UNDP/UNCHS (Habitat)/World Bank/SDC Collaborative Programme
on Municipal Solid Waste management in Low-Income Countries

URBAN MANAGEMENT AND INFRASTRUCTURE

Conceptual Framework for Municipal Solid Waste Management in Low-Income Countries

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Foreword

This working paper has been prepared by the Urban Management Programme (UMP) in the framework of a collaborative programme with the Swiss Agency for Development and Cooperation (SDC).

The UMP is a ten-year global technical cooperation programme designed to strengthen the contribution that cities and towns in developing countries make toward human development, including economic growth, social development, and the reduction of poverty.

The Programme is a partnership of the international community: UNCHS (Habitat) is the executing agency; The World Bank is the associated agency and UNDP provides the core funding and overall monitoring. Bilateral donors, multilateral agencies such as the World Health Organization and Non-Governmental Organizations (NGOs) provide various types of support.

The ultimate beneficiaries of the Programme are the citizens who live in and use cities and towns, particularly the urban poor, who will receive better-managed services and more accountable, participatory, and transparent management as a result of the Programme.

The Urban Management Programme

Through its regional offices in Africa, the Arab States, Asia and the Pacific, and Latin America and the Caribbean, the UMP seeks to strengthen urban management by harnessing the skills and strategies of networks of regional experts, communities and organizations in the public and private sectors. The goal of the Programme is to strengthen this local and regional expertise.

- **City and Country Consultations**. The UMP brings together national and local authorities, the private sector, community representatives, and other actors within a country to discuss specific problems within the UMP's subject areas and to propose reasoned solutions. Consultations are held solely at the request of a developing country and often provide a forum for discussion of a cross-section of issues generally resulting in a concrete action plan for policy programme change.

- **Technical Cooperation**. The UMP uses its regional networks of expertise to sustain follow-up to the consultations by providing technical advice and cooperation to facilitate the implementation of action plans and to mobilise the resources needed for their implementation.

Through its Core Teams in Nairobi and Washington, D.C., the UMP supports the regional programmes and networks by synthesising lessons learned, conducting state-of-the-art research, identifying best practices, and disseminating programme-related materials.

The UMP Dissemination

The UMP produces a number of publications which present the findings of specific research activities, summarize the results of case studies, research, and the insights and broad recommendations developed under the work of the UMP to date, and illustrate instruments, techniques, or procedures, the UMP has found useful in addressing the issues surrounding the five components.

The UMP's Working Papers Series

The working paper series has several objectives. The **content** of the series seeks to highlight examples of good and best practices in the various components of urban management or give an overview of main issues and options in a particular field of urban management. This will range from case studies and training materials on one or more aspects of urban management in a particular city to regional and even global syntheses of experiences. Much of the latter will increasingly be drawn from the UMP's regional programmes. The **timeliness** of the information in the series is an important objective. Hence, the review and production processes for issuing the series have been streamlined to allow for rapid publication and dissemination. The **sources** of material that will be published in the series are intended to be diverse. Authors will be drawn from the UMP's regional coordinators, Programme consultants, members of the UMP's regional networks, UMP core team members, and others.

The **audience** for the working papers will also be diverse, varying according to publication. The series should be of use to urban managers, urban policy makers at different levels of government, External Support Agencies (ESAs) that provide support for urban development, community and non governmental organisations, academics, and the media.

In parallel, the UMP also issues a formal publications series that consists of discussion papers, policy framework papers, and management tools. A list of titles that have been prepared in the formal series and working paper series is attached at the end of this paper.

Many of the formal series publications are available in English, Spanish, and French. The working paper series is available only in English though translations could be available at a later date.

Acknowledgements

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An earlier draft of this paper, incorporating preparatory work by Klaus Grimm, was presented at the International Interagency Workshop on Municipal Solid Waste Management (MSWM) in Ittingen, Switzerland, April 1995[1]. The present version owes very much to the contributions and comments of the Workshop participants. The author gratefully acknowledges the overall guidance of Carl Bartone of the World Bank, and Walter Meyer of SDC, and the collaboration, assistance and support of Jürg Christen and Karl Wehrle of SKAT, who provided substantive and editorial inputs towards completion of the paper. Valuable inputs and comments were also received from Sandra Cointreau-Levine, Philip Rushbrook and David Wilson.

[1] See: SKAT / P. Schübeler; SDC/UMP Collaborative Programme on MSWM, Proceedings of the Ittingen Workshop, available at SKAT, St.Gallen, Switzerland

Abbreviations

CBO	Community-based Organisation
CCWSS	Collaborative Council for Water Supply and Sanitation
ESA	External Support Agency
MEIP	Municipal Environmental Improvement Programme
MSWM	Municipal Solid Waste Management
NGO	Non-Governmental Organisation
NIMBY	“Not in my back yard”
O&M	Operation and Maintenance
SCP	Sustainable Cities Programme
SDC	Swiss Agency for Development and Cooperation
SKAT	Swiss Centre for Development Cooperation in Technology and Management
UMP	Urban Management Programme
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UNICEF	United Nations Children’s Fund
WSSP	Water and Sanitation Programme, UNDP/World Bank

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Executive Summary

Introduction

1. Municipal Solid Waste Management (MSWM) is major responsibility of local government. It is a complex task which requires appropriate organisational capacity and cooperation between numerous stakeholders in the private and public sectors. Although it is essential to public health and environmental protection, solid waste management in most cities of developing countries is highly unsatisfactory.

2. The Conceptual Framework provides brief definitions of the main concepts of MSWM and identifies the goals and principles that normally guide MSWM system development. It discusses key objectives and issues which should be addressed by MSWM strategies with regard to political, institutional, social, financial, economic and technical aspects.

3. MSWM is an important entry point for integrated urban management support; the Framework paper concludes by outlining possible directions for development cooperation.

4. The Conceptual Framework is not a finished product: it will be further elaborated by the UMP and its partners.

Describing Municipal Solid Waste Management

5. Municipal solid waste is defined to include refuse from households, non-hazardous solid waste from industrial, commercial and institutional establishments (including hospitals), market waste, yard waste and street sweepings. MSWM encompasses the functions of collection, transfer, treatment, recycling, resource recovery and disposal of municipal solid waste.

6. The first goal of MSWM is to protect the health of the population, particularly that of low-income groups. Other goals include promotion of environmental quality and sustainability, support of economic productivity and employment generation. Achievement of MSWM goals requires sustainable solid waste management systems, which are adapted to and carried by the municipality and its local communities.

7. The scope of MSWM encompasses planning and management systems, waste generation processes, and organisations, procedures and facilities for waste handling. Development strategies comprise specific objectives and measures in these areas. They need to consider the specific interests, roles and responsibilities of numerous actors, including:

   - households, community-based organisations (CBO) and other service users,
   - local and national government authorities,
   - non-governmental organisations (NGO)
   - formal and informal private sector enterprises, and
   - external support agencies (ESAs).

8. The functioning of MSWM systems — and the impact of related development activities — depends on their adaptation to particular characteristics of the political, social, economic and environmental context of the respective city and country.

Strategic Aspects of Solid Waste Management

9. To achieve sustainable and effective waste management, development strategies must go beyond purely technical considerations to formulate specific objectives and implement appropriate measures with regard to political, institutional, social, financial, economic and technical aspects of MSWM:

10. **Political aspects concern** the formulation of goals and priorities, determination of roles and jurisdiction, and the legal and regulatory framework:

- Society's goals and priorities regarding environmental protection and equitable service access must be clearly articulated in order to mobilise popular support and resources required for their realisation.
- A clear definition of jurisdiction and roles is essential to the political sustainability of MSWM systems. The "strategic plan" for MSWM provides a basis for putting the defined roles of government authorities and other actors into effect.
- Bylaws, ordinances and regulations for MSWM should be few in number, transparent, unambiguous and equitable.

11. **Institutional aspects** concern the distribution of functions and responsibilities and correspond to organisational structures, procedures, methods, institutional capacities and private sector involvement:

- Effective MSWM depends upon an appropriate distribution of responsibilities, authority and revenues between national, provincial and local governments. In metropolitan areas, where MSWM tasks extend across several local government units, inter-municipal cooperation is essential.
- Decentralisation of responsibility for MSWM requires a corresponding distribution of powers and capacities. It normally calls for revised organisational structures, staffing plans and job descriptions of the local agencies concerned.
- Capacity-building measures for MSWM should give primary attention to strategic planning and financial management. Discrepancies often exist between MSWM job requirements and the actual staff qualifications; training and human resource development are thus important components.
- Private sector involvement in MSWM implies a shift in the role of government institutions from service provision to regulation. Essential conditions for successful private sector involvement include competitive bidding, technical and organisational capacity, regulatory instruments and monitoring and control systems.
- The contribution of informal waste collection workers may be significantly improved through appropriate organisational measures.

12. **Social aspects of MSWM** include the patterns of waste generation and handling of households and other users, community-based waste management and the social conditions of waste workers:

- Waste generation patterns are determined by people's attitudes as well as their socio-economic characteristics. Attitudes towards waste may be positively influenced by awareness-building campaigns and educational measures.
- In many low-income residential areas, community-based solid waste management is the only feasible solution. Functional links between community-based activities and the municipal system are very important, however.

- Even where municipal waste collection services are provided, user cooperation is essential to efficient MSWM operations. Cooperation may be promoted through general awareness-building programmes as well as focused MSWM information campaigns.
- Waste workers — especially those in the informal private sector — live and work under socially precarious conditions and are subject to serious health risks. Support should aim to improve their working conditions, earnings, and access to social services.

13. **Financial aspects** of MSWM concern budgeting and cost accounting, capital investment, cost recovery and cost reduction:

- Although they are essential to effective MSWM, available practical methods of budgeting, cost accounting, financial monitoring and financial evaluation are too seldom employed. Their application should be actively promoted within institutional development programmes.
- The main options for financing capital investment for MSWM include local budget resources, loans from financial intermediaries and special central government loans or grants. While central financing is often needed, investment authority should be devolved to local governments.
- The main options for financing recurrent MSWM costs are user charges, local taxes and intergovernmental transfers; clear preference should be given to user charges. To achieve equitable service access, some degree of cross-subsidisation and/or financing out of general revenues is often needed, however.
- MSWM fee collection performance is often poor. Improvement can often be achieved by attaching solid waste fees to the billing for another service, such as water supply.
- Solid waste service revenues normally flow into a general municipal account, where they tend to be absorbed by overall expenditures. Clear political decisions and autonomous accounting procedures are required to ensure that MSWM revenues are employed for the intended purpose.
- The potential for increasing MSWM revenues is usually limited; cost reduction — "doing more with less" — is almost always the best way to improve financial sustainability.

14. **Economic aspects** of MSWM are concerned with the impact of services on economic activities, cost-effectiveness of MSWM systems, macro-economic dimensions of resource use and conservation, and income generation:

- Solid waste generation and the demand for waste collection services generally increase with economic development.
- A trade-off is normally required between the objectives of low-cost collection service and environmental protection.
- The economic effectiveness of MSWM systems depends upon the life-cycle costs of facilities and equipment and the long-term economic impact of services provided.
- Economic evaluation constitutes an important input to strategic planning and investment programming for MSWM.
- Measures should be introduced which discourage wasteful use of materials and encourage waste minimisation. The best way to promote efficient use and conservation of materials is to internalise the costs of waste management as far as possible in the production, distribution and consumption phases.

- Private sector involvement in waste management may actually reduce the number of jobs in the sector. Economic strategies should seek, firstly, to increase effectiveness and labour productivity of MSWM and, secondly, to generate employment by expanding service coverage.

