

Integrated Sustainable Waste Management - the Concept

Tools for Decision-makers
Experiences from the Urban Waste Expertise Programme
(1995-2001)

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Cover photos:

Photo 1: Shop of Mr. Watindi dealing with plastic waste from waste pickers, Kenya. *Photo: ©WASTE, Arnold van de Klundert*

Photo 2: Sorting solid waste for recycling, Brazil. *Photo: ©WASTE, Inge Lardinois*

Photo 3: Transfer of MSE collected solid waste into a haulage truck, Peru. *Photo: ©WASTE, IPES*

Integrated Sustainable Waste Management - the Concept is part of a set of five Tools for Decision-makers. The other four documents cover:

- Community Partnerships in Integrated Sustainable Waste Management
- Micro- and Small Enterprises in Integrated Sustainable Waste Management
- Financial and Economic Issues in Integrated Sustainable Waste Management
- The Organic Waste Flow in Integrated Sustainable Waste Management

ISBN number of the series: 90-76639-02-7

The research for this publication received financing from the Netherlands Agency for International Cooperation (DGIS), Ministry of Foreign Affairs. Citation is encouraged. Short excerpts may be translated and/or reproduced without prior permission, on condition that the source is indicated. For translation and/or reproduction in whole, WASTE should be notified in advance. This publication does not constitute an endorsement from the financier.

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Acknowledgements

The foundation for this document was laid during the first workshop of the Working Group on Solid Waste Management in Low-income Countries, which was held in Ittingen, Switzerland in 1994. As a preparation for that workshop Arnold van de Klundert and Inge Lardinois wrote an Action Plan document, which Anne Scheinberg edited. Later this document led to articulating the concept of Integrated Sustainable Waste Management.

During the six-year course of the Urban Waste Expertise Programme (UWEP) the concept was enriched by many colleagues and from the work of the UWEP partners. While there were many contributors - in conversations, email discussions and project cooperation - some made specific contributions, which we would like to acknowledge here.

The research on "Linkages between Stakeholders" was carried out in Colombia by Marie Dominique de Suremain, Margarita María Sierra (ENDA/America Latina), Françoise Coupé (IDEA-UN Medellín), Soledad Betancur (IPC) and Inés Duque (independent researcher); in Vietnam by Michael DiGregorio, Trinh Thi Tien, Nguyen Thi Hoang Lan, Nguyen Thu Ha and in the Philippines by Sonny Saniano, Joyce Munsayac, Judy Tapel and Dan Lapid. Later this UWEP research merged with parallel work and analysis done at the University of Amsterdam by Stelios Grafakos, who was supervised by Ms. I.S.A. Baud, Johan Post and Arnold van de Klundert. This joined research produced a UWEP Working Document on the "Assessment of the Sustainability of Alliances between Stakeholders". These and other UWEP experiences contributed to this series of tools on Integrated Sustainable Waste Management.

We would also like to acknowledge the valuable comments and contributions we received from Maria Muller, Reka Soos, Margarita Pacheco - Chairperson of the UWEP Steering Committee and Mr. B. van Heugten, Professor in Solid Waste Management at the International Institute for Infrastructural, Hydraulic and Environmental Engineering in Delft, the Netherlands.

The Urban Waste Expertise Programme would not have been possible without the efforts from a wide array of people, a team of nearly 50 local researchers, local and regional coordinators from various organisations. Most important among them have been CAPS in the Philippines, CEK in Mali, IPES in Peru, ACEPESA in Costa Rica and Waste Wise in India.

The UWEP programme received its financing from the Netherlands Agency for International Cooperation (DGIS), Ministry of Foreign Affairs.

Gouda, May 2001

Arnold van de Klundert
UWEP Programme director

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Chapter 1. Introduction

1.1 Why this document?

This document on Integrated Sustainable Waste Management (ISWM) is designed to give municipal managers and decision-makers a set of tools for managing the waste problem in their cities. It is a framework for understanding the problems, first, and looking for solutions, second. This is important because many of the failures in municipal waste management are related to an inadequate analysis of the problem, which leads to emergencies and poor, crisis-driven decision making.

This document with tools for decision-makers presents a unique, more systematic way of thinking and looking at waste management. This approach is called 'Integrated Sustainable Waste Management' (ISWM). It provides insights into aspects that are not so commonly considered to be essential, such as the environmental, social, legal aspects; the stakeholders: waste pickers, small-scale enterprises, women heads of household; and practical or technical elements of the waste management system, including prevention, reuse and recycling.

ISWM offers an unconventional way of thinking and looking at waste management, one that is designed to avoid and counterbalance the typical technology-centred approach, which has so often failed. It provides insights into the less obvious, but equally urgent planning aspects, including the environmental, socio-cultural, institutional, political and legal aspects. ISWM puts all stakeholders into focus, in a matrix with the more traditionally recognised elements of the waste management system, such as prevention, reuse and recycling, collection, street sweeping and disposal.

This set of tools summarises lessons learnt in the Urban Waste Expertise Programme (UWEP) in six years of field research and pilot projects in low- and middle-income countries in the South, i.e. in Africa, Asia and Latin America. Insights from similar initiatives outside the UWEP programme are also included.

1.2 Who should read this document?

These tools are written for municipal managers, decision-makers and members of city councils (primarily) in low- and middle-income countries in the South and countries in transition in Eastern Europe who:

- Have noticed that the current approaches to waste management do not usually succeed.
- Would like to use public funds responsibly.
- Are concerned for the environmental and public health of their citizens.
- Are concerned with improving waste management services, both liquid waste (wastewater) and solid waste.
- Are interested in the long-term health and well-being of their cities.
- Are searching for a more coherent way to analyse the situation, understand the problems and engage citizens in formulating solutions.

This document can also be of interest to other (international/development) organisations that aim at supporting municipal managers and decision-makers in these countries.

This ISWM document is part of a set of five publications covering other elements of an ISWM system: the Involvement of Micro and Small Enterprises; Community Partnerships; Understanding the Economics and Finance; and one focuses on a major fraction of the waste stream, the Organic Waste Flow.

1.3 What can be found in this document?

This document is divided into four chapters:

1. Chapter 1 is the introduction and sets the context.
2. Chapter 2 presents **ISWM** in the context of the problems many municipal managers face with waste management. It introduces ISWM as a concept to address these problems in an integrated and innovative way.

3. Chapter 3 gives examples of **ISWM in practice**, suggesting how systems can be improved and technologies selected, taking into account various aspects and elements of the waste management system.
4. Chapter 4 presents a guide to **planning for ISWM**, illustrating the major steps that can be taken to arrive at a more sustainable waste management system.

This document provides an overview of the following issues to be considered when planning for improvement of waste management:

- Models: waste management hierarchy, planning and design of systems, technology selection
- Systems: prevention and reduction of waste, separation at source, primary collection, secondary collection and transfer, reuse and recycling, composting and other treatment options, disposal and hazardous waste management
- Capacities and support structures: institutional framework, relations with communities and other stakeholders, and financial management

Since this document is limited to the broad outlines and approach to Integrated Sustainable Waste Management, further information about various aspects and 'how to do' approaches are mentioned in the last section on tool kits, manuals and sources of further information.

Chapter 2. The Concept of Integrated Sustainable Waste Management

2.1 Introduction

The core concept of Integrated Sustainable Waste Management (ISWM) has been developed out of experience, to address certain common problems with municipal waste management in low-and middle-income countries in the South, and also in countries in transition. ISWM recognises three important dimensions in waste management: (1) stakeholders, (2) waste system elements and (3) sustainability aspects. The waste management hierarchy – a policy guideline that is part of many national environmental laws and policies – is also a cornerstone of the ISWM approach.

2.2 The term 'waste' in the context of ISWM

The term 'waste' has a different meaning for different people. In general one can say that waste is 'unwanted' for the person who discards it; a product or material that does not have a value anymore for the first user and is therefore thrown away. But 'unwanted' is subjective and the waste could have value for another person in a different circumstance, or even in a different culture. There are many large industries that operate primarily or exclusively using waste materials – paper and metals are the commonest – as their industrial feed stocks.

In the context of ISWM, waste is regarded both as a negative and as a useful material providing a potential source of income. It can in fact be the only free resource available to poor people, or urban dwellers, who cannot cut wood or use other common property resources available in the country. This real value of waste in many low-and middle-income countries in the South is confirmed by the huge informal sector that lives from waste collection and recovery. There are also formal sector examples, such as sugar cane factories that sell their fibres and cane waste to paper factories who produce paper out of it. Unfortunately not all wastes can be regarded as resource. Many hazardous and toxic materials cannot be safely recycled or reused.

The category of waste can be divided into solid and liquid waste. Liquid waste is sometimes referred to as human waste or excreta. In this document we will look primarily at solid waste, but the framework applies to liquid waste as well.

2.3 Why is waste management important to a municipal manager?

Waste management is important to a municipal manager because it is a visible and politically sensitive service; inadequacies in the service can have severe implications for the credibility of public administrations. Waste management absorbs a considerable share of municipal budgets and is a major provider of public sector employment. Even larger numbers are employed in the micro sector, including the so-called 'informal waste recovery sector'.

Proper management of solid and liquid waste is important for public health, environmental, economic and political reasons and therefore deserves increased attention from municipalities. Improper waste management can have negative effects on public health, the environment and natural resources.

2.4 Common problems encountered by municipalities in waste management

Municipal managers – especially those in the South – face a number of common problems with regard to waste management. System failures include a lack of a comprehensive policy framework for waste management and a shortage of tools to analyse and improve efficiency, effectiveness and sustainability. A failure in models means that there is nowhere – including in the North – where a municipal manager can look and say "That system functions well and I could copy it".

Frequently quoted practical problems include inadequate, poorly maintained or out of date; or too little equipment or spare parts; or equipment that is inappropriate for local conditions, all of which are exacerbated by the increases in population and of volume of

waste per household. Other obstacles for waste management are connected to under-functioning staff that is not motivated or difficult to find because of low status, low salaries and difficult working circumstances.

Financial problems regularly mentioned by municipal managers in the South include imbalances between income and expenditure because of rising costs and inadequate revenues. Adding to the financial difficulties are inefficient (and sometimes overpriced) waste processing facilities and increasing costs of transportation and disposal due to regionalisation of disposal, the growing distance to disposal sites and increasing value of land close to the city centre.

Most municipalities do not find it easy to cooperate or communicate with their own citizens, who appear not to be cooperating with the municipality; behaviour such as illegal dumping of waste; misuse or non-use of containers; damaging and stealing communal storage containers; and resistance to service charges lead authorities to believe that the citizens are part of the problem, rather than an ingredient of the solution.

