creating highly accessible 6 to 7 ha. of built up space at each of the two bigger railway stations and about 7 ha. at smaller stations. Twenty six railway stations in New Bombay at the ultimate stage would, thus, create at least 68 ha of built-up-space for jobs¹⁷. A potential of 68,000 jobs (at a rate of 10 m²/office job) is thus expected to be created in the railway station-cum-commercial complexes. Location of jobs in these complexes means avoiding secondary mode of transport that is normally resorted to from suburban railway stations in Bombay and other places.

LAND RECLAMATION IN NEW BOMBAY

Given the land characteristics, there were two main options for reclamation, namely,

- a. extensive conventional reclamation, involving quarrying and transport of huge amounts of earth; and
- b. the dutch method of polders and dykes, wherein dykes are built around the periphery of low-lying areas (polders).

The second method as the name suggests is extensively used in The Netherlands. Its application in this project is different on the count that reclamation is sought for the purpose of urban development, in a heavy rainfall-intensity area, with unreliable energy availability for pumping. Secondly, no active navigation is being considered in the canals. CIDCO has, however, adopted a *via-media* wherein partial reclamation up to or above the high tide levels is necessary. This system necessarily needs:

- a. Storm water from developed areas to be carried to holding ponds near the creeks through drains and open channels, where it will be held for some time before being let off into the creeks at a slower rate and under more favorable conditions of low tide; and

¹⁶ Under the Bombay Metropolitan Region Specified Commodities Markets Act of 1983.

¹⁷ Assuming that 30% of the stations are going to be big, and assuming an employment rate of 10 sq.m./person.

- b. Storm water from the numerous hills and other catchment areas, to be collected and detained at the foot of the hills in detention ponds before being let off into the creeks through regular system of channels and holding ponds.

The latter option, though necessitates utilisation of 10% of the entire developable land in New Bombay for such ponds, reduces environmental degradation and improves environmental quality by adding holding ponds to the planned open spaces. This method also creates ponds at foothill areas for collection of rainwater from the larger catchment areas. The concept of detention ponds itself is relatively new in New Bombay, but is favoured as it enables reduction in size of storm water diversion channels, by regulating the flow from the catchment areas at an upstream location and providing damping effect. Storage of rain water in these detention ponds offers the possibility of utilising the same at least for secondary purposes of gardening. Possibility can also be explored of using this water for drinking purpose, which is under consideration in the new nodes of Kharghar and Ulwe.

SOLID WASTE MANAGEMENT

Thirty to forty five per cent of all solid waste generated in the region of Bombay is bio-degradable, as per statistics available. It is estimated that a total of nearly 325 MT/day of solid waste, including debris is generated in New Bombay. There are two dumping sites one each at Kopar Khairane and Kalamboli. Solid waste is collected by 14 garbage compactors and six dumpers working on one shift basis. Small scale vermicomposting is carried out in Vashi. Otherwise, unprocessed waste is dumped and levelled by bull dozers. CIDCO's expenditure on solid waste management is Rs. 48/capita/year, which is 40% of what BMC spends. The total approachability of plots and the daily and efficient collection systems result in economical collection and disposal methods.

STORM WATER DRAINAGE (SWD)

The storm water drainage system adopted in each node is based on reclamation levels, tidal levels and ground levels of existing villages. The systems comprise gravity drainage, holding & detention ponds with channels and partial pumping as well.

In New Bombay, the SWD system is designed for no inundation and for the highest intensities forecast for the next 100 years. To the extent possible, natural stable drainage courses are retained and strengthened. Storm water is collected through covered drains as part of the road sections, and carried to the open channels of widths up to 60 m. stored in the holding ponds and let off ultimately into the creeks during favorable conditions. The open channels at times are converted into covered box type RCC drains, to economise on the land requirement, and where point accesses are to be given to large number of plots.

Separate SWD systems are designed for villages at local levels¹⁸ and additional holding ponds are created. CIDCO maintains a record of specific needs of each node and also carries out regular pre-monsoon checks of all SWDs with the help of a detailed maintenance manual. The MEIP report finds the SWD methods adopted in the region to be generally adequate. It appreciates the SWD manual and maintenance practice of CIDCO and suggests that other organisations should follow this good practice. A proposal for installation of auto rain gauges by CIDCO, also a suggestion by the study, is already in the pipeline for selected locations in New Bombay.

SEWERAGE

Sewerage is designed as a distinct system for each node, again based on the above mentioned criteria. The designs are made with the assumption of generation of sewage as 100% of water consumption and rate of seepage of 20-25%. The underground sewerage system is run on gravity as well as intermediate pumping mechanism when depths exceed 6 m. below ground level. Sewage is treated at the Treatment Plants (STP) located close to creeks. The standards of MPCB are met before treated effluent is discharged into adjoining creek inlets, such as BOD levels brought down to 100 ppm.

However, the need for recycling of this treated water for gardening purpose has been recognised and there are few examples such as the use of treated sewage from STP of Belapur node for watering the plantation under the transmission corridor nearby. Another fine example is use of treated effluent from London Pilsner Beer factory near Nerul for irrigating the tree belt along the Sion-Panvel Expressway. It is now felt that centralised STPs are not suitable for certain areas where the water table is high or where the treated water is sought to be recycled locally. Thus, the concept of decentralised Package Treatment Plants (PTP) emerged for using the treated effluent for gardening and watering the plantation areas

WATER SUPPLY

In New Bombay, ground water is not potable, and hence can be used only for secondary purposes such as gardening and irrigating plantation areas, etc. The system is designed for a supply rate of 180 ltrs/capita/day for residential use. The system for each node has been designed separately, like other infrastructure systems in New Bombay. A hierarchy is planned, of Master Balancing Reservoir (MBR), Ground and Elevated Storage Reservoirs (GSR & ESR) or Hill Storage Reservoir (HSR), and distribution is made by dividing the node into water districts. Water is presently supplied through two existing sources of Barvi dam and Patalganga river receiving the tail water of Khopoli Hydro Power station of Tata Electric Company. Together they supply about 100 MLD/day. Three new sources of Morbi (100 MLD), Hetiwane (350 MLD) and Balganga (350 MLD) have been identified for future needs. CIDCO also

¹⁸ This is because the existing villages are at lower level than the designed reclamation levels of the node, and the same cannot be raised due to dense habitation in the villages

makes available funds to Maharashtra Water Supply & Sewerage Board (MWSSB) and MIDC for meeting the capital cost of developing water sources.

DIRECT MEASURES FOR ENVIRONMENTAL UPGRADATION

Development of Green Spaces

Apart from all the above mentioned environmental considerations having been given due attention while planning for New Bombay, developed green spaces have immensely contributed to the environmental quality of New Bombay.

The reservations of Regional Parks in the New Bombay Development Plan have been carefully chosen to be taken up for afforestation, or developed as planned open spaces within the nodes or outside.

The question of urban poor

The inevitable question of the urban poor along with their employment and housing needs arises. It has been the general experience that affordable housing options need to be created for the weaker sections of society, and if not, the most vulnerable areas for encroachment are going to be:

- the hill slopes,
- the lands below high tension lines,
- the undeveloped coastal no-development zones

Keeping the above in view, CIDCO has tried to cater to the housing needs of the lower income groups. Forty seven per cent of its housing stock created so far has been for this group including 20,000 developed plots (with or without core houses) Under the World Bank financed Bombay Urban Development Project (BUDP), Sites & Services Schemes are developed for the economically weaker sections in three phases. These are at Airoli (5000 core houses), Koparkhairane (5000 core houses and core plots) and at Nerul, New Panvel, Kalamboli and Kharghar (10,000 core plots together).

Protection of encroachable lands

However, plans have been simultaneously made and are being made to protect the unsafe lands mentioned above from being encroached, by converting them into environment friendly greens. The various measures adopted are

- the hill slopes are planted under afforestation programme. In addition, the hill slopes are also leased out to Institutions engaged in research and development of Ayurvedic medicine for growing medicinal plants,

- the coastal zones are developed as promenades wherever developments run close to the coast, as active public recreational open spaces along with plantation.

Private sector participation in the environmental measures

Bulk of the funds required for these measures comes from CIDCO's own resources. However, efforts are also made to rope in private and institutional financial resources:

- leasing out gardens, parks and traffic islands to Corporate bodies for development and maintenance on the condition that they be kept open to the public;
- leasing out open spaces in difficult areas/situations (areas that are prone to be quarried etc) to private individuals for development and maintenance, again on the condition to keep them open to the public;
- In the past, CIDCO developed active gardens under the corridors of transmission lines. However, under a new scheme, Corporate bodies and individuals are invited to develop productive and passive green areas on the lands reserved below these transmission line.

MULTI-ORGANISATIONAL RESPONSIBILITY

The external factors contributing to the present environmental status of New Bombay considered for the purpose of this study are:

1. environmental conditions in New Bombay, created by TBIA & Chembur Industrial areas;
2. multiple agencies being responsible for the current status and maintenance of environment of New Bombay.

INDUSTRIAL AREAS OF TBIA & CHEMBUR

TBIA is one of the largest Industrial Estates in India housing over 1200 industrial units and having an annual turnover of Rs.40 billion. Forty percent of its 2500 ha. area is put to industrial use. There are slums in the area accommodating about 50,000 population. Most of the data used here is from the MEIP reports.

Water Pollution

Ninety per cent of waste water from TBIA is generated by 43 out of the 1200 industrial units, and that of Chembur from nine units. MEIP Report finds that the industrial effluent is treated below the prescribed norm, and hence is causing water pollution through contamination of soil and ground water, rendering well water unpotable.

Air Pollution

The major source of air pollution is transport rather than industrial emissions. Other sources are found to be quarrying, construction works, burning of garbage, rubber, etc. For some considerable time, it is inconceivable that the quarrying and construction works will lessen in New Bombay. As a result there is large scale incidence of respiratory problems in New Bombay. It is felt that there are not enough escape routes in case of industrial disasters such as emission of toxic gases, explosions, leakages on the roads or accidents to vehicles carrying hazardous chemicals. This is so because of the peculiarity of the site of these nodes, having only one major road leading towards Kalwa and Belapur. The proposed bridge connecting Airoli to Mulund will give a new direction of escape and evacuation.

ORGANISATIONAL COORDINATION

One of the reasons for the present state of affairs in the residential areas trapped between the TBIA and Chembur industrial area, is the multiplicity organisations that are responsible for the welfare of these areas. Three major Organisations engaged in providing basic infrastructure in New Bombay are CIDCO, MIDC and NMMC. As mentioned in the MEIP report that brought the environmental status of New Bombay to date, the levels of efficiency with which CIDCO, NMMC and MIDC are managing affairs in their respective jurisdictions, are varied. The 74th constitutional amendment has given the planning powers to Municipal Corporations. MIDC is now vested with planning functions as well. However, in course of time, co-ordinated effort is expected to be made to resolve matters of common interest such as physical infrastructure, pollution and disaster management.

An example of the result of the multiplicity of functional areas is the sprawl of slums in TBIA, which otherwise is not a common phenomenon in New Bombay. The availability of industrial employment, non-availability of affordable formal sector housing to a matching scale and the fact that MIDC is not a competent authority to demolish the unauthorised constructions have together compounded the problem. While the main reason for growth of slums is not making legal housing affordable to the urban poor, providing affordable shelter options was not within the purview of MIDC until recently. Plans are currently being drawn to rehabilitate the 50,000 and odd squatters presently living on the hill slopes and other MIDC areas. CIDCO, MIDC, NMMC and others are now making a conscious effort in this direction by co-ordinating their respective roles. Each of these organisations is taking up responsibility of rehabilitating some of the squatters. There is now a beginning in the right direction.

FINANCING THE DEVELOPMENT OF NEW BOMBAY

Government decision to acquire for CIDCO the entire private

land of 166 sq.kms and 27 sq.kms. of salt pan land within the notified area of New Bombay and, to transfer to it free of cost the Government lands measuring about 54 sq.kms., provided its main asset base (other than the meagre seed capital of Rs.39.5 million). Land was identified as the main resource for financing the multifaceted development projects in New Bombay Project area. However, the value of land at that point of time was very meagre, due to its physical disposition and low agricultural productivity. Its urban potential was minimal too due to lack of linkage with Bombay and virtual absence of other infrastructure such as roads, telecommunications, schools, hospitals, etc. Thus, though there was an impressively large area of land made available to CIDCO, it was not of much financial consequence in its then existing raw and undeveloped form. The land acquisition awards had valued the land at rates ranging from Rs. 4 per Sq.m. to Rs. 30 per Sq.m. On this basis the total value of land was not considerable. It was essential for CIDCO to enhance the value of its assets so that they could be a lucrative source of finance for development expenditure. This section examines how the process of value-addition was stressed, and how it has finally become the major and only source of finance.

Till 1980, the major source of funds for financing the public housing schemes of CIDCO, particularly for EWS, LIG & MIG, was loan from HUDCO and financial assistance under the BUDP. For infrastructure works, finance was provided through the meagre sales of land. This had led to the creation of a kind of a vicious circle in the development process of New Bombay Project i.e. low demand for land leading to less income generated from land sale, and therefore, less capital expenditure on infrastructure development which in turn, resulted in low demand for land. The cumulative capital expenditure of CIDCO till 1980 was only about Rs.400 million. However, 1980s witnessed a remarkable change in the development scenario of New Bombay. The success achieved in the efforts to shift the agriculture produce markets from South Bombay to Turbhe (within Vashi Node) and, to some extent, the shifting of warehousing activities of steel trade from South Bombay to Kalamboli marked the heralding of this development. During this period, new nodes like Airoli, Kopar khairane, Nerul, Kalamboli and Dronagiri were also taken up for development. Large scale housing schemes for different income groups were taken up too. This was followed by planned development of office complexes in the CBD at Belapur through sale of plots.