15. **Technical aspects** of MSWM are concerned with the planning and implementation and maintenanceof collection and transfer systems, waste recovery, final disposal and hazardous waste management.

- Technical facilities and equipment must be designed and selected with careful regard to their operating characteristics, performance, maintenance requirements and expected life-cycle costs. Close attention should be paid to preventive maintenance, repair and spare parts availability.
- Design of transfer facilities and equipment must match the characteristics of local collection systems and the capacity of existing disposal facilities. Local collection systems should be designed with active participation of the communities concerned.
- Informal waste recovery and scavenging may be rendered more productive through support measures and appropriate technical design of the waste management systems. Public sector involvement in waste recovery and/or leasing of waste recovery rights to private sector enterprises may be considered..
- The most appropriate method of final disposal in developing countries is nearly always the sanitary landfill. To minimise their environmental impact, landfills must be carefully sited, correctly designed and well operated.
- Sources of hazardous waste materials must be identified, registered and targeted for appropriate management; special attention needs to be paid to infectious healthcare wastes.

Development Assistance Outlook

16. An initial assessment of MSWM needs indicates that development assistance should focus on policy support, institutional development, private sector involvement, user participation, technical development and hazardous waste management.

- **Policy support** applies to the formulation of appropriate bylaws, regulations and standards, and integration of MSWM into the relevant legal framework.
- **Institutional development and strengthening** promotes the decentralisation of authority and includes measures to build the powers and capacities of local governments commensurate with their MSWM responsibilities.
- **Private sector involvement** should be supported through practical guidelines and tools for establishing satisfactory working relationships with private sector actors, and related changes in the legal and regulatory framework.
- **User participation** should be supported through documentation, practical guidance and tools to assist governments to improve user cooperation and establish low-cost community-managed collection services.
- **Technical development** includes guidelines, methods and tools for the design and selection MSWM facilities and equipment; particular attention should be paid to operation and maintenance.

- **Hazardous waste** management support encompasses documentation, tools and guidelines; it refers to small and scattered hazardous waste sources as well large industrial and commercial waste generators.

17. MSWM related activities of the UMP and its partners would be closely co-ordinated with relevant ESAs and programmes. Possible forms include:

- Integrated, **city-level MSWM projects** and demonstration projects,
- **Process-oriented advisory services** at central government level,
- **Advisory services on specific components** of the MSWM system,
- Programmes and materials for **human resources development**,
- Applied **research and elaboration of manuals and guidelines**,
- **Dissemination of know-how** through literature, case studies, project documents and articles, and
- **Support to exchange of experience** and professional discussions.

Conceptual Framework

for Municipal Solid Waste Management in Low-Income Countries

1. Introduction

1.1 Importance of Municipal Solid Waste Management

Municipal solid waste management (MSWM) is a complex task which depends as much upon organisation and cooperation between numerous public and private sector actors and as it does upon appropriate technical solutions.

Municipal solid waste management (MSWM) is a major responsibility of local governments, typically consuming between 20% and 50% of municipal budgets in developing countries. It is a complex task which depends as much upon organisation and cooperation between households, communities, private enterprises and municipal authorities as it does upon the selection and application of appropriate technical solutions for waste collection, transfer, recycling and disposal. Furthermore, waste management is an essential task which has important consequences for public health and well-being, the quality and sustainability of the urban environment and the efficiency and productivity of the urban economy. In most cities of developing countries, waste management is inadequate: a significant portion of the population does not have access to a waste collection service and only a fraction of the generated waste is actually collected. Systems for transfer, recycling and/or disposal of solid waste are unsatisfactory from the environmental, economic and financial points of view.

MSWM is an important entry point for urban management support.

In recent years, MSWM has attracted increasing attention from bilateral and multilateral development agencies, due to the mounting urgency of urban environmental problems — identified, for example, in Agenda 21, Chapters 7 and 21 — and increasing concern for capacity building at the level of municipal management. With its broad organisational implications and close links to other sectors, MSWM constitutes an important entry point for integrated urban management support.

1.2 Origins and Use of the Framework Paper

This paper derives from a joint initiative to define critical MSWM issues, identify needs, and outline possible assistance activities.

An earlier version of this paper was presented at the Ittingen Workshop on "Municipal Solid Waste Management in Low-Income Countries" (Switzerland, 9-12 April, 1995). The workshop was a joint initiative of Swiss Development Cooperation (SDC) and the Urban Management Programme (UMP), aimed at defining critical issues of MSWM in developing countries, identifying support needs and outlining possible directions of development assistance.

The Conceptual Framework is not a finished product; it will be further developed and elaborated by the UMP and its partners.

The present paper incorporates the conclusions and recommendations of the Workshop. It will be used by the UMP and its partner organisations as a "check list" to facilitate and co-ordinate the preparation of activities and programmes in the field, and a starting point for the elaboration of a policy framework paper on solid waste management. Besides the Workshop participants and the UMP itself, this paper is directed towards municipal authorities and concerned government officials in developing countries, NGO and organisations active in waste management, as well as other External Support Agencies (ESAs) and development programmes. The conceptual framework is not a finished product; it will be further developed and elaborated by the UMP and its partners.

1.3 Structure and Content of the Conceptual Framework

The conceptual framework — illustrated in Figure 1 — is structured along three principle dimensions, corresponding to the questions:

- ***What*** is the scope of waste management activities?
- ***Who*** are the actors and development partners in the field?
- ***How*** should strategic objectives and issues be addressed?

The paper offers definitions of central concepts of MSWM and identifies the main goals and principles.

Chapter 2 offers brief definitions of the central concepts of MSWM and identifies the *goals* and *principles* which normally motivate and guide solid waste management. The *scope* of waste management activities ("what") and the concerned actors and partners in development cooperation ("who") are then described. The chapter closes with a brief outline of the *context* in which solid waste management systems operate at the political, socio-cultural, economic and environmental levels.

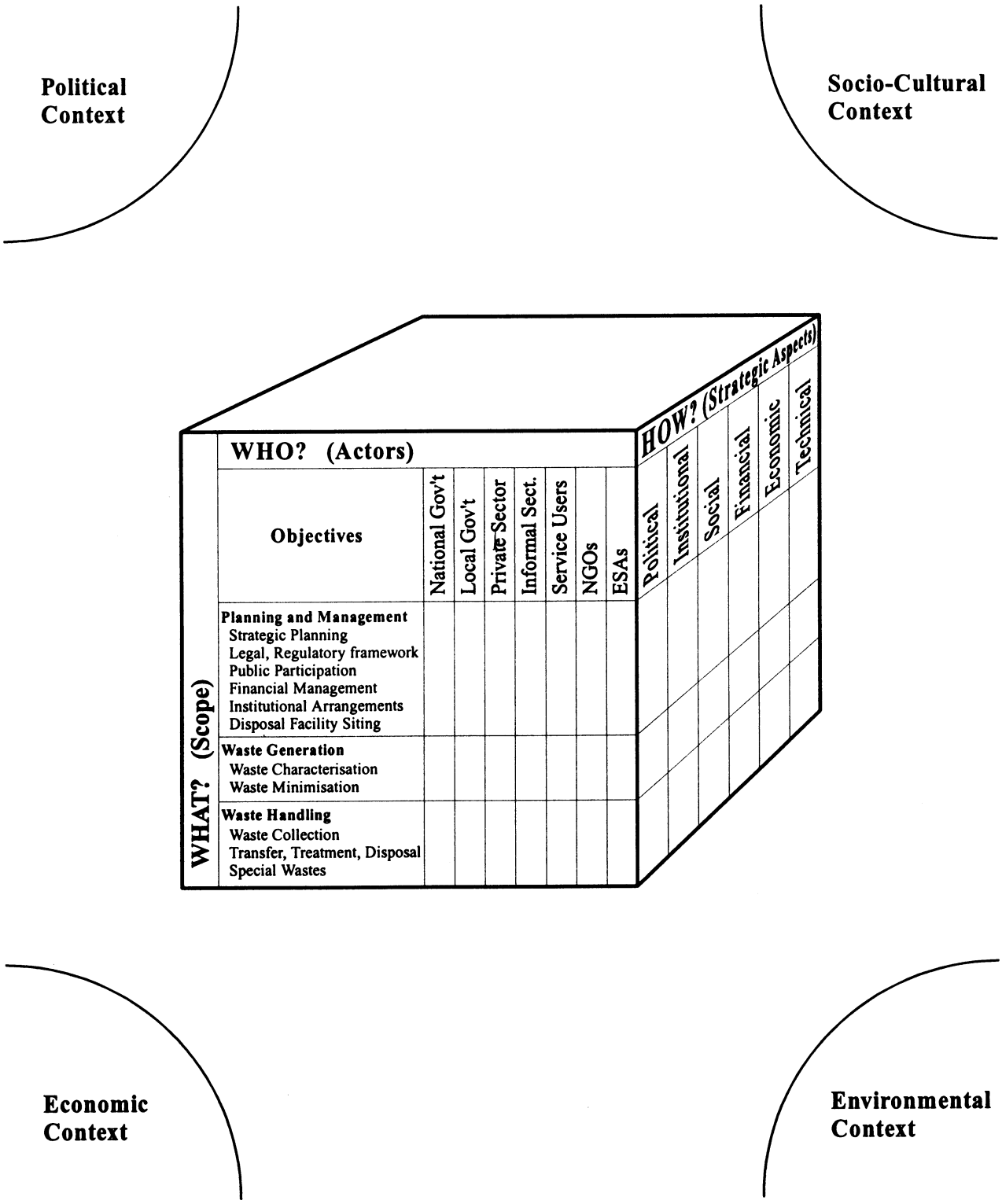
The paper discusses objectives and issues to be addressed by MSWM development strategies.

Chapter 3 discusses the *strategic aspects* of MSWM ("how"). These aspects may be understood as those portions of the context which are directly influenced and/or mobilised by waste management strategies. Although it does not propose specific strategies for waste management, the paper discusses key objectives and issues that should be addressed by MSWM strategies in the political, institutional, social, financial, economic and technical domains.

Possible directions of assistance are identified.

Finally, Chapter 4 discusses the *needs* for development assistance in MSWM and the outlook for *programmes of development assistance*.

Figure 1: Structure of the Conceptual Framework



2. Describing Municipal Solid Waste Management

2.1 Definitions

Municipal solid waste comprises refuse from households, non-hazardous solid waste from industrial, commercial and institutional establishments, market waste, yard waste and street sweepings.

Municipal solid waste is defined to include refuse from households, non-hazardous solid waste from industrial, commercial and institutional establishments (including hospitals), market waste, yard waste and street sweepings. Semisolid wastes such as sludge and nightsoil are considered to be the responsibility of liquid waste management systems. While hazardous industrial and medical wastes are, by definition, not components of municipal solid waste, they are normally quite difficult to separate from municipal solid waste, particularly when their sources are small and scattered. MSWM systems should therefore include special measures for preventing hazardous materials from entering the waste stream and — to the extent that this cannot be ensured — alleviating the serious consequences that arise when they do. Finally, debris from construction and demolition constitute "difficult" categories of waste which also require separate management procedures.

Management is a cyclical, goal-oriented process.

Management is a cyclical process of setting objectives, establishing long-term plans, programming, budgeting, implementation, operation and maintenance, monitoring and evaluation, cost control, revision of objectives and plans, and so forth. Management of urban infrastructure services is a basic responsibility of the municipal government. It is usually advantageous to execute service provision tasks in partnership with private enterprises (privatisation) and/or with the users of services (participation), but the final responsibility remains that of the government.

MSWM includes all phases of waste collection, recycling, treatment and disposal.