Municipal managers are also likely to have problems with private enterprises, both formal and informal. Local businesses may be dumping waste on roadsides and outside of official disposal sites. As service providers, they may compete with the municipality and be envied for their ability to raise fees for services. When businesses are involved in providing a service, they are hard negotiators and may require or pay bribes. Many municipalities are also unprepared to undertake the task of coordinating and monitoring their activities. The micro informal waste collection and recycling sector is usually considered a nuisance and not seen as businesses at all.

2.5 Answers without analysis

There is a tendency (in waste management, but also in other municipal functions) to move directly from problems to solutions without an analysis of what is actually occurring. The most obvious answers are more money or more equipment, even when money and equipment are not the essence of the problem. As a result, money and equipment are used incorrectly, and at large expense, for the many problems that they cannot solve. ISWM seeks to avoid this.

2.6 ISWM: Analysis and understanding first, then problem-solving

The ISWM insight is that most waste management problems have to do with something other – or more – than money and equipment. Some problems have to do with the attitude and behaviour of citizens, waste management staff, private enterprises and waste pickers. Other problems are caused or made more serious by factors that are not technical or financial, but relate to managerial (in)capacities, the institutional framework, the environment, or the social or cultural context. In these cases, it is not money or equipment that provide solutions, but rather changing social, institutional, legal or political conditions.

Cultural problems and waste collection in Pakistan

In one city in Pakistan, city workers and managers were frustrated by the fact that the household waste containers were never placed on the street in the right place for the collection. No amount of punitive enforcement or discussions seemed to fix the problem, until a local NGO with a gender focus thought of asking the women about their opinions. It turned out that the women were in a double bind: the men in the family refused to take the trash out themselves, claiming it was a dirty job and therefore the job of the women. But the women were in purdah and were not permitted to leave their household compounds or have contact with men, so taking the trash to the designated corner was forbidden to them. The NGO worked with the households and together they came up with a solution: children would take the trash to the corner: either children from the household or street children who would receive nominal payment. Women were permitted to talk with children, so this was no problem. Until a deep cultural and social analysis was performed, no amount of money or equipment could solve the problem.

Source: Bushra Gohar, UWEP Gender and Waste Email Discussion (May 1998).

The Integrated Sustainable Waste Management (ISWM) concept was developed to reflect this reality, as a means to articulate a vision of waste management that would pay attention to all these various aspects. ISWM promotes technically appropriate, economically viable and socially acceptable solutions -- which do not degrade the environment -- to waste management problems in cities in the South. ISWM promotes the development of a waste management system that best suits the society, economy and environment in a particular location. ISWM commits itself to take into account the particular conditions in countries in the South and in Eastern Europe, which are quite different from those in OECD countries in the North, such as the United States and Canada, Europe, Japan, Australia.

OECD countries have developed their own imperfect, unevenly functioning waste management models, systems and technologies that are suited to local conditions. These models are capital- and technology-intensive and labour extensive, like industries in the Northern industrial context. Exporting these models to the South where they may be less appropriate has proven not to be effective; there are many examples of failures of incinerators, composting plants and collection with compactor trucks.



Photo 1. Meeting of chairwomen of waste management associations, Mali.

Photo: ©WASTE, Maria Muller

ISWM provides some tools to look more in depth at the actual needs of communities and municipalities in the South and in Eastern Europe. It helps municipal managers and their technical staff to go beyond the simple importation of Northern models, systems and technologies.

2.7 The ISWM framework

2.7.1 ISWM principles

The ISWM concept takes as a point of departure four basic principles:

1. **Equity:** all citizens are entitled to an appropriate waste management system for environmental health reasons.
2. **Effectiveness:** the waste management model applied will lead to the safe removal of all waste.
3. **Efficiency:** the management of all waste is done by maximising the benefits, minimising the costs and optimising the use of resources, taking into account equity, effectiveness and sustainability.
4. **Sustainability:** the waste management system is appropriate to the local conditions and feasible from a technical, environmental, social, economic, financial, institutional and political perspective. It can maintain itself over time without exhausting the resources upon which it depends.

Equity goes beyond a moral imperative because:

1. Pollution in one part of the city ultimately affects the rest of the city, including its air and water supply. Pollution 'travels' in the form of communicable diseases, flies, insects, rats, air and water pollution.
2. Polluted areas lead to poor living conditions, which in turn foster social unrest and anti-governmental activities. Abandoned waste is a symbol of a failed public service.
3. Unclean neighbourhoods can affect the city's economy and inhibit development. Investors will not invest in a dirty place and sick labourers have low productivity.

The *effectiveness* of a service is the extent to which the objectives of the service have been met in practice. For example, a street sweeping service is effective if the streets are clean. Effectiveness for waste management in general means that all waste is removed, as planned and all recoverable materials are recovered. When effectiveness is limited to the city centre, tourist areas or business districts the overall waste management system is not fully effective. *The less visible parts of the city are as important as – sometimes more important than – the visible ones!*

The service is *efficient* when the benefits of clean streets are balanced by all beneficiaries paying a reasonable cost to keep them that way, using the optimal combination of labour, money, equipment, machinery and management.

Sustainability refers to the ways in which resources are used and how these fit into the local culture, context and society. These resources can be human (manpower), material (equipment) or natural resources (water, air, soil). It includes distinguishing between the use of renewable and non-renewable resources on the earth. It also refers to the interplay of all the aspects, such as social and political with technical and environmental. A system is considered sustainable when it can reproduce itself without reducing the possibilities open to the following generation of systems.

2.7.2 The dimensions of ISWM

ISWM has three major dimensions: (1) the stakeholders involved in waste management, (2) the (practical and technical) elements of the waste system and (3) the aspects of the local context that should be taken into account when assessing and planning a waste management system.

2.7.3 Stakeholders, the first ISWM dimension

A stakeholder is a person or an organisation that has a stake, an interest in –in this case– waste management. A number of potential stakeholders are listed in Figure 2. However, stakeholders in waste management differ in each city, so they need to be identified in the local context.



Photo 2. Members of Swabhimana stakeholder platform meeting in Bangalore, India.

Photo: ©WASTE, Arnold van de Klundert

Stakeholders have various interests and roles in their particular waste management, but they can cooperate for a common interest. Their *influence* (the extent to which stakeholders are able to persuade or coerce others into making certain decisions or following certain courses of action) and *importance* (the extent to which the problems, needs and interests of a particular stakeholder are a priority in a project or plan) varies. The following box describes some of the less well-known stakeholders involved in waste management in cities in the South.

Stakeholders in waste management

In all countries, but especially in low- and middle-income countries many people outside of the official municipal workforce are involved in reuse and recycling. This includes:

1. Informal sector waste pickers who pick up discarded materials from streets and dump sites.
2. Itinerant waste buyers who collect and buy 'unwanted' items door to door from households.
3. Dealers, who buy, sort and sell materials.
4. Wholesalers, usually specialised in one material, who aggregate materials and compress them for more efficient shipment and who sell them to industries.
5. Recycling enterprises that process recyclables into intermediate industrial feed stocks.
6. End-user industries, which purchase processed recyclables as feed stocks to make their final products.

Municipal workers are sometimes also involved in sorting the waste they collect from the households or from the streets during street sweeping and (door-to-door) collection of waste. They supplement their usually low salaries by selling these materials to dealers strategically located along the road to the dump sites.

The lower levels of the recycling chain are often called the 'informal recovery sector' because they often operate outside official structures. This sector recycles large proportions of waste produced in Southern cities. For example 25% of the 180 tons of waste that is generated each day in Manizales, Colombia, is recyclable. Small-scale and informal sector enterprises recover around 80% of this recyclable material, or 36 tons per day, (Arroyo, 1999) without being paid by the municipality. In Cairo, Egypt, one third of all waste (8,000 tons daily in 1999) is collected, sorted and recycled by the approximately 30,000 informal sector workers, called Zabbaleen. The Zabbaleen recycle 85% of all recyclable waste (Sawiris, 2000). In many of the larger cities in Latin America and Asia it is not uncommon to find 50,000 people employed in this business, in each city.

2.7.4 Waste system elements, the second ISWM dimension

All waste system elements should be looked upon as being stages in the movement, or flow, of materials from the mining stage, via processing, production and consumption stage towards final treatment and disposal. A waste management system is a combination of several stages in the management of the flow of materials within the city and the region. A waste management plan is part of an integrated materials management strategy, in which the city makes deliberate and normative decisions about how materials should flow. The waste elements then become specific tactics to deal with specific materials after they have been consumed.

ISWM recognises the high-profile elements 'collection', 'transfer' and 'disposal' or 'treatment'. It gives equal weight to the less well understood elements of 'waste minimisation', 'reuse' and 'recycling and composting'. These major elements all appear in Figure 2. The history and character of the locality influence which system elements are present and which are absent or under-developed. A full ISWM process seeks to supplement the existing system so that all elements are represented. Usually this means adding waste prevention or minimisation, reuse and recycling to the existing mix.