The subsequent boost to development can be attributed to the construction of Mankhurd-Belapur commuter railway line and the goods railway line between Kalwa and Turbhe. Physical shifting of a large number of wholesale agriculture produce markets to Vashi and the construction of large commercial complexes above the railway stations of Vashi, Sanpada, Jui Nagar, Nerul and Belapur further hastened the process of urbanisation and helped to build up a strong and broad economic base for further rapid growth. The housing development by CIDCO and also by private developers to whom CIDCO sold the plots have consolidated the process. This has set a self-

sustained momentum of overall growth which is vividly reflected in rising land value

During the period 1980-90, the appreciation in land values for predominant uses, such as residential, shop-cum-residential and commercial has shown a steadily rising trend, which has enabled CIDCO to mobilise the funds required for taking up various infrastructure projects within the identified nodes as well as major projects at city level. After 1990, the commissioning of wholesale agriculture produce markets at Vashi and commissioning of commuter railway line from Mankhurd to Vashi in May 1992 has provided a sudden spurt in economic activities and population growth. The demand for land for residential and commercial uses has shown a manifold increase. In fact, the market price of land for these uses has shot up to be almost at par with rates in well developed suburbs of Bombay. The trend of faster development of New Bombay has thus really set in from 1990 and has continued to grow at a progressively faster pace.

SYSTEM OF LAND PRICING

Land being the most precious resource to finance multi-sector urban development projects, the pricing of land in each node is done by CIDCO with great care, in the form of a well structured Project Report for each node. CIDCO works out the Reserve Price of land for each node almost every year by taking into account the compounded value of net past expenditure, year-wise, and the discounted value of the future year-wise estimated cost. While doing so, CIDCO takes into account the comprehensive cost details covering on-site, off-site and city level infrastructure as well as non-saleable social infrastructure, etc. The Reserve Price is fixed based on the present worth of the project cost covering total net compounded value of the past year-wise net expenditure and the discounted value of future year-wise expenditure - the sum total of the two is divided by the available saleable area of land in a node, to determine the Reserve Price of land. The Reserve Price of land in New Bombay varies from Rs 1050/sq.m. to Rs 2800/sq.m. the latter being prevalent in the most developed nodes like Vashi.

Along with the policy of determination of the Reserve Price of land, CIDCO has formulated a clear cut land pricing policy for different uses of land, in a well structured form, depending on the affordability of the end users and the market value for particular land use. The policy stipulates that for weaker sections like EWS & LIG housing and sites and services type of development, price of land should be charged between 25%-50% of the Reserve Price. The subsidy given to this wide spectrum of end uses is recovered by charging market price of land for commercial uses and prices higher than Reserve Price for MIG & HIG group housing

In the first five years of the project, CIDCO had to incur substantial expenditure far in excess of receipts from the sale of land. But this was the preparatory stage which is inevitable considering that CIDCO had initiated development in a totally

virgin area. In subsequent years, the project started showing a surplus of receipts over expenditure, even though the scale of expenditure too had become much larger.

In the process of development of a planned node, care was taken to give a healthy environment to its potential residents. Through land use and density controls, CIDCO has been able to achieve the required environment. Land use plan accordingly provides for proper system of roads, pathways, open spaces, gardens, playgrounds, parks, fountains, schools, hospitals, community centres and various other social amenities. Out of the total nodal area of 1146.40 Ha., the saleable area is only 516.60 Ha. or 44.55%. This means that a large component of the area goes for public amenities. An outstanding example of this is the environmental improvement through provision of large number of gardens and parks in Vashi-Sanpada area and also providing a number of plots for future development.

Land under the transmission lines is also developed for the purposes of horticulture through private sector participation. This provided green cover and also prevents unauthorised slums below the power transmission lines. Another important input for environmental improvement is the density norm. Provision of a better environment entails costs due to diversion of land from saleable to non-saleable component. This can be sustained only if the market forces are favourable. CIDCO has been able to sustain this demand by value addition to its lands.

CIDCO has so far sold 340 Ha. of land in Vashi-Sanpada Node. The balance land available for sale is 177 Ha. The average land price realised by CIDCO has increased from a mere Rs.56/sq.m. till 1978 to a high of Rs.1600/sq.m. during 1988-89 to 1992-93 even after considering land sales at affordable rates, for social amenities and for shifting of trades. The rate has further gone up after 1992-93. This has been possible through sale of selected land for commercial use by competitive tender system after 1990.

In the initial stages of the project, it was essential to offer land at lower prices which the market was ready to bear. This was necessary to attract public participation in the development, since CIDCO could not take on its shoulders the entire load of construction of houses, shopping, offices, social facilities, etc. It was only after development was well under way and basic infrastructure had been laid, that CIDCO could command terms more favourable to itself. In a sense, CIDCO has to evolve and strike the best possible balance in its land disposal strategy as would be consistent with attaining the desirable speed of development and also meet the need for resources at any given time.

To sum up, Vashi Node is an interesting case study in the arena of New Town Development, which demonstrates how a large township project planned on a totally virgin/marshy land can be made self-financing/self-sufficient over a period of time, without compromising either the speed of development or the gamut of planned social requirements of a growing but balanced

community. There were periods when this project looked rather dismal because of strong popular resistance or lack of demand. But farsightedness and flexibility combined with firmness, its multifaceted activity style coupled with judicious land use planning with an eye on environment quality and bold land disposal policies have helped in reaping rich dividends. Capturing of market price for land under commercial and other uses have helped CIDCO to meet the deficit in M & R account without overloading the poorer or the social utility users.

Vashi is now considered by many as the prime residential area of the future and also a vibrant nodal centre for economic activities. Shifting of wholesale trading activities with warehousing and transport has been a major breakthrough and probably has happened for the first time in the country. It is said that the final barometer of development is market response, reflecting the law of supply and demand. The spot land prices as indicated above are really an eye opener and provide important tips on financing multifaceted urban development projects. Integrated approach was thus successfully adopted by CIDCO, wherein development of infrastructural services guided urban growth in a desired manner, nurturing in the process, partnerships between public and private sectors in various fields.

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Community Based Sanitation and Environmental Improvement Programme : Experiences of Indore, Baroda and Ahmedabad

Shri Himanshu H. Parikh

CONCEPT OF SLUM NETWORKING

Slum Networking is not just a physical solution to the problem of urban slums but more an attitude to development which embraces scales, activities and agencies. It builds upon previous experiences and good practices in India and abroad. Indeed, it does not exclude other options of development for the urban poor such as 'sites and services', land banking and slum reconstruction but, instead, has a potential to be an umbrella to a multitude of alternatives.

Slum Networking has some unique facets which blend together to make it an enduring and replicable development mechanism. The main features are the holistic approach in the context of the city, significant cost reduction, mobilisation and convergence of substantial human and material resources, increase in community control and improvement of overall quality of life with an integrated mix of physical, educational, health and income generation inputs.

The slum fabric is seen in the context of the whole city and interventions proposed are mutually beneficial to the slums as well as the rest of the city. The objective is not to find solutions unique to slums but, instead, explore the commonality between the slums and better parts of the city to integrate the two. As slums are not the causes of urban degradation but the consequences of distorted development, the solutions likewise must treat the slums as mere symptoms and use them to work back into the city fabric to the origins of the problems.

Physically, Slum Networking involves upgradation of the entire city using slums not as individual islands but as an urban net, exploiting the inter-linkages between the slums and also the transitions between the slum and the city fabrics. The spatial spread of slums over a city together with contiguity between slum settlements gives an opportunity to strengthen the city level infrastructure networks. Studies of cities, both in India and abroad, show that the two fabrics are generally bound together by the skeletons of natural drainage courses. As there is a close correlation between the location of slums and the natural water paths, the slums become the entry points to urban renewal. Next, the functional and the aesthetic potentials of the natural drainage skeleton can be realized with the installation of low cost service trunks, particularly for gravity based systems

of sewerage and storm drainage, along its lengths. This makes possible extensive environmental improvements such as cleaning up of polluted rivers, creation of fresh water bodies, development of green pedestrian spines and the restoration of waterfront structures. Finally, one can permeate back into the urban fabric other than the slums to complete the cycle of development.

The slums naturally benefit from the improved city level support. For the city too, the slums offer opportunities of change through this symbiotic process instead of drawing upon its resources. This coordinated process replaces the overlapping, and often conflicting, developments normally undertaken in a piecemeal way by a legion of agencies. As a vehicle for urban development Slum Networking is both catalytic and cost effective.

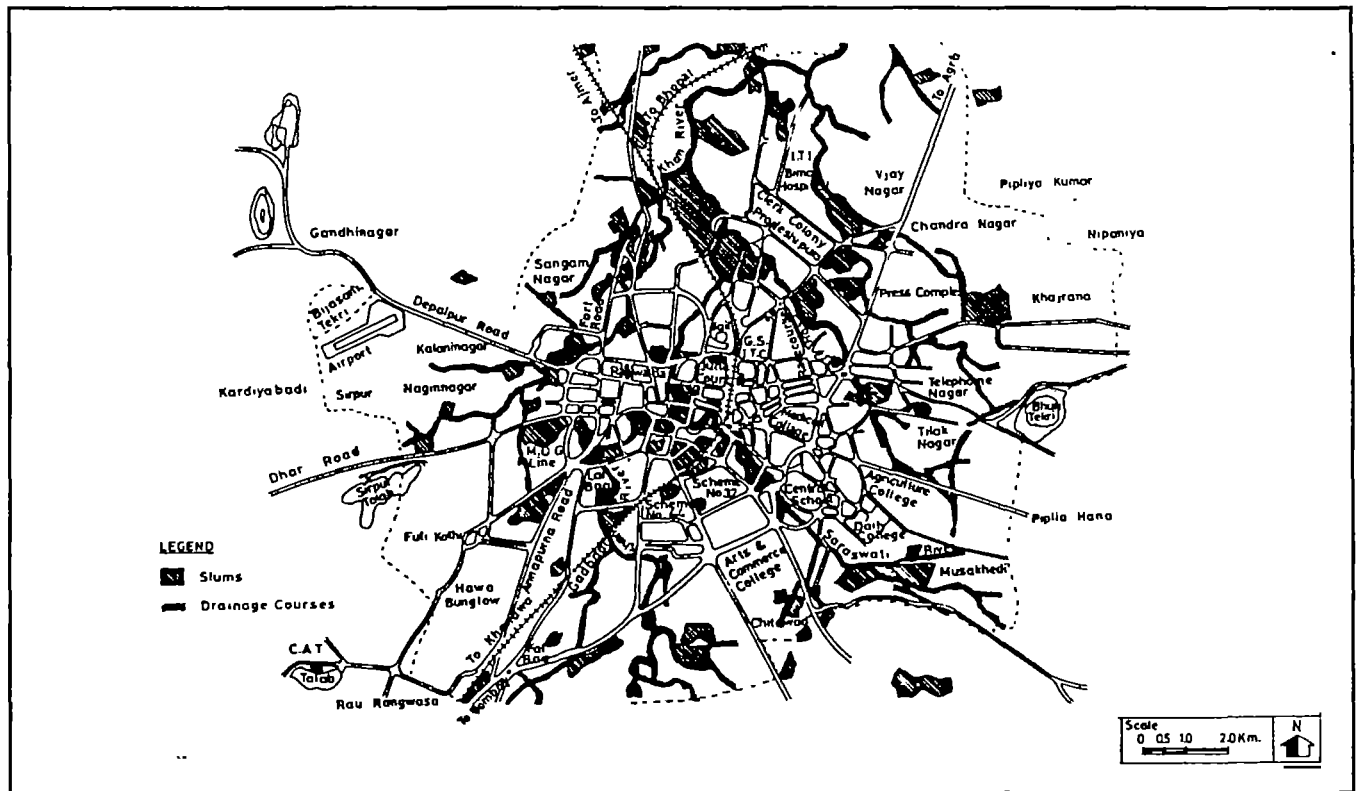
Unconventional concepts such as topography management, earth regradation and constructive landscaping are introduced. Service infrastructure is simplified and modified so that individual services (instead of shared facilities) can be offered to slum families at low costs. At the same time the maintenance burden is reduced and shifted from the local government to individual families.

The strategy prescribed requires sensitive and intense participation of the public through self-help in the development process. NGOs play an active role in motivating the communities, mobilising resources from the slum dwellers and converging the efforts of the people with the inputs from the local government and the business community of the city. The mechanisms evolved for community interaction are used equally gainfully for health, educational and income generation programmes. The net effect is holistic development which changes the functional, physical, socio-economic and environmental qualities of a city at a fraction of the cost of the conventional approach.

A HOLISTIC AND INTEGRATED FRAME

The integration of both scales and activities intrinsic to Slum Networking opens up exciting possibilities missing in other development strategies.

The method ties up micro-level improvements with the whole



Indore city slum fabric and Natural Drainage courses

city through the Networking principle and in the process makes possible many solutions which would otherwise be mutually exclusive. For example, it would not be conceivable to environmentally improve the city's water bodies unless the open gutters discharging into them from the slums and other areas are seweried in close pipes. Similarly, working across scales, many solutions at first thought unviable at micro level become quite economic. A comparative study in Indore showed that the cost of underground sewerage and centralized treatment by Networking was Rs. 1500 per slum family for the on-site provisions and Rs. 1000 for the off-site collection and treatment. Against this, the cost of a shared UNDP twin pit latrine, normally considered to be the 'appropriate' solution for developing countries, worked out at about Rs. 2500 per family. Although the costs appear to be comparable, the UNDP toilet does not take care of the grey waters from kitchens and bathrooms, whereas the sewerage system does. The additional advantages of piped sewerage are, firstly, that all the families have individual facilities and, secondly, the families other than in slums can also be connected to the same system without recurring the off-site costs - i.e. per family cost decreases as the contributing families increase.

In slums, most components of physical and community infrastructure are missing or deficient. By making slums the foci of development strategy, this apparent disadvantage turns into a virtue. There is an opportunity to work simultaneously on all

aspects of development in an integrated manner, a luxury rarely available in the non-slum areas. For the physical works, abortive duplication is avoided and fine tuning of the related components is possible. For example, roads do not have to be repeatedly dug and be made good to install various services. Or, grades of roads and sewers can be jointly tuned to economize on both. When extended to the entire city, the compounded savings are substantial.

Physical upgradation by itself cannot improve the overall quality of life unless the economic, social, educational and health conditions change. Although the concept of community development running parallel to the physical improvements is often promoted, in practice, the two rarely keep in step for the want of coordinating mechanisms. In Slum Networking, integration is facilitated by the nature of physical works such as earth management, landscaping and individual services. These demand an active participation of the community and provide the necessary platform for weaving in the socio-economic components of development.

SPATIAL COVERAGE AND LINKAGES

In an Indian city, slums are usually spread over the city's entire area forming a loosely connected matrix. The spatial coverage as well as the near contiguity of slums enables infrastructure networks to be developed at the total city level to augment or

even replace existing and decaying services. It would normally be inconceivable to overhaul the city networks in view of the disruptions, costs and non-availability of land/access. The slum fabric makes this massive urban renewal possible at costs marginally more than those for conventional upgradation of slums.