Municipal solid waste management (MSWM) refers to the collection, transfer, treatment, recycling, resource recovery and disposal of solid waste in urban areas.

2.2 Goals and Principles of MSWM

A first goal of MSWM is to protect the health of the entire urban population.

The first goal of MSWM is to protect the health of the urban population, particularly that of low-income groups who suffer most from poor waste management. Secondly, MSWM aims to promote environmental conditions by controlling pollution (including water, air, soil and cross media pollution) and ensuring the sustainability of ecosystems in the urban region. Thirdly, MSWM supports urban economic development by providing demanded waste management services and ensuring the efficient use and conservation of valuable materials and resources. Forthly, MSWM aims to generate employment and incomes in the sector itself. The goals of MSWM are:

1. **To protect environmental health,**
2. **To promote the quality of the urban environment,**

3. **To support the efficiency and productivity of the economy**
4. **To generate employment and income.**

To achieve the goals of MSWM, sustainable systems of waste management must be established.

To achieve the above goals, it is necessary to establish sustainable systems of solid waste management which meet the needs of the entire urban population, including the poor. The essential condition of sustainability implies that waste management systems must be *absorbed and carried by the society* and its local communities. These systems must, in other words, be *appropriate* to the particular circumstances and problems of the city and locality, employing and developing the capacities of all stakeholders, including the households and communities requiring service, private sector enterprises and workers (both formal and informal), and government agencies at the local, regional and national levels.

Waste management should be approached from the perspective of the entire cycle of material use.

Waste management should be approached from the perspective of the entire cycle of material use, which includes production, distribution and consumption as well as waste collection and disposal. Whilst immediate priority must be given to effective collection and disposal, waste reduction and recycling should be pursued as equally important, longer-term objectives. The principles of sustainable waste management strategies are thus to:

- minimise waste generation
- maximise waste recycling and reuse, and
- ensure the safe and environmentally sound disposal of waste.

Solid waste management goals cannot be achieved through isolated, sectoral approaches.

Solid waste management goals cannot be achieved through isolated or sectoral approaches. Sustainable waste management depends on the overall effectiveness and efficiency of urban management, and the capacity of responsible municipal authorities.

2.3 Scope of MSWM

The scope of MSWM encompasses planning and management, waste generation and waste handling processes.

Within the overall framework of urban management, the **scope** of MSWM encompasses the following functions and concerns:

1. **Planning and Management**
   - Strategic planning
   - Legal and regulatory framework
   - Public participation
   - Financial management (cost recovery, budgeting, accounting, etc.)
   - Institutional arrangements (including private sector participation)
   - Disposal facility siting

2. Waste Generation

- Waste characterisation (source, rates, composition, etc.)
- Waste minimisation and source separation

3. Waste Handling

- Waste collection
- Waste transfer, treatment and disposal
- Special wastes (medical, small industries, etc.)

Practical strategies for improving MSWM will thus comprise specific objectives and measures in these areas.

2.4 Actors and Partners

MSWM concerns a wide range of public and private sector actors.

A wide range of individuals, groups and organisations are concerned with MSWM as service users, service providers, intermediaries and/or regulators. The interests, agendas and roles of these actors are briefly described below:

2.4.1 Households, Communities and other Service Users

Residential households want effective and dependable waste collection service at an affordable prices.

Residential households are mainly interested in receiving effective and dependable waste collection service at a reasonably low price. Disposal is not normally a priority demand of service users, so long as the quality of their own living environment is not affected by dump sites. Only as informed and aware citizens do people become concerned with the broader objective of environmentally sound waste disposal.

In low-income residential areas where most services are unsatisfactory, residents normally give priority to water supply, electricity, roads, drains and sanitary services. Solid waste is commonly dumped onto nearby open sites, along main roads or railroad tracks, or into drains and waterways. Pressure to improve solid waste collection arises as other services become available and awareness mounts regarding the environmental and health impacts of poor waste collection service.

Community groups have considerable potential for managing local collection services.

Poorly served residents often form community-based organisations (CBO) to upgrade local environmental conditions, improve services and/or petition the government for service improvements. CBOs — which may arise in middle and upper income neighbourhoods as well as in low-income areas — may become valuable partners of the government in local waste management. When sufficiently organised, community groups have considerable potential for managing and financing local collection services and operating waste recovery and composting activities.

Other service users — including small and large scale industrial and commercial establishments and institutions — are similarly interested in reliable and affordable waste collection service. Commercial establishments are particularly concerned to avoid waste related pollution, which would inconvenience their customers. Industrial enterprises may have a strong interest in reducing waste generation and can play an active role in managing waste collection, treatment and disposal in collaboration with government authorities and/or specialised private enterprises.

Commercial and industrial establishments are interested in effective waste collection and, in many cases, waste minimisation.

2.4.2 Non-Governmental Organisations

Non-governmental organisations (NGOs) operate between the private and governmental realms. Originating outside of the communities in which they work, NGOs are motivated primarily by humanitarian and/or developmental concerns rather than an interest in service improvement for their own members. The self-creation of meaningful employment for members may also be a motivation for NGO formation.

NGOs may help increase the capacity of people or community groups to play an active role in local solid waste management by contributing to:

NGOs may help to increase the community's capacity to manage waste collection.

- people's awareness of waste management problems,
- organisational capacity and the formation of community-based organisations (CBO),
- channels of communication between CBO and government authorities,
- CBO's voice in municipal planning and implementation processes,
- technical know-how of locally active CBO, and
- access to credit facilities.

NGOs may also provide important support to informal sector waste workers and enterprises, assisting them to organise themselves, to improve their working conditions and facilities, increase their earnings and extend their access to essential social services such as health care and schooling for children.

2.4.3 Local Government

Local government authorities are generally responsible for the provision of solid waste collection and disposal services. They become the legal owner of waste once it is collected or put out for collection. Responsibility for waste management is usually specified in bylaws and regulations and may be derived, more generally, from policy goals regarding environmental health and protection. Besides their legal obligations, local governments are normally motivated by political interests. User satisfaction with provided services, approval of higher government authori-

Local governments are motivated by political interests as well as legal obligations.

ties and financial viability of the operation are important criteria of successful solid waste management from the local government perspective.

Problems arise when local government's authority is not commensurate with its MSWM responsibilities.

The authority to enforce bylaws and regulations, and to mobilise the resources required for solid waste management is, in principle, conferred upon local governments by higher government authorities. Problems often arise when local government's authority to raise revenues is not commensurate with their responsibility for service provision. Besides solid waste management, municipal governments are also responsible for the provision of the entire range of infrastructure and social services. Needs and demands for MSWM must therefore be weighed and addressed in the context of the needs and relative priorities in all sectors and services.

To fulfil their solid waste management responsibilities, municipal governments normally establish special purpose technical agencies, and are also authorised to contract private enterprises to provide waste management services. In this case, local authorities remain responsible for regulating and controlling the activities and performance of these enterprises.

Local governments seek to enhance public awareness of MSWM problems and priorities.

Effective solid waste management depends upon the cooperation of the population, and local governments should take measures to enhance public awareness of the importance of MSWM, generate a constituency for environmental protection and promote active participation of users and community groups in local waste management.

2.4.4 National Government

National governments are responsible for the MSWM institutional and legal framework.

National governments are responsible for establishing the institutional and legal framework for MSWM and ensuring that local governments have the necessary authority, powers and capacities for effective solid waste management. In many countries, responsibility is delegated without adequate support to capacity building at the local government level.

National governments should provide assistance with cross-jurisdictional problems.

To assist local governments to execute their MSWM duties, national governments need to provide them with guidelines and/or capacity-building measures in the fields of administration, financial management, technical systems and environmental protection. In addition, national government intervention is often required to solve cross-jurisdictional issues between local government bodies, and to establish appropriate forms of association when — as in most metropolitan areas — effective waste management calls for the collaboration of several local bodies.

2.4.5 Private Sector Enterprises

Private enterprises are primarily interested in earning a return on their investment.

The formal private sector includes a wide range of enterprise types, varying from informal micro-enterprises to large business establishments. As potential service suppliers, private enterprises are primarily interested in earning a return on their investment by selling waste collection, transfer, treatment, recycling and/or disposal services. Operating in various forms of partnership with the public sector, they may provide capital, management and organisational capacity, labour and/or technical skills.

Private enterprises are can provide more efficient, lower cost MSWM services.

Due to their profit orientation, private enterprises can, under appropriate conditions, provide MSWM services more effectively and at lower costs than the public sector. However, private sector involvement does not, in itself, guarantee effectiveness and low costs. Problems arise when privatisation is poorly conceived and regulated and, in particular, when competition between suppliers is lacking.

Private sector waste collectors may be contracted directly by individual households, neighbourhood associations or business establishments. More often, they operate under contractual agreement with municipal authorities. In this case, the authorities commonly retain responsibility for user fee collection. This arrangement ensures more equitable service access; when private enterprises depend on the direct collection of user charges they have little incentive to provide services in low-income areas where revenue potentials are weak.

2.4.6 Informal Private Sector

Informal sector workers are often driven by poverty to work as waste collectors.

The informal private sector comprises unregistered, unregulated activities carried out by individuals, families, groups or small enterprises. The basic motivation is self-organised revenue generation; informal waste workers are often driven to work as waste collectors or scavengers by poverty and the absence of more attractive employment possibilities. In some cases, informal waste workers belong to religious, caste or ethnic minorities and social discrimination is a factor which obliges them to work under completely unhygienic conditions as waste collectors or "sweepers". Their association with an activity which the public perceives to be filth-related tends, at the same time, to perpetuate discrimination against them.

Informal waste workers live and work under extremely precarious conditions.

Informal waste workers usually live and work under extremely precarious conditions. Scavenging, in particular, requires very long working hours and is often associated with homelessness. Besides social marginalisation, waste workers and their families are subject to economic insecurity, health hazards, lack of access to normal social services such as health care and schooling for children, and the absence of any form of social security.

The job stability and earning capacity of informal waste workers can be improved.

The waste collection, transfer, separation, recycling and/or disposal activities of informal waste workers constitute economically valuable services. Informal waste workers work, normally, on a "self-employed" basis or as informally organised groups; in some cases they may be hired directly by households and/or neighbourhood groups. In general, however, the marginalised and unstable social and economic circumstances of informal waste workers make it quite difficult to integrate their contribution into the MSWM system. As an initial step, informal workers require organisational and technical support to promote their social rehabilitation and alleviate the unacceptable socio-economic conditions in which they live and work. Through the formation of co-operative societies or micro-enterprises, it is often possible to considerably increase the job stability and earnings of informal sector workers, and to enhance the effectiveness of their contribution to waste management.

It is difficult to integrate informal waste collection into the MSWM system.

2.4.7 External Support Agencies

For external support agencies (ESAs), MSWM is often part of a broader urban management programme.

Numerous bilateral and multilateral external support agencies (ESAs) are engaged in supporting MSWM in low-income countries. While some ESAs have acquired considerable expertise in the area of waste management, MSWM is often a component within a broader development programme aimed at improving urban management capacities and/or urban environmental protection.

There is a pressing need to improve cooperation between ESAs.

There is a pressing need to improve cooperation between ESAs active in the field of MSWM. Due to a lack of coherence in the technical and developmental concepts of successive ESA contributions, many cities of developing countries are encumbered with incompatible and ineffective MSWM facilities and equipment. Coordination of approaches and activities would also enhance the effectiveness of ESA contributions at the national and regional levels. Besides multi- and bilateral development agencies, coordination should encompass external NGO working in areas related to waste management.