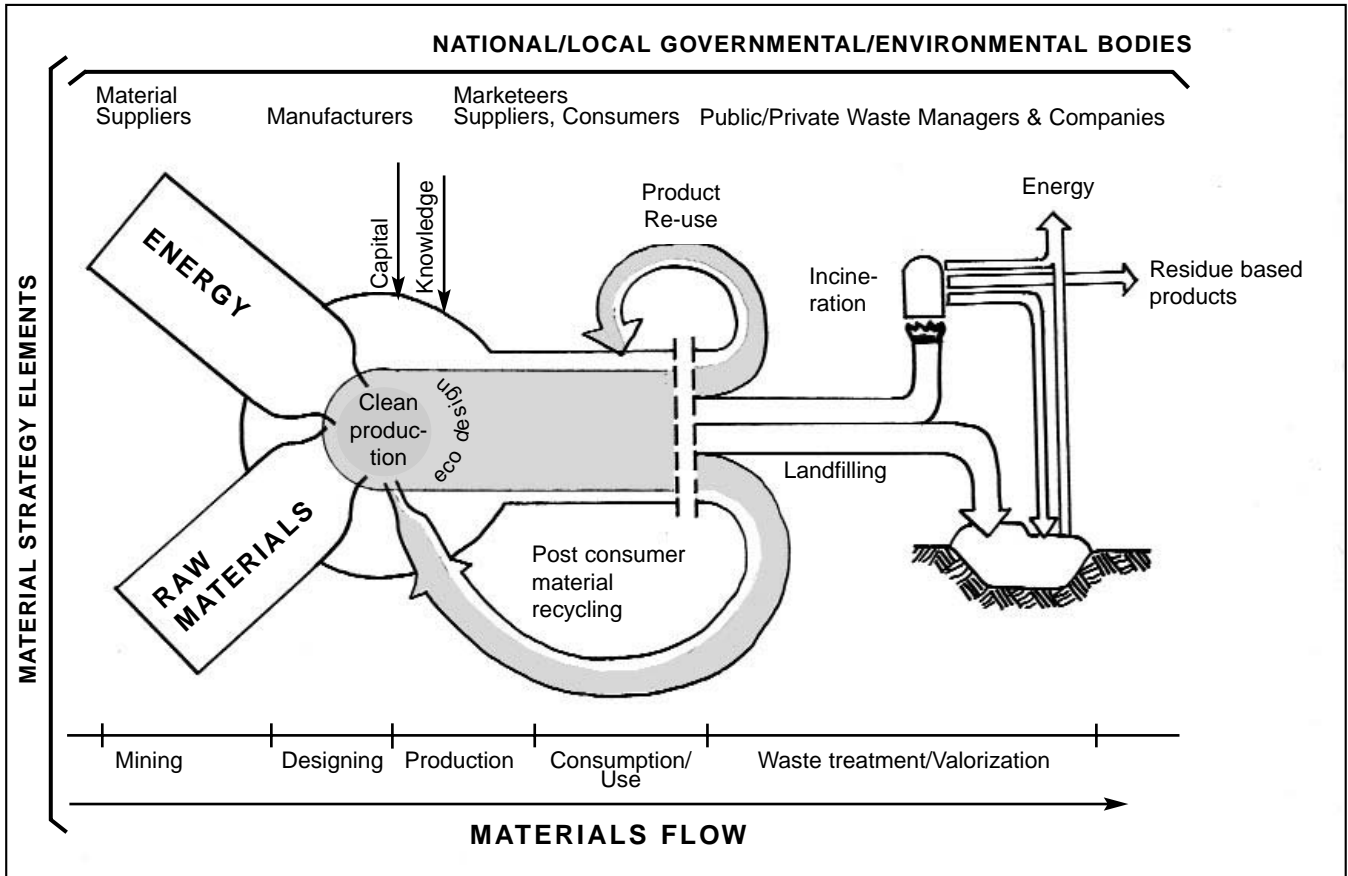


Figure 1. Materials flow

Source: Drawing by Arnold van de Klundert, WASTE

2.7.5 The third dimension: ISWM aspects

The ISWM concept distinguishes six aspects, or lenses, through which the existing waste system can be assessed and with which a new or expanded system can be planned. The ISWM aspects give a municipal manager a set of tools to perceive, study and balance priorities and create measures to give the desired results.

The six aspects of ISWM are described below:

1. *Environmental aspects* focus on the effects of waste management on land, water and air; on the need for conservation of non-renewable resources; pollution control and public health concerns.
2. *Political/legal aspects* address the boundary conditions in which the waste management system exists: setting goals and priorities; determination of roles and jurisdiction; the existing or planned legal and regulatory framework; and the basic decision-making processes.
3. *Institutional aspects* relate to the political and social structures which control and implement waste management: the distribution

of functions and responsibilities; the organisational structures, procedures and methods implicated; the available institutional capacities; and the actors such as the private sector who could become involved. Planning is often considered the principal activity in relation with institutional and organisational aspects.

4. *Socio-cultural aspects* include the influence of culture on waste generation and management in the household and in businesses and institutions; the community and its involvement in waste management; the relations between groups and communities, between people of various age, sex, ethnicity and the social conditions of waste workers.
5. *Financial-economic aspects* pertain to budgeting and cost accounting within the waste management system and in relation to the local, regional, national and international economy. Some specific issues are: privatisation; cost recovery and cost reduction; the impact of environmental services on economic activities; the commodities marketplace and how the recycling infrastructures connect to it; efficiency of municipal solid waste management systems; macroeconomic dimensions of resource use and conservation; and income generation.
6. *Technical and performance aspects* concern the observable practical implementation and maintenance of all of the waste elements: what equipment and facilities are in use or planned; how they are designed; what they are designed to do; whether they work in practice; and how clean the city is on a consistent basis.

Development and planning are long-term issues, which require time to occur and to mature. Foreign donor agencies and local decision-makers do not always realise this, which leads them to take ad hoc decisions or propose short-term projects that reflect well on their term in office.

Local and national elections may bring in new politicians who reverse previous policies and obstruct attempts to arrive at sustainable, long-term solutions. Under the best conditions, it still takes time to learn new habits (and to forget old, bad habits). It may take a while before new attitudes and behaviour regarding for example separation at source are rooted in society and new measures and approaches prove their value.

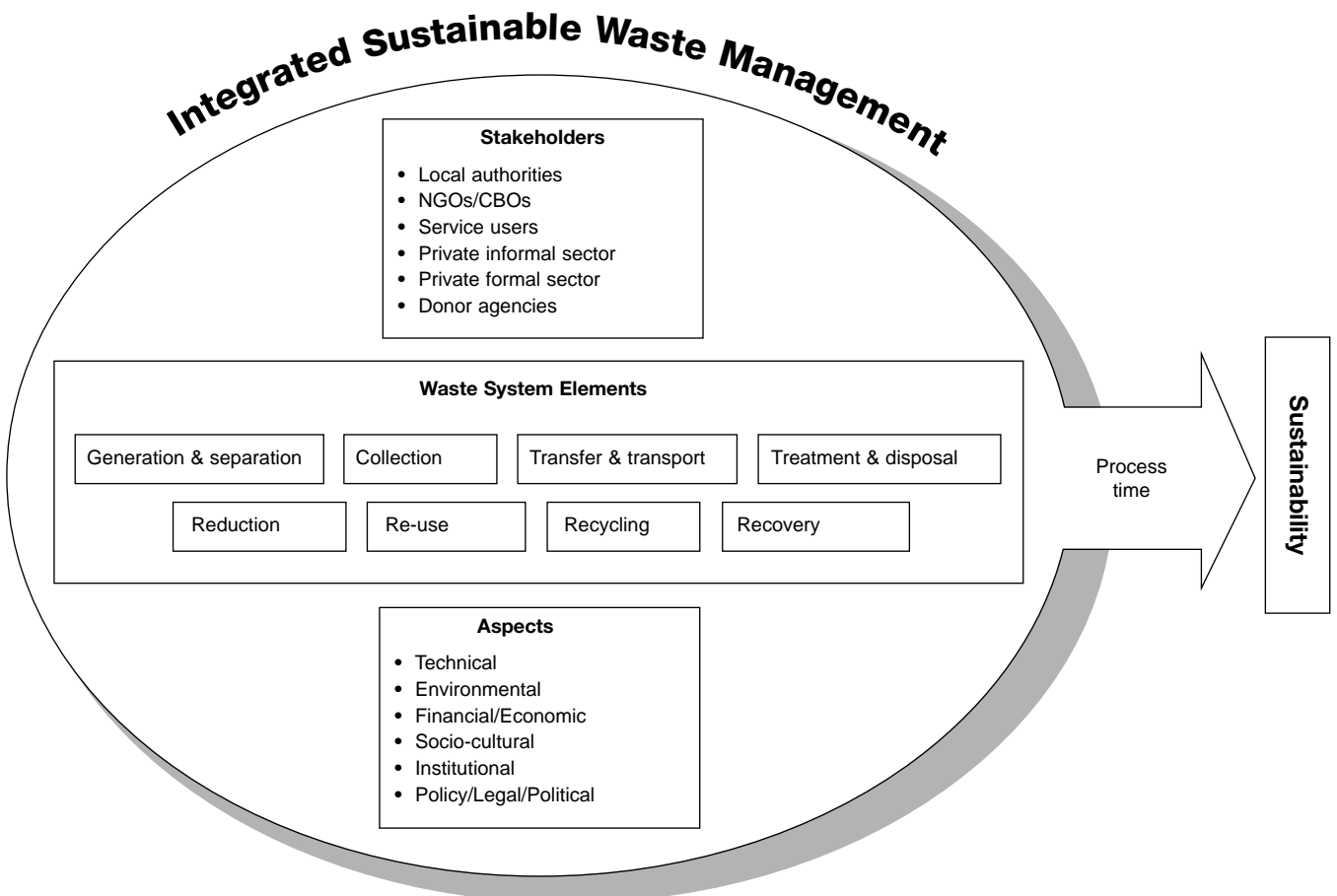


Figure 2. The ISWM model

2.7.6 An integrated and multi-disciplinary approach

ISWM strives for an integrated approach, on many levels. It aims at the integration of:

1. Various stakeholders, governmental or non-governmental, formal or informal, profit- or non-profit oriented (cooperation, relationships)
2. A variety of aspects (technical, environmental/public health, financial)
3. Various collection and treatment options adapted to a specific habitat scale, i.e. household, neighbourhood and city level
4. The waste management system and other urban systems (such as drainage, energy, urban agriculture)

ISWM **integrates various stakeholders** in waste management, since fostering cooperation between these stakeholders over a longer period of time will lead to lasting results. This integrated approach also means looking at all the six aspects of waste management in evaluations and decision-making processes, not merely the technical and the financial. Chapter 3 gives examples of these.

Waste management **cuts across all socio-economic levels**: household, neighbourhood, city, region and nation. While at some level the most important level of waste management system is the city scale, but this does not necessarily mean that the system must be uniform. The 'dominant' system may not work in low-income areas or on hillsides, so that uniformity means these areas tend to be marginalized and receive little or no waste collection. In contrast to this, an ISWM approach promotes a variable, customised, decentralised and neighbourhood-oriented approach, looking at specific requirements and conditions as the basis for providing service to the various neighbourhoods and communities.

A last aspect of integration refers to the integration of waste management with other urban systems such as urban agriculture; urban greening and silviculture; sewerage and drainage; water and energy. For example, improperly managed solid waste will end up in drains, harming the drainage system in a city. The goal of integration with other urban systems is to maximise the positive effects of integration and to minimise the negative effects of non-integration.

The waste management hierarchy

1. Prevent the creation of waste in product design and packaging
2. Reduce the toxicity or negative impacts of the waste that is generated
3. Reuse in their current forms the materials recovered from the waste stream
4. Recycle, compost, or recover materials for use as direct or indirect inputs to new products
5. Recover energy by incineration, anaerobic digestion or similar processes
6. Dispose of waste in an environmentally sound manner, generally in sanitary landfills

Source: Many policy documents, as adapted in Lardinois and Furedy (1999)



Photo 3. Small enterprise buying a variety of recyclables, El Salvador.

Photo: ©WASTE, Carlos Avalos

2.8 The waste management hierarchy

The waste management hierarchy is a tool that policymakers have used to rank waste management options according to their environmental benefits. The waste management hierarchy considers products from their 'cradle' to their 'grave'. Waste is seen as closely linked to production and consumption processes. The previous box outlines its main principles.