Networking, though a more sensitive and painstaking process, essentially involves a constructive intervention rather than replacement. Because of its incremental nature it consumes far fewer resources. For example, as a city grows, new branches are drawn from the existing water supply pipes. The process of sub-branching continues with each successive growth cycle until the end pressures become almost negligible. At any one stage, it is unthinkable to replace the existing system because the costs are too high and the disruptions unacceptable to meet the incremental demand. With Slum Networking, this imbalance of pressure across the city can be redressed without a major overhaul by using the internal lines provided in the slums to short circuit the existing city branches and automatically turn them into more efficient loops. This way, by using slums, the deficient city systems can be salvaged to improve their performances.

Since slums abut the natural drainage paths of the city, it is possible to build up sewerage networks for the entire city by simply providing the missing links between the slums. Likewise, roads on slum peripheries can be interlinked to create a secondary network in order to relieve traffic congestion on trunk roads of the city.

TOPOGRAPHY AND LAND MANAGEMENT

Site topography has a powerful influence on the layout and functioning of the gravity based infrastructures. Coordinating the roads, storm drainage and sewerage to natural gradients results in better function and economy.

At the city level only 40% of the land is marketable, out of which half is generally built upon. The powerful impact of the remaining 80% of the open land on the urban character and environment is often not appreciated. Slums spring up on many of these sites because of the lack of clear territoriality. Often slums are located on topographically disadvantaged sites or on marginal lands such as road verges, railway margins, high tension line corridors, residual open spaces, river beds and drainage courses. Otherwise neglected areas of the city can be brought under environmental control by focusing on them.

Topography and land management coupled with the locational attributes of the slums with respect to the water courses and marginal lands has certain ramifications. The natural water courses and low lying areas tend to form nuclei around which slums cluster. By sensitive treatment of these lands several advantages are possible.

Firstly, areas prone to flooding and waterlogging may be lastingly improved by earth regrading at marginal costs. For ex-

ample, a storm drainage system for Baroda was planned in 1985 to alleviate the frequent flooding in the central areas of the city. The then project cost of Rs. 222.5 million has now escalated to almost Rs. 500 million and the proposals are lying on the shelf for the want of funds. And yet, there is already a natural drainage system permeating deep into the city which can be activated with nominal efforts to relieve the flooding. The cost implications of the latter are only Rs. 40 million.

Secondly, the natural drainage courses are highly efficient routes for the gravity based city services such as sewerage and storm drainage. Further these paths eliminate the usual problems of land acquisition and demolitions. Thirdly, these drainage nets bind the slums with the city fabric, thus integrating the two. Lastly, topography management measures like cut and fill, site grading and landscaping dramatically improve the environmental qualities of a city at costs far lower than those for the conventional alternatives.

EQUITY FOR THE NEEDIEST

The 27% of the urban population living in slums makes a vital contribution to urban productivity but does not enjoy commensurate access to urban services. This is compounded by a disproportionate growth in the slum population of around 8-10% per annum compared to the average urban growth in India of about 4%. In many cities (i.e. Vijayawada in Andhra Pradesh) almost the entire population growth in the last decade is accounted for in the slums. Slum Networking automatically gives a high priority to this very large group which is also suffering the greatest deprivations.

The ultimate aim is to assimilate these settlements into the city so that there is equity between the income groups in terms of the quality of life enjoyed and the distribution of benefits.

CONCENTRATION OF RESOURCES

Where resources are scarce, it is prudent to give priority to the worst distresses. Slums naturally qualify for this bias. Further, the 27% of the urban population living in slums occupies only about 5% of the residential area of the cities. Thus, by exploiting the slum fabric, massive impact can be made on the city by just working on one-twentieth of the landmass. Focusing resources in this way is highly cost effective.

HEALTH

Faecal-oral contact, flies and mosquitoes account for most of the illnesses in our cities. Slums become the centres of epidemics because of contaminated water supplies, open sewers and waterlogging. As the central themes of Networking are slums, underground networks, intercepting drains and earth management, it is clear that its positive impact on urban health must be enormous.

In many cities throughout the world, the sharpest declines in the urban death rates have occurred with the advent of under-

ground sewerage coupled with safer water supplies. London is one such example. Similarly, in the tropical countries, the elimination of mosquito breeding sites has had the same effect.

POTENTIAL FOR RESOURCE MOBILISATION

Development for the urban poor is normally financed with public funds, normally in the form of grants. The limited public revenues are rarely enough to match the overwhelming needs. In any case grants foster dependency. Loans, on the other hand have a recycling element which helps to stretch resources. Both these mechanisms, however, depend on the revenue base of the government. As 80% of the population falling under the EWS and low income categories is not eligible for direct taxation, resources are raised from the remaining 20% who fall in the tax net. Similarly, the greatest contribution to the indirect taxes also comes from the middle and upper income groups whereas the basic needs of the urban poor are met through subsidised public distributions. The investments, therefore, tend to be lop-sided in favour of high income areas where the resources are raised in the first place and where subsequent recovery of investments is also easier.

Once the upper income groups become beneficiaries of slum upgradation rather than the other way round, the resource base expands and the willingness to cross-subsidise increases. Thus, with Slum Networking, the tables are turned. When the greater concentration of inputs is in slums, recovery can be directly and justifiably be made from a very large section of the population which remains untapped. A quid pro quo approach of services for payments does work, particularly if individual services are provided. The individual contributions may be small but the aggregate across a large population base is significant. As the higher income groups also gain from the improved city level services, they too are less reluctant to contribute through connection charges and betterment taxes.

The greatest advantage of Networking, however, is that because of its catalytic nature as well as its strong emphasis on public participation, huge resources from the private sector as well as direct contribution of the benefitting individuals comes into play. The concepts of 'affordability' and 'cost recovery' are not new. However, the resources which the poor can marshal are greatly underestimated.

A large number of slum dwellers prefer to become ratepayers, provided they get adequate services. It legitimises their right to the land, specially when there is no land tenure. Municipalities and Corporations cannot ignore such a large source of recurring income which can be used to meet the maintenance costs.

THE GENDER ASPECT

The urban poor are trapped in a vicious cycle of poverty, ill health, miserable living conditions and illiteracy in which the 'causes' cannot be clearly distinguished from the 'effects'. Improvements in the environmental and sanitation conditions alone cannot break the cycle and a holistic outlook is required.

Care has, however, to be taken to stop this from turning into a blunderbuss approach in which a plethora of actions are launched at random in the hope that some may work. Instead, it is much better to target the endeavours to specific objectives or groups. In Slum Networking many of the community development interventions are focused on women and girls, who will in turn be tomorrow's mothers. The reason for doing so is to stem the carry over of disadvantages from one generation to another. For example, there is a clear correlation between the female literacy rate and an array of other indicators such as infant mortality rate, birth rate, educational levels of children and family incomes. Thus, activities such as mother and child care, female literacy, income generation, vocational training and legal literacy assume special importance in Slum Networking.

Many of the above activities are specially designed to empower the women to control their destinies. Legal literacy for women, for example, covers the legislations related to marriage, divorce, property rights, inheritance and dowry and also teaches the women to effectively use the complaints and redressal systems. The income generation programmes encourage the women to formalise their cottage industries into registered Cooperative Societies, make value addition to their products, develop marketing outlets and establish linkages with the formal sector financial institutions. Further, the right to majority representation of women, both in terms of the numbers and also the key positions held, is enshrined in all the projects. In Indore, not only are the majority of members in all the 79 Basti Vikas Mandals women but they also predominantly hold positions of the chairpersons, secretaries and treasurers.

On the physical front, women in slums face the worst hardships of environmental and sanitation degradations. Sometimes hours have to be spent just to fetch enough water for the day. Often girls miss school to help with the daily chores of cleaning the house and its insanitary environs. Women are, therefore, highly motivated to initiate development and play a more mature role in reaching consensus and resolving differences which arise in the community. They also show a greater degree of responsibility in managing money and making repayments. The Baroda project came to fruition in spite of a long incubation period of three years simply because of the persistence of the women there to have individual water taps and toilets. In Indore, as a result of Indore Habitat Project, slum women now prefer to marry in areas which have underground sewerage and individual sanitation. This in turn has triggered a social change which will have long term repercussions.

INDORE

In view of a large slum population in the city of Indore and its anticipated growth over the next decade, the Indore Habitat Project for slum upgradation was launched by Indore Development Authority (IDA) in March 1989 with financial assistance from Overseas Development Administration (ODA), U.K through the Government of India. However, effective implementation on the ground could not start before early 1991.

The project builds upon the precedent of integrated development evolved in other cities of the country and overlays on it the structure of Slum Networking. Slum Networking exploits the extensive spatial coverage, contiguity and locational attributes of the slum fabric and other environmentally distressed areas within the context of the city as effective mechanisms of intervention at the total city scale. It seeks convergence of scales, activities, agencies and resources to improve the quality of life in a holistic manner.

Slum Networking as implemented in Indore has for the first time shown that the slum fabric can be exploited to transcend from a settlement scale to that of the city and in the process change the urban environment and infrastructure to the extent which was not possible through the conventional route. This section gives the basic outline of Indore Habitat Project. The subsequent sections give greater details of the components to illustrate the principles of Networking as applied in practice.

CITY PROFILE

Indore, the largest city of Madhya Pradesh State in India, is situated at latitude 22°-43' North and longitude 75°-57' East. The average level above Mean Sea Level is 550 meters, though, the general elevation of the town varies from 536 to 563 meters. The city is located almost centrally on the fertile Malwa Plateau.

Indore is an important textile manufacturing centre of India. The city has numerous engineering industries engaged in the production of finished and semi-finished goods. The industrial development in nearby towns has also increased its commercial importance. Because of its central location and excellent linkages, the city is an important marketing and distribution centre for cotton, ground nut, wheat and a number of other cash and commercial crops.

The city is very well connected with the rest of the country. It is situated on the Bombay-Agra trunk road and is a railway junction on the Meter and Broad gauge lines of Western Railway. There are regular flights between Indore and Bombay, Delhi, Bhopal, Gwalior, Ahmedabad, Calcutta and Pune.

In the last two decades the population of the city has grown very rapidly from 0.56 million in 1971 to 1.25 million in 1992. The present population of the city is about 1.4 million.

INDORE SLUMS

As the leading industrial city, Indore exercises a great 'pull' on the adjoining hinterlands. This coupled with the natural increase in population has meant that the city has seen a mushrooming growth of slums with unhygienic living conditions. As seen in Table 10.1 below, from 1971 to 1991, whereas the city population doubled, the slum population almost quadrupled over the same period.

TABLE 10.1 GROWTH OF INDORE SLUMS

| | 1971 | 1981 | 1991 | 2001 |
|-------------------------------|--------|--------|---------|---------|
| Total Population (000) | 560.95 | 827.07 | 1250.00 | 1800.00 |
| Annual Growth Rate % | 4.74 | 5.11 | 4.4 | |
| Slum Population (000) | 100.00 | 208.00 | 350.00 | 540.00 |
| Annual Growth Rate % | 10.80 | 6.82 | 5.42 | |
| Slum Population as % of Total | 17.82 | 25.15 | 28.00 | 30.00 |

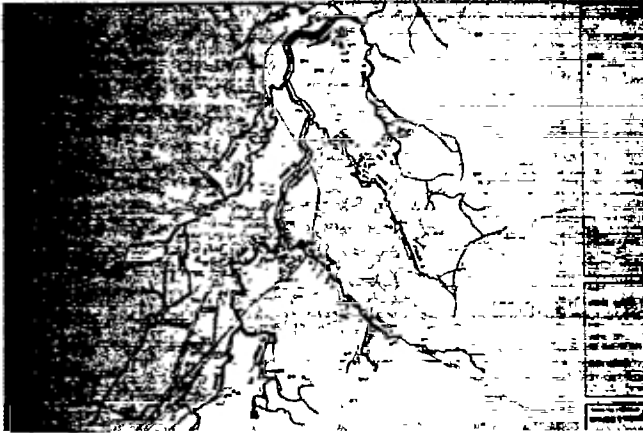
Source: IDA 1992, Indore Habitat Project Report

Slums in Indore are characterised by overcrowding, kutcha or dilapidated structures, unhygienic conditions, grossly inadequate basic amenities, unplanned layouts and poor accessibility. These areas generally house economically weaker sections of the community who are often engaged in casual service occupations. More than half of the total slums of the city are situated in the textile mill areas. The remaining are either in the inner core or scattered on the periphery around the trunk roads.

Indore is an old city and a large number of its houses are in dilapidated condition. Nearly 30% of the houses are unfit for human habitation. In 1971 the housing shortage was 20,000

dwelling units which by 1981 increased to 51,000. This shortage has forced a large number of households into slums. Over half the houses in slums are kutcha (temporary) the rest being semi-kutcha (35%) or permanent (15%). In terms of tenure, 31% of the families are tenants.

As per a 1990 survey, over two-thirds of the slum families are below the poverty line earning less than Rs. 1000 per month. Temporary and daily wage workers in the surveyed slums form a large proportion of the workers, being almost 54%, followed by 31% who are self employed or engaged in petty trading. Only 66% workers find work for at least 14 days a month indicating a high level of underemployment (estimated at 35%).



Slums joined up to install sewerage in Indore

The rate of underemployment among females is as high as 79%.

Literacy rate in slums is relatively high, being almost 60 per cent, suppressing the age group 0-5 years. However, there is a marked difference between the sexes. A break up of the overall statistics into male and female shows literacy rates of 73% and 47% respectively. Only 35% of males and 16% of females have gone up to high school level.

A relatively large proportion of persons (12%) had reported being sick in the fortnight before the survey with the higher than average per treatment cost of Rs. 63. Surprisingly, allopathic treatment from private sources is preferred to public health services or traditional medicines. About 8% of the monthly income was reportedly spent on medical expenses. Most commonly adopted method of family planning is vasectomy. Of the 43% of couples following family planning, 93% have resorted to the operation as the safest method. Level of awareness among the residents regarding ante-natal and natal services is high. A large number of deliveries (60%) take place in hospitals. This accounts for the very high percentage of immunisation with BCG vaccine which is given at birth. As a source for immunisation, 66% of households use primary health centres or government run dispensaries.