2.5 Context

The effectiveness and sustainability of MSWM systems depend upon their adaptation to the prevailing context of the city and/or country in which they operate. The most important aspects in this respect are outlined below at the political, socio-cultural, economic and environmental levels:

2.5.1 Political Context

Administrative decentralisation affects the character of local governance and MSWM systems.

MSWM is influenced in numerous ways by the political context. The existing relationship between local and central governments (the effective degree of decentralisation, for example), the form and extent of citizens' participation in the public processes of policy making and the role of party politics in local government administration all affect the character of management, governance and the type of MSWM system which is possible and appropriate.

2.5.2 Socio-Cultural Context

The functioning of MSWM is influenced by the people's attitudes and patterns of waste handling.

The functioning of MSWM systems is influenced by the waste handling patterns and underlying attitudes of the urban population, and these factors are, themselves, conditioned by the people's social and cultural context. Programmes to disseminate knowledge and skills, or to improve behaviour patterns and attitudes regarding waste management, must be based on sound understanding of the social and cultural characteristics.

Fast growing low-income residential communities may comprise a considerable diversity of social and ethnic groups, and this social diversity strongly influences the capacity of communities to organise local waste management. At the same time, urban communities often preserve rural traditions of mutual self-help and cooperation, which significantly enhance the potential for community-based waste management.

The effectiveness of waste management depends on people's identification with the MSWM system.

The effectiveness and sustainability of municipal waste management systems depends on the degree to which the served population identifies with and takes "ownership" of the systems and facilities. To this end, it is important that the people be involved from the outset in the planning of the local segments of waste management systems. Community involvement is particularly important regarding the siting of facilities such as waste transfer stations and landfill sites.

2.5.3 Economic Context

The level of economic development is a determinant of waste generation and the demand for MSWM services.

The character of waste management tasks and the technical and organisational nature of appropriate solutions depend a great deal on the economic context of the country and/or city in question and, in fact, on the economic situation in the particular area of a city. The level of economic development is an important determinant of the volume and composition of wastes generated by residential and other users, for example. At the same time, the effective demand for waste management services — the willingness and ability to pay for a particular level of service — is also influenced by the economic context of a particular city or area.

2.5.4 Environmental Context

The design of MSWM systems must be adapted to the physical characteristics of the area.

Firstly, at the level of the built environment, the size and structure of a settlement has an important influence on the character and urgency of waste management needs. In quite low-density semi-urban settlements, for example, some form of local or even on-site solution to the management of organic solid wastes may be more appropriate than centralised collection and disposal. In urban areas, the physical characteristics of a settlement — including such factors as density, width and condition of roads, topography, etc. — need to be considered when selecting and/or designing waste collection procedures and equipment such as containers and vehicles.

The proliferation of vermin and disease vectors depends, in part, upon climatic conditions.

Secondly, at the level of natural systems, the interaction between waste handling procedures and public health conditions is influenced by climatic conditions and characteristics of local natural and ecological systems. The degree to which uncontrolled waste dump sites become breeding ground for insects, rodents and other disease vectors - and a gathering place for dogs, wild animals and poisonous reptiles - depends largely on prevailing climatic and natural conditions. In practical terms, climate determines the frequency with which waste collection points must be serviced in order to limit negative environmental consequences.

The suitability of a waste disposal site depends upon a number of natural and developmental conditions.

Finally, environment health conditions may also be indirectly affected through the pollution of ground and surface water by leachates from disposal sites. Air pollution is often caused by open burning at dumps, and foul odours and wind-blown litter are common. Methane, an important greenhouse gas, is a by-product of the anaerobic decomposition of organic wastes in landfill sites. In addition, waste dumps may also be a source of airborne bacterial spores and aerosols. The suitability of a disposal site depends upon many factors, including specific characteristics of the subsoil, ground water conditions, topography, prevailing winds and the adjacent patterns of settlement and land-use.

3. Strategic Aspects

Development of sustainable MSWM systems implies that specific objectives be formulated and appropriate measures taken regarding a range of strategic aspects.

Development cooperation in the field of MSWM aims at establishing *sustainable* waste management systems. Supported solutions must, in other words, be appropriate to the circumstances, problems and potentials of the particular city and locality, so that they are absorbed and carried by the municipality and its local communities. A sustainable solution will not necessarily represent the highest standards of service and environmental protection, but those which can be afforded; it is important not to raise inappropriate and unachievable expectations in this regard. At the strategic level, appropriateness means more than passive adaptation to the prevailing context, however. Sustainable strategies of MSWM require that specific objectives must be formulated and appropriate measures taken with regard to the political, institutional, social, financial, economic, and technical aspects of waste management.

In practice, MSWM support programmes often focus on one or two aspects as entry points. Although it is possible to begin with any one of the above aspects, the sustainability of development strategies will depend upon the eventual engagement of the entire range of these aspects.

Development support aims to facilitate linkages and synergy effects between on-going efforts.

The implementation of development strategy is a long-term process involving cooperation and coordination between various actors and partners. Each contribution needs to build upon existing activities and programmes, avoiding duplication and promoting linkages and synergy effects between on-going efforts. Development assistance should enable a "learning by doing" approach and promote the dissemination of successful solutions.

The goals of MSWM, and the objectives and issues characterising each strategic aspect, are summarised in Figure 2.

3.1 Political Aspects

The political aspects of MSWM strategies encompass:

- formulation of **goals and priorities**,
- determination of **roles and jurisdiction**, and
- establishment of **legal and regulatory framework**.

3.1.1 Goals and Priorities

A public articulation of demand is required to express the full value of waste management to society.

Certain goals of MSWM, such as the provision of waste collection service to the poor and the environmentally sound disposal of solid waste, have the character of "public goods", meaning that the total private economic demand for services is considerably lower than the full value of those services to society. In these cases, a public process is required to

articulate the full public demand for services and mobilise the corresponding resources. To be politically sustainable, this process must be based on clearly formulated goals which enjoy broad popular support.

Trade-offs between alternative MSWM goals and objectives are inevitable.

Under conditions of limited resources and extensive waste management needs, trade-offs between alternative goals and objectives are inevitable. Society may have to choose between a more extensive coverage of collection services as opposed to higher environmental standards of waste disposal, for example, or between improved waste management as opposed to the upgrading of another infrastructure sector. Governments should also assess the potential for waste minimisation and determine what priority should be given to minimisation efforts in relation to waste collection and disposal activities. This kind of policy issue cannot be resolved at the technical level alone; it calls, rather, for a consultative, political process of goal formulation and prioritisation.

3.1.2 Role and Jurisdiction

The absence of clear jurisdiction may undermine politically sustainability.

Effective waste management and environmental protection programmes call for a clear definition of roles, jurisdictions, legal responsibilities and rights of the concerned governmental bodies and other organisations. The absence of clear jurisdiction may lead to controversies, ineffectiveness and/or inaction, undermining the politically sustainability of MSWM systems.

The strategic plan provides a basis for operationalising the roles of authorities concerned.

The potential for establishing effective institutional arrangements for MSWM depends largely on the existing systems of urban planning and administration. As a basis for performance-oriented management, a comprehensive "strategic plan" for the sector is required. This plan should provide relevant quantitative and qualitative information on waste generation and specify targets for waste reduction, reuse, recycling and service coverage. It should describe the organisation of waste collection, transfer and disposal in the medium- and long-term. Such plans would outline the major system components and the projected relationships between various bodies and organisations involved in the system. They would provide guidelines regarding the degree of decentralisation of specific waste management functions and responsibilities, the forms of private enterprise involvement in waste management processes and the role of people's participation. Objectives concerning cost-effective and locally sustainable MSWM would be specified, along with the associated financial policies.

3.1.3 Legal and Regulatory Framework

Regulations should be few in number, transparent, unambiguous and equitable.

The instrumental basis for implementing the strategic plan comprises a legal and regulatory framework which is elaborated in the form of by-laws, ordinances and regulations concerning solid waste management, and includes corresponding inspection and enforcement responsibilities

and procedures at national, state, and local levels. These would also include provisions for the management of industrial and hazardous wastes. Regulations should be few in number, transparent, unambiguous, easily understood and equitable. Furthermore, they should be conceived with regard to their contribution to urban physical and economic development.

Besides regulations, economic incentives and non-economic motivations are important instruments of waste management.

Regulation and controls are not the only type of instrument available for achieving waste management goals. Other options include economic incentives — the internalisation of externalised costs according to the "polluter pays" principle — and non-economic motivations based on environmental awareness and solidarity of the population. Authorities should consider the full range of available instruments within the policy framework.

3.1.4 Summary of Political Objectives

In summary, the main political objectives are:

1. to determine society's **goals and priorities for waste management** and mobilise public support for these goals,
2. to achieve a clear **definition of jurisdictional arrangements** for waste management tasks among the concerned government bodies and private sector actors, as well as the roles, rights and responsibilities of service users, and
3. to elaborate an appropriate **legal and regulatory framework** and body of instruments which enable responsible authorities to achieve and sustain the defined goals.

3.1.5 Outline of Political Issues

In pursuit of these objectives, policy makers will need to deal with numerous issues, for example:

1. Are there significant **trade-offs** to be made between the expansion of collection service as opposed to improved, environmentally sound disposal?
2. Is it possible to define a **"lowest acceptable level"** of collection and/or disposal service as a practical basis for determining necessary trade-offs?
3. What priority should be given to **waste minimisation** and resource recovery in relation to waste treatment and disposal?
4. How should authorities deal with the **service needs of irregularly settled residential areas**?
5. What weight should be given to **alternative instruments** of waste management: i) regulations and controls, ii) economic incentives, and/or iii) non-economic motivations and solidarity?

6. What steps should be taken to incorporate **financial and economic analysis** into strategic planning functions?
7. What is the **role of ESAs** regarding the political aspects of waste management; what emphasis should be placed on awareness building, demonstration effects and/or project-linked policy dialogue?

3.2 Institutional Aspects

Institutional aspects of MSWM concern the institutional structures and arrangements for solid waste management as well as organisational procedures and the capacity of responsible institutions:

- **distribution of functions, responsibilities and authority** between local, regional and central government institutions (i.e. decentralisation), and among local governments in a metropolitan area,
- **organisational structure** of the institutions responsible for MSWM, including the coordination between MSWM and other sectors and/or urban management functions,
- **procedures and methods** employed for planning and management,
- **capacities of institutions** responsible for MSWM and the capabilities of their staff, and
- **private sector involvement and participation** of communities and user groups.

3.2.1 Decentralisation and Distribution of Responsibilities

Effective MSWM calls for an appropriate distribution of responsibilities, authority and revenues.

Effective solid waste management depends upon an appropriate distribution of functions, responsibilities, authority and revenues between national, provincial and local governments, as well as intra-urban entities such as wards or communities. Problems arise when certain functions — such as investment programming and revenue collection — are centralised, while responsibility for operation and maintenance remains at the local government level.

In metropolitan areas, inter-municipal cooperation is essential.

In the wake of metropolitan growth, waste management tasks often extend across several local government units. These circumstances call for "horizontal" cooperation between the municipalities concerned, to achieve an effective and equitable division of MSWM responsibilities, costs and revenues.

Decentralisation of authority requires a corresponding distribution of powers and capacities.

Local authorities responsible for solid waste management should be granted the authority to manage all related affairs and, in particular, to collect and employ user charges and other revenues for the purpose of MSWM. Decentralisation of authority should be accompanied by a corresponding distribution of financial and administrative powers and ca-

pacities for system planning, implementation and operation. This normally requires improved procedures for preparing local solid waste management budgets based on actual costs, and allocating the required funds.

Devolution of MSWM authority reduces the work load on central authorities.