Separation at source, reuse and recycling take an important place in the waste management hierarchy. Waste materials should be separated at source as much as possible to improve the quality of materials for reuse and recycling (including organics for composting), to reduce energy use in collection and to improve working conditions at all stages. This will benefit also those earning a living from waste recovery (Lardinois and Furedy, 1999). Separation at source of hazardous waste has the additional advantage that it reduces the risks of handling municipal waste.

In addition, the hierarchy promotes the recovery – through reuse, recycling composting – of as many waste materials as possible before disposal or incineration. Advantages of reuse and recycling are:

1. Reduction of the amount of materials requiring collection and disposal, which means:
2. Longer lifetimes for landfills; more capacity for waste in other kinds of treatment facilities
3. Lower transportation and landfill costs
4. More reliable and local supply of raw materials to local industries, avoiding using foreign exchange and import procedures
5. Reduced extraction of non-renewable raw or virgin materials and associated environmental devastation
6. Reduced deforestation
7. Conservation of resources, energy and water
8. Provision of income and employment
9. Availability of affordable products for the poor

Policies based on the hierarchy seek to maximise the recovery options and to minimise disposal through open dumping, controlled disposal and landfilling. Once possibilities for recovery have been exhausted, policies based on the hierarchy favour safe disposal, limiting negative impact on the environment and natural resources as much as possible.

The waste management hierarchy is an example of how ISWM adapts an existing environmental policy to support its environmental aspect in determining the form of the waste elements. Similar policy instruments support other aspects, such as non-discrimination policies, which support the social aspect. Like all policies, the hierarchy needs to be applied with certain flexibility. Sometimes recycling may not be the right solution and other solutions like incineration may be more appropriate, for example in the case of healthcare waste. Nevertheless, the waste management hierarchy is an important guideline for ISWM.

2.9 Conclusion

This chapter has provided a brief introduction to the ISWM concept and principles. In the following chapter, we will look at the practical application of ISWM for the design of new systems and the assessment of existing systems.

Chapter 3. Application of ISWM in Practice

3.1 Introduction

This section will provide guidance on how to use the ISWM concept in the practice of waste management planning and implementation. It will first focus on the assessment of existing waste management systems (analysing and building on what exists), will then focus on some major improvements of the present system and will finally focus on the introduction of new elements into the existing system: prevention & reduction, reuse & recycling.

3.2 When is ISWM useful?

In the context of a city ISWM can be used for two main purposes:

1. To assess and monitor existing waste management systems
2. To plan a new waste management system, including the selection of appropriate technologies, making sustainable investment decisions

In practice, numbers 1 and 2 often occur in sequence, with an in-depth assessment being the first step in an integrated and sustainable planning process.

ISWM is particularly useful when the goal is:

1. To prepare and formulate a waste management strategy
2. To design a system for an area that does not yet have waste management
3. To improve existing collection or disposal systems
4. To extend the waste collection service to low-income areas or neighbourhoods with difficult access (narrow streets, steep streets, etc.)
5. To prepare a pilot project for one waste management system element
6. To decide on selection of waste management technology or systems
7. To decide whether or not to accept a grant or loan for a new waste management facility
8. To privatise waste management

In the following paragraphs we will focus on these two main applications of ISWM:

1. **Assessment of existing systems**
2. **Design of new systems and selection of new technologies**

3.3 ISWM as an assessment tool

ISWM is useful to evaluate existing waste management systems, whether the goal is upgrading or installing something new. The goal of the assessment is to develop an overview of how materials flow in the city: a kind of input-output analysis. Ideally, you track the materials from their sources (imported or domestic) to manufacturer, distributor, retail dealer and ultimately to consumers. Then the most strategic points can be identified where to intervene in the waste flow - usually as close to the source as possible. This also helps highlight certain simple measures to be included in an ISWM strategy. In this process, stakeholders agree on indicators to be used in assessing the performance of the existing waste management system.

3.3.1 Basic information needs

The beginning of the information process can be described as field or primary research and you will be gathering information in four areas:

1. Know your waste
2. Know your city and relevant neighbourhoods
3. Know your citizens and clients of the waste system
4. Know all waste management activities in your city

1. Know your waste

- The source: who is generating what type of waste, in what quantities and where. Households, commercial establishments, institutions such as school, hospitals and government offices, factories and farms all generate different quantities and types of waste on different locations in the city. Usually not more than 50% of waste generated by households in cities in the South reaches the collection vehicle and disposal site, because of extensive waste picking and reuse at household level.
- The composition of household waste: this is determined among other things by eating and cooking habits (affluence, culture) and is subject to seasonal variations (agricultural production, religious feasts, presence of tourists). These differences in composition mean that different waste management systems may be considered for the various sources of waste (e.g. type and size of collection vehicles) to be able to diversify waste streams for reuse and recycling and to make use of small scale collection and recycling services.
- The composition also partly determines the suitability of the waste for certain types of treatment: the moisture content and calorific content (% of combustible material) for incineration and the organic content for composting.
- The density or the weight per m³: a high content of inorganic materials (e.g. paper, plastics in affluent or office areas) means the waste has a low density. Much dust, ashes and organic residues in the waste means it has a high density.

2. Know your city and relevant neighbourhoods

The physical infrastructure in your city and neighbourhoods should be taken into consideration when selecting systems and technologies for waste management. Examples are:

- Road and traffic conditions (wide, narrow, winding, paved, one or two-way traffic, traffic jams)
- Space for transfer or temporary storage of waste
- Lay-out of neighbourhoods and type of buildings related to socio-economic differences between neighbourhoods: space for separation at source bins, gardens generating organic waste, presence of markets

These conditions not only will influence your choice of collection and transportation technology, it may also influence the collection routes and opportunities for recycling (separation technology, quantities to be collected per type of vehicle). For example it will make a difference if the clients live in high rise apartment blocks with limited space for (separate) waste storage or in villas with a garden and personnel that will take care of the waste separation and storage. Maps showing roads, building densities etc. are essential to obtain this kind of information.

3. Know your citizens and clients of the waste system

- Their ability and willingness to co-operate in the operation and management of the service (self-help organisation, taking part in a joint management committee, an environmental committee at city level, or neighbourhood-based committees).
- Their ability and willingness to pay for the service; the level of service and the mode and cycle of payment they prefer.
- The demands they have for the type of service and its frequency.
- Their attitudes and behaviour in participating in experiments or pilot projects, particularly relating to separation at source, reuse, recycling and waste minimisation efforts.

Importance of citizen involvement

In one country a sophisticated waste collection system was introduced using a truck with an automatic loading system to empty plastic bins which had been placed outside the houses. The distributed plastic bins were far too valuable for the local population and were frequently used for other purposes such as washing clothes, bathing children, brewing beer. No waste could be collected as planned. Because there was no discussion beforehand, programme managers were caught with no insight in attitudes and behaviour of citizens.

4. Know all waste management activities in your city

Mapping the whole waste management sector in your city is extremely important when you want to design a new system or to improve an existing system. It includes identifying who is doing what in the current formal and informal waste management systems. It also involves involving stakeholders in assessing the performance of municipal waste management, as well as the performance of waste management by large, small and micro-scale enterprises, community groups etc. This performance assessment could take the form of a SWOT analysis (exploring Strengths, Weaknesses, Opportunities and Threats of the various actors). For example, planning for recycling will always require a close understanding of the informal, customary recycling system that has developed spontaneously according to market demand. The new recycling system will be more sustainable (and likely have greater acceptance) if it builds on the existing activities, rather than pretending that they do not exist.

Separation at source and recycling collection built on involvement of the informal sector

The Linis Ganda programme (which literally means Clean-Beautiful) is a waste separation at source initiative of the Metro Manila Council of Women's Balikatan Movement (MMCWBM) who started it in 1983. Linis Ganda aims to enhance existing recycling efforts by assisting and organising existing waste dealers and the itinerant buyers who sell to them. Earlier attempts in the 1970s to organise such a system without involvement of the informal sector collapsed.

The approach of MMCWBM consists of the following:

1. Improving and strengthening linkages between middle dealers and itinerant buyers with both the generators and buyers of recyclables
2. Organising middle dealers and itinerant buyers into co-operatives to obtain recognition from society
3. Obtaining cheap credit from financial institutions to expand the middle dealer's working capital base

Linis Ganda also aims to expand the range of materials being collected by itinerant buyers: scrap paper, broken bottles, scrap plastics, tyres.

The programme was implemented at three levels.

First MMCWBM mobilised women in 21 barangays (quarters) to separate waste which they generally do not separate. Flyers were distributed to inform those willing to participate. Secondly, 10 middle dealers from San Juan city were mobilised to buy the separated materials. They were given assistance in the form of push carts, uniforms and identification cards for the itinerant buyers – re-named 'eco-aides' – that they were working with. Prior to the project itinerant buyers were often not allowed to enter high-income estates due to security concerns. The ID cards for the eco-aides removed these barriers. Thirdly, Linis Ganda identified processing and recycling industries; established links between them and middle dealers and encouraged them to purchase the newly collected waste materials. Linis Ganda thus worked to strengthen the entire chain, from waste generators to traders to recycling industries.

The Linis Ganda programme has since expanded and at present includes 587 middle dealers all over Metro Manila (33% of the total). They are organised in a federation. Support from local and national leaders provided them with valuable resources such as an office and funds for operation and credits.

Source: Dan Lapid, as quoted on page 255 in Lardinois and Furedy (1999)

3.3.2 Assessing existing waste management systems

An assessment is useful when the goal is to:

1. Engage stakeholders at the beginning of a process, so that they become members of the team and do not obstruct the process later on.
2. Monitor the performance of a municipal service offered by public sector workers or private companies.
3. Decide how to improve a waste management system.
4. Select an area, activities and partners for a pilot project.
5. Take a decision on privatisation of some services in some areas or
6. Develop a waste management action plan

An ISWM analysis or assessment includes both the technical and performance aspects (how much waste is collected, how many trucks do we have), as well as all of the other aspects: social, institutional, economic, environmental and political. Ideally it should cover the eight waste system elements as well.

By involving all important stakeholders in the process of developing the questions and issues to be covered in the assessment, you can add to the quality of the information gathered and foster greater engagement.

Technical performance

- How well is waste management functioning?
- What system elements are included in municipal waste management at present?

- How well are waste management systems adapted to the local physical conditions and topography?
- Is waste management working with or against any other urban systems?