LEVELS OF SERVICES

SETTLEMENT LEVEL

Quite a large number of slum families (86%) are served by public water distribution system either by public taps or through individual connections. The rest use alternative sources of water such as wells and handpumps. 76% of families are apparently served by public or individual toilets. The reality, however, is grimmer because most of the public toilets which serve 68% of the households are ill maintained and unusable. For example, about 47% of children sit near open drains or in the open grounds for defecation. Separate bathrooms are virtually absent. Most families (62%) bathe in the house or in the toilet. The remaining bathe in the open or near public taps.

Thirty five percent of the households had secured their electricity connections in the three years prior to the survey whilst 34% households got theirs in the previous 4-7 years.

Solid waste is mostly dumped in the vicinity of the houses. As city level solid waste management is very poor, this waste eventually either collects in local dumps or finds its way into the natural water courses, causing serious health hazards.

CITY LEVEL

The existing underground sewerage system serving the city dates back to 1936. It serves only about 5% of the city's population and covers less than 10% of the city area because of the lack of proper collection network or treatment facilities. The city has two low level pumping stations to lift the sewage at intermediate points. The treatment plant, comprising three settling tanks, is now hopelessly overloaded and most of the waste is pumped into the nearby farms or is diverted to river Khan passing through Indore. The textile mill effluent further adds to the problem as river Khan joins river Kshipra at a point little upstream of the city of Ujjain. Ujjain draws its city water supply from this river.

The large population not served by the sewerage system discharges its waste in the open gutters and open storm water channels which eventually discharge into the river. In any case, the existing underground sewer lines are inadequate to serve the increased population and in order to avoid the flooding of manholes, they have often been diverted straight to the river. Thus the river carries the major portion of the city sullage and sewage. This results in bad odours right in the heart of the city and the fly and mosquito nuisance poses a serious threat to the health of the inhabitants of the city.

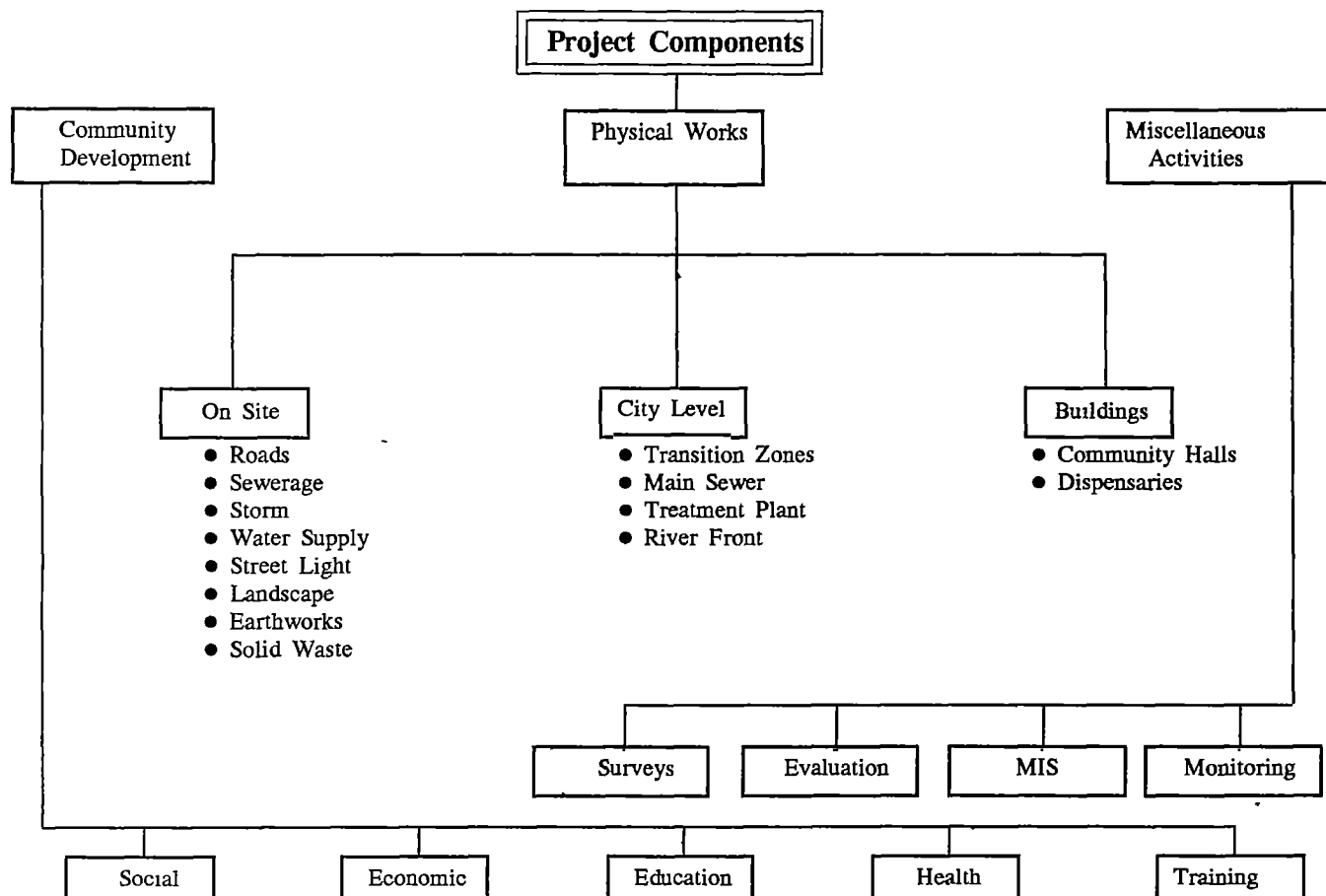
The first phase of water supply to Indore city from river Narmada, which is already executed, and the second phase, which is under implementation, will eventually supply 199 MLD water to the city. However, until the second phase is commissioned, the city will continue to have intermittent supply with low pressures. In some houses the water connections pass through open drains carrying sewage. So, when the pressures in the water lines are low during non-supply hours, the sewage enters the supply pipes through leaking joints.

As the city expands, it experiences increasingly frequent flooding during monsoons as the impermeable built surfaces grow and as the natural water paths get destroyed.

PROJECT COMPONENTS

As seen below, Indore Habitat Project has three major components.

- a) Physical works in the slums and at city level
- b) Community development works.
- c) Miscellaneous activities



Components of Indore Habitat Project

PHYSICAL WORKS

COMMUNITY LEVEL WORKS

Out of the 183 slums covered under the project, 22 were previously upgraded under a World Bank scheme. Thus, improvement of physical infrastructure and environment was initially taken up in 161 slums with the rest having just the community development component. The slums developed under the World Bank scheme did not have individual sanitation nor did they have a major environmental improvement component. There was a strong representation from 11 of these slums that they should be taken up again for physical works because girls now preferred to marry in the Indore Habitat Project slums with sewerage and individual toilets in preference to the slums without. As this demand augured a major change in social attitudes, Indore Development Authority acceded to it. Hence, 11 World Bank slums were also taken up for upgradation bringing the total to 172. In total 450,000 persons were covered.

CITY LEVEL WORKS

The service infrastructure and landscaping of transition zones between the slum boundaries and the surrounding higher income areas was taken up to integrate the slum fabric more smoothly into the city. In any case, off-site infrastructure around slums has to be upgraded to accept the additional loading. Symbiotically, the slums can also strengthen the city level services they depend upon. For example, out of the 360 km. of roads provided in slums, about 80 km. on the slum peripheries were linked up at the city level to reduce the traffic congestion on the existing trunk roads.

About 90 kms. of new city mains were laid along the natural water courses to intercept the underground sewer lines from the slums. The main sewers were designed to receive the additional loads from the non-slum areas of the city presently discharging directly into the river. A new sewage treatment plant was necessary to deal with the effluent generated. However, the budgets reserved for the plant were eventually merged with

those available under National River Action Plan (NRAP) to facilitate a much higher capacity plant which could treat the effluent of other towns and the industries upstream of Indore city

As the stretches of the rivers passing through the centre of the city became pollution free, they were turned into fresh water lakes and the banks were extensively landscaped. So far 4 kms. of banks have been taken up for environmental improvement. As the cost of this work can be met from the development of commercial cum recreational facilities along the banks, no additional financial burden is placed on the project.

BUILDING WORKS

To facilitate community development activities, 120 community halls were planned out of which 80 have already been constructed and under use. A total of four vocational training and production workshops have been built. For primary health care, two health centres are planned out of which one has already been built. In addition, three existing dispensaries which serve the city slums have been upgraded. In relation to the total project, the building works have been kept to a minimum with the view to integrate the existing city facilities into the project in preference to building new ones.

COMMUNITY DEVELOPMENT

Community development activities have been built into Indore Habitat Project to improve the socio-economic standards of the slum dwellers. These are described in detail in later section.

MISCELLANEOUS ACTIVITIES

BASELINE SOCIO-ECONOMIC SURVEY

The objective of this survey was to establish the baseline data of the physical and socio-economic conditions in the slums against which the efficacy of the project could be measured. The baseline survey also gave details of the 'perceived' needs of the slum population and also their willingness to pay for the upgradation. This gave useful inputs for the final project formulation.

It was necessary to survey at two levels. One a detailed survey of sample families and the other a survey of statistically selected slums for the overall slum profiles. The survey report contained the raw data, analysis, conclusions and also checklist parameters and indicators for the follow-up evaluation surveys.

The work was undertaken by a professional operational research agency based on a brief jointly prepared by the agency, Indore Development Authority and the specialist advisors.

PROJECT EVALUATION

Following the baseline surveys, further surveys were planned for evaluating and monitoring the project. This work was entrusted to the same agency engaged for baseline surveys.

Two evaluation surveys were proposed. The first one was conducted during the course of execution to determine the major lacunae in the project and to take the necessary corrective action. The second survey would be done some time after the project is over in order to determine the longer term effects of intervention.

MANAGEMENT INFORMATION SYSTEM

- The objective of MIS is to give with brevity the status information on the project and projections of the targets. The system must be capable of giving the information area wise, activity wise or chronologically as per the needs of the users. Details of all the components of the project must be available, if needed, for closer scrutiny. Detailed or consolidated information on the status of the project in terms of progress, costs, incomes and staffing must be available.

The development of MIS for Indore Habitat project started in 1989. Meetings were held with the project staff and experts at various levels. MIS reports of the State government and other institutions doing similar work were also studied. Based on this, features such as completeness, brevity, frequency and addressing were built into the system.

It was decided to prepare the progress reports, both physical and financial, separately for the three principal wings of Community, Health and Engineering. In each wing the reports are addressed to three levels. Monthly reports are prepared for the field workers giving the total achievements till previous month, achievements in the given month and the targets. Consolidated quarterly reports are generated for the supervisory level by summing up the progress of the principal indicators in each slum. A summary report reflecting jointly the progress of all three wings is produced for the senior management.

Slum wise progress of all activities is obtained on designed proformas and fed into the computers. Proprietary data base and spreadsheet softwares are used to organise and analyze the data.

MONITORING

The entire project is monitored under the overall control of the project director. A Project Monitoring Committee is constituted which has representatives from the community together with experts from many disciplines. The committee meets once every month.

Officials from the Field Management Office of Overseas Development Administration visit the sites regularly and give the necessary guidelines after assessing the progress. In addition, it has appointed an independent consultant for the monitoring of the physical works in relation to progress, quality and costs

A team from the project consultant's office also visits the sites for one week every month to clarify any problems in the

execution of the physical works. The same team also monitors the quality of the works during these frequent visits.

Once every year, a high level mission evaluates the progress and make recommendations. The group comprises a team from British High Commission, Central and State government representatives, the project consultant and the officials of Indore Development Authority and Indore Municipal Corporation.

IMPLEMENTATION FRAMEWORK

The scale and the complexity of Indore Habitat Project obviously demands inputs from a large number of sources. Indore Development Authority is the main executive agency, assisted by its consultants. Overseas Development Administration, U.K., which is the principal funding agency, also provides the technical expertise in developing and executing the programme. Many public agencies such as Indore Municipal Corporation, District Collectorate, State Ministries, Public Health Engineering, Forestry Department, State Health and Education Departments contribute to the project. The project staff and the community participants are trained by the local School of Social Studies and many other voluntary bodies. Links are also established with local hospitals for training as well as referral services.

The greatest contribution, however, is from the people themselves. The army of community volunteers, teachers, local birth attendants, members of the Neighbourhood Committees, Youth Organisations and Womens' Cooperatives actively participate in the day to day execution of the project and its sustenance.

Overseas Development Administration, U.K., is the principal funding agency for the slum upgradation components of the project. The objective of Indore Habitat Project is to multiply the quantum of development by, firstly, appending other sources of finance to this seed funding and, secondly, to encourage contribution from the beneficiaries in cash or in kind.

Madhya Pradesh State Government is providing Rs. 24 million for the main sewage outfalls for the city. The costs of river front environmental improvements are being met from marketing the associated recreational and commercial facilities. Indore Municipal Corporation is bearing the running and maintenance costs of all the infrastructure assets created. The resources for this can be generated by drawing the upgraded slum families in the tax net and imposing connection charges to the non-slum population for the better services they will enjoy. The running and maintenance expenses of the sewage treatment plant are expected to be met from the sale of treated water and manure to the farmers. The health and educational facilities created are sustained by the respective State Departments.

The direct contribution of the community takes many forms. All families contribute a proportion of the sewerage costs by

paying for the house connections from the main lines. Funds for social activities are also collected in each settlement by the respective Neighbourhood Committee. The earthworks and landscaping components are directly executed by the communities through self-help and largely at their own expense. Some incentives are offered under the project in terms of free plants and token cash rewards for trees which have survived after two years of planting. The health, educational and social components of the projects are run at the grassroot level by community volunteers who either offer their services free of charge or are paid just token honorarium through the project funds and community contributions.

The project is designed to be catalytic in nature so that vast resources are also indirectly drawn into the improvement of the urban fabric. For example, the project resolutely avoids investment in housing stock in the hope that the infrastructure development will, in turn, prompt the residents to invest in house improvements. Sample surveys of slums already completed show that this activity has indeed started. Following physical and environmental upgradation, which cost about Rs. 4200 per family, each household has on average invested around Rs. 10,000 towards the improvement of its shelter.

A separate account head is maintained for the project under which all incomes, expenditures and assets are recorded. Separate project files, vouchers and receipts are maintained. The accounts are prepared on a double entry basis. The detailed accounts are audited continuously by an independent State audit branch.