Effective decentralisation makes solid waste management more flexible, efficient and responsive to local requirements and potentials. At the same time, the devolution of decision-making, financial management, procurement and implementation functions reduces the load on the central authorities, allowing them to focus on their main responsibilities in the areas of legislation, definition of standards, environmental monitoring and support to municipalities.

3.2.2 Institutional Arrangements and Sectoral Integration

Decentralisation and improved MSWM capacity may require new organisational structures.

Decentralisation and improved MSWM capacity normally requires innovations in the organisational structures, staffing plans and job descriptions of responsible local government bodies. Assistance should aim at identifying institutional constraints inherent in the system and increasing competence and autonomy at the local level. Procedures and forms of cooperation between local and central government authorities normally need improvement. In this regard, central government bodies may also require development assistance to enable them to accomplish the shifts in their functions and tasks which are associated with decentralisation, and to better support local governments in the acquisition of new capacities.

Institutional arrangements vary with the size and developmental status of the city.

The organisational status of the technical agency responsible for solid waste — as a municipal department or authority, for example — needs to be determined. The appropriate institutional arrangements will vary with the size and developmental status of the city. It may be advisable for large and medium-sized cities, either to establish an autonomous regional or metropolitan solid waste authority, or to delegate collection responsibility to the individual local governments, with the metropolitan authority retaining responsibility for transfer and disposal tasks. In the case of small cities, it may be necessary to provide support for planning and standards development as well as technical and financial assistance from national authorities.

Linkages between MSWM and other service sectors are important.

The relationships and linkages between MSWM and other municipal service sectors (sewage and drainage, public works, roads, public health, etc.) need to be clarified within the overall framework of urban management.

Finally, the development of municipal level administrative structures themselves calls for institutional development, elaboration of job descriptions, operational procedures, definition of competencies, etc.

3.2.3 Planning and Management Methods and Procedures

MSWM agencies often pay too little attention to management methods.

The management approaches, methods and techniques employed in MSWM are often inadequate. In comparison with other sectors, agencies responsible for solid waste management often pay too little attention to integrated management approaches based on adequate information systems, decentralised responsibility, interdisciplinary interaction and cooperation between functional levels.

Primary attention should be given to strategic planning and financial management.

Based on the defined role of the local government in MSWM, improvement efforts would give primary attention to appropriate strategic planning and financial management methods, including cost-oriented accounting systems, budget planning and control, unit cost calculations, and financial and economic analysis. With regard to operational planning, appropriate management methods and skills include data collection techniques, analysis of waste composition, waste generation projection and scenario techniques, formulation of equipment specifications, procurement procedures and management information systems for effective monitoring, evaluation and planning revision.

3.2.4 Capacities of Municipal Waste Management Institutions

Discrepancies often exist between MSWM job requirements and staff qualifications.

Large discrepancies often exist between the job requirements and the actual qualification of the staff at the managerial and operational levels. As an initial step towards improvement, awareness-building measures regarding environmental and sanitation issues may be required among responsible staff. On the basis of the organisational development plan, job descriptions and training needs analysis, a programme for manpower development may be elaborated and an appropriate training programme implemented. As appropriate, institutional capability for training and human resources development for MSWM should be established at the city, regional or country level. Creation of a national professional body for solid waste management may help to raise the profile of the profession and promote improved operational and professional standards.

3.2.5 Private Sector Involvement and User Participation

Formal Private Sector

There are four essential preconditions for successful private sector involvement.

Private enterprises can usually provide solid waste collection, transfer and disposal services more efficiently and at lower cost than the public sector. However, as noted earlier (Section 2.4.5), formal private sector involvement in solid waste management does not in itself guarantee efficiency. The preconditions for successful private sector involvement include: i) competitive bidding, ii) existence of enterprises with adequate technical and organisational capacity, iii) effective regulation of the part-

nership arrangements (see political aspects, Section 3.1) and iv) adequate management of the private partners through clear specifications, monitoring and control.

Private sector involvement implies a shift in the role government institutions.

Private sector involvement in MSWM implies a shift in the principal role of government institutions from service provision to regulation. To effectively regulate and control the activities and performance of contracted private enterprises, appropriate systems of monitoring and control need to be established, and corresponding skills and capacities developed at both local and central government levels. In some cases, it is also advisable to provide technical assistance to those enterprises that demonstrate a potential for engagement in MSWM.

Interest in cost minimisation often leads to inadequate disposal practices.

Where municipal waste collection services are insufficient, industrial and commercial establishments occasionally hire private enterprises directly to collect and dispose of their solid wastes; larger companies sometimes undertake disposal themselves. Both waste generators and private waste management enterprises are interested in reducing costs to a minimum, and this often leads to inadequate waste disposal practices. In this case, the public sector's main task is regulation — to ensure that hazardous wastes are separated from ordinary wastes and that both types are disposed in an environmentally safe manner.

Informal Private Sector

The contribution of informal waste collection workers should be officially recognised.

Enhancement of the contribution of informal waste collection workers depends, above all, on improved organisation among these workers. Support should aim to: i) improve working conditions and facilities, ii) achieve more favourable marketing arrangements for services and scavenged materials (see economic aspects) and iii) introduce health protection and social security measures (social aspects). It is essential that the contribution of informal workers to MSWM be officially recognised and that their activities be integrated into the planning of municipal collection and resource recovery services (see economic aspects).

Communities and User Groups

Responsibility for managing local waste collection may be decentralised to the user communities themselves.

Finally, in the interest of effective service delivery and cost efficiency, solid waste management authorities should seek to establish partnership relationships with residential communities and user groups. Where municipal capacities are inadequate and/or low-cost solutions are essential, responsibility for local collection may be decentralised to the communities themselves. Preconditions for effective participation and community-based waste management include adequate problem awareness and organisational capacities (see social aspects). The support of NGOs may be very useful in building the capacity of communities to participate in local solid waste management.

3.2.6 Summary of Institutional Objectives

The main objectives at the institutional level are:

1. to **devolve responsibility for MSWM** to the local government level and ensure a corresponding decentralisation of power and authority,
2. to establish **effective institutional arrangements** for waste management at the municipal and, in the case of large cities, at the metropolitan level,
3. to introduce **appropriate methods and procedures** that enable efficient waste management services which meet the needs of the entire population,
4. to build the **capacities of municipal institutions** and their staff so that they are able to provide the demanded waste management services,
5. to introduce competition and increased efficiency into solid waste management through the **involvement of private sector** (formal and informal) enterprises, and
6. to lower costs and improve the effectiveness of waste management through the **participation of communities and service users** in local waste management.

3.2.7 Outline of Institutional Issues

Typical issues at the institutional level are:

1. Which MSWM functions, responsibilities and powers should be assumed by **which level of government**?
2. How can the responsibility and authority for planning and developing waste management be devolved to local governments when these institutions **lack the necessary experience and capacity**?
3. What **institutional arrangements and approaches** would foster more demand-oriented solid waste services?
4. How can the commercial attitude of **"doing more with less"** be introduced into the municipal waste management operations?
5. How can a more holistic, **life-cycle approach to waste management** be introduced among institutions whose mandate is commonly limited to the functions of waste collection and disposal?
6. On what basis should authorities decide which waste management functions should be contracted out to **private sector enterprises**?

3.3 Social Aspects

The social aspects of MSWM strategies concern the:

- patterns of materials use, **waste generation and waste disposal** of the population, and the associated MSWM needs and demands,
- **user and CBO participation** in municipal waste management and community-based waste management activities, and the
- **social conditions of solid waste workers**, both formal and informal.

3.3.1 Waste Generation and Disposal Patterns

Waste generation is also conditioned by people's attitudes.

The waste generated by a population is primarily a function of the people's consumption patterns and, thus, of their socio-economic characteristics. At the same time, waste generation is conditioned to an important degree by people's *attitudes* towards waste: their patterns of material use and waste handling, their interest in waste reduction and minimisation, the degree to which they separate wastes and the extent to which they refrain from indiscriminate dumping and littering.

People's attitudes towards waste may be positively affected.

People's attitudes influence not only the characteristics of waste generation, but also the effective demand for waste collection services, in other words, their interest in and willingness to pay for collection services. Attitudes may be positively influenced through awareness-building campaigns and educational measures on the negative impacts of inadequate waste collection with regard to public health and environmental conditions, and the value of effective disposal. Such campaigns should also inform people of their responsibilities as waste generators and of their rights as citizens to waste management services.

Local waste management also depends on reliable collection options and consensus among neighbours.

Whilst attitudes towards solid waste may be positively influenced by public information and educational measures, improved waste handling patterns can hardly be maintained in the absence of practical waste disposal options. Awareness-building measures should therefore be coordinated with improvements in waste collection services, whether public or community-managed. Similarly, people's waste generation and disposal patterns are influenced by those of their neighbours. A collective logic is involved, because improved waste handling practices will only yield significant environmental impacts if most households in an area participate in the improvement. Thus, besides general awareness, improved local waste management depends upon the availability of practical options for waste collection *and* a consensus among neighbours that improvements are both important and possible.

The sources of hazardous industrial wastes are often small and scattered

Finally, industrial establishments present special problems regarding waste disposal patterns due to the volume and/or the occasionally hazardous nature of the generated wastes. Regulation and control measures should be employed as far as possible. However, these measures are seldom very

effective when — as is often the case — large numbers of small industrial establishments are scattered throughout residential and semi-residential areas. Problem awareness, reliable service options and consensus are crucial to improving waste generation and disposal patterns of industrial enterprises.

3.3.2 User Participation

Waste management problems in low-income settlements are exacerbated by inadequacies in other sectors.

Rapidly growing, informally constructed low-income residential areas present a particular challenge to MSWM. Besides the physical constraints of dense, low-income settlement, the inadequacies of other infrastructure services such as roads, drains and sanitary facilities often exacerbate waste management problems. The access of collection vehicles or push carts may be difficult where roads and foot-paths are unpaved, for example. Existing drains are often clogged with waste materials, and solid waste itself may be contaminated with faecal matter. These conditions lead to a proliferation of vermin and disease vectors, and increase environmental health risks.

Integrated and participatory approaches are required.

The interrelated nature of service problems and the active role of residents — who are often owner-builders of their house — call for adapted, sectorally integrated development approaches which depend, to a considerable degree, on the cooperation and participation of residents. Households and community-based organisations (CBO) have important roles to play, not only as consumers or *users* of waste collection services, but also as *providers* and/or *managers* of local level services. In many low-income residential areas, community-based solid waste management is the only feasible and affordable solution.

Community-based waste management may be the only feasible solution.

Community-based waste management must be linked to the municipal system.

The introduction of community-based solutions calls for awareness building measures as well as organisational and technical support. Local NGOs and community leaders may provide essential inputs towards building community capacity for waste management. Particular attention needs to be paid to the role of women, who normally bear principal responsibility for household waste management. While management is often limited to local collection, it may also encompass waste treatment, (e.g. community composting), recovery and disposal. It is important that community-based collection systems are carefully linked to the municipal system; local collection activities may break down if waste deposited at municipal transfer points tends to accumulate, rather than being transferred to final disposal sites by municipal services.

NGOs and community leaders can help to build local waste management capacity.

User cooperation in municipal collection is also essential.

Even where waste collection services are provided by municipal authorities, user cooperation is essential regarding such factors as proper storage of household waste, waste separation, placement of household containers and discipline in the use of public collection points. Households and community participation in the proper operation and maintenance

of waste collection and disposal system may be promoted by broadly conceived awareness building programmes dealing with general public health and environmental issues, as well as focused information campaigns on specific MSWM issues. Formal education courses, school programmes, dissemination of teaching and learning materials and directed training and motivational programmes for CBO and local leaders are effective means for improving awareness and user participation in MSWM.