Technical performance can be measured through:

- Collection rate (how much waste is collected as a % of total amount generated)
- Collection coverage (how many people are served as a % of the total population)
- Areas not served by regular collection (which and how many)
- Number of litter bins in commercial areas
- Vehicle productivity (amount of waste collected per route and per time unit)
- Duration and volume of one collection round trip (collection, transfer to disposal site and back)
- Average % downtime of vehicles
- Performance of waste processing plants (amount processed as % of design capacity)

Environmental performance

- Disposal rate (% of waste collected which is disposed of in a sanitary or controlled landfill)
- Hazardous waste collection and disposal (% of hazardous waste generated which is collected and treated appropriately)
- Recovery rate (how much waste is recycled/reused by government and private sector (formal and informal) as % of total amount generated)
- Health status of the population measured by prevalence of waste/excreta related diseases such as hepatitis A, typhoid/paratyphoid, cholera, amoebic dysentery, ascariasis, schistosomiasis, filariasis
- Presence and enforcement of local regulations supporting recycling and reuse
- Existence of policies to promote waste prevention, (safe) reuse and recycling
- Policy, budget and activities for environmental awareness-raising

Financial-economic performance

- Does the municipality have the authority to raise its own funds for waste management (through fees or taxes)?
- Does waste management have its own budget lines? Are these guaranteed (only to be used for waste management), contingent (budget items only funded when enough fees are collected) or in competition with other functions?
- Are costs analysed before fees are set? What costs are included, what percentage of the costs are recovered?
- Do collected fees go into a special earmarked budget, which is only used for waste management?
- Investment and operational cost of waste management
- Level of cost sharing by other stakeholders
- Level of cost recovery (revenues generated through waste collection fees and taxes as percentage of total costs of waste management)
- Are fees the same for commercial and residential clients?

Social and cultural performance

- Who are the stakeholders in waste management in your city? Who has an interest in waste management or is affected by it?
- What type of activities do these stakeholders carry out?
- Does the municipality co-operate with these stakeholders?
- How do they communicate with each other? Is there a structure (platform, committee, regular meetings, specific person inside the municipality) for communicating with other stakeholders?
- Is there any complaint mechanism in the municipality for the general public (to complain about missed collection, illegal dumping)?
- Is this complaint mechanism functioning well?
- Do clients have influence on the fee structures and service levels via some form of public participation (discussion in local elected councils, public meetings, social survey)?
- Do women have a recognised influence on waste management? Have they ever been asked their opinion separately from men?

Institutional and organisational performance

- Is solid waste management the responsibility of one department or are tasks divided over several departments?
- Are all waste management, recycling and composting functions under a single municipal jurisdiction?
- Does the municipality have the authority to contract private enterprises?
- How easy are the conditions for contracting of small-scale enterprises and community-based organisations?

- Is there sufficient skilled staff for waste management?
- How are the working conditions for waste management workers (uniforms, gloves, low loading height, extra allowance for risks incurred, health insurance, health services)?

Policy and legal performance

- Is there a national framework waste management law?
- Do municipalities have jurisdiction and authority to plan, finance and operate waste management systems and/or to contract them out?
- Is there rule of law? Are contracts binding and enforced in law?
- Are laws and regulations for waste management sufficient (do they cover all necessary issues, are sanctions severe enough)?
- How well does enforcement of these regulations function?
- Is there a strategy or plan for waste management at the city level? Is there a planning requirement or mandate?
- Who is the disposer of last resort for waste? Who is the payer of last resort?
- If there is, what are the main obstacles for attaining the objectives in the strategy/plan?

Waste elements of special concern

Hazardous waste should be a particular area of concern during assessments of waste management systems. Hazardous waste is waste that is potentially dangerous to living beings and/or the environment. Hazardous waste is produced by a variety of sources including households, large- and small-scale industries, healthcare establishments, commercial operations like vehicle servicing, airports and dry cleaning shops and agriculture (e.g. unused pesticides, herbicides).

It is necessary to know what type of hazardous waste is produced by which sources in what quantities in your city. Also the existing methods of collection and treatment of hazardous waste need to be identified. Because of its dangerous character, hazardous waste needs special attention during collection, treatment and disposal. Hazardous waste collection from larger companies is often taken care of by private firms, which is no guarantee for safe transportation and disposal. There are also numerous small enterprises that store their hazardous waste with the ordinary household waste, so it is mixed collected and disposed.

3.3.3 Methodological notes

A multi-disciplinary team with representatives from the major stakeholders should be charged with collecting the data to ensure that all ISWM aspects are fully covered. The involvement of stakeholders increases the credibility of the results. The sources for the information are waste management workers, supervisors, financial administration departments, private entrepreneurs, waste pickers, junk shops and the like. For certain issues it is advisable to consult other stakeholders such as members of local elected councils, households, shop owners, small-scale private enterprises, community-based organisations, the Ministry of Health.

Waste characterisation studies, industrial, commercial and institutional waste audits and social surveys are important sources of detailed information. Each type has a well-defined set of methods, which produce valid data.

The municipality does not have to conduct the research all on their own. Other stakeholders in waste management like research institutes, universities, non-governmental and community-based organisations could be involved in:

1. Design of the research questions and parameters
2. Data collection and analysis
3. Discussions of the results
4. Implementation of actions based on the research

3.4 ISWM to analyse and improve existing systems

After using the ISWM approach to collect basic data, it will be possible to analyse the existing waste system elements: waste collection, transportation, treatment and disposal. It will also be possible to look at ways to improve the existing waste management system and in particular the formal and informal systems of reuse and recycling in low- and middle-income countries in the South.

3.4.1 Improving reuse and recycling

Recycling is a good example of a waste element where it is necessary to work on all aspects if the initiative is to succeed. It has a social aspect (low or no-income people, minority groups, gender), an institutional/organisational aspect (urban space for workshops,

storage and transfer, links between formal/informal collection system), a political aspect (recognition and inclusion in waste strategy), a technical aspect (low-cost technology, labour intensive, working conditions), though the latter aspect may get ignored and last but not least an economic aspect (marketing of the collected –waste– materials).

In most cities in countries in Eastern Europe and in the South, and in many Northern cities as well, a lot of recycling experience can be found in the informal sector. So instead of seeking to abolish informal waste recovery activities (because they seem messy or dirty), an ISWM process would consult with these experts, and working together, would assess the effectiveness of their activities and build on them. How can a city government support and build on activities of the informal recovery sector?

1. Study the entire waste management system, including the 'informal' one, in order to understand existing recycling practices by households and small-scale enterprises and model their recovery rates and effectiveness (environmental aspect).
2. Research how many people are employed (social and economic aspect), the type and quantities of waste materials that are being recovered and their environmental effects (environmental and social aspect), its market value and net savings for the local economy (economic aspect).
3. Take into account the needs of informal recovery sector when designing new systems and ask their opinions (social and institutional aspect). Their suggestions may include using open containers instead of closed ones, avoiding the use of compactor trucks which damage, contaminate and mix recyclables and setting up recycling storage sheds at secondary collection points (technical aspect).
4. Consult with workers about their health problems and work together to improve working conditions (environmental aspect).
5. Give waste pickers the exclusive right to salvage recyclables in a protected location and under better work conditions at a transfer station (technical and environmental aspect), based on conditions stipulated in a transparent contract with clearly defined criteria for monitoring (legal and institutional aspect).
6. Support them with access to loans, low-rent or free space for storage and by valuing their role (financial aspect).
7. Educate the general public about the importance of recycling and the role of the informal recovery sector and teach them to co-operate even better with this sector (social aspect).
8. Support the establishment of reuse centres and the promotion of reuse through door to door collection schemes of reusable items (institutional aspect).



Photo 4. Painting buttons made from recycled plastic, India.

Photo: ©WASTE, Johannes Odé

3.4.2 Improving waste collection

As waste collection is one of the most expensive and visible elements in waste management (therefore a political aspect too), it is necessary to improve efficiency in this field. Waste collection and street cleansing often consume 10-20% of the total budget of a municipality in a year. In spite of this, on average up to 50% of urban dwellers in cities in low- and middle-income countries have no regular collection service (on average around 50% of the population and less in low-income areas). Money made available through improved collection efficiency can be used to increase collection coverage and to improve secondary collection and disposal.

Pluralism in approach

Instead of copying high-tech waste collection systems from abroad, ISWM encourages:

1. Allowing a mix of approaches and technologies to be included in a well-planned overall collection system, which includes sufficient secondary collection and transfer points, adequate storage space and drop off centres (technical aspect).
2. Enabling and specifically allowing pluralistic approaches in laws, ordinances and regulations, and encouraging pluralism in private sector contracts (legal and economic aspect) i.e. opening up the system and allowing the integration of other parties (institutional aspect).
3. Selecting a combination of collection techniques that allow for optimum recovery of valuable materials by municipal and private collectors (e.g. use of open but covered trucks with baskets and/or compartments for the various materials, rather than compactors) (technical aspect).

Vehicle productivity

Vehicle productivity (in kg/vehicle/day) is usually the most important factor influencing collection efficiency, because the cost of vehicles in the South is usually much higher than the cost of labour. Improving vehicle productivity means increasing the total number of generators served and the total amount of waste transported each day when the vehicle is in operation (social aspect, institutional aspect).

Major improvements in collection efficiency and vehicle productivity are:

1. Picking the right vehicle for the job. In most cities in the South, the right mechanised vehicle is a box truck of some type, or a tractor pulling a trailer, but animal or hand carts might also be the preferred choice (technical aspect).
2. Linking the various types of collection vehicles, routes and crews, creating transfer points to allow for easy transfer of waste and e.g. waste sorting and storage.
3. Developing and installing easily accessible storage containers to avoid dumping outside the containers (environmental aspect) through monitoring by residents.

Maintenance

Maintenance is an important factor influencing vehicle productivity: it is not uncommon to find more than 30% of vehicles out-of service at any moment.

The ISWM approach would favour maintenance consistent with the local context: the vehicles selected should be available locally, easily repairable and with locally manufactured parts (technical aspect). Workers would be consulted to develop a participatory plan for preventive maintenance. This will probably maximise the use of labour and minimise the use of materials (social and economic aspects). So parts would first be repaired, and only replaced when repair is no longer feasible (institutional and social aspects). Low-input maintenance such as frequent checks of fluid levels, washing, removal of sand and grime, and regular inspection for early problem detection would take a priority (institutional aspect).

Subcontracting with micro- and small enterprises to optimise collection efficiency

Another way of improving collection is subcontracting primary waste collection to micro and small enterprises (MSEs), co-operatives or community-based organisations (CBOs). MSEs and CBOs usually operate at low cost, they are flexible, accepted and supported by the local community, and they create employment and income in low-income urban areas (Haan et al., 1998, Lardinois, 1996). They have especially gained their spurs in areas that are frequently under-served or are not easily accessible.