Although land tenure is not the primary catalyst of shelter upgradation for the urban poor, it is, nevertheless, an important stimulus. For all the slum settlements in the city, a parallel and independent programme is in motion to transfer the legal rights of the land to the dwellers.

PHASING AND COSTS

Slum Networking is a continuing process and not a one time project.

Complex programmes requiring intense interaction with all the participants have to respond to the changing needs and the experience gained. Normally, the project designs, budgets and time frame are all set before starting the work. This invariably leads to cost over-runs, time extensions and improper or incomplete implementation. It is preferred that project formulation be dynamically built into the project rather than be a predetermined precursor.

For Indore Habitat Project, this involves a multi-stage implementation. The project components, their budgets and the time frame were initially broadly set as per the previous experiences and norms. The preparatory work of surveys, data collection, designs and execution of pilot works was included in the same stage. Based upon the feedback from this stage and also the subsequent stages, the precise scope, character, financial needs

and phasing are periodically reviewed and published in the annual Project Status Reports.

The physical works of Indore Habitat Project are phased over four years. The community development activities are coordinated with the physical works so that the two run in tandem. Allowing for vagaries of the Indian monsoon the overall project duration was set at five years.

Table 10.2 gives the year wise and activity wise financial allocations set in December 1991. Whilst the programme is broadly on target, it has been realised that a transition period will be needed for the community and the local government to take over the long term sustenance from Indore Development Authority. A further two years have been added to the programme for this gradual weaning.

TABLE 10.2 SUMMARY OF PROJECT PHASING AND COSTS (in Rs. Million)

| Component | 90/1 | 91/2 | 92/3 | 93/4 | 94/5 | Total |
|-------------------------|------|-------|-------|-------|-------|--------|
| Physical Works in Slums | 5.76 | 31.10 | 55.99 | 72.56 | 70.47 | 235.88 |
| Overheads @ 8% | 0.46 | 2.48 | 4.48 | 5.80 | 5.64 | 18.87 |
| Sub-total | 6.22 | 33.57 | 60.47 | 78.36 | 76.11 | 254.75 |
| Community Halls | 4.23 | 11.41 | 7.39 | 0.00 | 0.00 | 23.03 |
| Dustbins | 0.34 | 0.00 | 0.24 | 0.14 | 0.19 | 0.57 |
| Dispensaries | 0.00 | 0.86 | 0.93 | 1.01 | 0.00 | 2.80 |
| Overheads @ 8% | 0.00 | 0.98 | 0.69 | 0.09 | 0.02 | 2.12 |
| Worksheds | 0.00 | 2.81 | 3.03 | 0.00 | 0.00 | 5.84 |
| Sub-total | 4.57 | 16.06 | 12.28 | 1.24 | 0.21 | 34.36 |
| Riverfront Development | 0.00 | 0.00 | 3.77 | 2.05 | 0.00 | 5.82 |
| Sewerage Scheme | 0.00 | 13.67 | 15.75 | 17.01 | 0.00 | 46.43 |
| Overheads @ 8% | 0.00 | 1.09 | 1.26 | 1.36 | 0.00 | 3.71 |
| Treatment Plant | 0.00 | 0.00 | 0.00 | 0.00 | 8.00 | 8.00 |
| Sub-total | 0.00 | 14.76 | 20.78 | 20.42 | 8.00 | 63.96 |
| CD, HQ Staff | 0.45 | 0.49 | 0.52 | 0.57 | 0.61 | 2.64 |
| CD, Field Staff | 0.40 | 0.77 | 1.00 | 0.98 | 0.71 | 3.86 |
| CD, Transport | 0.06 | 0.03 | 0.02 | 0.00 | 0.00 | 0.11 |
| Staff Training | 0.27 | 0.14 | 0.16 | 0.16 | 0.04 | 0.77 |
| Health Programmes | 1.23 | 2.05 | 2.85 | 2.56 | 1.77 | 10.46 |
| Economic Programmes | 2.25 | 3.20 | 1.60 | 3.69 | 3.74 | 14.48 |
| Social Programmes | 1.47 | 1.09 | 1.74 | 0.66 | 0.44 | 5.40 |
| Education Programmes | 1.42 | 3.73 | 5.09 | 3.60 | 2.15 | 15.99 |

| Component | 90/1 | 91/2 | 92/3 | 93/4 | 94/5 | Total |
|----------------------|-------|-------|--------|--------|-------|--------|
| Office Costs | 1.12 | 0.13 | 0.14 | 0.15 | 0.16 | 1.70 |
| Mechanical Equipment | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.89 |
| Computer | 0.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 |
| Consultants | 1.32 | 1.45 | 1.39 | 0.68 | 0.29 | 5.13 |
| Evaluation | 0.50 | 0.00 | 0.00 | 0.63 | 0.00 | 1.13 |
| Project Preparation | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 |
| Sub-total | 12.78 | 13.08 | 14.51 | 13.68 | 9.91 | 63.96 |
| Grand Total | 23.57 | 77.49 | 108.04 | 113.70 | 94.22 | 417.03 |
| Inflation Factor | 1.00 | 1.08 | 1.17 | 1.26 | 1.36 | |

INDORE - PHYSICAL WORKS AT COMMUNITY LEVEL

Around a third of the urban population of India lives in slums. Although it is well known that the physical conditions in the urban slums are quite appalling, the degree of distress and its effect on the overall socio-economic development of the slum communities is not always fully understood.

Most slums have little or no physical infrastructure support in terms of roads, water supply, sanitation, storm drainage, solid waste disposal, streetlighting, pavings and landscaping. Public agencies normally responsible for this work ascribe this to the lack of resources. They point to the infrastructure conditions in non-slum areas of our cities which are also far from satisfactory. However, the conditions in slums are much worse. The severe resource constraint may account for the overall deficiencies in urban infrastructure but cannot explain the gross imbalance between slum and non-slum areas. Lack of will, inappropriate priorities, inadequate institutions and inappropriate delivery mechanisms play a greater role in creating these distortions.

The lack of service infrastructure in slums causes severe environmental and sanitation problems. Unpaved roads and open gutters make access difficult. In the rains the roads become muddy and the gutters overflow. There is widespread flooding and waterlogging in the monsoons. Water supply is generally inadequate and often contaminated. Poor sanitation facilities lead to defecation in the open. Slums thus become foci of seasonal epidemics of diarrhoea, typhoid, cholera and malaria. Even in slums where improvements have been undertaken under the Environmental Improvement of Urban Slums (EIUS) or Low Cost Sanitation (LCS), the result are far from satisfactory. The work is undertaken in piecemeal fashion, poorly planned

and shoddily executed, becoming infructuous in a short period. The net impact of these cosmetic measures is not much although the resources expended are not negligible.

Physical improvements are but a component of the overall socio-economic upliftment of a community but their immediacy eclipses the other priorities such as education, health and economic development. This is reflected in the interviews with the slum communities in which their perceived needs in the order of priorities are almost invariably adequate water supply, better sanitation, storm drainage and paved access to their homes. As the field workers in the slums cannot satisfy these primary demands, their credibility is limited.

GENERAL APPROACH

In India, the planning and design of service infrastructure generally leaves a great deal to be desired. As a result, the costs are enormous and the performances poor. The following checklist has been prepared for the designers to ensure that in terms of the approach as well as details, the proposals are basically sound. The list is primarily designed for Slum Networking but is also quite relevant to other applications:

FORM AND FUNCTION

The infrastructure networks are important determinants of the urban form and can also influence the future growth patterns of a settlement. The road skeletons are particularly critical because apart from giving physical access, they are the main corridors for other services.

In addition to the form, the infrastructure systems must efficiently take care of the day to day functional needs of urban life. The movements of pedestrians and vehicles must be smooth.

All basic services must reach the entire population in an equitable manner related to the land uses and income mixes. Further, they must be easy to maintain, repair and upgrade.

HOLISTIC FRAMEWORK

Infrastructure must be conceived in a holistic framework in which the individual components are integrated into the unified whole in relation to the other planning requirements, natural features and constraints, topography, functional needs and the resources available. The components must complement each other to avoid wasteful overlaps, uncoordinated performance and micro-level conflicts.

The time element must also be built into this frame so that both physical extension as well as additional capacity can be accommodated with growth. Replacement of infrastructure systems in the future is more costly than upgradation.

LONG TERM SOLUTIONS

Solutions which are short term or which are not amenable to change should be avoided. This is particularly important in slum upgradation where, under financial constraints, there is a temptation to adopt cosmetic measures such as community toilets, public standposts, open gutters and cheap paving. Without proper care of the public facilities coupled with poor durability, these slums rapidly deteriorate to their original state. The money spent on improvement is thus largely wasted. Studies of the slums upgraded in this manner have shown that the health of the residents does not improve either because the underlying physical factors such as water ponding, contact with excreta or contamination of water have not been really taken care of.

Often the solutions adopted are static and cannot respond to the changes in the physical, financial or social conditions of the residents. For example, as a slum matures and the income levels increase, people aspire for higher levels of services. Private toilets and house to house water supply are then favoured in preference to community facilities. At that stage, it is not easy to change from one system to another and the previous investments become redundant.

Flexibility is all the more required where a combination of solutions are used or where slum upgradation is a transient stage to redevelopment. Here, a two tier approach may help. The primary services on the boundaries and on the main skeletons of the settlement could be designed for a longer life span and in tune with the city's long term development. The internal services would be planned to meet the short term needs so that infructuous expenses are minimised when internal restructuring takes place.

DATA BASE

The success of a project depends on the data base available. Physical and other relevant surveys must be undertaken before

starting a project, preferably, by professional agencies having the expertise. Numerous sewerage or drainage projects are conceived without detailed topography surveys resulting in expensive and ineffective systems.

Data banks and drawing archives must be established prior to design so as to ascertain the need, determine the extent of existing services and avoid any conflicts of coordination. Previous experience has shown that such data is rarely collected and often drawings of existing services are not even available. The data relevant to the urban development of the city would include census data, volumes of the reports of the past projects, town planning and zoning maps, transportation and other infrastructure plans, land and estate records, data on Municipal finances, etc.

PROFESSIONALISM

For successful conception, execution and management of a project, highest level of professionalism is necessary. This would involve meticulous data collection, physical surveys, feasibility studies, detailed engineering designs, preparation of complete and coordinated execution drawings, detailed specifications, accurate quantification, time and resource management, regular site supervision and testing. This regime can ensure excellence in quality, timely execution and cost controls.

Slum upgradation is more complex to plan and execute than conventional engineering projects. Under severe resource constraints there is also a need for innovative solutions. It is odd that whereas these would demand greater professional inputs, the reverse is true in practice.

INTERACTIVE DESIGN APPROACH

Often designers do not have clear perceptions of the needs of the people. Their approach, though well meaning, is not the most appropriate for the lack of research and dialogue. In these situations, an iterative design process is suggested which can take into account the views of the target population. This would start with the preparation of alternative sketch proposals for discussion with the community groups. Once a broad consensus is reached, the details of the chosen option are then firmed up in stages in joint consultations. The process not only prepares the communities for the changes to come but also increases their willingness to pay for and maintain the systems.

When working in slums, the problem is all the more acute because of the wide disparities in the lifestyles of the designers and their clients. The slum residents often assume that any work undertaken is for political expediency and tend to demand the maximum that they can get for nothing. In response, the designers often develop cynicism. However, if there is extensive dialogue between the two, the slum dwellers accept the limitations of tight budgets and cooperate with the designers. When given alternatives, the slum dwellers more often than not

opt for longer term solutions and for doorstep infrastructure (rather than shared services) even if it means additional personal expenditure on their part or missing out on some of the facilities.

TECHNICAL INNOVATION

Appropriate and innovative technologies should be incorporated into the designs. For example, conventional manholes or road sections will not work in the narrow and twisting lanes in the slums. Solutions should be amenable to local work practices and materials. They should be of scale and nature which complement the human resources. For example, expensive brick manholes can be replaced by small earthenware chambers. Precast components such as manhole covers and kerbs can be introduced to stimulate cottage industries.

This does not mean that high technology has no place. For example, computers can be gainfully used to investigate a large number of options and reach optimum solutions through interactive processes. At the same time they can simplify the processing of quantities, contract documents and other administrative chores.

REALISTIC STANDARDS AND WORKABLE SPECIFICATIONS

There is a tendency in public health engineering to follow inherited norms in preference to analysis and design. For example, there is no point in designing urban water supply systems for an ideal per capita consumption of 250 litres when that standard can clearly not be achieved. This would simply result in expensive water supply systems and dry sewer runs. Similarly, the Indian road width standards emulate the widths prescribed in the developed countries whereas the indigenous need is for frugality within the constraints of traffic intensity and grades. Essentially the standards must be constantly questioned in relation to performance and not accepted slavishly.

Under budget constraints, the ambitious standards have to be often compensated with watered down specifications at the cost of durability. Economy must be achieved through appropriate design and not by substandard specifications.

AFFORDABILITY

There is a linkage between the standards adopted and the affordability. When solution do not match the paying capacity, effectively there is subsidization. This may work on an individual project but cannot be replicated on a larger scale. Alternatively, work not fully executed to save costs can result in impaired function. For example, if service roads are planned but not executed on a major bypass, there would be serious safety hazards.

MAINTENANCE V/S. CAPITAL COSTS

Infrastructure systems must be assessed on the basis of both the capital costs and the maintenance expenses. Elements such as

pumping stations, which consume energy and require permanent maintenance, should be avoided even if it means slightly more initial capital costs. Community facilities such as public latrines often appear to be more economic at the time of construction. However, once the maintenance costs are taken into account or the under-utilisation of the facilities in the event of disrepairs is considered, the picture changes. A way to balance the capital and the maintenance costs is to capitalise the running costs before making comparisons.

TOPOGRAPHY MANAGEMENT

Site topography has a very powerful influence on the layout and functioning of physical infrastructure, specially on the gravity based services. Coordinating the roads, storm drainage and sewerage to natural gradients results in economy and improved function. The relatively inexpensive measures such as cut and fill, site grading and landscaping for topography management also have substantial environmental impact. Special attention must be paid to the design of road margins, public and semi-public spaces, water courses, railway and electrical corridors and other marginal lands.

The basic principles of topography management shows that the roads are proposed in cut below the surrounding ground. Normally roads are raised above the ground level and the plot holders in turn fill up their plots even higher. In the event they do not, water logging is common which, apart from physical inconvenience, is the root cause of the majority of diseases prevalent.