User participation may be promoted by awareness building programmes.

Finally, participation is also important regarding the development of large centralised facilities such as waste transfer stations and landfill sites. While the adjacent residential population may understand the need for such facilities, they would rather have them located elsewhere; this is the common, "not in my back yard" or "NIMBY" attitude. Overcoming the NIMBY attitude requires general public understanding of the requirements of waste management, effective communication and participation of the concerned community in siting decisions.

Overcoming the NIMBY attitude requires communication and participation.

3.3.3 Social Conditions of Waste Workers

Informal sector waste workers are often socially marginalised and fragmented. They live and work without basic economic or social security, under conditions which are extremely hazardous to health and detrimentalto family social and educational development. Support to informal waste workers should aim to improve their working conditions and facilities, increase their earning capacity, and ameliorate their social security, including access to housing, health and educational facilities. At the same time, the effectiveness of informal workers' contribution to the waste collection, recycling and reuse may be significantly enhanced.

Informal waste workers live and work under precarious conditions.

Public sector waste workers and formal private sector workers are also subjected to unhealthy working conditions and poor social security. Access to social and health care services should be ensured. Proper equipment and protective clothing can reduce health risks. By contributing to the "professionalisation" of the waste worker's role, proper clothing and equipment may also help to alleviate the social stigmatisation which is often associated with waste work.

Formal public and private sector waste workers are also subject to serious health risks.

3.3.4 Summary of Social Objectives

The principle social objectives are:

1. to orient municipal waste management towards the **real service needs and demands** of the population,
2. to encourage **patterns of waste handling and disposal** which contribute to the effectiveness and efficiency of municipal waste services,

3. to raise the population's **awareness of solid waste problems and priorities** and promote an effective economic demand (willingness to pay) for waste collection and disposal service,
4. to mobilise and support the contribution of communities and user groups to the **self-management of local waste collection** and disposal services; to foster their participation in the planning, implementation and operation of municipal waste management systems, and
5. to protect the **health of formal and informal waste workers**, improve their socio-economic security and alleviate their social marginalisation.

3.3.5 Outline of Social Issues

Questions which arise regarding the social aspects of waste management include:

1. How may municipal waste management systems be adapted to **specific demands and requirements** of residential populations, including, in particular, those of women and low-income households?
2. What is the **potential role of community in local waste management**, and what inputs are required to promote community-based waste management?
3. What instruments of awareness building and incentives should be employed to mobilise peoples' contribution to **waste minimisation** and recovery?
4. How should authorities deal with the problem of **equity of service access** in areas where the population is too poor to pay the full cost of waste management?
5. What forms of **collaboration between informal sector waste workers and municipal authorities** may be established to improve the productivity and working conditions of informal sector workers?

3.4 Financial Aspects

Financial aspects of MSWM include:

- **budgeting and cost accounting** systems,
- resource mobilisation for **capital investments**,
- **cost recovery** and operational financing,
- **cost reduction** and control.

3.4.1 Budgeting and Cost Accounting

In many cities officials do not have accurate information on MSWM costs.

Adequate budgeting, cost accounting, financial monitoring and financial evaluation are essential to the effective management of solid waste systems. In many cities, however, officials responsible for MSWM do not have accurate information concerning the real costs of operations. This is often the result of unfamiliarity and/or lack of capacity to use available financial tools and methods; it is sometimes exacerbated by a lack of incentive or even reluctance — in the bureaucratic culture of many local administrations — to achieve transparency regarding costs and expenditures.

Introduction of improved cost accounting and financial analysis should thus be associated with broader efforts to increase the accountability, efficiency and commercial orientation of municipal infrastructure management. Where accounting expertise is lacking, it may be brought in from the private sector.

3.4.2 Resource Mobilisation for Capital Investments

Investment authority should be devolved to local governments.

The main options available to local governments for financing capital investment in the solid waste sector are local budget resources, loans from financial intermediaries and/or special loans or grants from the central government. In some countries, municipal bonds may be a workable source of financing. A further option, private sector financing, has attracted increasing interest in recent years. In many countries, though, the central government is — and will continue to be — the principal source of funding for major infrastructure investments in solid waste and other sectors. It is important, however, that full responsibility for the functions of planning and investment programming remain with the local government, which must subsequently operate and maintain the acquired facilities and equipment. Procedures which facilitate central financing while devolving investment authority and responsibility to the local government (e.g. infrastructure development funds or banks) should therefore be promoted.

There are three main sources of capital for MSWM investments.

To ensure the appropriateness of investment decisions and avoid "white elephants", adequate financial analysis procedures are needed at the local government level at the strategic planning phase.

3.4.3 Financing Operating Expenses

Financing of recurrent MSWM costs should rely as far as possible on user charges.

There are three main options for financing the substantial recurrent costs of MSWM: user charges, local taxes and intergovernmental transfers. To promote the responsiveness of the supplying agency to user needs — and ensure that collected funds are actually applied to waste management — it is usually preferable to finance operations through user charges

rather than general tax revenues. Collection efficiency may be increased by adding solid waste utility charges, such as the water bill. Where property tax coverage is universal and the municipal government is responsible for its collection, an itemised line on the tax bill may be appropriate.

Variable fees may, in some cases, manage the demand for MSWM services.

User charges should be based on the actual costs of solid waste management, and related, as far as possible, to the volume of collection service actually provided. Among larger waste generators, variable fees may be used to manage the demand for waste services by providing added incentive for waste minimisation.

Some degree of cross-subsidisation and/or financing out of general revenues is usually necessary.

While the economic demand for waste collection services may cover primary collection costs, it seldom covers full transfer, treatment and disposal costs, especially among low-income groups. To achieve equity of waste service access, some cross-subsidisation and/or financing out of general revenues will be required. Large scale waste generators should pay the full cost of disposal services on the "polluter pays" principle, however.

MSWM fee collection performance is often quite poor.

In practice, municipal government performance in the collection of waste service fees is often quite poor. People are reluctant to pay for municipal waste collection services which are perceived to be unsatisfactory; at the same time, poor payment performance leads to a further deterioration of service quality, and a vicious circle may arise. Improved fee collection can usually be achieved by attaching waste collection charges to the billing of another service such as water supply or electricity. Such systems may be made progressive, in the sense that large users would pay a higher rate per volume of collected waste than small users. In the case of large single point producers such as industrial or commercial enterprises, volume or weight-based charges may be more appropriate; this has the advantage of linking waste revenues to the actual volume of services provided.

In some cities, MSWM revenues are absorbed into overall municipal expenditures.

In many cities, solid waste service revenues flow into a general municipal account, where they tend to be absorbed by overall expenditures instead of being applied to the intended purpose of waste management. The danger of such misallocation of funds is even greater when locally collected fees and revenues are transferred to the central government before being redistributed to the local level. Besides the simple fact of reducing funding for waste management, the absence of linkage between revenues and the actual levels of service provision tends to undermine the accountability of local waste management institutions and remove their incentive to improve and/or extend services. Resolution of this problem calls for clear political decisions and autonomous accounting procedures which ensure that the collected revenues are actually applied to solid waste management.

3.4.4 Cost Reduction and Control

The best way to ensure financial sustainability is almost always by cost reduction — "doing more with less".

To ensure the long-term economic sustainability of MSWM systems, investments in system development should correspond to the level of resources which the society can make available for waste management. The potential for increasing revenues from solid waste operations is usually quite limited, though, and the most effective way to ensure financial sustainability is through cost reduction — "doing more with less". There are almost always opportunities to significantly reduce the operational costs of MSWM services.

In principle, the most straightforward way to lower the variable cost component of waste management is to reduce the waste load at source, i.e. to minimise the generation of waste. In the low-income residential areas, the potential for waste reduction is usually quite limited, however.

Community participation in local waste management may reduce public collection costs.

Public waste collection costs may be reduced through the participation of residential communities in local solid waste management. In most cases, this involves hiring of small scale enterprises or informal waste collection workers by CBO. Besides lower cost collection service, informal waste recovery and/or scavenging also contributes to cost savings by reducing the volume of waste which needs to be transferred and disposed.

Private sector involvement in waste management is the most promising avenue of cost reduction.

Important cost reductions may be achieved by introducing competition through public-private partnerships for waste management. Private enterprises are highly motivated to lower costs and may introduce innovations and efficiency-raising measures to this end. The outcome may be useful for defining realistic performance standards which are also applicable to the public segment of the waste management system.

Cost reduction implies better utilisation of available resources.

At the most fundamental level, cost reduction implies a better utilisation of available manpower and equipment, improved maintenance of equipment, introduction of appropriate technologies and the elimination of inefficient bureaucratic procedures. Authorities concerned at local and central government levels should have access to information on the actual cost of MSWM services and relevant performance standards to better judge the potential for cost reduction. The collection and dissemination of cost data, efficiency indicators, performance standards and the like may serve to focus managers' attention on those areas of operations which require improvement.

3.4.5 Summary of Financial Objectives

The principal financial objectives are:

1. to establish practical systems of **budgeting and cost accounting** for MSWM which yield transparency with regard to the real costs of waste management and provide a basis for planning and improving operational efficiency,

2. to mobilise required **resources for investment** in waste management facilities and equipment,
3. to achieve **cost-oriented revenues for waste management operations** which are based, as far as possible, on user charges, and to ensure that the collected revenues are applied to the intended purpose of waste management, and
4. to **reduce the costs and improve the efficiency of waste management** operations.

3.4.6 Outline of Financial Issues

Critical financial issues include:

1. How may the **use of appropriate cost accounting systems** be promoted in spite of the possible reluctance of municipal officials?
2. How may local governments ensure that **MSWM revenues are applied to the intended purpose**?
3. How may **incentives for cost reduction** and increased operational efficiency be built into municipal waste management operations?
4. In which task areas and under what conditions will **private enterprises** contribute most effectively to cost reduction and service effectiveness?
5. What system of MSWM **revenue collection** will produce adequate cost recovery while, at the same time, creating real incentive for cost reduction and effectiveness?

3.5 Economic Aspects

Economic aspects relate to the entire urban and national economy, and are primarily concerned with:

- the impact of waste management services on the **productivity and development of the urban economy,**
- the economic **effectiveness of waste management systems**,
- conservation and **efficient use of materials** and resources, and
- **job creation and income generation** in waste management activities.

3.5.1 Economic Productivity and Development

Solid waste generation and service demand generally increase with economic development.

Large and small scale industrial activities and commercial activities — including shops, markets, hotels, restaurants — are important waste generators. Businesses are obliged to dispose of these wastes which would

otherwise encumber their establishment and negatively affect workers, clients and customers. There is therefore a substantial economic demand for waste collection services from economic activities. As frequently observed, waste generation and the demand for collection services generally increase with economic development.

Accurate information on the sources and composition of industrial and commercial wastes — including hazardous wastes — is essential.

Efficient, reliable and low-cost MSWM service is vital the development of the urban economy. The objective of lowering service costs may conflict with goal of environmental protection, however. To determine the appropriate trade-off, it is important to obtain accurate and, as far as possible, complete information on the sources and composition of industrial and commercial wastes, including hazardous wastes. Authorities should work closely with private sector firms to devise the best technical, organisational, economic and environmental solution to the problems of normal and hazardous waste disposal. Considerable efforts at awareness building and technical support are usually required to gain the cooperation of industrial and commercial waste generators. A broad, inclusive and transparent approach is required, as private enterprises will be very reluctant to pay the extra cost of proper waste handling if they believe that their competitors do not pay.

Private enterprises are reluctant to pay for proper waste handling if their competitors do not pay.