The municipality can support MSE and CBO waste collection initiatives by:

1. Keeping to its part of the deal, e.g. making sure that secondary collection is regular and reliable
2. Easing bureaucratic obstacles and regulations for MSEs and CBOs, e.g. officially recognise them as candidates for service contracts, monitor quality of their services
3. Providing standby vehicles in case of (temporary) breakdown
4. Assisting in the building of community awareness
5. Assisting with loans for equipment or business training

Improving transportation efficiency and introducing transfer

A traditional technology-intensive approach to improving transportation efficiency would almost certainly focus on getting better, more efficient vehicles, or moving to high-input transfer stations, which would prevent waste picker access. But this might do violence to existing institutional and commercial agreements, which would conflict with the ISWM approach.

When does ISWM indicate that a transfer station might be necessary? Unlike traditional planning or engineering, the impulse behind a transfer station in ISWM might be social or environmental, rather than technical. In Nairobi, there is a big problem at Dandora, the official landfill, because the waste pickers beat up the truck drivers when there is not enough food waste in the load for them to eat. A transfer station with recycling is indicated in this instance because it would improve the livelihood of the waste pickers (social and economic aspects) and motivate them to co-operate with the collection, rather than obstructing it (institutional and social aspects). It also promotes resource conservation. In Figure 3 examples of split-level transfer stations are shown.

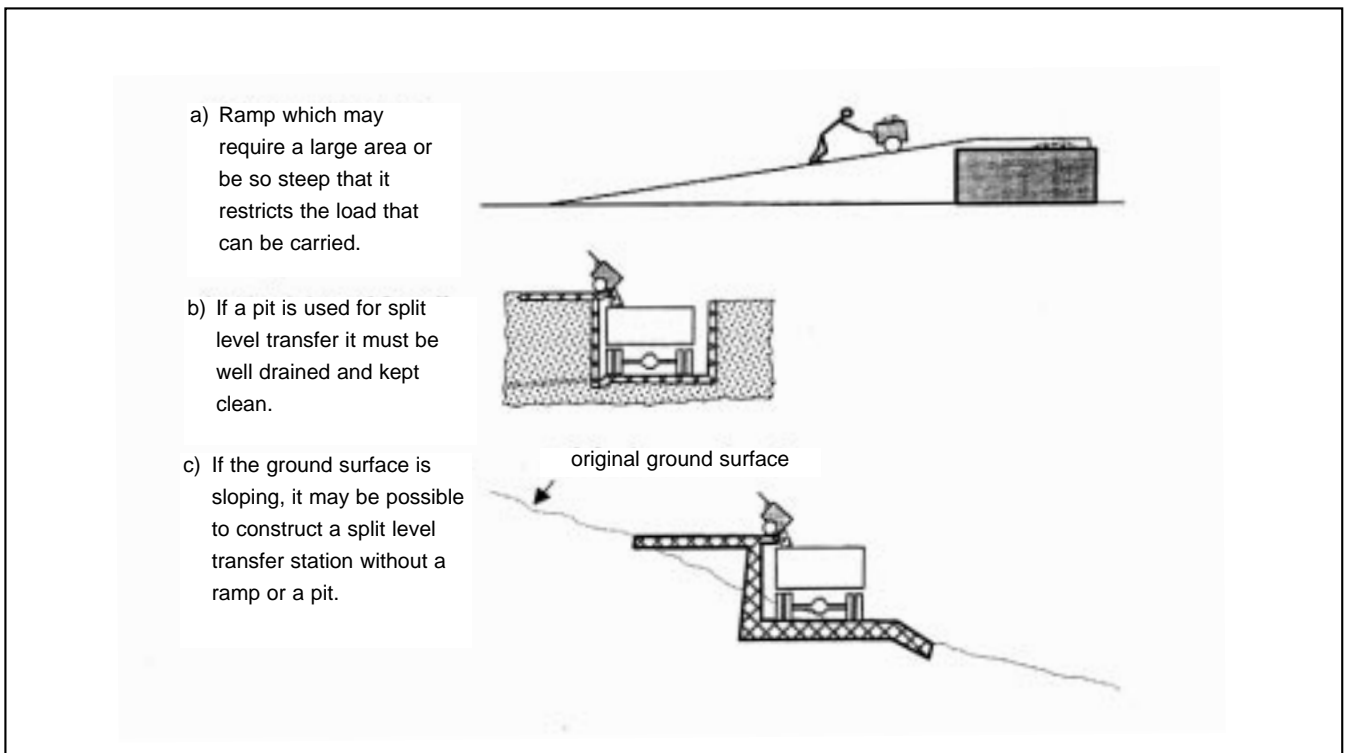


Figure 3. Split level transfer stations

3.4.3 Improve treatment

Waste treatment takes place in the final stages of the whole waste management system, is related to disposal, and partly an alternative to it. In ISWM terms, working on waste treatment requires understanding the technical, environmental and economic aspects.

ISWM promotes treatment as close to the source as possible to lower transportation costs, decrease the risk of contamination and increase possibilities for community participation and management. It makes income and resources (including nutrients from the organic waste stream) available at the local level. It also prevents environmental 'problems' (like waste) to be shifted to other places, urban fringes, remote areas or future generations.

ISWM supports integrating waste management with other urban systems such as drainage, urban agriculture, tree nurseries, urban greenery, energy etc. For instance:

- Compost made from urban organic waste and applied in urban agriculture, public parks etc. can lead to a closed-cycle system within the city, thereby reducing import of raw materials and goods from outside and concurrent burdens on the environment from transportation, manufacturing of chemical fertilisers etc.
- Composting of municipal organic waste together with sludge from wastewater treatment plants, and the re-use of effluent from wastewater treatment plants in irrigation in city parks and urban agriculture. The following box gives an example of the integration of waste management with other urban systems.

Neighbourhood composting and urban agriculture in Thiès, Senegal

In Medina Fass, a low-income neighbourhood of the city of Thiès, Senegal, an integrated sustainable waste management initiative was started with the support of ENDA GRAF. 15 Micro- and small enterprises (MSEs) jointly co-ordinate an experimental recycling programme, which includes separation at source by young people, composting activities and urban agriculture, workplaces where plastics are recycled and cloth sacks are produced, and a knitting course for young girls. Next to these activities 65 small farmers, who have been trained in composting methods, run kitchen gardens. Some of the refuse left from the sales of vegetables from these gardens is returned to the small farmers and to the MSEs. The enterprises have set up a mutual credit fund to finance sanitation facilities. Thanks to the integrated approach, the project releases financial resources (compost, recycling) that are reinvested to finance sanitation facilities (cesspits). The programme has also assisted in improving healthcare and literacy levels. An additional benefit is that the project stimulated the formation of 'think tank' committees at neighbourhood level to formulate new neighbourhood projects. Benefits have included: investments made in equipment and land acquisition; profits returned by smallholders on the sale of their produce; the creation of 30 permanent jobs; doubling of the number of collection teams; increase of coverage to 1300 households; and increased community control of neighbourhood decision-making.

Source: Bulle (1999)

3.4.4 Improve disposal

A sanitary landfill is an important environmental improvement over open dumping, but it may be too expensive for cities in the South at the moment. Still, the costs of open dumping are also high: uncontrolled disposal threatens drinking water supplies and poses many other health and environmental risks.

An ISWM strategy would mobilise stakeholders (consumers, manufacturers and local authorities included) to identify opportunities for prevention, reduction, reuse and recycling of waste, as this will reduce the amount of waste to be landfilled considerably. Mobilising the community, providing incentives and developing a set of sanctions for excess disposal will strengthen the initiative (social aspect). Likewise the use of transfer stations which allow for the segregating and subsequent recycling of waste will contribute to a reduction of the use of landfilling.

3.5 ISWM to introduce new waste system elements

The focus in the following paragraphs will be on the less well-known waste system elements: waste prevention and reduction and separation at source and selective collection. It will also cover small-scale options for composting and co-composting as well as interventions in the field of hazardous waste management.

3.5.1 Introducing waste prevention and reduction

In ISWM, waste prevention and reduction is one of the areas where integration with other urban systems is the most important. In particular, waste prevention and reduction will require good co-operation with the commercial, industrial and institutional sector.

- Working with factories on product design, through packaging covenants with industries on reduction of packaging quantities and changing the type of packaging material used (reusable instead of disposable packaging, deposit-refund systems, such as the ones already used for soft drink bottles in many countries).
- Working with institutions like hospitals to think about disposal implications of their policies and purchasing practices.
- Public education: campaigns on raising awareness of changing products and packages; promoting neighbourhood cleanliness as a means to environmental health; supporting resistance to plastic carry bags; encouraging and educating about composting within the household compound; to encourage reuse, recycling and composting by households or other waste producers.

3.5.2 Introducing recycling, separation at source systems and selective collection

Separation at source is not an objective in itself. However, it can be a useful element of the waste management plan developed after the initial assessment and analysis of the existing system.

Important considerations before establishing a separation at source system are:

- *Market*: is there a demand from the market for the available recyclables?
Where no market exists, it can be developed, but this process takes several years. Therefore close co-operation with the recycling sector should be developed.
- *Materials quantity & quality*: does the separation at source generate sufficient quantity and quality of waste materials to economically maintain a separate collection scheme?
- *Vehicles available*: are sufficient vehicles (and of the right type) available to cope with the separate collection? The decision to establish a separation at source system should be balanced against the need to cover all low-income areas with a proper waste collection service and the ability of the clients to pay fees (social and economic aspects).
- *Informal sector*: what role does and can this sector play in the separate collection? Can their present efforts be integrated and improved? Are they in favour of innovations?

From a study on separation at source systems undertaken in Pakistan, the Philippines, India, Brazil, Argentina and the Netherlands (Lardinois and Furedy, 1999) it proved that:

- In the South small and medium-sized cities appear to have been more successful in setting up organised source separation systems than large cities (policy and institutional aspect).
- The system should be affordable for the population served. Therefore it is better to establish a source separation system in middle to high-income areas, because it requires a willingness to separate, a relatively high level of education and of environmental awareness and willingness to pay (economic and social aspects).
- Introducing gradual changes in the existing waste collection system may be far less complex and less expensive than copying bins and collection vehicles from elsewhere (technical and institutional aspects).
- For the sake of institutional sustainability related to large-scale source separation of organic materials, implementation by municipalities is recommended above implementation by non-governmental and community-based organisations (institutional aspect).

3.5.3 Analysis preceding the selection of new technologies

Selecting appropriate waste management technologies is not an easy matter. It depends on the local context in which the technology will be applied but also on national and even international conditions.