ROADS AND FOOTPATHS

All the main circulation roads are designed in relation to the traffic intensities, grades and the soil bearing capacities. These roads give a long-term structure to the settlement and are designed for a suitable life span accordingly. The layouts have been integrated with the branches and loops needed for other services. The main roads have the minimum widths necessary for access to emergency vehicles such as ambulances and fire tenders.

All internal roads are made as narrow as possible. The surface cleanliness of the margins is achieved with grading and planting instead of expensive paving. In any case, as slums change constantly with time, infructuous expenses on roads should be minimised. At appropriate turnings, road junctions and cul-de-sacs small public squares have been incorporated for festivals and other community activities. The layout of internal roads is generally informal in tune with the organic character of the slums. The internal roads are designed for a longer lifespan than the main roads because they are not likely to be upgraded frequently by the authorities.

As far as possible, all roads in urban areas must be in excavation and must have positively downward slopes from high points to drainage courses. The road edges must be protected by curbs. This approach has the following benefits:

- Road sections act as channels and attenuate the rain peaks, resulting in smaller pipe sizes of storm drains.
- Sewers and storm drains together with manholes remain shallow and, therefore, cheap
- Lengths of storm drains reduce as their function is partly taken over by roads.
- Road sections with curbs are more durable.
- The expense of road filling, which may be as much as 25% of the total road cost, can be avoided if the conventional raised road section is not adopted.
- Fill needed for regrading and earthworks is generated on-site from the road excavations rather than importing from outside. This again saves costs.
- Road base and sub-base thickness can often be reduced when in excavation because the virgin ground is likely to have greater bearing capacity than fill.

Most areas in Indore are on black cotton soil. This is a soft silty clay which is expansive and requires the following additional precautions in road construction in order to minimise the damage caused by soil movements.

- Replace sub-grade soil by inert material such as sand.
- Use flexible surface such as stone paving in preference to asphalt. Concrete paving may also be used provided it has frequent movement joints.
- Provide high cambers to allow for some settlements.

CONCRETE V/S ASPHALT ROADS

Bitumen is an expensive, imported product which has to be used sparingly. Wherever possible, stone, brick or concrete paving for internal lanes is preferred to asphalt. The Indore experience has shown that concrete roads are cheaper, easier to clean and more durable. Expensive reinforcement can be avoided by providing movement joints. These roads become extensions of the houses and can be used for sleeping out at night. The technology of the concrete roads is such that the local tradesmen are participating in the construction.

STORM DRAINAGE

Open masonry storm drains are expensive. They are also unsanitary because of the dirt, debris and even excreta collecting in them. Contrary to popular belief, the underground piped storm drains are relatively cheaper and hydraulically more efficient. They also incur lesser maintenance costs.

In Indore, the concept of combined road section and piped drains was successfully introduced which had all the advantages of the piped system at a fraction of the cost. Roads laid in

excavation with positively downward slopes form the primary water carriers which are supplemented by piped drains only when the loads increase. It should be understood that it is not the transient flow of water which damages roads but long term stagnation, particularly on the margins of elevated roads, which undermines the road base.

The comparative cost analysis of 100 m. lengths of piped and open drains based on the Schedule of Rates of Indore Development Authority shows that in addition to the saving in per metre length, the total lengths of piped drains reduce very substantially because roads perform part of the function. As a result, the per family cost for storm drainage in Indore has reduced to just Rs. 110 against sewerage cost of Rs. 1,450.

The storm system in Indore is designed to suit the rain intensities, storm durations and permeability coefficients of the ground.

SEWERAGE

Many alternatives were considered, namely, dry pit latrines, aqua-seal pit latrines, UNDP toilets, dry composting toilets such as 'Multram', bio-gas plants, septic tanks, reticulated sewerage and community toilets. Some options were rejected because of poor soil conditions, high densities, etc. For reasons of hygiene, open gutters were not considered.

On the cost criterion community toilets and reticulated sewerage were the most attractive. The option of reticulated sewerage became viable because of the scale of the project and the presence of a new sewerage main. Further, the slums in Indore are almost contiguous and do not require long lengths of additional pipes to connect to the main sewers.

On the grounds of performance, reticulated drainage was found to be more acceptable in terms of hygiene, preference for use, maintenance costs and durability. Hence, piped sewerage was proposed, designed sensitively to the topography. For better flows, the system was designed to carry both the soil sewage and foul water. In view of the scarcity of water in Indore, nodular networks are used to increase the flows and at the same time reduce the number of manholes. All families have been encouraged to take individual water connections so that most of the water supplied returns to the sewer lines. Allowance was made for some rain water infiltration in the system during monsoons.

The system was designed such that at the initial stages, when there are fewer connections, the minimum cleansing velocity is maintained and in the future, at maximum peak flows, the pipes have adequate capacities. In terms of costs the main trade off is between the pipe diameters and the slopes which generate deeper excavations and dearer manholes. Computers were used to study the various options and reach optimum solutions.

With a design sensitive to topography, pumping was avoided in the system resulting in elimination of capital, running and

maintenance costs of pumping stations. Expensive appurtenances such as drop manholes and vent shafts were omitted by making suitable changes to the design. The inspection chambers for the house connections, which account for a large part of the sewerage cost (ie. almost 30%), were replaced by small, inexpensive intercepting traps developed specially for the project. Most of the blockages in piped sewerage happen at the entry points. The traps which replaced the chambers were sufficiently small in size to be placed at the doorstep or even inside the houses. The maintenance burden, therefore, shifted from the Corporation to the individual families

Generally water consumption of 135 to 250 litres per person per day (LPCD) is assumed for urban sewerage systems. Surveys of Indore slums, however, showed water consumption of between 40 to 60 lpcd. It was, therefore, decided to use realistic design standards. However, allowances had to be made for possible improvements in the water supply in the future as well as the population growth. This required a rather tricky balance between the slopes and the diameters such that flushing velocity was achieved in the early days and that the pipe capacities were not exceeded in the future. To be able to do this with very economic pipe sections and shallow slopes, computer software was developed to quickly investigate a large number of options for each settlement for the best solutions.

WATER SUPPLY

As most of the slums in Indore have reasonable water supply, an attempt was made to selectively repair or upgrade the existing systems in preference to total replacement. New networks were proposed only in the remote or newly developed sites. The existing hand pumps and wells were salvaged and integrated into the system to the extent possible. The cost of upgrading in this manner was around Rs. 450 per family in contrast to the conventional cost of water supply of Rs. 1000 per family. In addition, the supply was to individual households instead of the community standposts normally provided. The advantages of the individual water connections are obvious in terms of better maintenance, greater convenience and better sewerage flows.

In the design of new networks, the principal trade offs were between the terminal pressures, reservoir heights and the pipe diameters. For a more even distribution of pressure, looped networks were generally used in preference to branches. Some of the internal water supply runs were also used to short circuit the main branches of the city, converting them into loops. The benefits of pressure equalisation were, therefore, extended to the rest of the city.

Cast iron pipes were used for the critical runs in the main roads, whereas, for the reasons of economy and better frictional properties, cement pipes were used for all internal runs. Galvanised iron pipes were used for house to house connections.

Computers were used extensively to make the trade offs between performance and costs.

POWER AND STREETLIGHTING

Most houses in Indore have electricity and most streets are well lighted. The main problem, however, is that the lines are overhead. Both from the point of view of safety as well as performance, underground lines are better. Though the initial capital costs of the underground system are greater, the running and maintenance is cheaper. The Indore Habitat Project did not have the resources to convert the existing overhead lines to underground. Thus the existing lines can only be replaced over a period as and when resources become available. A provision has, however, been made to repair the existing streetlights in slums and provide new ones wherever necessary.

EARTHWORKS AND SOFT LANDSCAPING

These works are critical to Slum Networking for several reasons other than those of mere aesthetics.

Thoughtful planting can improve the micro-environment of the settlements. Shade trees cool the streets in summer and at the same time reduce the dust in the air. Decorative trees and flowering plants add to the beauty. Vegetable, herb and fruit yielding plants, in addition, supplement the daily needs of the families.

Landscaping was also used as an engineering tool. By sinking the roads below the adjacent land, the excavated material was used to fill up the low lying areas and regrade the slopes in order to drain the water towards the roads and the storm systems instead of ponding on site. Subsequent grassing gave clean and firm surfaces at a fractional cost of hard paving. Compared with paved surfaces, grasses absorb more water and reduce its speed of flow, thus reducing the peak flows in the storm systems. Grasses at the same time check silt erosion.

Earth management and grassing very significantly reduce the costs of roads and pavings, the most expensive components of urban infrastructure. Moreover, the work can be undertaken directly by the communities because they have the knowledge and the sensitivity of their surrounding environment.

Special attention was given in the selection of the species to the following needs:

- hardy
- maintenance free
- quick growing
- perennial
- not eaten by cattle
- low watering needed
- suitable to black cotton soil

SOLID WASTE

Solid waste management is a vital, yet often neglected urban service from the point of view of hygiene and environment. As discovered in Indore, the problem cannot be solved by mere installation of dustbins. A whole system has to be evolved from the doorstep collection to the final disposal.

Shared dust bins and community level collection points were provided to the slum families covered under the project. House to house collection and primary separation of waste (i.e. paper, glass, metals, plastics, rags) was to be undertaken by the residents themselves. An active drive was launched to educate and organise the communities for the task. As the people are more concerned about their immediate environment, it was felt that they would take greater care than the public agencies especially if the economic benefits of recycling can be ploughed back into the communities. The Indore Municipal Corporation is theoretically responsible for collecting the waste from each locality and disposing it safely.

Contrary to expectations, the results of the solid waste programme at Indore have been rather poor. It is becoming increasingly apparent that the solid waste component of the project is very weak. The Corporation does not have either the appropriate equipment or the manpower to discharge its duties. Thus the attempts at the grass root level are being frustrated by the deficiencies of the civic authority. At the same time, the educational programme has not been too effective in convincing the population about the health hazards of solid waste. Hence, waste often collects in the side lanes and, worse still, gets dumped in the sewer manholes and storm drainage chambers, thereby blocking the systems.

In the light of this experience, new proposals are now being prepared for the post sustenance period of the project in order to salvage the situation. It is clear that this operation will have to go beyond the mere movement of waste and start looking more closely at the human chain associated with waste collection. Action will have to be taken to assimilate rag-pickers and the municipal sweepers into the programme. There is also a scope for introducing innovative technologies for recycling the waste or processing it for energy. Every opportunity has to be taken to use the solid waste as a potential resource instead of treating it as nuisance.

As seen in the cost breakdown of physical works in Table 10.3, the solid waste component is only Rs 10 against the total cost per family of Rs 4,200. In retrospect this expenditure is not enough. However, even with additional financial inputs for strengthening the programme, the solid waste component will remain a small fraction of the total. It nevertheless can jeopardise the whole project if not handled well.

COSTS PER FAMILY

Based on 1992 prices, the cost breakdown per family for on-site upgradation of physical infrastructure is given in Table 10.3

TABLE 10.3 ON-SITE DEVELOPMENT COSTS PER FAMILY BY COMPONENTS

| Component | Cost per family (Rs.) |
|------------------------------|-----------------------|
| Roads and footpaths | 1750.00 |
| Asphalt courses | 250 00 |
| Storm drainage | 110 00 |
| Sewerage | 1450.00 |
| Water supply | 450.00 |
| Earthworks and landscaping | 130 00 |
| Street lighting | 50.00 |
| Solid waste management | 10.00 |
| Total cost per family | 4200 00 |

INDORE - COMMUNITY DEVELOPMENT

The aim of the project is to improve the quality of life of the urban poor. This can only be achieved by integrating the physical works with economic, social, educational and health improvements. Community development is perhaps the most critical component of total development because it can give the urban poor the self confidence and the executive ability to initiate their own development. Thus community development activities spearhead physical works. The principle that the communities will actively determine and participate in the process is enshrined in the Indore Habitat Project.

The precise needs vary from community to community. To some extent they also depend on the aspirations and the abilities of the people involved. In each settlement, the Community Organisers (COs) of Indore Development Authority do considerable preparatory work to establish rapport with the people and identify their needs. Meetings are held with small groups to explain the project objectives and to identify Resident Community Volunteers (RCVs), each representing about 20 families. RCVs are the spokespersons of their respective groups and form the backbone of all the community development activities. They are organised into democratically functioning Neighbourhood Committees. This promotes two-way communication by which the grassroots problems are brought out in the Neighbourhood Committee meetings and the decisions and the project objectives disseminated back to the people.

Community development work is not capital intensive but it does require intensive human interaction. To the extent possible, non governmental organisations, voluntary agencies and motivated individuals have been drawn into the project in preference to direct implementation by the public agencies.

COMPONENTS AND OBJECTIVES

Components:

- Social Activities.
- Economic Activities/Income Generation.
- Educational.
- Health.
- Training.

Objectives:

- To develop a sense of belonging to the urban community through increased participation in community affairs using a problem solving approach with community initiative, organisation and self-help.
- To develop community leadership and skills, to identify community needs, plan programmes and implement them on a priority basis and to supervise them at the community level.
- To create a sense of social cohesion on a neighbourhood basis through cooperative civic action and to bring about improvements in social conditions and the physical environment.
- To ensure maximum utilisation of the resources of NGOs and government awareness of the needs of the slums communities
- To ensure full community participation in planning, implementation and management of the project components.
- To involve the communities in the long-term sustenance of the programmes and physical assets, created by the project.
- To contribute to the process of integration of the slum communities into the city and the externalisation of social and economic relations.

SOCIAL ACTIVITIES

The social inputs in the project comprise.

- Setting up a neighbourhood committee in each settlement
- Setting up youth clubs and womens' co-operatives.
- Building community halls

- Arranging for social activities at community halls.
- Encouraging the groups to arrange competitions and functions both within their own area and also with the neighbouring settlements.
- Holding regular awareness programmes on various issues such as, environment, solid waste management, use and maintenance of infrastructure, etc.
- Starting physical education centres.

ECONOMIC ACTIVITIES

These are set up to increase the incomes of the slum families so that their standard of living improves. The following activities for income generation have been set up in Indore Habitat Project:

- Setting up workshops for developing vocational and entrepreneurial skills and providing counselling for the aspiring entrepreneurs to register, set up and run their own industries or business.
- Establishing community based cottage industries, specially for the housewives, and creating linkages with local industries and markets.
- Setting up revolving funds for giving short term loans for raw materials, machinery and establishment.
- Providing technical education scholarships to promising students in slums.