3.5.2 Life-Cycle Costing and Economic Evaluation

The economic effectiveness of MSWM systems is based on life-cycle costs and long-term economic impacts.

The overall economic effectiveness of waste collection and disposal service depends, on the one hand, upon the life-cycle costs of facilities, equipment and services and, on the other hand, on the long-term economic impact of waste management systems. Economic impacts may include such factors as the reduction of illness and health care costs, enhancement of environmental quality and property values, reduction of disturbances and increase of business volumes. The economic evaluation of such factors is, in principle, an important input to strategic plans and investment programmes for developing MSWM systems. Besides their use in the appraisal and justification of investment decisions, economic evaluations may be employed to demonstrate the externalised costs of waste pollution and, thus, to build popular support for improved waste management. In most cases, however, municipal authorities do not have the capacity to conduct economic evaluation or to tackle the methodological issues involved.

Economic evaluation constitutes an important input to strategic planning and investment programming.

3.5.3 Resource Efficiency

Policies should be introduced which encourage waste recovery and reuse.

At the macro-economic level, waste management begins with the efficient use of materials and avoidance of hazardous materials at the phases of production and distribution. Policies should be introduced which restraint wasteful use of materials and encourage waste recovery and reuse.

The best way to promote materials efficiency is to internalise the costs of waste management in the production and distribution phases.

The most effective way to promote material conservation and efficiency is, in principle, to internalise as far as possible the associated future costs of waste collection and disposal — or, alternatively, the pollution costs which arise from non-collection — in the production, distribution and consumption phases, according to the "polluter pays" principle. Legally obliging producers and/or sellers to take back and safely dispose of used products (e.g. refrigerators, batteries, etc.) is an important means to this end which should be introduced where practicable for appropriate products.

Raising service charges in line (or progressively) with the generated waste volume affects consumer behaviour (e.g. packaging materials) and disposal patterns (e.g. waste separation), and may thus be applied to manage demand in the interest of waste minimisation. These measures are only effective when applied to high income areas and/or relatively high volume waste generators, however.

3.5.4 Employment and Income Generation

Private sector involvement in MSWM may actually reduce the number of jobs in the sector.

Besides reducing costs, privatisation of waste management services (see Section 3.4.4) is also relevant to employment and income generation; in this case, however, the impact is not necessarily positive. Public solid waste departments often employ large numbers of relatively unproductive workers, and private enterprises are able to lower costs and increase efficiency precisely because they manage to "do more with less" — to accomplish the same job with fewer workers.

Jobs may be generated through increased labour productivity and expanded service coverage.

In a static situation, higher labour productivity (and higher pay) evidently implies a lower number of jobs. However, higher labour productivity and efficiency can also lead to an increase in the number of jobs through the expansion of lower-cost services. Economic strategies should seek, firstly, to increase labour productivity and efficiency and, secondly, to generate more revenues and jobs by expanding coverage of lower-cost, more efficient services. Experience in the formal and informal private sectors demonstrates that it is possible to significantly increase waste workers' earnings through better facilities and equipment and more productive use of workers' time.

3.5.5 Summary of Economic Objectives

The main economic objectives are:

1. to promote the **productivity and development of the urban economy** through the efficient provision of waste collection and disposal services for which users are willing and able to pay,
2. to ensure the **environmentally sound collection, re-cycling and disposal** of all generated waste, including hazardous industrial and commercial wastes,

3. to ensure the **overall economic effectiveness of waste management** services through the adequate evaluation of economic costs and benefits,
4. to promote **waste minimisation**, materials conservation, waste recovery and reuse — and the long-term efficiency of the economy — by practical application of the "polluter (and user) pays" principle, and
5. to **generate jobs and earns** in the waste management activities.

3.5.6 Outline of Economic Issues

Principal economic issues are:

1. What is the appropriate balance between **low-cost waste management service** and optimal environmental protection?
2. What can be the **role of economic incentives** in promoting materials efficiency and managing industrial wastes?
3. What practical steps may be taken to internalise the **externalised costs of waste management** and/or pollution?
4. To what extent should **public subsidies** be used to promote environmentally safe waste disposal in landfills?
5. What improvements are needed in MSWM procedures, processes and capacities in order to facilitate **public-private partnerships for waste management**, and improve the linkage between formal and informal private sector activities?

3.6 Technical Aspects

Technical aspects of MSWM include:

- **technical planning and design** of MSWM systems,
- **waste collection systems**,
- **transfer systems**,
- **waste recovery and disposal**, and
- **hazardous and special waste management**.

3.6.1 Technical Planning and Design

Technical MSWM systems are often poorly suited to the operational requirements of the city.

The technical systems established for primary collection, storage, transport, treatment and final disposal are often poorly suited to the operational requirements of the city. In many cases, the provision of imported equipment by international donors leads to the use of inappropriate technology and/or a diversity of equipment types which undermines the efficiency of operation and maintenance functions.

Performance characteristics and maintenance requirements are major determinants of MSWM systems' design.

Solid waste management facilities and equipment should be evaluated, and appropriate technical solutions designed and selected, with careful attention to their operating characteristics, performance, maintenance requirements and expected life-cycle costs. Technical evaluation requires data on waste composition and volumes, indications of important area-specific variations of waste generation and their expected changes over time, an understanding of the disposal habits and requirements of different user groups, and assessment of the technical capability of public and/or private sector organisations responsible for operating and maintaining the systems. Concepts for the progressive up-grading of technical systems should be elaborated within the framework of the strategic plan for MSWM.

3.6.2 Waste Collection Systems

Selection of collection equipment should be based on area-specific data.

Collection systems comprise household and neighbourhood (primary) waste containers, primary and secondary collections vehicles and equipment, and the organisation and equipping of collection workers, including the provision of protective clothing. Selection of collection equipment should be based on area-specific data on waste composition and volumes, local waste handling patterns and local costs for equipment procurement and operation and maintenance (labour, fuel, lubricants, tires, etc.).

Local collection systems should be designed in collaboration with the communities concerned.

Regarding the design of local waste collection systems, the most effective results may be obtained through the participation of the concerned communities. Where appropriate, the objectives of material recovery and source separation should be considered. The introduction of source separation must be done in a pragmatic and incremental manner, however, beginning with pilot activities to assess and encourage the interest and willingness of users to participate.

Preventive maintenance, repair and spare parts availability are crucial.

To extend service coverage, especially in low-income areas, the use of low-cost, community-managed primary collection systems should be considered. In the interest of lower costs and efficient operation and maintenance, appropriate, standardised and locally available equipment should be selected. Design and procurement should be made with close attention to the requirements of preventive maintenance, repair and spare parts availability. The privatisation of maintenance and repair may be considered as a means of lowering maintenance costs and optimising equipment utilisation.

3.6.3 Transfer Systems

Transfer facilities and equipment must match the characteristics of local collection systems.

Transfer systems include temporary waste storage and transfer points, vehicles and equipment for waste transfer, and the procedures for operating and maintaining these facilities and equipment. Design and expansion of transfer facilities and equipment must match the characteristics

of local collection systems and the available capacity of environmentally safe disposal facilities.

The size, number and distribution of transfer stations must be carefully designed to facilitate local collection while achieving efficient transfer operations and minimum transport distances and costs. Detailed cost analysis is required to determine the optimal solution.

The technical characteristics and design of transfer points and vehicles must consider the characteristics of local collection systems (hand cart dumping requirements, etc.). Careful attention must be given to the objectives of reducing local pollution and limiting, as far as possible, the access of rats and insects. Transfer points are often a choice location for scavengers' activity, and arrangements should be explored for accommodating scavenging without accentuating local pollution problems.

Practical techniques are available for specifying vehicle requirements.

The selection of vehicles must be based on careful cost-analysis which considers transfer ease, haul volume, operation costs and maintenance requirements. Practical techniques are available for the specification of vehicle requirements.

3.6.4 Resource Recovery and Disposal Waste Recovery

The effectiveness of informal waste recovery may be enhanced through appropriate equipment design.

In low-income countries, recovery of recyclable materials — mainly paper, glass, metals and plastics — is normally undertaken by informal private sector workers (see Sections 2.4.6 and 3.2.5). This economically useful activity should be facilitated by the appropriate design of equipment and facilities for each stage of the collection and disposal process. The effectiveness of informal waste recovery may be further enhanced through active support aimed at improving the organisational capacity of informal workers, improving equipment and facilities for the collection and sorting of materials, and co-ordinating municipal waste collection and disposal operations with informal recovery. Formal public sector workers often engage in some form of scavenging activity on the side, and it may be necessary to specify the rights and recovery conditions of both formal and informal workers.

The public sector may consider involvement in waste recovery and/or leasing of waste recovery rights.

The public sector may itself become involved in waste recovery or lease waste recovery rights to formal private sector enterprises. Composting is a most promising area for the recovery of organic materials. Besides reducing the volume of waste which needs to be transferred and disposed, composting generates a valuable soil conditioner for agricultural and horticultural use. However, decisions to introduce composting must be market-oriented and based on careful economic and financial analysis. Large-scale sector composting operations are seldom financially viable, and the alternative of small-scale, decentralised composting plants may be worth considering. In either case, the potential for financially viable composting may be significantly improved through the introduction of waste separation at source.

Composting is a promising area of resource recovery.

It is often advantageous to let private concessionaires assume the commercial risks of composting. In this case, governments may need to undertake accompanying measures such as the promotion of appropriate household waste storage facilities and information campaigns to encourage waste separation. Alternatively, community-based composting may be promoted. The location of composting operations adjacent to the "market" for soil conditioners (e.g. near farms or nurseries) may also bring advantages. Key factors for success include careful attention to product quality, adequate control and the use of simple technologies.

Energy Recovery from Waste

Landfill gas recovery may be a promising approach to energy recovery.

Other recovery options focus on the energy value of waste materials: incineration and landfill gas utilisation are the main options. Due to the composition of wastes in many developing countries (high organic and moisture content), and the high investment and operating costs of the sophisticated technology, incineration is rarely a viable option. On the other hand, landfill gas recovery and utilisation may be a more promising approach to energy recovery.

Final Disposal

The most appropriate method of final waste disposal is almost always the sanitary landfill.

Even when waste minimisation and recycling are actively practised, there is always a large quantity of waste remaining for disposal in an environmentally sound manner. Urban authorities should ensure that appropriate sites for new solid waste disposal are made available, and that these sites will become accessible for the timely execution of MSWM improvements. While the technology is fairly simple, landfills involve complex organic processes. To ensure their efficient operation and to limit disturbances and environmental pollution, landfills need to be carefully sited, correctly designed and well operated. Particular attention must be given to ground water, soil and air through the control of leachate and gases. Environmental impact assessment, appropriate design criteria and guidelines on recurrent landfill development and operation should be made available to local authorities. Landfill siting is often politically difficult and requires active public information and participation in order to reach a negotiated solution.

Sanitary landfills need to be carefully sited, correctly designed and well operated.

The main benefits of properly designed and correctly operated sanitary landfills derive from the discontinuation of current, unacceptable dumping practices and the environmentally sound closure and recovery of existing dump sites. It is seldom possible to move from open dumping to fully contained sanitary landfill operations in one step, however. More often, a transformation process must be foreseen in which dumping practices are progressively improved and existing sites gradually upgraded. Municipal authorities should be encouraged to start the transformation process rather than wait until it is possible to construct a completely new and appropriately designed landfill facility.

3.6.5 Hazardous and Special Waste Management

Hazardous waste sources must be identified, registered and targeted for appropriate management.