In the ISWM process, the assessment phase described above is the appropriate moment to research, document and analyse the local context. This assessment will likely confirm the following general conditions in low- and middle-income countries in the South:

- Low labour costs and extreme shortages of capital, an indication that solutions should minimise capital expenditures and maximise hand and animal power (economic aspect)
- A waste stream dominated by organic waste (environmental aspect)
- A complex informal sector that is very active in collection, separation and recycling of waste (social aspect)
- Significant mixing of hazardous wastes with municipal waste (environmental aspect)
- Few people adequately trained in solid waste management (institutional aspect)
- High proportions of the urban population with low levels of education, combined with low awareness in the community of the health and environmental hazards of waste (social aspect)
- Inadequate physical infrastructure (institutional and technical aspects)

- Shortage of spare parts, especially from abroad, because of lengthy procedures for obtaining foreign exchange and arranging customs clearance (institutional and legal aspect)
- Weak legal context for contracting and bias against contracting with micro and small enterprises (legal and institutional aspects)

ISWM aspect	Areas to investigate
Technical	<ol style="list-style-type: none"> 1. Waste quantities, waste composition, density 2. Capacity of collection or treatment technology (how much waste can be collected, how many people can be served, which areas can be served with it) 3. Physical infrastructure (condition of roads, traffic) 4. Sturdiness of equipment/technology 5. Local availability of spare parts
Environmental	<ol style="list-style-type: none"> 6. Effects of technology on the environment 7. Effects of technology on opportunities for reuse and recycling 8. Working conditions and environmental health of waste workers
Financial-economic	<ol style="list-style-type: none"> 9. Capital and labour cost 10. Operation and maintenance costs compared with waste management budget 11. Feasibility of covering depreciation (cost of replacement)
Socio-cultural	<ol style="list-style-type: none"> 12. Average level of awareness among population 13. Willingness and ability to pay 14. Cultural attitudes towards waste and implications for waste handling, separation at source, recycling 15. Gender and sex roles relating to management of waste within the household
Institutional	<ol style="list-style-type: none"> 16. Skill level waste management staff 17. Procurement methods for imported spare parts
Policy/legal/political	<ol style="list-style-type: none"> 18. Political priorities (e.g. increase employment, reduce imports, improve environment) 19. Policy and regulations regarding technologies and equipment 20. Contracting rules; biases in contracting procedures

Table 1. ISWM aspects and the selection of waste management technology

3.5.4 Introducing hazardous waste management systems

Hazardous waste is generated by industries, businesses, institutions, agricultural activities and also by some households. Hazardous waste from hospitals and other healthcare establishments is another concern. Many cities in the South believe that they cannot afford to build special disposal facilities for hazardous waste treatment and therefore they do not bother to inventory the hazardous waste generated in their cities, nor to analyse the generation patterns.

An ISWM framework would support making a detailed analysis, in order to see if there are other, pluralistic approaches to neutralising the dangers represented by hazardous waste generation and disposal. Treatment of healthcare waste at Ramaiah Medical College in Bangalore is a good example of taking this pluralistic approach (see also the following box). The hospital leadership understands that their infectious healthcare waste should be incinerated, and that larger incineration plants jointly operated by a group of hospitals or private clinics are more likely to generate ‘sufficient’ quantities of healthcare waste and to have appropriate air pollution devices than small-scale incinerators. However, they cannot afford an incinerator right now and have not yet identified a donor who could finance it. So they have pursued combined treatment using a well-planned selective collection system inside and outside the healthcare institutions.

3.6 Conclusion

ISWM does not promise any kind of ‘magical solution’ to all waste problems (and a vendor selling one is probably not to be trusted). But ISWM does suggest the dangers of a high-profile attempt to modernise or upgrade the technical aspect of a single

waste element like collection system without taking into account the effects upon the rest of the system. ISWM teaches us that the waste system should be considered as an integrated whole and seen through the lens of all aspects.

Pluralistic approach to healthcare waste management in Bangalore, India

In 1996 the private teaching hospital MS Ramaiah Medical College in Bangalore, India, set up a healthcare waste management system. The project aims at changing the current practice of mixing medical waste with general municipal waste and to establish a closed system of hazardous waste management in healthcare institutions from identification to disposal. The project was supported by the Department of Ecology and Development of Karnataka State and the UWEP programme.

A training manual was prepared for segregation of hazardous from non-hazardous waste in healthcare establishments and also covering proper storage, collection, treatment and disposal. Training has been given to waste handling personnel, doctors and nurses in healthcare institutions. Segregation of hazardous from non-hazardous waste was initiated in 12 institutions and a separate collection system for hazardous waste was set up. The local Rotary Club contributed a car for the collection. After collection hazardous waste is incinerated in the old incinerator of the MS Ramaiah Medical College and sharps are disposed in a special sharps pit, which is locked at all times.

A Forum for Safe Management of Healthcare Waste was set up in 1999, composed of representatives from medical doctors' associations, private hospitals and nursing homes.

MS Ramaiah Medical College has been actively involved in development of policies for healthcare waste management at State and national level. The National Bio-Medical and Hazardous Waste Rules have been issued on July 1999.

For the future it is planned to charge the participating institutions a monthly fee (Rs 750/month, which is around US\$ 17) for healthcare waste collection and treatment. Privatisation of healthcare waste collection and joint treatment possibilities are being studied.

Source: Iyer, A. (2000)

Chapter 4. **The Integrated Sustainable Waste Management Planning Process**

4.1 Introduction

This section will provide some guidance on how to include ISWM in waste management policy and planning into the day-to-day practice of a municipality. It will also give some ideas on how to deal with resistance to the principles and practice of ISWM. For more detailed information the reader is referred to the references section, which includes a list of tool kits, manuals and other literature that will answer most of the 'how to' questions.

4.2 Planning for ISWM: getting started

Planning is an essential part of ISWM. The planning process is a critical way to engage stakeholders, as well as to move beyond crisis management. Often decisions on waste management in cities in low- and middle-income countries in the South are based on ad hoc solutions and crisis management.

Planning for ISWM means adopting policies and plans for waste management that include: (1) participation of stakeholders; (2) all six aspects of ISWM and (3) all waste system elements. The basis for ISWM planning is the baseline assessment described above, to analyse and document the existing waste management system, work with clients and stakeholders to evaluate its functioning; identify resources and needs; and the like. This assessment of the existing situation is the basis for articulating criteria; setting goals and indicators; formulating a plan of action and taking measures to implement the plan.

Two examples of stakeholder platforms and waste management coordinating bodies

1. Establishment of a waste management coordinating body in the Philippines

Tingloy is an island in the Philippines with 19,000 inhabitants. It is located in the Batangas Bay region. As part of the UWEP programme various pilot projects were set up in Tingloy aiming at improving public health and environmental conditions. The intention to organise stakeholders in waste management and to form a body in which they would meet, cooperate and make decisions was included in the objectives of one of the pilot projects.

In 1999, after a community needs assessment, an ISWM seminar and a process of stakeholder identification, stakeholders agreed to form a 'Pangkaunlaran Kilusan tungo sa Kalikasan' (movement towards cleanliness). This is a coordinating body composed of representatives from various sectors: local government unit (at quarter and municipal level), municipal health officer, youth council chairperson, junkshop operators (dealers), church, non-governmental organisations, local school teachers, the police and other interested parties.

So far, this coordinating body organised workshops and consultations. It is also managing a community-based collection system, a redemption centre and a controlled disposal site. Its Articles of Cooperation and By-laws have been written and the body is in the process of being legally established.

Four committees:

Executive Committee (including local officials and municipal employees)

Ways and Means Committee (including council officials)

Information and Education Committee (including school teachers)

Implementation, Monitoring and Evaluation Committee (including health workers)

Source: Palmares, M.S. (2000)

2. Swabhimana, an Indian initiative for better coordination in solid waste management

Swabhimana is an Indian initiative for better co-ordination between citizens and the local government agencies in the delivery of urban services. Swabhimana, meaning 'self-respect', was set up in 1995 by a group of active environmental NGOs in the Bangalore, India (5 million inhabitants).

Swabhimana consists of representatives from the municipality (Bangalore City Corporation), government agencies providing important services such as water supply and sewerage, bus transport, telephones and electricity, several NGOs and CBOs and resource persons. In the area of solid waste management, its objectives are to co-ordinate activities between various NGOs representing different stakeholder interests and the BCC, to encourage partnerships at the neighbourhood level for the environmentally friendly management of solid waste.

Several cities in India including Bangalore have a decentralised management system including committees and councils at city, ward and block level. Swabhimana has helped create awareness amongst the citizens to enhance the transparency and accountability of the functioning of these committees at the third tier of governance. Through its member organisations, it has assisted a number of CBOs to start about 60 projects in separation at source, waste collection, recycling, composting, environmental awareness-raising and other solid-waste related activities.

Since April 2000, Swabhimana has actively assisted the BCC in initiating Primary collection in 50 of the 100 wards of the city through its staff. Swabhimana has trained all the municipal staff to take on the task of primary collection, and has helped the BCC in creating awareness on waste management.

Source: UWEP project documents as prepared by Anjana Iyer, 1997.

The hallmark of an ISWM process is that it is pluralistic and inclusive, including city council members, city officials and other groups and individuals that have an interest in or are affected by waste management. Such stakeholders include: waste collection workers; private collection companies; informal waste recycling businesses: residents; shop and business owners; neighbourhood organisations; chambers of commerce; labour unions; church and service organisations; women's groups; environmental non-governmental organisations; local development committees; chambers of commerce; and the like. The assessment may also identify even more stakeholders.

Some stakeholders are organised entities, have offices and are part of the formal institutional structure. Others are not and need to be approached in their own neighbourhoods or fields of work, since some groups such as women, informal entrepreneurs, municipal waste collectors may not be comfortable or able to attend meetings in an official building. These groups need to be met in their own surroundings by representatives of city councils (possibly together with members of neighbourhood organisations). Including other stakeholders means also asking and negotiating support from these other stakeholders to improve waste management. It means sharing responsibility between the municipality and other stakeholders.



The process can also be started from the bottom up: citizens may have organised themselves in platforms, or another form of interest group. They may have received training to empower themselves to be able to articulate their grievances and needs and to learn how to deal with municipal officers and to know what their rights are (e.g. seeking justice through court cases or amendments of legislation). It may be these groups who take the initiative and invite municipal officials to their meetings. They may also organise workshops in which various stakeholders participate so that all know each other's roles and activities.

*Photo 5. Planning workshop PPS Bamako, Mali.
Photo: ©WASTE, Jaap Rijnsburger*

4.3 Developing sustainable waste management: steps to be taken

Seven basic steps to arrive at a sustainable waste management system:

1. Start a participatory planning process
2. Analyse the existing waste management situation
3. Publish and circulate the findings of the analysis
4. Formulate a draft action plan and budget, including a plan for cost recovery
5. Present the action plan to the stakeholders and incorporate their comments and input.
6. Refine and formulate a final action plan, which is approved by the City Council or other legislative body.
7. Implement the action plan and monitor the results.