EDUCATIONAL ACTIVITIES

The educational inputs in Indore Habitat Project comprise pre-primary education for children of three to five years of age, non-formal education for school dropouts and adult education classes aimed at improving basic literacy levels, specially of women. These particular areas of intervention have been chosen for the following reasons:

- Pre-primary education is an important link in the education chain, providing an entry point into the city's primary education system and giving slum families the encouragement and confidence to send their children to primary and secondary schools.
- Non-formal education provides additional coaching to the school going children in slums who would otherwise find it difficult to keep up with children from more privileged backgrounds. It also provides opportunities for school dropouts.
- Literacy level of slum adults is quite poor and among

women it distressingly low. For example, 73% of working women are illiterate. The adult education programme provides opportunities for the adult population, particularly those in the 15-35 age group, with an emphasis on women.

HEALTH

The health programme creates awareness, gives training and provides the basic infrastructure for mother and child care, family planning, disease detection/curative facilities and better health statistics. A close interaction is required with the local hospitals and the state health department for auxiliary support.

The health component is managed by one community health manager, four public health nursing officers, one health education officer and three field medical officers. Training of both management and field staff is undertaken by the Regional Family Welfare Training Centre, the Indore City M Y Hospital, the Indore School of Social Work and the Social and Preventive Medicine Department of the Medical College.

Community based workers namely Auxiliary Nurse Midwives (ANM), Community Health Workers (CHW) and *dais*, the traditional birth attendants, play a major role. There is one auxiliary nurse midwife per 1,000 households and one community health worker per 200 households. These workers are complemented by strengthening the existing curative health services which involve physically upgrading three dispensaries which serve slums, and appointing a medical officer to each of these.

The activities are phased in the same way as the community development component, i.e. the project supports inputs for a three year period in each slum. A full contingent of health management staff is in place for the five year period of the project. Field Medical Officers are attached to the upgraded dispensaries as and when they are completed (during the first three years of the project). ANMs have their physical base in the community halls which are provided with appropriate furniture and equipment. Mopeds are provided for the three field Medical Officers, the four Public Health Nursing Officers and the Health Education Officer.

LONG TERM SUSTENANCE

Any development strategy must make provisions for the long term sustenance of the assets created. This is an activity which requires joint participation of the community and the local bodies. The special difficulty with Indore Habitat Project is that it is executed by Indore Development Authority which has the trained staff whereas the sustenance of the assets is to be taken over by Indore Municipal Corporation which is plagued by shortage of funds and appropriate manpower. On the other hand, the persons trained during the project in the Development Authority and in the slums may become redundant at the end. Proposals are prepared to absorb these persons in the Corporation

and in the community as a permanent resource pool. These proposals also address the following issues:

- Sensitising the individuals and institutions on the importance of post project maintenance of assets created.
- Fixing institutional roles and responsibility for post project assets.
- Creating a community cell in the Corporation to assist community based post project sustenance
- Making provision for the required resources.
- Making available the infrastructure and equipment needed.
- Training and reorienting the personnel on post project maintenance and making provisions for additional personnel required for the purpose.
- Planning for the transfer of assets to different agencies who are responsible for their maintenance
- Insuring proper co-ordination and integration between the project staff and the agencies who are responsible for post project maintenance after the transfer of assets
- Training the community to actively participate in post project maintenance.
- Strengthening the neighbourhood committees and involving them in the post project maintenance
- Identifying non-governmental organisations ready to involve themselves in post project maintenance.
- Assisting the interested project staff related to community development to become NGOs.

INDORE - IMPACT AT CITY LEVEL

The essence of Slum Networking is to use the spatial coverage, contiguity and the locational attributes of slums to avail benefits for the total city. In Indore Habitat Project, the process has made a substantial impact on the city as a whole in several ways.

By interconnecting the internal sewerage in slums along the natural water courses, main intercepting drains have been installed to serve the whole city which, like most other cities in India, did not have underground sewerage to speak of before the project started. As a result, the pollution of the natural water courses has been arrested in the central portions of the city. These areas are now turning into fresh water lakes and a network of pedestrian green is being built up along the banks.

Through the Networking principle, other infrastructures of the city have also been strengthened, mainly by exploiting the transition zones around the slums. New networks have been built up for storm drainage and roads and existing water supply networks have been improved. These networks naturally serve the slums well but in the process have become equally valuable to the city.

Even the physical developments within the slums have had a city level impact. Although work in each slum may be too little in terms of the city scale, the sum of these works spread across 172 pockets does make a difference to the city. When the most distressed areas of the city, covering almost 30% of its population, are improved environmentally, the whole urban landscape changes.

Normally, major changes as above would be inconceivable in a city over a such a short time span because of high costs, disruptions to the city, land acquisition difficulties and coordination problems between a multitude of executing agencies. In Indore this city level transformation has happened over a five-year period as a mere byproduct of Slum Networking.

The details of the city level impact of Indore Habitat project are given in the following paragraphs.

ENVIRONMENTAL IMPROVEMENTS

By exploiting the contiguity of slums and their relationship with the natural water courses, it has been possible to introduce underground sewerage mains in the entire city which was previously discharging its waste into the water courses. In the absence of sewage, the water courses are turning into fresh water bodies with parks and pedestrian paths on both the banks. The river front structures in the city centre have been restored and together with the environmental improvements are becoming major recreational areas. The treatment facilities planned in the wake of the new sewerage system will ensure that the cities downstream of Indore will no longer receive polluted waters. It must be noted that these benefits are direct consequences of



Indore city centre - before Slum Networking

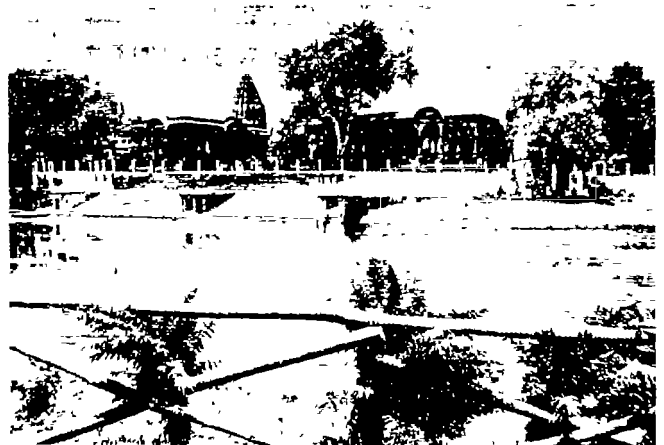
Slum Networking and emphasise the fact that slums offer unique opportunities to our cities.

INTERCEPT SEWERS

Most cities in the world have good natural drainage courses. Without these, young towns would never mature into cities because they would drown in their own waste. There are a small number of cities in the world which have survived in low-lying troughs through constant pumping. However, these are exceptions which can not be sustained in countries other than the most affluent. The natural streams and rivers passing through our cities define the ideal gravity paths. At the same time, for reasons which are not yet fully understood but which can be speculated, slums and the other poor areas of a large number of cities studied in India and abroad are closely linked to these drainage paths. These factors have jointly given birth to the intercepting main sewers in Indore as a consequence of Slum Networking.

Five years ago, the housing colonies and the slums on the streams and the rivers were discharging untreated sewage directly into the water courses of Indore. By providing the missing links along the banks between the sewerage networks laid within the slums, city level mains were built up at costs which are a fraction of the amounts required using conventional methods. By increasing the pipe diameters of the links, the capacity of the main sewers was increased to accept the larger city load at a marginal additional cost of Rs. 24 million. About 90 km. of sewer mains now permeate deep into the city fabric. A basic framework has thus been provided to convert the whole city to underground sewerage in place of the traditional open gutters. As the banks along the natural streams are owned by the nation and because there are no major built form obstacles, the time and costs normally associated with land acquisition, demolitions, litigations and compensations have been avoided.

The secondary and tertiary networks in the slums were constructed as part of the project but those in the higher income areas were excluded because it was felt that the people there



Indore city centre - after Slum Networking

could well afford to lay their own internal networks. This process has now started and more and more of the upper income areas are now connecting in the sewer mains laid. They are finding this to be a cheaper alternative to the conventional on-site treatments like septic tanks and soakpits. Even in slums the innovatively designed internal networks in combination with the economical intercept mains have proved to be the most viable of all the sanitation options considered.

In a city not experienced with underground sewerage, there are bound to be teething problems of maintenance in the early years. In Indore, blockages caused by the solid waste dumped into the manholes were quite frequent in the early years though the complaints are reducing each year as the public becomes accustomed to the system. Indore Municipal Corporation has a very large staff of sweepers and cleaners for maintaining the open gutters. This staff is not yet well equipped to maintain the underground system and will need to be retrained. However, in the long term, piped sewerage requires far less maintenance staff than open gutters and will result in substantial saving in the running expenses.

Indore is located on a plateau and, therefore does not have good slopes across the city. In spite of that, by using the natural gravity paths along the streams, the entire sewerage system remains at shallow depths, generally not exceeding two metres. Moreover, just as nature does not need pumping stations to keep the rivers flowing, they are also not required for the sewers running parallel. In fact it is for the first time in Asia that a city of this scale and terrain has no pumping stations. The savings in both capital and running costs are so enormous that the piped system not normally affordable in developing countries has become feasible in Indore. Table 10.4 below gives comparative costs of underground sewerage systems for the city of Indore, one based on networking of slums and the other for the conventional city system as was originally proposed by the Public Health Engineering Department. The city level outfalls and the distribution systems in the slum areas are executed under the project. The distribution systems in the upper income areas are to be jointly financed by the users themselves and a government grant available under National River Action Plan (NRAP).

TABLE 10.4 COMPARATIVE COSTS OF NETWORKING AND CONVENTIONAL SYSTEMS

| Component | Slum Networking Method | Conventional City System |
|---------------------------|------------------------|--------------------------|
| Outfall drains | Rs. 60 million | Rs. 200 million |
| Sewer mains | Rs. 100 million | Rs. 200 million |
| Distribution systems | Rs. 220 million | Rs. 400 million |
| Pumping stations | Nil | Rs. 30 million |
| Capitalized pumping costs | Nil | Rs. 20 million |
| TOTAL | Rs. 380 million | Rs. 850 million |

The work on the outfall drains and the intercepting mains between the slums is nearing completion and some portions of the river are becoming pollution free. In the final stages of the work, as the cross drainage works are taken up and the existing city gutters discharging into the river diverted to the intercepting mains, longer stretches of the river will improve.

RIVERFRONT DEVELOPMENT

River Khan and River Saraswati, both of which are no longer perennial, flow through Indore in the north-south direction. In the heart of the city, the Saraswati merges with the Khan which continues to flow north through the city. Several minor streams through the city also flow into these two rivers. Once out of the city, River Khan joins River Kshipra which passes through the holy city of Ujjain further downstream. Over the years, River Khan had turned into an open sewer as the city's waste discharged into it. The old waterfront structures became dilapidated and the city turned its back to the river. Slums grew up

along these neglected stretches. Until two years ago, the banks were no more than smelly sites of open air defecation and dumping grounds for garbage.

Once the intercepting drains were installed between the slums and along the banks, the sewage in the river started drying up in some stretches. This opened up exciting possibilities of revitalising the riverfront. Initially a 1.8 km. stretch in the centre of the city, at the confluence of Khan and Saraswati rivers, was taken up for improvement. The old temples and the stone steps along the banks were painstakingly restored. Even the people of Indore had forgotten that such fine heritage existed in their city. The river bed was dredged to a grade and the surplus earth used to widen the banks. The slopes were stabilised by the cheap and natural method of cutting the sides to the natural angle of soil repose, dressed and then extensively planted with the earth binding grasses and shrubs. Stone pitching and masonry toe walls were used to retain the banks where the space was too limited to permit the natural slopes. Pedes-

trian paths and gardens were then laid on the banks. As the earthworks and the landscaping stabilised, short bund walls were built across the bed to retain the water. Thus, in the monsoon rains, the river flows freely over the walls but in the dry summer months, water is retained in the lake formed by the bunds. The city centre has been transformed into a major recreational area. The results were so stunning that another stretch of the river near the temple site of Panchkuyia area in Indore was taken up successfully to become a beautiful picnic spot for the people of Indore.

By using Networking, the cost of the intercepting drains was met from the slum sanitation budget. All other improvements and the landscaping was made self financing. As the banks improved, it was realised that shops and other economic activities compatible with the recreational use could be introduced. The incomes from these sources exceed the costs of environmental improvement. A pedal-boat operator has already bid for contract to run boats across the water. Restaurants, eating parlours and retail traders are similarly very keen to set up in the shops constructed along the banks. Fountains and lights are being installed and maintained in the lake by industrial and commercial houses. Apart from the aesthetics, these fountains aerate the water when it is stagnant in the non-monsoon period. As it is gradually realised that good environment can be profitable too, the improvements are gaining their own momentum and four more areas are to be improved.

A recent study undertaken by a post-graduate student of the local engineering college shows that the groundwater qualities in the wells near the improved stretches are now better than those near the sections of the river yet to be improved. In just two years and with paltry resources available for slum sanitation, stretches of Indore river have seen changes which the more grandiose anti-pollution projects elsewhere have not managed in years. This has been made possible by the slums of Indore and their association with the natural drainage courses.

TREATMENT

A rudimentary sewerage system was introduced in Indore about 60 years ago and a treatment plant built to serve 10,000 families. The plant was designed for primary treatment and comprised three sets of screen chambers and settling tanks. A pumphouse lifted the sewage into the settling tanks and a gravity bypass line was provided to the nearby Khan river in the event of an overload. The sewerage system and the treatment facilities did not grow at a rate commensurate with urban growth. With the population rising to about 300,000 families at present, the installed lines were overloaded. As the treatment plant became grossly inadequate, it fell into disrepair and disuse. The sewage was simply diverted back to the river through the bypass. The new developments now have on-site treatment or discharge waste into the open gutters of the city or into the river. The pumping stations installed by the Corporation to augment the old system are also inadequate and overflow in the

river. It was said that the pilgrims of Ujjain city downstream bathed in the sewage of Indore.

The slums of Indore are now being served by underground sewerage. The main intercepting lines are also designed to pick up a matching population from the non-slum areas. In total the system will serve 600,000 persons discharging 75 mld effluent. With a grant of Rs. 24 million from the state government, the end outfalls of this system have been further increased in size to cater for the total city population projected to year 2000. The conversion of the entire city to underground sewerage will take several years, hence, the treatment load in the immediate future is expected to be a fraction of the ultimate. A provision of Rs. 8 million was made in the Indore Habitat Project for the treatment of this initial load.