Concerted efforts are required to institute and improve environmental monitoring and controls to keep hazardous wastes out of the municipal system, especially landfills, sewers and drains. Most importantly, potential sources of hazardous materials in industrial wastes — whether they are served by public or private waste collectors — must be identified, registered and targeted for appropriate management.

Special attention should be given to infectious healthcare wastes.

Although the laws controlling industrial and hazardous wastes are normally enacted at the national or state level, the municipality has the key role in monitoring the generation of industrial and hazardous waste in urban areas, identifying suitable sites for environmentally safe disposal and monitoring the collection and disposal operations. Industrial discharge programmes and guidelines on incoming wastes are required to keep hazardous industrial wastes out of sanitary landfills. Special attention must also be given to the management of infectious waste originating from hospitals and other health care institutions.

3.6.6 Summary of Technical Objectives

The main technical objectives are:

1. to achieve optimal **life-cycle cost-effectiveness** of solid waste management equipment and facilities, with due consideration of operation and maintenance requirements, operation costs and dependability,
2. to introduce **coherent technical systems** which are adapted to the requirements and operations of all concerned actors including: service users, informal sector workers, private enterprises and public sector waste operations, and
3. to install and operate technical systems for waste collection, transfer, recovery, treatment and disposal which **reduce local pollution, limit the proliferation of vermin and protect the urban environment**.

3.6.7 Outline of Technical Issues

1. How may operational integration and coherence of technical systems be achieved in spite of the **diverse local collection needs, variety of actors and decision makers, and incremental development** of facilities and equipment?
2. How can reliable estimates of the **life-cycle costs** of alternative equipment and facilities be obtained which take account of operating costs, maintenance requirements, down-time, etc.?
3. What system characteristics are required to **facilitate private and community involvement** in waste management?

4. What technical equipment and procedures are required for optimal **separation of hazardous wastes** at the source?
5. What constitutes an **"appropriate" landfill design** for low-income countries?

4. Development Assistance Outlook

4.1 Development Support Needs

The preceding discussion of strategic aspects has highlighted numerous improvements and developments required to up-grade MSWM performance and achieve its main goals. Effective and sustainable MSWM systems cannot be achieved by focusing on the technical aspects alone; clearly formulated objectives and co-ordinated actions are also required in the political, institutional, social, financial and economic fields. While these measures relate most directly to local government institutions, they also apply to service users, NGOs, private sector actors and national government institutions.

Initial review of needs indicate several priority areas for development assistance.

It is evidently not possible, in a global paper such as this, to identify specific needs of development cooperation. Nonetheless, an initial review of needs indicates several areas in which improvements and support are generally most urgently required. These include: policy support, institutional development, private sector involvement, user participation, technical development and hazardous waste management

4.1.1 Policy, Planning and the Legal Framework

Policy support would apply to the formulation of bylaws, regulations and standards.

Governments may be supported in their efforts to clarify the goals and priorities for waste management and environmental protection. Policy support would apply to the formulation of appropriate legislation, bylaws, regulations and standards, and the integration of solid waste management into the general legal framework for public health and environmental protection. Special attention would be paid to legislation and regulations for control and disposal of industrial and hazardous wastes.

Support is also required for strategic planning of MSWM at national and local government levels, responding to the specific needs of both large and small cities.

4.1.2 Institutional Development and Management Strengthening

An overriding need is the decentralisation of MSWM authority.

The main thrust of development cooperation is oriented towards establishing an effective institutional framework for MSWM, and strengthening the responsible bodies within this framework. At the national level, support would be provided for a national authority or centre for appropriate solid waste management and standards. An overriding need is the effective decentralisation of authority for waste management and, more generally, infrastructure development, to the local government level, including measures to ensure that local government's powers and capacities are equal to its responsibilities.

Support activities would aim to build management capacity through the introduction of appropriate methods and techniques for:

- strategic planning,
- operational planning,
- cost and revenue accounting,
- budgeting and financial control,
- monitoring and evaluation, and
- management information systems.

Particular attention would be paid to the process of strategic planning for MSWM, and to the establishment of adequate capacity for operating and maintaining existing facilities and equipment.

Manpower development would be supported through guidelines, training programmes and technical assistance, including support for the establishment of institutional capacity for training and human resource development.

4.1.3 Private Sector Involvement

Governments have little experience in collaborating with private sector actors.

While important improvements in MSWM may be achieved by the formation of public-private partnerships involving both formal and informal actors, governments generally have little experience or confidence regarding the steps which may be taken towards establishing satisfactory working relationships with private sector actors. Support would therefore focus on practical guidelines for the preparation of contracts and bidding documents, along with technical support for such functions as performance-based specifications, payment mechanisms, organisation of the bidding process, conditions for promoting competition between service suppliers, arrangements for quality and performance control, as well as required changes in the policy and in the legal and regulatory framework.

By means of guidelines, enabling actions and organisational and technical support, governments may be assisted in strengthening informal sector waste workers and establishments, and forming effective partnerships at the neighbourhood and municipal levels.

4.1.4 Community Participation and People's Involvement

Experience demonstrates that community-based solid waste management may be quite effective.

Experience is available which demonstrates the effectiveness of community-based solid waste management and environmental development. Information concerning this experience and practice may be provided, along with practical guidance and tools, to enable governments to establish active partnerships with community organisations in the interest of more

extensive, low-cost waste collection service. In most cases, effective community involvement in waste management depends upon the functional link between community groups and private sector enterprises. Community-based micro-enterprises for solid waste management may be an effective form for such community-private sector linkage, for example.

Material and guidelines may be provided for awareness building programmes.

More generally, local governments may be supported in their efforts to improve community and user cooperation in MSWM through the provision of materials and guidelines for awareness building programmes as well as formal and informal education programmes dealing with solid waste, sanitation and environmental health.

4.1.5 Technical Development

Improvements to technical systems are required at the levels of collection (container and vehicle specification, vehicle routing, vehicle maintenance), transfer (primary to secondary transfer points, large transfer stations), recovery (composting, sorting facilities and organisation) and final disposal (sanitary landfills, energy recovery from landfill gas). Guidelines, methods and tools for appropriate equipment concepts and selection may be provided.

Major importance is attributed to operation and maintenance.

Major importance is attributed to improvement of the local government's operation and maintenance capacity for MSWM systems.

4.1.6 Hazardous and Special Waste Management

Critical problems are posed by small and scattered sources of hazardous wastes.

The most critical requirements arise in relation to hazardous wastes from small and scattered waste generators such as small-scale industries, which are practically impossible to prevent from entering the normal waste stream. Documentation, tools and guidelines should deal with these, as well with large industrial and commercial waste generators.

In addition, there is an urgent need for planning and implementation of medical waste management systems, and for the integration of appropriate procedures and methods into both health care and waste management systems.

4.2 Indicative Programme Directions

MSWM activities would be closely co-ordinated with relevant ESAs and programmes.

The activities of the UMP and its partners in the field of MWSM will be co-ordinated as closely as possible with relevant organisations and programmes, in particular:

- Collaborative Council for Water Supply and Sanitation (CCWSS)
- Municipal Environmental Improvement Programme (MIEP)

- Sustainable Cities Programme (SCP)
- United Nations Children's Fund (UNICEF)
- United Nations Environmental Programme (UNEP)
- World Health organisation (WHO)
- Water and Sanitation Programme (WSSP), UNDP/World Bank

The possible forms and directions of development cooperation are manifold; the appropriate form will depend upon the situation, needs and institutional linkages of cooperation partners, and the levels and areas of intended intervention. Possibilities include:

1) ***Implementation of integrated solid waste management projects and/ or demonstration projects at the municipal level.*** This would generally require medium and long-term cooperation and support schemes with a substantial input of experts, hardware and financing, including appropriate monitoring and evaluation activities.

2) ***Process-oriented advisory services at the central government level with focus on policy formulation, legislation, strategic planning, institutional development, and financial support.*** These projects would require continuous consultancies over the medium-term.

3) ***Advisory services concentrating on specific components of the waste management system***, such as management and organisation, financial management, technical systems, public relations, privatisation, etc. Depending on the depth and range of institutions involved, this kind of advisory service may provided through short-term advisors or medium-term consultancies.

4) ***Conceptual planning and implementation of human resources development programmes for MSWM.*** Cooperation in this field may range from long-term professional programmes to theoretical and practical courses and on-the-job training, and could include strengthening of local professional associations and educational programmes.

5) ***Applied research and the elaboration of manuals and guidelines,*** as well as information and training materials on selected sector aspects, distributed through existing networks.

6) ***Transfer and dissemination of know-how through compilation and distribution of case studies and project documents, articles and other literature*** on selected sector aspects and components, employing existing networks.

7) ***Support to the exchange of experience and professional discussion on selected MSWM aspects and components*** through the organisation of national, regional and international conferences, seminars and workshops.

Figure 2: Overview of the Conceptual Framework for MSWM

Goals

To promote the health and well-being of the entire urban population	To protect the quality and sustainability of the urban environment	To promote the efficiency and productivity of the urban economy	To generate employment and income

Overall Aim

To establish sustainable MSWM systems which meet the needs of all citizens, including the poor

Strategic Objectives

Political	Institutional	Social	Financial	Economic	Technical
Determine MSWM goals and priorities	Devolve responsibility *and* authority for MSWM to local governments	Orient MSWM to the real needs of people, including the poor, women & children	Establish practical and transparent cost accounting and budgeting systems	Promote economic productivity & development through adequate MSWM service	Achieve low life-cycle cost of waste management facilities and equipment
Define clear roles and jurisdiction for MSWM	Establish effective municipal institutions for MSWM	Encourage proper waste handling patterns by the population	Mobilise adequate capital investment resources	Environmentally sound waste collection, recovery and disposal	Technology that facilitates user and private sector collaboration
Establish an effective legal and regulatory framework	Introduce appropriate management methods, procedures and service targets	Raise people's awareness of MSWM problems and priorities	Raise sufficient revenues for recurring expenses —ensure adequate O&M	Ensure long-term economic effectiveness of MSWM systems	Ensure that technical systems effectively limit environmental pollution
	Build municipal capacity for MSWM	Mobilise community participation in local waste management	Improve the efficiency and reduce costs of MSWM service	Promote waste minimisation and material efficiency	
	Increase efficiency and through private sector involvement	Protect health and socio-economic security of waste workers		Generate employment and incomes in waste management	
	Extend lower cost MSWM service through community participation				

Strategic Issues

Relative priority of collection services in relation to safe waste disposal	Optimal distribution of functions and responsibilities?	Adaptation of waste management services to the needs of poor households and women	Failing incentive of local institutions to use available cost accounting methods	Trade-off between low-cost waste service and environmental protection	Coherence of technical systems in spite of differing requirements and decision makers
Priority attributed to waste minimisation —reduction and recovery	Devolution of MSWM responsibility in spite of limited local government capacity	Effectiveness of awareness building or direct community involvement	Use of collected revenues for the intended MSWM purposes	Control of industrial and hazardous waste in spite of small, scattered sources	Estimation of life-cycle costs of technical alternatives
Meeting the service needs of irregular and illegal settlements	Involving local governments in system planning and development	Equity of MSWM service access to the poor	Incorporating incentives for cost reduction and efficiency	Trade-off between efficiency of waste service and employment creation	Appropriate standards for sanitary landfill design and operations
Mix of instruments for waste management: regulations, incentives and/or motivations	Responsiveness of waste management to real needs and demands	Collaboration with and support of informal waste workers			
Contribution of ESAs to MSWM policy formulation	Raising the professional standing of waste managers				

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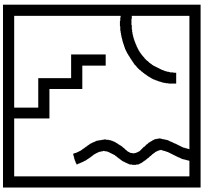

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