4.3.1 Step 1 - Start a participatory planning process

A participatory planning process means planning together with other stakeholders, ensuring all to have a say in preparation and decision-making. Each set of stakeholders involved in waste management -- waste producers, waste collectors, recyclers, clients of waste collection services, waste buyers, -- have different interests, backgrounds and preferences. New and perhaps unexpected stakeholders should be invited too: chambers of commerce, the union of waste pickers or the union of municipal workers. The latter are often powerful and vital bodies to deal with when planning an improved waste management system.

Stakeholders do not all have an equal starting position. It is necessary to consistently empower and support the weaker, underprivileged groups such as low-income households, waste pickers, small-scale entrepreneurs, women, children, ethnic groups with a low social status. In a participatory process all stakeholders should have entry to information vital for their role. This may be

considered a political risk for the local authorities, but they need to be convinced that sharing information is vital for a good cooperation. Support to the weaker stakeholders may include: establishing citizen's associations and platforms, training such groups in waste management and the ISWM concept in all its aspects.

A participatory process works best when the meeting is moderated by a trained facilitator who sets the agenda and prepares the agenda items with the municipal staff person (or consultant) responsible for planning. In most cases the agenda should include:

- Goals of the participatory planning process for each stakeholder
- An introduction to the waste management system and its problems, from the point of view from each stakeholder
- Explanation of ISWM by a trainer or experienced person
- A presentation of one or more specific issues and items, such as separation at source, a proposed fee system
- Discussion of these issues, sometimes facilitated by games, role playing, or small group exercises
- Exploration of potential roles of the various stakeholders in implementation of ISWM
- Discussion of the plans for the waste management assessment

A participatory planning process can lead to a bundling of resources to start the assessment of the existing waste management situation. For example some stakeholders (a non-governmental or community-based organisation, a research institute or university) may be able to provide volunteers to carry out the study, some could provide specific information (researchers, libraries, web sites, consultants, donor organisations), others can sponsor the study financially (private companies, social organisations), again others may be able to provide space for meetings (the municipality itself, companies, larger non-governmental organisations) or lend a car, or provide office space with computers or typing machines to work out the results. There is often an astonishing willingness of stakeholders to cooperate also financially when the atmosphere of the group meeting is positive and all participants understand their intertwined interests.

4.3.2 Step 2 - Analyse the existing waste management situation

The next step is to analyse or assess the present patterns of waste management: where the materials are generated, where they are manufactured into products, where they are sold and consumed and by whom, if the waste materials are recovered and where they are disposed. The analysis when complete offers a comprehensive picture of materials flow in the city.

An assessment of the present waste management system using the ISWM aspects gives you the opportunity to make a collective diagnosis of the kind of problems that exist in your city related to waste management. It is a basis for the development of an action plan to improve waste management.

4.3.3 Step 3 - Publish and circulate the findings of the analysis

The findings of the assessment should be published and made available to all stakeholders. This can best be done through the local media (newspapers, radio, TV). Copies could be sent to stakeholders directly involved in the planning process.

Then one or more meetings should be organised to present and discuss the findings. These meetings can include brainstorming about possible solutions to the problems presented. The meetings will thus be the basis for the formulation of a local waste management action plan.

The meetings can focus on:

- What does the assessment report say?
- What are the main problems?
- How can we change the situation and make waste management more sustainable?
- Which issues deserve priority attention?

4.3.4 Step 4 - Formulate a draft action plan and budget, including a plan for cost recovery

The next step in implementing ISWM focuses on developing a draft integrated sustainable waste management action plan. This starts with collecting all opinions and ideas voiced during meetings and the results of the assessment and compiling them. It is useful to engage a local expert or consultant, to evaluate the potential steps that could go into a draft action plan, including:

- Goals and targets to be achieved in certain number of years
- Measures to be taken (to achieve goals)
- Pilot projects to be set up
- Resources needed (financial, material, human)
- Division of responsibilities (between various stakeholders)

- Commitment to deliver resources (by various stakeholders)
- Implementation schedule and timeline
- Monitoring indicators to measure success

Goals can be set according to ISWM principles, covering technical, social, environmental, institutional, organisational and policy aspects. The goals should be supported by specific, verifiable indicators for monitoring and evaluation. These indicators should also be acceptable to the stakeholders. Planned activities will tend to cluster around the eight waste system elements and no plan is complete without addressing them all. Such a plan ideally results in a comprehensive view of the flow of materials in the city and the various levels of action that are needed to intervene and to manage them sustainably.



Photo 6. Waste collectors campaign in Lima to educate the people to keep their own street clean, Peru.

Photo: ©WASTE, IPES

4.3.5 Step 5 - Present the action plan to the stakeholders and incorporate their comments and input

Then the draft action plan needs to be presented or delivered to the various stakeholders, who are invited to discuss it among their constituencies and also in large group meetings. The feedback from these meetings then goes to the coordinator of the process, for incorporation in the final plan.

4.3.6 Step 6 - Refine and formulate a final action plan, which is approved by the City Council or other legislative body

Once the stakeholders are in agreement, those staff persons, local experts and/or consultants in charge of the process finalise the plan, which is then presented to the political authorities for discussion and approval. This step is critical to get the authorities to 'buy in' to the ideas in the plan, since they will have to approve budgets and other items later in the implementation process.

4.3.7 Step 7 - Implement action plan and monitor the results

Once the City Council or other body approves the action plan, implementation can begin. A launching party or parade can be organised to attract public attention to the start of the implementation phase. Starting with some high profile activity, such as a

clean-up campaign in a particularly dirty area, motivates participation, since people can see something happening. It is good to organise follow-up immediately, so the process gains credibility from the beginning.

After implementation has started, keeping track of improvements through monitoring becomes important. Monitoring implies collection of data, storage of these data in a database or other structure; analysis of the information and publication and dissemination of the results. The municipality does not have to do all the monitoring on its own, but it needs to be involved with the establishment of indicators and it has a role in quality control. The Urban Waste Expertise Programme had success with monitoring by community and non-governmental organisations. The stakeholder platform may be a good forum for discussing or presenting the results of the monitoring. The information should be accessible to other stakeholders so that they feel involved and can be stimulated to take action from their part.

4.4 Dealing with resistance to ISWM

Sometimes the municipality may encounter resistance to the principles or practices of ISWM among certain individuals or groups. Resistance to ISWM could come, among others, from:

- Local politicians
- Waste management staff
- Decision-makers
- National or provincial government
- Private sector companies

Possible explanations for resistance are complex, but centre around the fact that by de-emphasising economics and technology, ISWM challenges established ideas about what solid waste management is and should be. Specific forms of resistance may include:

- ISWM ideas are against some established interests and these stakeholders believe that ISWM will open the process and diminish their monopoly on certain kinds of power.
- ISWM goes against many kinds of 'received wisdom' and people do not like to give up their illusions. In particular, ISWM challenges cultural notions that waste is dirt only, the informal sector is a nuisance, poor households cannot pay for waste collection, and the like.
- ISWM is a framework for change and change inspires resistance, even among people who know the current situation is not good. People feel insecure about their position, they are not used to democratic decision-making and they feel that "the devil they know is better than the devil they do not know".

Some of these resisters can be convinced through peer discussions or demonstrations. Others will never agree, and for these one approach is to co-opt them by giving them a high profile, but largely symbolic role in the system. In general visual aids (video, slides and pictures) and live presentations are of great help, especially if they answer two key questions: "Where has it been done?" and "What does it cost?"

For the municipal decision-makers, the main thing to know about resistance is that it is good news, not bad. The fact that the process has inspired resistance shows that you are doing your job and people are taking the results seriously. Be respectful of opinions, but know that resistance does not form a barrier to success.

4.5 Conclusion: benefits of the ISWM approach

Why should you consider the issues discussed in this document summarised under the term ISWM?

Because ISWM can bring benefits to your city, the city government and its citizens, including:

1. Lower costs (of waste management itself and cleaning up later)
2. Less environmental pollution (of soil, water and air)
3. Conservation of raw materials
4. Better coordination between urban services

5. More active citizens who contribute to urban development
6. People that are more satisfied with the service provided and thus less inclined to subversive activities
7. Better image of your city
8. Fewer health hazards
9. Better cost management and higher cost recovery
10. Better performance waste management departments
11. More income from tourism, fishing and agriculture

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Sources of Further Information and Other Tools

This publication is far too concise to provide detailed answers to the 'how to' type of questions. Here we list a selection of what we think is the best literature on a number of topics that have been addressed. Some of these titles are also quoted in the References section as we consulted them in writing this document.

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As part of the Urban Waste Expertise Programme WASTE has also published a large number of case studies covering the following subjects:

- Micro- and small-scale enterprises in waste management
- Neighbourhood-based collection of human excreta
- Plastic recycling
- Composting
- Separation at source
- Ship and port waste
- Special waste fractions
- Linkages/Alliances between stakeholders
- Community participation in waste management

WASTE offers some of these documents in downloadable format at the website www.waste.nl

Integrated Sustainable Waste Management – the Concept focuses on the framework first for understanding the problems of urban waste management - by assessing the current situation in all its aspects -, and secondly, for planning a more sustainable waste management system.

This document is part of a set of five Tools for Decision-makers. The other four documents cover:

- Micro- and Small Enterprises in Integrated Sustainable Waste Management
- Community Partnerships in Integrated Sustainable Waste Management
- Financial and Economic Issues in Integrated Sustainable Waste Management
- The Organic Waste Flow in Integrated Sustainable Waste Management

This series of *Tools for Decision-makers on Integrated Sustainable Waste Management* presents a unique approach to municipal waste management. Integrated Sustainable Waste Management is a concept, analytic framework and assessment that pays attention to aspects often neglected in conventional municipal waste management. Integrated Sustainable Waste Management covers institutional, social, environmental, technical and financial aspects, while emphasising the critical role that a variety of stakeholders - including waste pickers, women and micro- and small enterprises - play every day in waste management operations such as collection, treatment, reuse, recycling and prevention.

The Urban Waste Expertise Programme (1995-2001) was coordinated by WASTE and funded by the Netherlands Agency for International Cooperation (DGIS) of the Ministry of Foreign Affairs. In the UWEP programme a wide array of partner organisations collaborated. Most important among them were CAPS in the Philippines, CEK in Mali, IPES in Peru, ACEPESA in Costa Rica and Waste Wise in India.

ISBN: 90-76639-02-7

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