DEVELOPMENT OF TRANSITION ZONES

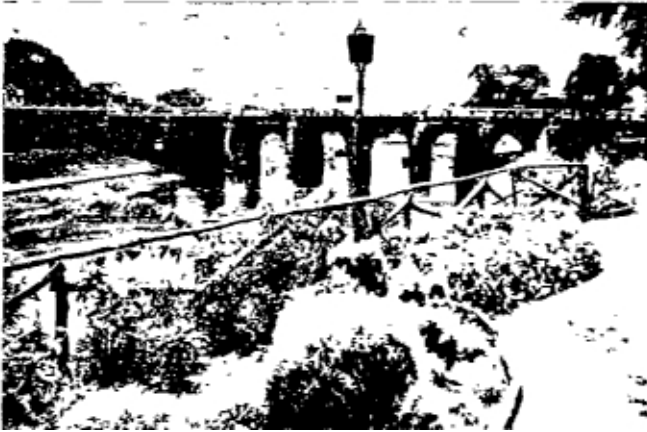
Slums do not have clear boundaries. There are normally transition zones between the slums and the formal settlements around them. In order to assimilate the slums fully into the urban fabric and at the same time strengthen city level infrastructure, these grey areas have to be designed with special sensitivity. The concept of interlinking the slums and treating the transition zones around them has for the first time been introduced in Indore Habitat Project to avail several benefits at a level higher than that of the individual pockets. The internal services of the slums depend on the city infrastructure available on their peripheries. At the same time, if the slum services can be planned in such a manner that they help to reinforce the city networks as much as drawing upon them, the slum and the non-slum fabrics can become mutually supportive.

In this manner, the main collector runs, whether they be roads, sewers or storm drains have been linked with those of the adjacent slums to provide alternative networks of city services at nominal extra costs. For example, in Indore, out of the 360 km. of roads provided in slums, about 80 km. on the slum peripheries were linked up at the city level to reduce the traffic congestion on the existing city roads. Similarly, the storm drainage runs in the slums have helped to relieve flooding in the neighbouring portions of the city. The sewer mains around and in between the slums are now being used to connect non-slum areas. The internal water supply runs in the slums are used to short circuit the peripheral branches supplying the city which in turn is helping to distribute pressures more evenly across larger areas.

OVERVIEW - FROM INDORE TO BARODA AND AHMEDABAD

ACHIEVEMENTS

The immediate and tangible achievements in Indore have already been charted in the previous sections. The scale and the range of the accomplishments have been quite striking whether on the physical side with kilometres of services installed or on



Riverside gardens

the community development front with numbers of people covered by educational, health and economic programmes. However, the less perceptible and long term consequences just beginning to emerge are even more impressive. They show that secondary changes of more fundamental and enduring nature have started.

Literacy levels are rising. The incomes of women and youths covered by the programme are increasing. On the health front, methods of birth spacing are getting high acceptance, institutional child deliveries are going up and outbreaks of epidemics have reduced. Investments in physical infrastructure are also being capitalised upon. The improvement in environment has triggered off heavy investments by the families themselves in the upgradation of their shelters. About 60% of the slum families have now connected to underground sewerage and the numbers are still increasing. The project has successfully tied up with banks for disbursement of Rs. 17 million loan to construct over 5,500 private latrines. The demand for underground sewerage and private toilets is increasing because it has started to affect the marriage prospects of potential grooms in the unsewered areas. All these indicate shifts in attitudes which will have long term repercussions on future generations. Changes which normally take decades of development have happened in Indore in just five years.

Integrated slum upgradation is not new in India. Indeed, the Indore project is an evolution of good precedents already established in India and abroad. However, what sets it apart is the introduction of the Slum Networking backbone in the process of development. In a holistic frame, Slum Networking converges the scales, activities, agencies and resources to transcend from the slum fabric to the city as a whole to achieve sustainable improvement in the quality of life of its people. Instead of slums being at the receiving end of development, they become catalysts of a fundamental transformation of the city. The approach is innovative, cost effective and, more importantly, universally applicable. At the micro-level, aspects such as topography management, landscaping, simplified technologies and individual services increase the control which the communities have over their own development.

Against all odds and in an unimaginable short time, changes have happened in Indore city which would be inconceivable in other circumstances. The city, which until recently depended on open sewers now has 90 kms. of intercepting mains installed. About 80 kms. of new roads have been provided on the slum boundaries and interlinked to relieve traffic congestions on the city trunk roads. The stretch of the polluted river in the city centre has been turned into a freshwater lake and pedestrian greens have been laid on the banks. This has not been achieved by injecting massive investments but, instead, by using the limited resources available for slum upgradation more judiciously and developing innovative solutions which are economic.

Indore has demonstrated that slums can, indeed, change the cities for the better.

WEAKNESSES

The soft underbelly of the Indore project is that it is financed from a grant given by Overseas Development Administration, U.K.. The replicability value of the work can, therefore, be questioned. Grants do serve the useful purpose of supporting innovating and experimental programmes which would not otherwise attract finance from the conventional sources. However, it is clear that large scale development cannot be sustained by grants and that each country has to rely on its intrinsic strengths for progress. Further, bilateral grants are normally channelled through government structures. Hence the public agencies dominate development and in turn foster dependency on the beneficiaries.

The physical works and the community development components were integrated closely through the implementation structure established in Indore Development Authority. The Slum Networking concept too attempts to converge the two by using physical components such as earth management and landscaping as tools for high levels of public participation during execution. And yet, the engineering works in Indore could not always be integrated in the true sense with the socio-economic programmes. The technical and the community development wings found it very difficult to coordinate the activities on site. The result was that the communities often failed to understand the importance of underground sewerage, storm drainage, landscaping, earth management, solid waste and maintenance in spite of the fact that these related closely to health. Hence, not all the families connected to the system. The drains often get blocked by indiscriminate disposal of solid waste and streets were often not cleaned.

There are reasons for community apathy. In spite of all the intentions, the project is eventually delivered by the agency and not executed by the community. Neither did the community have any stake in the initial capital outlays. Community participation is not possible without commensurate responsibilities and commitments.

Although the Indore project had excellent linkages with a large number of other government programmes, the private sector

did not have a major role to play. The huge resources commanded by this sector together with its management skills and executive ability could not be tapped. The major commercial and industrial houses in the city would have effectively counterbalanced the government influence. If a full convergence of resources and other strengths of the three main forces in the city, namely, the business interests, the community and the government had been attempted, the replicability would have increased.

As mentioned earlier, the solid waste management programme in Indore has been far from satisfactory. The complex interlinkages of this programme were not well understood when the work started. The problem was seen simply in terms of dustbins and sweepers. An attempt is at present being made to salvage the situation through community education and linkages with the Indore Municipal Corporation. There have been complaints by the community that the cleaners and sweepers of the Corporation are uncooperative. Sometimes they deliberately dump the garbage in the sewer manholes in an attempt to sabotage the system. This is done because they see the sewerage system as a threat to their livelihood. This problem has now been recognised and a policy is being formulated to retrain and assimilate the existing cleaning staff of the Corporation in the subsequent maintenance of the slums.

When the work first started in Indore, it was seen more as a project and not a process. It was only during the course of implementation that the importance of sustaining the activities and the assets was fully realised. Although post-project sustenance came as an afterthought, a great deal could be done to redress the oversight. In Indore, whilst the programme was executed by the Development Authority, the maintenance fell within the purview of the Municipal Corporation. A system of 'handing over' was established whereby the physical works completed were jointly inspected by the staff of the Development Authority, Municipal Corporation and the members of the community before formally passing the assets to the Corporation for maintenance. It was realised that the expertise developed by the community development wing of Indore Development Authority would be wasted once the execution was over, unless a role could be found for this pool in the post-sustenance period. The group is now being converted to a registered NGO so that it can continue to provide its services both to Indore slums as well as to other cities if required. The maintenance costs of the physical works would be met by the Corporation. This naturally places burdens on the agency which were not earlier anticipated. Ideally it would have been better to make the slum dwellers the rate payers. However, that would require policy changes which at this juncture are not possible. The Development Authority together with the state government is now examining the possibility of creating a maintenance fund by legalising and selling the land to the slum dwellers at nominal rates. Although the cost per family would be small, the numbers are so large that enormous sums can be raised.

In spite of the apparent deficiencies mentioned above, the Indore Habitat Project has been an inspiration to other cities in India.

It has been a learning process for all the persons involved. Baroda and Ahmedabad have successively adopted the successful elements of Indore and plugged its deficiencies such that at each step the levels of self-sufficiency and community control have increased. In the process, Slum Networking has matured into a holistic and endurable strategy which can be replicated on a mass scale.

CONCLUSION

Slum Networking has a clear vision. It sees the cities of developing countries without slums. To be able to achieve that, three conditions have to be satisfied. Firstly, a workable physical concept has to be there which is economic, sensitive to the community, practical and can transcend from micro to macro scale. Secondly, resources have to be mobilised. And finally, the community has to have control over the development.

Slum dwellers have consistently demonstrated that they are very keen to change their physical conditions. They are willing to help themselves if guided and they are ready to invest their own resources. Instead of harnessing the greatest resource, namely, the slum dwellers themselves, the present programmes spread the scarce public resources too thinly over a large slum population, impose engineering solutions which are inappropriate and have failed in the past and use agencies which have proved ineffective. The ODA projects have shown that physically it is quite possible to pick cities and embrace their total slum populations. The subsequent efforts in Baroda and Ahmedabad show that surprisingly large resources can be mobilised directly from the slum dwellers.

If the above is accepted, it automatically leads to a very different approach and calls for alternative delivery mechanisms for improving the environmental and sanitation conditions in the slums.

It is normally assumed that the slum dwellers do not have the capacity to finance their own upgradation. Detailed interviews



Slums after improvement - Indore

show that in the right conditions, the slum dwellers do invest large sums in their housing and services. Studies undertaken in Bhopal by Human Settlement Management Institute have shown that this propensity to invest is primarily triggered not by land tenure but by "perceived security" and in faith that the locality will improve with time. Slum upgradation achieves these goals. The finance is generally raised by a) disposal of land or other property in village, b) disposal of jewellery (mainly silver), c) borrowing from friends and family and d) from the 'loan sharks' at exorbitant interest rates. It is interesting that the last is preferred to the loans from banks or other institutions because of the inaccessibility of the latter. Follow up studies in Indore showed that in the wake of environmental improvements the slum families were investing on average Rs 10,000 per annum from their own pockets on shelter improvement.

Huge resources currently being expended for poverty alleviation under various programmes are dissipated for the lack of focus and the net achievement is nothing more than sporadic amelioration. If instead they are converged with the resources which can be mobilised from within slums, a very different picture emerges. Studies undertaken in many cities over the country have shown that the slum dwellers are willing to invest for water and sanitation. The sums they can afford vary on average from Rs 1,500 to Rs. 5,000 per family depending on the city. In the pilot project in Baroda, the slum dwellers have very readily committed to spend Rs. 2,600 per family for environmental improvements. In Ahmedabad, in the pilot slums, the families are ready to invest Rs. 2,000 per family and the local industries are matching that contribution, bringing the total distress mapping of the city, prioritisation of needs, preparing proposals, determining resource needs, mobilising finance and preparing a time bound action plan for execution and maintenance. At present no such planning exists in most cities.

Instead, resources are spent on ad-hoc basis depending on the exigencies prevailing at that moment of time. For example, whilst most towns and cities in India do not have even rudimentary sewerage and storm drainage, grants for Integrated Development of Small and Medium Towns (IDSMT) are exclusively used for relatively non-essential expenses such as roads and shopping centres. The state governments should insist on distress mapping before considering IDSMT grants. Such an exercise would automatically highlight the slums as areas of major infrastructural deficiencies and would in turn enable a proportion of IDSMT grants to be channelled into this priority need.

Indore clearly demonstrates that it is quite possible to address the problems of the urban poor, both physical and socio-economic, at micro and macro scales parallel with the infrastructure and environmental improvements of the city as a whole. However, the project was delivered through the conventional government mechanisms and funded from a bilateral grant. Going back to the three essentials of Slum Networking, namely method, resources and community control, Indore has achieved a third of the goal vis-a-vis the method.

In Baroda, a substantial proportion of the development funds (over 50%) are being raised internally from the slum dwellers. Further, the control of development rests with the community. In Ahmedabad, the Slum Networking approach has been taken one stage further by replacing external aid by contributions from the city's industries so as to augment the resource needs of both the slum dwellers as well as the Municipal Corporation. This concept of multi-partite effort of the community, local economic forces, Municipal Corporation, NGOs and professionals now satisfies all the conditions needed to replicate Slum Networking throughout the country.

HUDCO and HSMI

The Housing and Urban Development Corporation (HUDCO) was established in 1970 under the Ministry of Urban Development as a techno-financial institution for dealing with the problems of housing and urban development. The main thrust of HUDCO has been to provide financing for the economically weaker sections of the society. Lately, in 1990s, HUDCO has acquired an all-pervasive presence in the field of housing, infrastructure, building materials, construction technology and research and training.

The Human Settlement Management Institute (HSMI) was founded in 1985 by HUDCO in collaboration with the Institute for Housing and Urban Development Studies (IHS) with the purpose to develop training programmes for technical and managerial staff of HUDCO's borrowing agencies as well as for the wide group of municipal administrators and professionals.

In addition to training, HSMI has been conducting on a regular basis research on new urban development matters, and incorporated these case studies into the various training materials developed at HSMI. Presently, the HSMI is also the Secretariat for the HABINET programme which is an international networking collaboration between six urban development training institutions: HSMI (India), IUIDP/Cipta Karya (Indonesia), NHA (Thailand), CHPB (Sri Lanka), CHS (Tanzania) and CEHAP (Columbia).

THE IHS

The Institute for Housing and Urban Development Studies (IHS), Rotterdam, The Netherlands is an independent, non-profit organisation. Since its establishment in 1958, IHS has offered training and related professional services in the field of housing and urban development management, with a focus on low-income settlement in developing countries.

Particular emphasis is placed on developing the institutional capacities of urban development related organisations in developing countries.

IHS organises various types of courses such as a 5-months post graduate course, short courses of 3-6 weeks, tailor made courses and 16 months master degree courses in urban management. Master courses will also be developed in the fields of urban heritage and renewal and urban environmental management.

